Supermarkets and the Meat Supply Chain

THE ECONOMIC IMPACT OF FOOD RETAIL ON FARMERS, PROCESSORS AND CONSUMERS

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Foreword

This publication is part of ongoing work within the OECD's Directorate for Agriculture on the structural and behavioural changes in the agro-food system. Agri-food supply chains have undergone important structural changes since the 1990s that have altered the way firms do business. One of the most striking changes is the ongoing rise in the scale of operations of food firms at all points along the supply chain, most notably in food retailing. The rise of retail concentration has led to the concern that retailers may abuse their market power *vis-à-vis* other actors with smaller market shares, in particular farmers and consumers. This study addresses this concern in two ways. First, it describes recent changes in retail concentration and the related changes in retail buying behaviour. Second, it shows, in an illustrative way, how one can possibly pursue empirical analysis of whether retail buying and selling behaviour disadvantages both suppliers, among which are farmers, and consumers.

The focus of this study is on the economic impacts of increasing retailer concentration on consumers, processors and farmers. It follows previous OECD work on market concentration in agro-food supply chains; it addresses growing concerns by producers that increased market concentration in the retail industry and the reorganisation of food supply chains may have distorted prices in agriculture away from their competitive levels. Policy makers have also been sensitive to claims that the potential to exercise market power at the retail level stimulates profits at the retail stage of the food chain at the expense of primary producers and consumers. However, rather than for reasons of market power, the increases in market concentration and changes in supply chain organisation may very well be driven by efficiency motives, costs and consumer demand for service.

This study uses basic economic theory to estimate retail market power and to assess price transmission in the beef, pork and poultry supply chains of Canada, the Czech Republic, Japan and the Netherlands. It also analyses the impact of farm marketing strategies on farm size and returns for three cases, namely retail versus other labelling in the Belgian pork and beef supply chains, producer organisation in Dutch horticulture and contract rearing in livestock production in the EU. The marketing strategies studied in these three examples relate farmers in different ways to either retailers or processors.

The principal authors of this study are Frank Bunte, who was seconded to the OECD from the Agricultural Economics Research Institute (LEI) in the Netherlands under a grant from the Dutch Ministry of Agriculture, Nature and Food Quality, and Pavel Vavra from the OECD Secretariat. Editorial and secretarial assistance for this publication were provided by Christine Cameron and Michèle Patterson.

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EXECUTIVE SUMMARY

The focus of this study is on meat supply chains, with important changes in retail buying behaviour, which hold for the food chain in general, highlighted. Several key elements have been identified. First, this study notes that concentration in food retailing rose sharply in the 1990s, especially on the buying side. Second, a key development in food supply chains is the fact that retailers have integrated backward in their supply chains by setting-up centralised buying and logistics units (Distribution Centres) and by selecting their suppliers throughout the entire supply chain. Third, price mechanisms in food supply chains are more elaborate than ever. Several price mechanisms, *e.g.* slotting fees or buy-back provisions, gained importance in the 1990s. Retailers may reap profits at the expense of suppliers by exerting such new forms of price pressure. Finally, in the 1990s, contracts started replacing spot markets rapidly for some agricultural products in some countries, among which hogs and tobacco in the United States and fruit and vegetables in the Netherlands (ERS, 2004; Bunte, 2000).

There is no conclusive evidence of a recent deterioration in farm returns. The literature indicates that average farm income actually rises rather than falls, among other things because farm size increases as well. Moreover, there is no systematic fall in the average farm-to-retail price spread which is an indirect indication of the situation at the farm level.

This study provides two in-depth assessments of the possible impact of changes in retail buying behaviour, in particular food retail concentration, on returns in the supply chain. Profit margins were measured and price transmission analysed for meat in four cases countries: Canada, the Czech Republic, Japan, and the Netherlands.

The price analysis showed that food retailers seem to make little profits on meat, at least in the four case countries studied. However, for beef in Japan and Canada, the results suggest that retailers make substantial profits, although the results for beef in Japan are sensitive to the model specification. The results may have been influenced by veterinary crises, the related trade effects and government programs, with sometimes dramatic consequences for market structure and apparent profit margins. In the Czech Republic, food retailers may use pork as a loss-leader. Loss-leading may benefit consumers and suppliers as retailers subsidise the products concerned. This, in turn, may lead to increases in consumer demand, which are reflected in increases in retail demand at the wholesale level and higher supplier prices. Suppliers may be worse off if retailers try to share the cost of their pricing strategy, the subsidy, with their suppliers. However, the present analysis is only partial and does not take full account of all cost factors. Nor does it compare retail pricing with respect to meat to retail pricing with respect to other products.

Price developments at the farm, wholesale and retail levels are related to each other in the meat supply chain of all the four countries studied. The extent to which this happens differs across countries and types of meat. In the Czech Republic and the Netherlands, a

price change at one stage of the food supply chain is more fully reflected at other stages of the food supply chain than is the case in Japan and, in particular, Canada. The latter may be due to the high level of concentration in North-American food processing and retail, not only at the national but probably also at the provincial level.

Retailers transmit price changes at the wholesale level to consumers in Czech Republic and Netherlands. Prices are transmitted less in Japan and even less in Canada. When compared across different types of meat, prices are more fully transmitted in the pork supply chain in all four countries. In Canada and the Czech Republic, price transmission is more complete and quicker in the case of retail to farm adjustments than the other way around. The opposite holds for Japan, while no significant difference could be observed for the Netherlands.

Price transmission is a slow process. It usually takes more than six months, but less in cases of very short production cycles. Asymmetry in price transmission occurs frequently in the meat supply chains of the four countries studied. This result, which is in line with a broad literature, indicates that price transmission processes do not correspond to the simple textbook perspectives of perfect competition. The speed of and asymmetry in price transmission can at times contrast more or less sharply with the extent to which prices are transmitted. According to our estimations for the four countries, markets with low concentration ratios, such as the Czech Republic, might exhibit longer adjustment periods and more asymmetries in price transmission than markets that are dominated by a few food retail chains, such as in Canada and the Netherlands. The "visible hand" (retail management) might be quicker in some cases and at first sight more consistent with respect to price adjustments than the "invisible hand" (the market). The Canadian and the Japanese cases seem to point out that asymmetry in price transmission is not observed if price transmission is small. If there is hardly any price transmission, it is hard to observe asymmetry in price transmission.

The discussion based on price analysis in this report suggests that, evidence of abuse of market power in the meat sector seems to be limited. However, the results also indicate that retailers sometimes make substantial profits, for instance on beef, in Canada and Japan. More importantly, there is evidence that price transmission is asymmetric. While this could benefit retail profits in the short run, this might be due to other factors than market power, such as for instance the costs of adjusting consumer prices. Possible market power abuse with respect to other payments than unit prices such as slotting fees and with respect to other retail buying practices such as threatening to delist a supplier is not included in this analysis. Further analysis is therefore required to better understand possible market power abuse.

This study also provides some preliminary analysis of the impact of farm marketing strategies on farm size and returns. It stresses that with the help of additional questionnaires, member countries and the OECD Secretariat could study whether the choice for a particular label or for contracting has an impact on farm structure and returns. The present analysis reveals in particular the increasing importance of production contracts in pork and poultry supply chains in the European Union. This may give a boost to a further rise in farm size.

CHAPTER 1.

CHANGES IN RETAIL BUYING AND PRICING BEHAVIOUR IN THE MEAT SUPPLY CHAIN

Introduction

Agri-food supply chains have undergone important structural changes since the 1990s that have altered the ways in which food firms do business. One of the most striking changes is the ongoing rise in the scale of operations of food firms at all points along the supply chain, most notably in food retailing (Connor, 2003; Dobson 2003). The rise of retail concentration has led to the concern that retailers may abuse their market power *vis-à-vis* other actors with smaller market shares, in particular farmers and consumers.

This publication addresses this concern in two ways. First, it describes recent changes in retail concentration and the attended changes in retail buying behaviour. Second, it shows, in an illustrative way, how one can possibly pursue empirical analysis of whether retail buying and selling behaviour disadvantages both suppliers, among which are farmers, and consumers.

The first section of this chapter discusses changes in retail concentration and subsequent changes in retail buying behaviour. Retail concentration has reached record levels in all countries with the top four retailers controlling 80-90% of the market in the smaller OECD countries, but also in the larger metropolitan areas in the US. Retail concentration at the buying side typically exceeds retail concentration at the selling side, because retailers centralise their buying activities, not only nationally but also internationally. There are three important changes in retail buying behaviour other than retail concentration. First, retailers have integrated backwards into the food supply chain by setting up Distribution Centres and selecting suppliers up to the farm level. Second, price mechanisms in food supply chains are more elaborate than ever. Several price mechanisms, *e.g.* slotting fees, gained importance since the 1990s. Third, in the 1990s, contracts rapidly replaced spot markets for some agricultural products in some countries, among which fruit and vegetables in Western Europe and pig production in the United States.

Recent developments in structure and returns in agriculture are then assessed. This section establishes that farm size continues to rise rapidly and that farm income rises with farm size. However, it also points out that unlike the situation in the retail sector, the structural picture of the primary farming sector remains dominated by a majority of smallholders. Moreover, this section also finds that the farm-to-retail price spread has not widened systematically since the 1990s.

Empirical evidence on the division of returns in the food supply chain based on the Secretariat's analysis is then provided. The first part of this section measures whether

retailers make profits on meat in Canada, the Czech Republic, Japan and the Netherlands. The overall finding is that profits on meat are small. Possible exceptions are beef in Canada and Japan where profits seem substantial. Czech retailers may use pork as a loss leader. This section will then assess whether consumer prices are still related to prices at the wholesale and farm level. For the cases studied, it is found that although there is a long term relationship between farm, wholesale and consumer prices, retailers typically do not transmit changes in wholesale prices to consumers in the short term. Moreover, price transmission also tends to be asymmetric. Price transmission is most complete in the vertically co-ordinated poultry supply chain as well as the Czech beef and pork supply chains which are characterised by low concentration levels.

Even though there is no overwhelming evidence for market power abuse by retailers, final part of this section investigates whether farmers may influence their returns by engaging in alternative, possibly innovative marketing strategies. It analyses among other things if selling under a retail label, under contract or through farmer co-operatives affects farm returns. Finally, recommendations are proposed for further research and policy.

Trends in retail buying behaviour and supply chain organisation

This part assesses recent changes in retail concentration and the related changes in retail buying behaviour.[1] Retail buying is becoming more and more concentrated, in part because retailers have become very large sellers and in part because retailers combine their buying activities. Retail firms have become larger since the recent period of merger and acquisition activity in the 1990s. Clarke *et al.* (2002) show that the recent increase in European retail concentration is due to merger induced growth by the 20 largest retail organizations, in particular the top ten. This has meant that the market share of the 'smaller' retailers has fallen. In the same period, buying associations have arisen in many European countries and grown in size. As a consequence, retail concentration is fairly high on the buying side throughout Europe. In most countries, concentration is higher on the buyer side than the seller side (Table I.1). Concentration is typically higher when smaller geographical markets are taken into account. Connor (2003) indicates that retail concentration at the metropolitan level amounts to 75% in the US and to 86% in Germany.

Table I.1. Market share of top five firms in food retail, 1999

	Seller concentration	Buyer concentration		Seller concentration	Buyer concentration
Australia	95.8	n.a.	Greece	26.8	33.5
Austria	60.2	58.6	Ireland	58.3	58.3
Belgium and Luxemburg	60.9	66.0	Italy	17.6	26.4
Canada	90.0	n.a.	Netherlands	56.2	71.7
Denmark	56.4	76.6	Portugal	63.2	67.0
EU 15	53.6	60.5	Spain	40.3	63.7
Finland	68.4	70.5	Sweden	78.2	80.6
France	56.3	64.7	United Kingdom	63.0	56.2
Germany	44.1	52.5	United States	27.4	n.a.

Source: Dobson *et al.* 2003 (EU), Parliament of Australia, Ministry of Agriculture (Canada) and ERS (US). The concentration ratio of Australia (Top 4) refers to 1998, the one for Canada to 2003 and one for the US (Top 4) to 2000.

When assessing market concentration, one caveat should be taken into account, namely that market concentration is only a relevant concept for assessing market power when the market is properly defined. Market definition involves a geographic dimension and a product dimension. A market is properly defined when within that definition a price rise for a certain product in a certain area evokes substantial demand and supply reactions while such reactions are absent outside the defined market. When a rise in the wholesale price for vine tomatoes in California evokes a substantial price or supply reaction for round tomatoes in California, apparently there is one (segmented) wholesale market in California for at least both types of tomatoes. When a rise in the consumer price for apples in the New York metropolitan area has no consequences for consumer prices in the Boston metropolitan area, apparently both consumer markets are geographically separated. Market definition is always an empirical exercise involving some arbitrariness: what is a 'substantial' price or supply reaction? For various reasons, in particular data limitations, this study uses national data on broadly defined product groups to assess possible market power. During the analysis, the paper indicates where the market definition chosen may not be fully appropriate.

**Box I.1. OECD research on market structure and market power
in agro-food supply chains**

In the past, the OECD has examined a variety of topics of relevance to the food distribution system and its links with farmers. In 1992, a workshop on Structural Adjustment in agro-food Industries was held to identify issues relating to competition in the agro-food supply chain. An overview of competition in the agro-food sector examined both domestic market behaviour and market access issues. In 1998, the OECD assessed the implications of retailer buyer power for manufacturers (OECD, 2000), and in 2001 empirical studies on market concentration and market power in the agro-food sector were evaluated (OECD, 2001). In 2003, the OECD conference on *Changing Dimensions of the Food Economy* in the Hague addressed the possible impact of market concentration on consumer prices on the one hand and farmer prices on the other hand. In 2004, the OECD assessed the market power of agricultural co-operatives together with the impact of exemptions from competition law for agriculture (OECD, 2004). Finally, in 2005, the OECD (2005) presented a paper defining price transmission and methods to measure price transmission. A full overview of OECD work on market concentration can be found in the references and most studies are reviewed in a recent report (OECD, 2001).

Retail buying

Until recently, retail selling and buying were primarily national activities (European Commission 1997; UK Competition Commission 2000; Grievink *et al.* 2002). Even the few global retailers one might have been able to identify in the 1990s organised most of their buying and selling activities at national levels (European Commission, 1997). In recent years, retailers have started sourcing across national borders. Global retailers have set up their own international buying divisions. These divisions are likely to operate on a large scale in the future. Carrefour, for example, is setting up buying agencies in countries such as China (Grievink *et al.*, 2002). The smaller, national retailers create or join international buying alliances. The overall impact of global sourcing activities on food supply in all its dimensions (*e.g.* quantity, price, quality, diversity, etc.) is largely unclear, among other things because the evidence available points to different directions. Several leading retailers indicate that they source food as much as possible from national markets, because consumers demand local produce.[2] So, global sourcing by retailers does not necessarily hold for food. There are several international buying associations. However, these associations primarily operate as platforms for information exchange. When decisions have to be made, national buyers tend to think that they are better off on their

own. National buyers consider buying decisions meeting specific national demands to be better than buying decisions that co-ordinate the demands from several countries. Grievink *et al*. (2002) conclude that voluntary co-operation with respect to retail buying is doomed to fail.

An important change in retail buying, probably, is the establishment of retail distribution centres (DCs). DCs are retailer owned warehouses and as such an example of backward vertical integration by retailers into wholesaling. The role of traditional wholesaling is being reduced to the supply of logistic services. Retailers may share a DC through a buying organisation. Food manufacturers and suppliers of fresh produce deliver their supplies to the DCs. Retailers supply their outlets from the DCs. DCs play a major role in reducing logistics costs, notably at the retailer level: stocks are reduced throughout the entire food supply chain and shifted from the retailer to their suppliers, while delivery times are reduced (Just-In-Time delivery and Efficient Consumer Response). The associated cost savings are made possible by increases in buyer size, the implementation of electronic sales information mechanisms and changes in distribution management (European Commission, 1997). The reorganisation of the food supply chain forces suppliers to address inefficiencies in supply.[3]

There are other important changes in food retail buying. Food retailers buy and sell a wider range of products. Not only do they expand their food product lines, but also they extend their assortment to include non-food products lines, such as health and personal care products, clothing, furniture, kitchen utensils and banking and insurance services. This multi-product retailing makes large supermarkets different from production industries or specialised retailing. Individual retailers sell more products than individual firms in any other industry do. Food retailers may sell up to 40 000 products. Phenomena such as loss leading and promotional activities are probably more important for the retail industry than for other industries because of their extremely wide and deep product assortment. Another aspect that makes retail different from most other industries is the fact that retailers sell to private households rather than institutional buyers. Retailers are the final stage in the food supply chain.

The very fact that retailers sell a large number of products creates an imbalance between them and their suppliers: retailers have a large number of suppliers, while suppliers usually have a small number of customers. Supplier dependence on retailers is much larger than retailer dependence on suppliers. In the UK, the share of the top five retailers in the sales of their suppliers is substantial; on the other hand, the share of the top individual suppliers in retail purchases is very small. Even for large suppliers, the top five retailers account for 86.2% of total sales on average (70.4% being the minimum). On the other hand, Tesco's largest supplier had a 2.7% share in Tesco's purchases and only 230 suppliers (out of 2 600) had a share exceeding 0.1% (UK Competition Commission 2000). Suppliers may have a good bargaining position relative to retail firms for two reasons. First, on a per product basis, the market share of suppliers may be substantial. Second, suppliers of branded products have a good bargaining position, because retailers have to carry certain branded products in order to meet consumer demands.

Do retailers have market power *vis-a-vis* processors and agricultural co-operatives, *i.e.* are they able to set consumer prices at above competitive levels and drive supplier prices to below competitive levels? According to the OECD (2000) a retailer has bargaining power if threats to de-list the supplier involve a bigger opportunity cost for the supplier than for the retailer. The OECD defines opportunity costs in relative terms. Retailer A has buyer power over Supplier B if, for example, a decision to de-list

Supplier B's product could cause Retailer A's profit to decline by 0.1% and B's to decline by 10%. Following this line of reasoning, retailers derive buyer power not only from market concentration, but also from their multi-product nature and from their size. Both factors explain the divergence between retailers' shares in supplier sales versus suppliers' shares in retailer purchases**.** The opportunity costs of suppliers and retailers do not only depend on the share of sales and purchases respectively, it also depends on the time suppliers and retailers need to change partners. Dobson (2005) argues that this aspect is more favourable for retailers than for suppliers: retailers need little time to change suppliers; suppliers need a lot of time to change customers (Dobson, 2005). In line with this analysis, the UK competition Commission establishes that large retailers pay lower wholesale prices than small retailers do. Tesco, for example, pays up to 10% lower wholesale prices than its smallest competitors do. If Tesco passes a part of the wholesale price reductions to consumers, it is able to increase its sales and its buyer power even further. This fact may evoke a virtuous circle in which the leaders become increasingly bigger (Dobson, 2005). In the long run, once retail competition has been reduced, Tesco could raise consumer prices. This is a classic trade-off for competition authorities: does one have to protect competitors today in order to preserve competition in the future?

Retail label penetration is steadily increasing in food retailing OECD-wide (Clarke *et al.,* 2002). In 2001, retail labels had a market share of roughly 15-25% in grocery retailing in OECD countries with the UK and Switzerland as the most prominent outliers (40%). Retail labels play a key role in the competitive position retailers have in relation to their suppliers, notably food manufacturers supplying brands such as Coca Cola (Grievink *et al.,* 2002). Consumer perceptions vis-à-vis manufacturer brands on the one hand and retail brands or labels on the other hand are crucial in this respect. If consumers switch between brands rather than between retailers, it follows that retailers have substantial market power. Delisting a manufacturer brand in favour of the retail label hurts the manufacturer and not the retailer (Bergès-Senou and Caprice 2002). Some retailers expect that they will brand fresh produce in the future (Grievink *et al,.* 2002). The current paper measures returns in the food supply chain without relating returns to explanatory factors such as concentration and retail label penetration. This would be an interesting venue for future research.

Retailers may derive bargaining power from the fact that they perform three interlinked roles in the supplier-retailer relation (Dobson, 2005): retailers act as customers; (retailers compete directly with suppliers, since they supply competing retail labels; retailers supply the most crucial asset in the food supply chain: shelf space or access to consumers. Retailers may be able to charge a rent for the use of this asset, for instance by charging slotting fees. The control over shelf space is especially important, if opportunities for entry into retailing is limited, for instance due to planning regulations. This fact inhibits competition between retailers.

Retail pricing behaviour

Transactions between retailers and their suppliers have become more complex in the last two decades. In 1984, slotting allowances were introduced in the US grocery supply chain. Retailers may charge suppliers a slotting fee (a fixed payment for allocating shelf-space to a new product). Ever since, the importance of slotting and many other fees has grown. As a result, pricing arrangements have become much more complex, since they do not depend on unit prices only. Analyses based on unit prices alone may miss essential

elements of pricing arrangements. This may have consequences for the national collection of agricultural prices. Information that focuses exclusively on per unit (spot market) prices may lead to biased answers. US evidence for fresh produce shows that slotting fees are limited so far (1% of shipping sales), except for bagged salads (8% of shipping sales) (ERS 2001; Box I.2). Limited as they may be, slotting fees may have a large impact on shipper profits, which equal only 1-2% of their sales. Slotting allowances are among the most controversial trade practices (Larivière and Padmanabhan, 1997). Controversy is partly due to a lack of understanding of the role slotting allowances play, among other things with respect to new product introduction. The assertion that slotting allowances bear little relationship to the (accounting) costs incurred by retailers (Marion, 1998) may be one of the reasons for this controversy.

Box I.2. Fees in US fresh produce

Retailers do not only pay fresh produce shippers for the products they deliver; retailers also request payments from shippers. Retailers request fees for various reasons: volume discounts; a share in product-related promotional expenses; discounts on new products; fees charged for being listed on e-commerce sites; product failures (*e.g.* produce being not-fresh); retail investments (*e.g.* in refrigerators); and shelf space (pay-to-stay or slotting).

Fees, with the exception of volume discounts, are a relatively new business practice. Fee requests are on the increase. On basis of a survey among fresh produce shippers and retailers, ERS reports nearly half of all fee requests to be new within the last five years (Table). The number of requests differs per product: they are low for tomatoes and high for grapefruit and lettuce/bagged salads.

Requiring fees may be associated with buyer power, since non-compliance may result in the loss of an account. ERS (2001) reports that the number of cases where non-compliance led to the loss of at least one account indeed is substantial (*ibid*). Note, however, that the accounts lost may have been minor. Fees may be associated with market power; they also may have efficiency effects. Slotting fees facilitate product selection by retailers when there is an abundance of (new) products. Retailers may use shipper willingness to pay slotting fees as an indicator of consumer willingness to pay. Only shippers with high-quality products are willing to pay high fees. When new products are concerned, developed and tested by processors but yet unknown to retailers, slotting fees transfer information on consumer willingness to pay from shippers to retailers.

Fees requested by retailers and mass merchandisers, by type, in 1999 in US fresh produce

Fee type	Average share of supplying firms		Average share of requests		
	Paying fee	With a fee request	New	Complied with[1]	Lost account for non-compliance[1]
			Percent		
Volume incentives	40	73	18	68	33
Promotional allowances	34	62	41	67	50
Other rebates	29	58	38	61	64
E-commerce fees	28	42	26	78	25
New product discounts	12	24	92	62	0
Buy-back requirements	11	22	42	58	25
Retail investments	9	40	64	27	23
Pay-to-stay fees	8	27	93	33	63
Slotting fees	6	24	92	31	57

Source: ERS 2001.

1) For any fee type requested, the shipper may comply, not comply without suffering consequences, not comply and lose an account or even negotiate another deal. A shipper may have more than one account and more than one response for the same type of fee. So, the results do not necessarily add up to 100%.

The UK Competition Commission (2000) investigated whether retail business practices, among which new price mechanisms, involved an element of market power. The analyses referred to the following practices: payment delays, breach of contract, changes in contract conditions without due notice, the threat to de-list, buyback requirements and fees for various contingencies (wastage, underperformance, listing, shelf-space or even having been a good customer). The UK Competition Commission (2000) concluded that some of these practices occur with some frequency and that some of these practices have been anti-competitive. The threat to de-list a supplier may be the ultimate device to exert buyer power. In the UK, the number of firms being de-listed does not seem excessive. The following UK retailers indicated how many suppliers they stopped trading with in the last financial year before the survey of the UK Competition Commission (2000). Safeway stopped trading with 93 suppliers (4.7% of all suppliers), Tesco with 63 suppliers (2.4%) and Sainsbury with less than 100 suppliers (4.2% maximum).

Non-retailing down stream sectors: Processing, wholesaling and food services

Possible buyer power is not restricted to food retailing. There are other stages in the food supply chain which may exert buyer power as well, notably the food processing industry. Concentration in food processing has been high ever since the 1970s. Even in large economies such as the US and Japan, the top 4 firms often command more than 40% of the market (Table 1.2). Concentration is usually higher in more narrowly defined markets, *e.g.* potato processing or steer slaughter. Industry concentration is low in Italy and France. In the US, concerns on possible buyer power abuse by the meat packing industry remain on the policy agenda, especially with respect to beef (ERS 2004). Meat packers may exert market power through business practices, among which captive supplies, which, in general, may be defined as supplies owned or contracted by the buyer at least one or two weeks before actual delivery,[4] (Box I.3). So far, empirical studies have found limited evidence of abuse of market power in meat packing. Nevertheless, policy measures have been introduced or adapted to scrutinise the meat packing industry more carefully, notably through mandatory price reporting.

In principle, food wholesale trade and food services may also exert buyer power. Generally, however, the literature is convinced that food wholesale trade does not exert any kind of market power (Von Schirach-Szmigiel, 2005). Food wholesale traders buy and sell less and less on their own account, but rather provide logistic services to retailers. Food service is still far less concentrated than food retailing. On the other hand, there are large food service companies (*e.g.* McDonalds) which may derive market power from both their size and their market share. More important is probably the fact that growth in food services limits the possibilities for food retailing to exert buyer power towards its suppliers through the provision of alternative distribution channels.

Concentration and possible abuse of market power is not only an OECD-issue. In non-member economies (NMEs), such as the smaller Eastern-European countries, Latin America, South-Africa and South-East Asia, there has been a dramatic change in the structure of food retailing with the rapid rise in the role of large supermarkets, predominantly Western multinationals such as Walmart, Carrefour and Aldi, who have quickly become major players, replacing small "Mom and Pop shops" and even wet markets. (Reardon and Timmer, 2005; Senauer and Venturini, 2005).[5] This has led to

Table I.2. The market share of the top four processing firms (C$_4$)

	Canada	France	Germany	Italy	Japan	Korea	Nether-lands	New Zealand	US[2]
	2001	**2002**	**2002**	**2001**	**2002**	**2002**	**2002**	**2002**	**1997**
Meat[3]	79.0	19	37.7	8.8	68.7	57.3	66	60.7	57.0
Poultry	61.6	29	45.1	…	…	…	51	…	40.6
Fish	…	…	43.9	17.3	…	65.1	41	…	12.4
Dairy[4]	…	48	26.4	8.4	…	…	90	86.5	16.5
Fruit and Vegetables[5]	59.7	…	42.7	7.0	…	…	38	72.1	27.9
Flour milling	78.1	…	33.7	…	…	…	81	…	48.4
Wine	…	14	76.1	4.0	48.6	…	…	…	43.2
Malt	84.4	86	51.5	…	99.1	…	96	55.8	89.7

1. German numbers refer to the top six (C$_6$).

2. US data for 2002 will be available in spring 2006.

3. Meat refers to animal slaughter for Canada, Netherlands and USA; animal slaughter and processing for France, Germany and New Zealand; and meat processing for Japan.

4. Dairy includes ice-cream for USA, but not for the other countries.

5. Fruit and vegetables are canned, pickled and dried fruit and vegetables for Canada and US; all processed fruit and vegetables for all other countries.

Source: Canada: Statistics Canada "Measuring industry concentration in Canada's food processing sectors"; France: INSEE website, www.insee.fr; Germany: Statistisches Bundesamt "Statistisches Jahrbüch über Ernährung, Landwirtschaft und Forsten"; Italy: ISTAT. Japan: Nikkei Sangyo Shimbun, "Handbook of market shares 2005"; Korea: Korean Food Industry Association; Netherlands: CBS, Statistics Netherlands; New Zealand: Statistics NZ, annual enterprise survey; USA: US Census Bureau, 1997 Economic Census.

concentration in food retailing and processing and may have serious implications for small-scale local farmers who are unable to produce at low costs for these supply chains. This process is not a one-way street. Multinationals rearrange their investment portfolio on a regular basis. They buy retail chains in order to increase local market share, but also sell retail chains.

Box I.3. Captive supplies in US meat packing

In US meat production, contracting has risen sharply from the mid 1990s. There has been a sharp and sudden increase in hog contracting. From 1994-1995 to 2001 the share of contracting in total sales rose from 31% to 61%. Contracting has traditionally been substantial in cattle and broiler sales. Because an increasingly large share of meat production is contracted, spot markets become thinner. This affected price reporting in US animal sales. Prices were reported ever less due to low trading volumes. In 1990, 10% of daily local fed cattle cash market prices were not reported for Kansas and Texas cattle due to low trading volumes; in 2000, non-reporting had risen to 60%. This reduced transparency. Transparency was further reduced by the fact that reported prices were based on fewer and fewer transactions. Since the number of transactions on which price reporting was based fell and since there are quality differences between contracted and non-contracted cattle, the prices reported became less reliable indicators of overall price developments. Moreover, price reporting and spot market buying may have been subject to strategic actions from the packers' side.

A part of the cattle contracts contains price formulae. The price formulae depend, among other things, on spot market transactions. Meat packers may lower their marketing bill, both their spot market and their contract bill, by trying to lower spot market prices. Now, since spot markets are thin, strategic pricing may have become easy.

In 1999, US Congress responded to the lack of transparency with the Livestock Mandatory Price Reporting Act. Meat packers are now required to post prices paid to producers for their animals.

A similar concern has been brought forward with respect to fruit and vegetables sales in The Netherlands, when the Dutch auction mechanism was replaced in favour of bargaining mechanisms. Auction supplies have become thin for fruit and vegetables. Contract prices depend to some extent on auction prices, leaving scope for strategic pricing.

Market structure and returns in agriculture

The changes in retail buying behaviour that occurred since the 1990s may have consequences for farm size and returns. This part investigates how farm size, farm returns and the farm-to-retail price spread have developed since the 1990s in order to see whether there is a possible deterioration in farm returns.

While retailers and processors have grown in size throughout the OECD so has the scale of farm operations, although there are differences in the speed at which this has occurred. Changes in market structure in agriculture, possibly induced to some extent by changes in market structure at other levels of the supply chain, have likely had effect on farm returns. This section explores these linkages.

In the EU15, farm size increased rapidly in Northwest-Europe and Spain, but substantially less so in the other Mediterranean countries (Figure I.1). Agricultural production is becoming increasingly concentrated and specialized even though levels of concentration differ across countries. Against this overall background, concentration in agricultural production remains low on average, but there are some exceptions. In some countries, several commodities exhibit some concentration in production at the national level as shown in Box I.4.[6] Concentration is more prevalent in agricultural marketing. In some countries, farmers are organised in increasingly larger co-operatives and

associations. Increasing use of co-operatives and associations are leading to increased concentration of agricultural sales, which may allow producers, who own the co-operatives, to counter the market power of the large processors and retailers. In the Netherlands, for example, co-operatives for dairy, fruit and vegetables, mushrooms, sugar and starch potatoes control a substantial share of national supply.

Figure I.1. Change in household income from farming (EUR 1 000) and farm size (European Size Units) per member country between 1991 and 1999 (three year average)

Development of farms per country
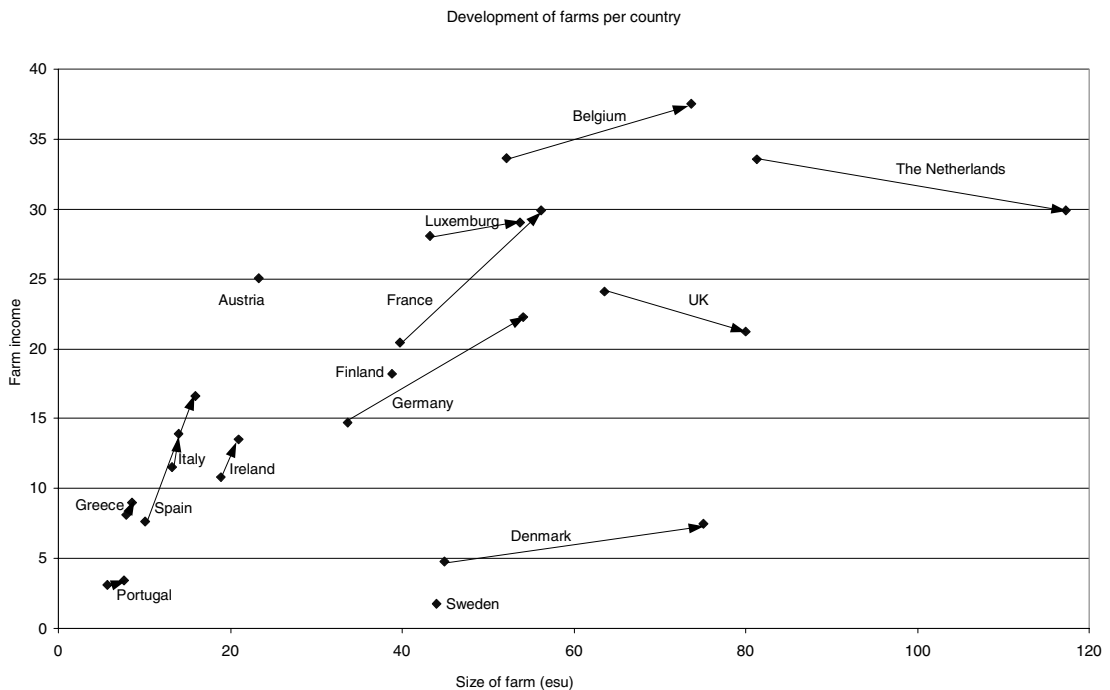
In popular discussions, a direct link between farm prices and the farm-retail price spread on the one hand and returns in agriculture on the other hand is assumed. The relation is obvious. Farm prices determine gross receipts and thereby influence farm income.[7] Although insight in retail profit margins with respect to food is missing, there is no empirical evidence that the recent concentration in retail buying is causing a general increase in the farm-to-retail price spread and thereby a systematic fall in the farmer share of consumer expenditure.[8] The farm share in consumer expenditure on food has not fallen systematically for all products from 1990 onwards according to a study covering eight European countries and fourteen products. London Economics (2004) finds that for most product-country combinations studied (65 cases) the farm share does not show a particular trend; for 15 product-country combinations the farm share has decreased, notably for beef (and to a lesser extent potatoes), and for 9 product-country combinations it has actually increased (Figure I.2). The farm-retail price spread for beef may have deteriorated due to market power, but also due to measures introduced after the BSE crisis (LEI, 2003). Unfortunately, London Economics does not provide an explanation of the differences found in the development of the farm-to-retail price spread for eggs, lamb and bread.

Figure I.2. Trends in farm-retail price spread: 1990-2002[1]

	Austria	Denmark	France	Germany	Ireland	Italy	Nether-lands	Spain	UK
Apples									
Beef									
Bread									
Cabbage									
Carrots									
Poultry									
Eggs									
Flour									
Lamb									
Onions									
Pears									
Pork									
Potatoes									
Tomato									

Decrease in farmer share

Negligible or insignificant change

Increase in farmer share
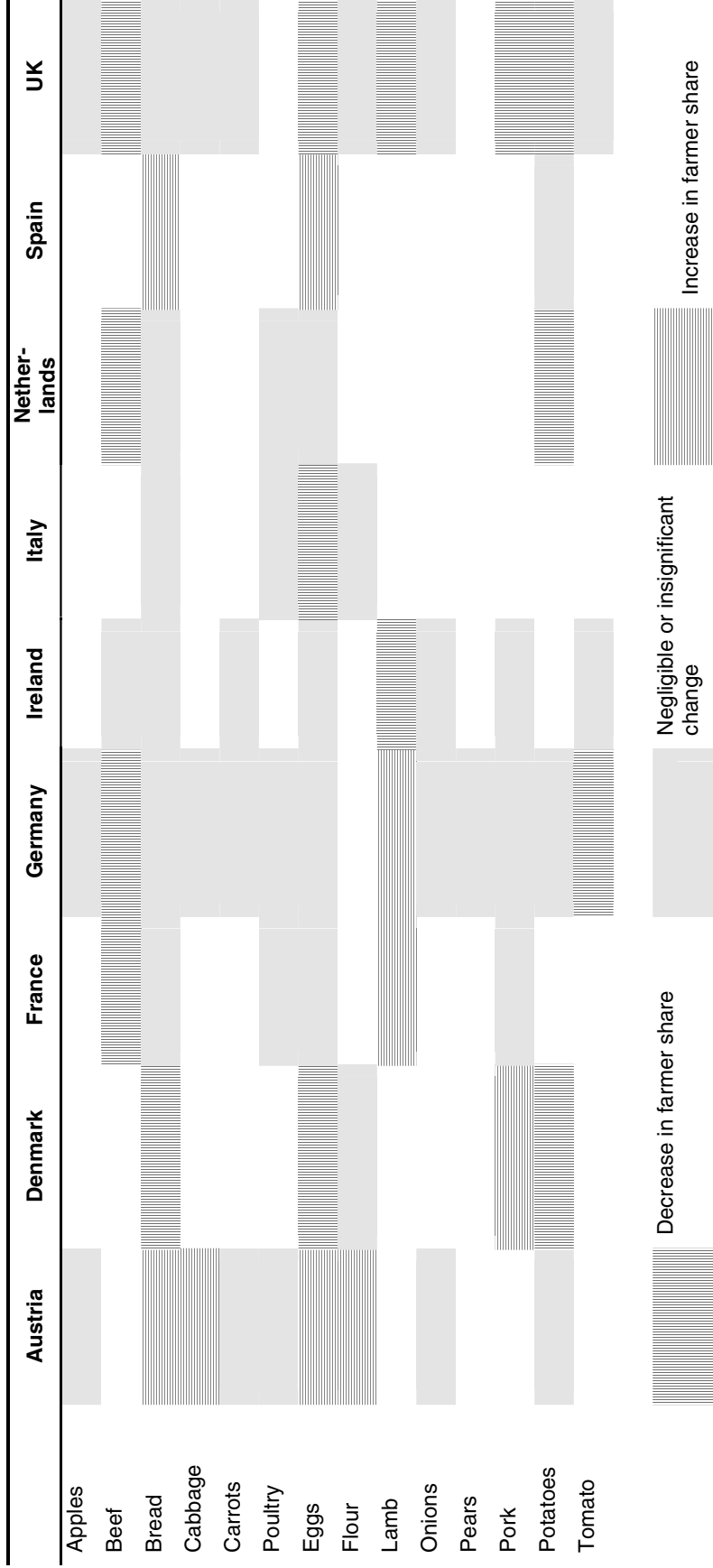
1. The farm-to-retail price spread has been calculated by London Economics (2004) by dividing farm prices as obtained from Eurostat by consumer prices as obtained from national statistical agencies.

Source: London Economics (2004).

Box I.4. Concentration in Dutch agriculture

Concentration has steadily risen in Dutch agricultural production from 1980 onwards, with the exception of table potatoes and poultry. What is striking about market structure in the Netherlands is the fact that in 2003 concentration has become noticeable. The market share of the Top 4 (C_4) is around 5% for poultry, eggs, veal and tomatoes and well-above 20% for specific vegetables. Concentration is even more pronounced when product differentiation is taken into account. Even though concentration in tomato production is not that high (6.5%), concentration is substantial in submarkets, amounting to 48.3 for cherry tomatoes. Concentration remains low in large, homogeneous goods industries such as milk production.

Market share of the top 4 producers (C_4) in The Netherlands (%)

Commodity	1980	2003[1]
Dairy	0.1	0.2
Potatoes, table	1.6	1.4
Veal, white	n.a.	4.6
Poultry	7.4	4.9
Veal, rose	n.a.	5.6
Tomatoes	1.1	6.5
Eggs	6.5	6.6
Tomatoes, vine	n.a.	7.9
Cod	n.a.	15.6
Washed and bunched carrots	11.3	23.4
Lettuce	5.8	33.5
Winter carrots	6.8	38.5
Tomatoes, cherry	n.a.	48.3
Mackerel	n.a.	100.0

n.a. not available; 1. Data are 2002 for tomatoes, vine and cherry and 2001 for cod and mackerel.
Source: Statistics Netherlands and Ministry of Agriculture.

Concentration in agricultural marketing is generally much higher. A limited number of marketing co-operatives control Dutch supply for dairy, fruit and vegetables, mushrooms, starch potatoes and sugar. In 2002, the six dairy co-operatives controlled 85% of Dutch supplies, while the six fruit and vegetables co-operatives controlled 60% of Dutch supply. The single marketing co-operatives for mushrooms, sugar, starch potatoes controlled 45, 63 and 100% of Dutch supply, respectively (Nationale Coöperatieve Raad, 2005).

Price behaviour in the meat supply chain

The previous part concluded on basis of literature research that in the 1990s farm income has risen together with farm size and the farm-retail price spread has not declined systematically. This part analyses more in depth whether market power is exercised in the meat supply chain of four OECD countries: Canada, the Czech Republic, Japan and the Netherlands. It discusses, in an illustrative way, how one may establish empirically whether retail pricing behaviour lowers the returns of other stakeholders in the food supply chain, notably suppliers and consumers. More, in particular, this part analyses whether retailers make excess returns and whether changes in farm or wholesale prices are transmitted into consumer prices. In addition, this part analyses to what extent farmers may influence their returns by choosing a particular marketing strategy, for example to

apply a retail versus a specific label, to sell under contract or to join a particular type of co-operative.

This section analyses the meat supply chain in the four OECD countries mentioned above. Within meat, three product categories are distinguished: beef, pork and poultry. Veal, lamb and other types of meet are not considered. Meat has been chosen as a first test case for a number of reasons. First, meat belongs to the more important supply chain in terms of number of farmers involved and valued added. Second, there are many allegations of market power abuse in the meat supply chain in many countries, both at the processing and the retail level (ERS, 2004; Gohin and Guyomard, 2000; Harrison, 2005; Hyde and Perloff, 1998; Zachariasse and Bunte, 2003). Third, the meat supply chain is easy to analyse, because supply chain organisation is relatively simple. The (fresh) meat supply chain is made of a limited number of subsequent links. Fresh produce is the only supply chain that is organised in a simpler way: farm production, wholesale and retail trade.

This section is divided into four parts. This first briefly describes the meat supply chains in the four countries. The description serves as background material and may be used in later stages as a first step to explain possible differences in pricing behaviour between countries and between supply chains. It then measures retail margins for beef, pork and poultry and assesses to what extent retail margins are at the expense of suppliers and consumers. Price transmission in the meat supply chains are then studied and, finally, the implications of farm marketing strategies on farm size and returns are analysed.

The meat supply chain

A brief description of the structure of the meat supply chains in the four case countries is given before analysing retail pricing behaviour. There is a particular focus on elements which may influence the bargaining position of actors in the supply chain, such as market definition, concentration and vertical co-ordination. Some noticeable similarities and differences in the structure of the supply chains of the four countries are highlighted. A more extensive description of the meat supply chains is provided in Chapter 2.

There are major differences in the import and export orientation of the meat supply chains in the four countries (Table I.3). Japan depends on substantial meat imports in order to meet its domestic demand, while it hardly exports meat. The Canadian and the Dutch meat supply chains are export oriented. Canada exports a large share of its production of cattle and beef, pigs and pork; The Netherlands pigs, pork and poultry. Imports and exports are on the rise in the Czech Republic. Trade is primarily regional. Canada trades with the US. More in particular, western Canada trades with western US. Midwest and Eastern Canada trade with Midwest US. The Netherlands and the Czech Republic trade with other European countries, primarily their neighbour countries. Most trade refers to meat rather than live animals, but there are exceptions. Canada exports live animals to the US processing industry, because large-scale US processors have a comparative advantage over their small-scale Canadian counterparts. US processors subsequently supply a small quantity of the meat they processed to Canadian distributors. Since the early 1990s, Canadian and US meat trade has become increasingly integrated as a result of trade agreements and Canada exports an increasing amount of weaner pigs and live cattle to the US where large feeding operations and processing plants finish them off. A similar pattern applies to the pork supply chain in the Netherlands.

**Table I.3. Meat trade: import and export ratios 2004 (% of domestic supply,
sum of production and imports)**

	Beef		Pork		Poultry	
	Import	**Export**	**Import**	**Export**	**Import**	**Export**
Canada	8	37	4	56	13	8
Czech Republic	10	23	15	7	20	13
Japan	54	0	49	0	21	0
Netherlands	62	43	15	68	38	67

Source: Chapter 2.

Due to imports and exports the meat produced in a country is not necessarily related to the meat consumed in a country. In the Netherlands (and the Czech Republic) most beef production refers to dairy cows. As a consequence, beef quality is low and beef imports contain a substantial share of high quality produce. There are major differences in the prices of imported and exported beef in the Netherlands. As a consequence, import, export and domestic wholesale prices differ as they may refer to different levels of processing, different parts and different qualities (Annex B). Meat therefore is not a homogeneous product. The discrepancy between the beef quality demanded and offered on the Dutch market explains why the major Dutch supermarket chain – Ahold, the Holding Company of Albert Heijn – imports most of its beef from Ireland, which is a supplier of high quality beef. This fact illustrates why one should be careful in defining markets and supply chains and in comparing national farm, wholesale and consumer prices.

Agricultural policy is one of the main factors determining the competitive position of industries within the meat supply chains. The MacSharry reforms of the Common Agricultural Policy triggered a reduction of Dutch beef production. The abolition of the Western Grain Transportation Act reduced the competitiveness of Canadian cereal production, but shifted it to animal production. An increasing amount of Prairie grains were diverted to the domestic feed grain market where they are fed to livestock. The competitive position of the Canadian poultry system depends to a large extent on the system of supply management. Trade liberalisation in Japan in the 1990s with respect to beef gave a boost to beef consumption, notably beef distributed through food services (Chapter 2).

Meat production

Meat production in the four countries considered is still scattered over a large number of small-size farms (Table I.4), even though the number of farms has decreased substantially over the last fifteen years, for instance by 40-65% in the Netherlands and by 50-75% in Japan. In the Czech Republic, however, due to its past of central planning, meat production takes place on large-scale farms with for instance farms with 50 000-100 000 chickens being the rule rather than the exception.

Table I.4. Meat production in 2004

	Cattle		Pork		Poultry	
	Number of farms	**Production tonnes[1]**	**Number of farms**	**Production tonnes[1]**	**Number of farms**	**Production tonnes[1]**
Canada	90 066	1 500 000	15 472	2 300 000	2 850	1 115 000
Czech Republic[2]	25 823	109 305	24 638	414 569		220 725
Japan	122 700	515 000	8 880	1 275 000	2 778	1 250 000
Netherlands	38 361	200 000	10 039	1 835 000	771	525 000

1. Carcass weight.

2. Data for 2000.

Meat processing

Animal slaughtering is highly concentrated in the Netherlands and Canada, while it still takes place in small-sized plants in Japan and the Czech Republic (Table I.5).[9] The high level of concentration in meat processing in the Netherlands and Canada does not necessarily imply that processing plants have substantial market power because markets do not necessarily coincide with national boundaries. In fact, Dutch and Canadian processors compete with German and US slaughterhouses over their supplies.

In all four countries, poultry production is tightly vertically integrated. Poultry slaughterhouses own feed companies and hatcheries and contract multiplication and broiler farmers specifying tight production schedules, delivery quantities and prices. Vertical co-ordination guarantees steady supplies and product quality. Beef and pork production, on the other hand, are vertically integrated to differing degrees in the four countries. For Dutch and Czech beef production, vertical integration is low, among other things because beef is a side product of dairy production. In Canada, vertical integration contracts between specialised beef producers (feedlots) and processors are more common than in the other three countries. Supply chain co-ordination in the Canadian pork supply chain has increased substantially, with contracting rising to 90% of production in Canada. In the Netherlands and the Czech Republic, vertical relations in the pork supply chain have become tighter in recent years in order to reduce veterinary risks and to save on transaction costs.

Table I.5. Concentration in meat processing: market shares of the leading firms (2003)

	Beef	Pork	Poultry
Canada	Top 3 = 95%	Top 3 = 74%	Top 5 = 55%
Czech Republic	Top 10 = 21%	Top 10 = 27%	Top 5 = 58%
Japan	n.a.	n.a	Top 3 = 17%
Netherlands	Top 3 = 56%	Top 2 = 75%	Top 4 = 40%

Source: Chapter 2.

Consumption and distribution

Food retail buyer power is curtailed by the fact that food retail is not the only customer of the meat processing industry. Food service is an important and rapidly growing alternative distribution channel for the meat processing industry, notably in Canada and Japan (Table I.6).[10] When assessing the fact that food service may be an alternative to food retailers from the suppliers' point of view, one should take into account that the products demanded by the different distribution channels may differ. A chicken with the Bresse brand (*Poulet de Bresse*) is not a MacNugget for a consumer, nor for food retail or food services, and nor for the meat processing industry. For individual meat processors, distributors and consumers, the alternatives available may be much more narrowly defined.

Apart from product definitions, geographic delimitations matter when defining markets. This is most obvious for consumers, because national markets are not relevant, when assessing food retailers' market power vis-à-vis consumers. For residents of Paris, Paris rather than France is the relevant market (and probably even a small part of it, *e.g.* a particular arrondissement). Because consumer markets are defined at the local level and retail competition may differ from one local market to the other,[11] there may be a divergence of consumer prices and the development of consumer prices throughout the country. In Canada, consumer prices for meat indeed develop differently from one province to the other (Chapter 3).

Taking these qualifications into account, one may establish that consumers depend for the major part of their purchases of food for home consumption on food retailers and that food retailing is highly concentrated at the national level in Canada and the Netherlands, and even more so at local levels. In the Czech Republic, retail concentration still is low, but it grows rapidly due to acquisition and merger activities by 12 western retail conglomerates. Due to intense price competition the number of retail chains is likely to fall (IGD, 2005). The retail chains probably conduct a 'war-of-attrition': they suffer losses in order to gain market share, among other things in the expectation that rival retail chains draw out of the price war. [12]

Table I.6. Food distribution (2003)

	Food retail concentration	Retail share in meat distribution	Food service share in meat distribution
Canada	Top 5 = 90%	62%	38%
Czech Republic	Top 4 = 33%	n.a.	n.a.
Japan	n.a.	53%	47%
Netherlands	Top 4 = 70%	73%	27%

Source: Chapter 2.

Buyer and seller power in food retail

This part assesses whether retailers make profits at the expense of either their suppliers or consumers by reducing wholesale prices below their competitive levels and/or raising consumer prices above their competitive levels. The analysis is based on a structural model of retailer pricing behaviour. The model measures the retail profit margin as a function of consumer demand, meat industry supply and retailer pricing behaviour. The model and the econometric estimations are described in Chapter 3. The detection of market power is analytically a very complex issue. The focus in this analysis

is on retailer pricing behaviour. Possible market power abuse with respect to other payments than unit prices such as slotting fees and with respect to other retail buying practices such as threatening to delist a supplier is not included in this analysis.

This section categorises and summarises the findings of the estimations. The classification is based on the estimates of a market power parameter. The implications of the market power parameter for retail margins are discussed further below. Three situations are identified with respect to retail pricing:

- *Competitive pricing*: Retail prices more or less equal retail costs
- *Possible market power*: Retail prices are substantially above retail costs;
- *Cut-throat competition*: Retail prices are substantially below retail costs.

Retail costs are measured using the price of meat and labour.[13] Food industry supply is taken into account by estimating a supply function relating food industry supply to wholesale prices.

The results of the analysis in Chapter 3 indicate that in general retail pricing with respect to meat is competitive (Table I.7). Most measures of the market power estimate are significant, but typically small. There are two exceptions: beef in Japan; and pork in the Czech Republic.

Table 1.7. Retail pricing with respect to meat

	Pork	Beef	Poultry
Canada	Competitive	Competitive	Competitive
Czech Republic	Cut-throat competition	Competitive	Competitive
Japan	Competitive	Possible market power	Competitive
Netherlands	Competitive	Competitive	Competitive

According to the estimates, retail prices are above retail costs for beef in Japan which suggests that Japanese retailers make substantial profits on beef. However, the estimates of the market power parameter are incomplete in the sense that the estimates take only the costs of two inputs into account: meat and labour. It is very well possible that when other inputs are taken into account, the market power estimate becomes smaller and possibly insignificant.[14] For all four countries, the market power estimate is higher for beef than it is for pork and poultry. This pattern may be explained by cross subsidies in retail pricing: retailers may set low margins or even make losses on 'necessary' products (pork and poultry) in order to make profits on 'luxury' products (beef).[15] Probably, retailers use "necessary" products as loss-leaders in order to attract consumers.

In the Czech Republic, retailers make substantial losses on pork. The empirical analysis does not provide a clear-cut explanation for this, among other things because the analysis does not include explanatory factors such as retail concentration. In the Czech Republic, twelve foreign retail companies struggle for market share and only a few retail chains may be expected to survive this ongoing 'war of attrition'. The retail chains may use one or more products — *in casu* pork — as loss leaders, trading off current losses versus future profits. If pork indeed is used as a loss-leader in the Czech Republic, both

suppliers and consumers gain. Cutthroat competition benefits consumers via lower prices; suppliers also benefit, because the increase in consumer and retail demand drives up supplier prices. Cutthroat competition may have detrimental effects for suppliers and consumers when other elements are taken into account.

The estimates of the market power parameter may be used to estimate retail net margins (Annex C). Since these estimates are not based on accounting principles, some caution with respect to the interpretation of these margins is warranted. In qualitative terms the estimates give the same picture as Table I.7. Retail net margins on meat are low except for beef in Canada and Japan. On the other hand, they are negative for pork in the Czech Republic. Retail margins are high for beef in Canada, because the price elasticity of supply for beef is low.

After presenting the results of the analysis, it is important to stress some findings.

First, according to our sectorial analysis, food retail market power seems limited, at least for the four cases studies. For most product categories and countries analysed, the market power estimates and the implied retail margins are significant, but low. This result coincides with those found by, for example,. ERS (2004) for the US, Hyde and Perloff (1998) for Australia and Weber and Anders (2005) for Hessen (Germany). Gohin and Guyomard (2000) are an exception, and they report a high net-profit rate in food retail. Some of the studies using micro-level or regional data find high net-profits in food retail as well (*e.g.* Villas-Boas, 2003), although not all of them (*e.g.* Morrison Paul, 2001; Nevo, 2001).

Second, the analysis suggests that retail buyer power and retail margins may be substantial if exertion of market power arises. This result is among other things due to the low price elasticities of supply found. This result contrasts with the findings of OECD (2000). OECD (2000) argues that price elasticities of supply in general tend to be low and that as a consequence buyer power is not really an issue. OECD (2000) does not refer to specific industries or supply chains such as food. If price elasticities of supply in food supply chains indeed are small, retail buyer power is less innocent than OECD (2000) presumes.

Third, the retail-wholesale price-gap found for beef in Canada and Japan is relatively high. Market power is not the only possible explanation. The analysis for Japan shows that other factors may explain the price gap as well, among other things developments in the prices of other inputs such as labour.

Fourth, cut-throat competition is not detrimental to suppliers and consumers given the model specification chosen.[16] Cut-throat pricing (pricing below costs) lowers consumer prices, increases consumer and retailer demand and subsequently raises supplier prices. Suppliers and consumers may be worse off if low retail prices have consequences for product quality and variety by reducing profit margins in the food processing industry and the industry's financial ability to innovate and to meet consumers' perceptions with respect to quality.[17] Suppliers may be worse off if retailers try to share the bill of their pricing strategy with their suppliers. The model specification does not take account of different bargaining situations that may exist at various stages of the supply chain.

Fifth, individual product categories, for instance beef, may not be the relevant scope for assessing the impact of retail pricing on consumer well-being. Consumers are interested in the price of baskets of products, for instance food, and less so in the price of

individual products or product categories. After all, positive profit margins on some product categories coincide with losses on other product categories (Annex C).

Sixth, beef, pork and poultry are treated as homogenous commodities. Quality and associated price differentials are not taken into account. This implies that price behaviour with respect to specific varieties is not considered.

The above findings should be interpreted with caution given the qualifications one may make with respect to the analysis performed.

First, some of the analyses are based on limited data sets, notably for Canada and the Czech Republic. This may have consequences for the demand and supply parameters found and the market power estimates based on these results. The data set for Japan on the other hand is extensive. Moreover, the analysis is based on aggregate data which requires major restrictions on the economic model employed.[18] The analysis may be improved by using micro-level data with respect to prices, costs and demand (Morrison Paul, 2001; Nevo, 2001; Villas Boas, 2003). This is likely to be an available option for individual Member Countries which have easier access to micro-level data bases than the Secretariat does.

Second, for all four countries the estimates of the supply function are not convincing. Some of the price elasticities of supply found have the 'wrong' sign or are insignificant. The price elasticities of the supply functions found tend to be low. Chapter 3, however, shows that changes in the price elasticity of supply do not influence the outcomes of the analysis in qualitative terms, except for beef in Japan.

Third, the estimations are based on historical data. The parameters found apply to the economic and institutional setting in the past two decades. This limits the possibilities to extend the findings to the future. Some major changes have occurred in the economic and institutional setting. The Czech Republic has entered the European Union and its meat imports and exports rise rapidly. The retail war-of-attrition in the Czech Republic referred to above will probably end at some time in the future.

Price transmission[19]

Price transmission in the meat supply chains of the four case countries are examined here in order to find out whether changes in farm and wholesale prices are still reflected in consumer prices. The analysis here concentrates on vertical price linkages and evaluates the links between farm, wholesale and retail prices. Vertical price relationships can be characterised by the magnitude, speed and nature of the adjustments through the supply chain to market shocks that are generated at different levels of the marketing process. It summarises the findings of the estimations presented in Chapter 4. When assessing the individual results in this chapter, it is important to bear in mind the general limitations of time series estimation with highly aggregated data. The estimation may generate in individual cases less intuitive outcomes. For the current study, the focus should be on general tendencies and regular patterns.

The method employed to estimate price transmission in this study follows the method advanced by Goodwin and Holt (1999), Goodwin and Harper (2000) and Goodwin and Piggott (2001). The method implements a threshold vector error correction model. Threshold models allow for the possibility that the initial price shock has to exceed a specific "threshold" level before firms at other levels adjust prices. There may be different threshold levels for upward versus downward price adjustments. The model

allows to evaluate the size and speed of price transmission and to test for possible asymmetries in price transmission. The aspects of vertical price transmission, possible causes for asymmetric price transmission and empirical procedures are reviewed in OECD (2005). The detailed description of the threshold vector error correction model used in this study is available in the same publication (*ibid*).

The basic time series diagnostics indicate that price developments at the farm, wholesale and retail level are related; or, in technical terms, are co-integrated. Changes in retail prices are primarily explained by changes in wholesale prices rather than farm prices. When retail prices are related to both wholesale and farm prices, farm prices have very limited explanatory power with regard to retail prices. This is true for all countries except Japan where both farm and wholesale prices were found to have limited explanatory power in the retail price regressions.

Estimation of the threshold vector error correction model established the existence of statistically significant thresholds for the beef and pork supply chains with the exception of the pork supply chain in Japan. Interpreting differences in thresholds for upward versus downward price changes is somewhat opaque. For example, the threshold for upward price changes being larger in absolute terms than the threshold for downward price changes may be interpreted as upward price changes being more costly to firms than downward price changes. If this interpretation is valid, the results suggest that in Canada downward price adjustments are more costly than upward price adjustments. The opposite is true for the Netherlands pointing to certain reluctance to increase prices. In Japan, thresholds are significant only in the beef market where upward price changes seem more costly compared to downward price changes. In the Czech Republic, the threshold for downward price changes seems higher for beef than for pork implying that even small decreases in pork wholesale prices are transmitted to consumers. This is consistent with the loss leader hypothesis posited for pork in the Czech Republic.

The thresholds found for poultry were not significant for all four countries with the exception of Canada. This suggest that even small price changes are transmitted along the poultry supply chain which may be due to the high degree of vertical integration of the supply chain in the countries studied.

Tables I.8 and I.9 summarise the results of the estimations. Table I.8 refers to supply chain price transmission in general and includes all possible types of price transmission: farm to wholesale, farm to retail, retail to farm, retail to wholesale, wholesale to farm and wholesale to retail.[20] Table I.9 focuses on the wholesale to retail price transmission.

Table I.8 summarizes whether and how price shocks at some level of the supply chain are transmitted to other levels of the supply chain. The transmission magnitude measures to what extent price shocks are transmitted, the transmission speed indicates how long the price transmission takes and the asymmetry whether there are differences in reactions to positive and negative shocks. The number of pluses in the table indicates a relative position (ranking) for individual countries where more pluses imply that prices are more fully transmitted (magnitude), that price adjustments occur more quickly (speed) and that there is more asymmetry.

Table I.8 illustrates that price changes are more fully transmitted in the Czech Republic than in the other three countries for beef and poultry, but not for pork. It may be argued that low industry concentration at each level of the meat supply chain may facilitate the size of the price adjustments given that low concentrated industries can be

Table I.8. Price transmission in the analysed meat markets

	Beef			Pork			Poultry		
	Magnitude	Asymmetry	Speed	Magnitude	Asymmetry	Speed	Magnitude	Asymmetry	Speed
Canada	+	+	++	+	+	++	+	++	+++
Czech Republic	+++	++++	+	+++	++++	++++	++++	+	+
Japan	+	++	++	++	+	+	++	++++	++
Netherlands	+++	+++	++++	++++	+++	+++	+++	+++	++++

Legend: + stands for lowest price transmission, lowest speed and lowest asymmetry (highest symmetry).

++++ stands for highest price transmission, highest speed and highest asymmetry (lowest symmetry).

Table I.9. Wholesale to retail price transmission

	Shock	Beef			Pork			Poultry		
		Magnitude	Speed	Asymmetry	Magnitude	Speed	Asymmetry	Magnitude	Speed	Asymmetry
Canada	positive	+	+	No	+	+	Yes	+	+	No
	negative	++	+		++	+		+	+	
Czech Republic	positive	+++	+	Yes	+	+	Yes	+++	+	Yes
	negative	+++	+		+++	+++		++	+	
Japan	positive	+++	+	Yes	+++	+	Yes	+	+	Yes
	negative	+	+		+++	+		+	+	
Netherlands	positive	+++	+	Yes	+++	+	Yes	+	++	No
	negative	+++	++		+++	+++		+	+	

expected to be more competitive. In the Netherlands, price changes are also well transmitted throughout the supply chain, especially for pork. On the other hand, price changes at a specific level in the supply chain are less well reflected at other levels in Japan and, in particular, Canada. The analysis does not substantiate an explanation, but high concentration in the North-American meat processing and food retail industries may explain this finding.

While price transmission is generally high in the Czech Republic, the occurrence of asymmetry is also high. With the exception of poultry, which is a highly integrated supply chain, it exceeds that in the other case countries. In Canada, on the other hand, asymmetry in price transmission is generally less significant than in the other three countries. When assessing this finding, it is important to bear in mind that the ranking for asymmetry is to some extent influenced by the ranking for the transmission magnitude. It is more difficult (and less meaningful) to establish possible asymmetry in price transmission if price transmission is low and less significant to start with. When focusing on observations with strong price transmission, Canadian price transmission exhibits asymmetry, which is consistent with other empirical literature.[21]

Price adjustments are put through quickly in the Netherlands and to a lesser extent Canada. Price shocks are transmitted more slowly in the Czech Republic compared to the other countries with the exception of pork where the Czech Republic shows the fastest adjustment rate for all four countries. This may point to the fact that pork is a price sensitive product in the Czech Republic.

Table I.9 shows the results for wholesale to retail price transmission. The results indicate whether retailers are responsive to changes in supplier prices. The number of pluses for the transmission magnitude indicates to what extent retailers transmit changes in supplier prices to consumers: from hardly at all (+) to fully (+++). The number of pluses for the transmission speed indicates the speed from slow (+, more than a year) to quick (+++, 1-6 months).

The results are again mixed depending on the analysed country. Retailers transmit prices best in the Czech Republic and Netherlands. On the other hand, prices are not well transmitted in Canada. When compared across different products, they are best transmitted in the pork supply chain.[22] In the Czech Republic, the wholesale pork prices are more fully and faster transmitted for negative shocks as compared to positive shocks, again a result consistent with the loss leader hypothesis posited for pork there. In all cases, the transmission speed is low. Full price transmission generally takes more than twelve months, possibly due to contracting. Asymmetry in price transmission is established in majority of the cases.

It was also assessed whether there are differences in retail to farm price transmission (*i.e.* the price shock occurs at the retail level) versus farm to retail price transmission (*i.e.* the price shock occurs at the farm level). Chapter 4 illustrates the variety of results that differ by country and by commodity. In about half of the cases price transmission upstream and downstream show similar patterns. In general, in Canada and the Czech Republic, price transmission is more complete and quicker in the case of retail to farm price transmission than in the case of farm to retail price transmission. The opposite holds for Japan. For the Netherlands, no significant difference could be observed between retail-to-farm versus farm-to-retail price transmission.

Overall, the price transmission analysis found considerable differences among individual meat markets and countries. Possible explanations of these differences include;

a different degree of competition and market power along the supply chain, variations in the degrees of vertical integration, as well as dissimilarities in adjustment costs and price sensitivity. There are other possible causes of imperfect price transmission suggested in the literature. However, the literature on asymmetric price transmission and models based on price time-series are typically not very strong in identifying the precise causes of imperfections found. The analyses of the individual possible explanations, both theoretically and empirically, are outside of the scope of this study.[23]

In conclusion, the results of the price transmission analysis in this study confirms the broad findings of the empirical literature that establishes asymmetries in price transmission for a large number of food supply chains in a large number of countries (Meyer and von Cramon-Taubadel, 2004). However, the literature has not yet established a systematic pattern in price transmission. Why does asymmetry in price transmission occur in supply chain A in country X and not in supply chain B in country Y? The literature also does not provide (many) examples in which explanatory factors such as industry concentration are explicitly taken into account. It appears that beyond finding evidence of price asymmetries, more research is also required on explaining it.

Farm marketing strategies

In the meat sector, the price analysis found limited evidence of market power, so far, although price transmission seems far from perfect. In the final analytical part of the paper the Secretariat explores what farmers can do themselves in order to improve their returns. This part studies whether farm size and returns depend on the way farmers market their products. Marketing strategies influence farm returns in two ways: through their impact on the creation of value-added and through their impact on farmers' bargaining power. The paper focuses on the relations that farmers have with their customers, notably retailers and processors. Do farmers selling directly to retailers perform better than farmers that do not? This question is analysed by simply comparing farms selling directly to retailers with farms not selling directly to retailers. The analysis does not imply any causality between retail buying behaviour, in particular alleged retail buying power, and farm returns.

This section presents three preliminary analyses: one of them carried out by Bosmans *et al.* (2005) for Belgium; two others carried out by or for the Secretariat for the Netherlands and the seven largest EU countries before the accession of ten new Member States in 2004. All three studies are based on the micro-level databases of agricultural holdings that are available in all OECD countries in one form or the other. At this moment, there are a limited number of studies of farm marketing strategies available. The number of observations used in the studies is so low that it is not possible to draw 'hard' conclusions on the basis of the results found. Moreover, the micro-level databases of agricultural holdings are not yet tailored to the research question at hand: the effects of farm marketing strategies on farm size and farm returns. The merit of this part is primarily to point to a new direction of future research in the New Food Economy: the interface of the food supply chain and farm structure and returns based on databases which are already available to the Member States.

Labelling in the Belgian beef and pork supply chain

Bosmans, Verbeke and Van Gysel (2005) analysed differences in farm returns between farmers selling pork and beef under generic labels among which retail labels, specific labels or no label for 1999-2002. They analysed farm returns on the basis of

Belgian FADN[24] data complemented with data from an additional questionnaire. Generic labels refer to retail labels such as the Carrefour labels and public-private labels laid down by the government and farmer associations, for instance Meritus (beef) and Certus (pork). Specific labels refer to among other things organic products, rural development labels, "Bleues des Prés", Centre Ardenne and labels of co-operatives (Coprosain). Because the analysis distinguishes generic labels rather than retail labels, the analysis does not permit strong conclusions with respect to the possible absence or presence of retail power abuse. Bosmans *et al.* (2005) surveyed farmers selling high-quality meat.[25] Other farms in the database were not surveyed. Table I.10 presents the returns of farmers selling high quality livestock without a label, with a generic label and with a specific label as well as the returns of all other farmers in the FADN database: the low-quality reference population. Bosmans *et al.* (2005) provide a good example of what may be achieved in future work based on the FADN database, but as of now the study is not tailored to the problem statement at hand. Future analysis requires adaptations in terms of the questionnaire and sample selection.

For pork, the results indicate that high-quality producers selling under a generic label have a similar income per animal as low-quality producers in the reference group, while high-quality producers selling under no label or specific labels have higher returns (Table I.10). For beef, average income per animal is similar for all groups except high-quality farmers selling under specific labels who sell at higher prices.[26] So, again, the high-quality producers selling under a generic label or no label do not perform better than the low-quality producers in the reference population. Maybe, it does not pay off to sell high-quality pork to retailers, because the reference group determines the retail price. This may point to market power. However, recall that the results in this part do not allow any conclusions in terms of why market power, may exist, because the analysis simply compares farm returns without explaining them. Moreover, the number of observations is very limited. Furthermore, Table I.10 and Annex A illustrate that farm returns do not only depend on the label employed, but also on other factors, such as the number of animals sold, the fattening period, animal mortality, feed conversion and costs in general. Finally, price (average income per animal) is not the only argument which may be influenced by retail market power. Retailers may also exert market power through other arguments such as the number of animals sold and product specifications.

Table I.10. Labelling and returns in Belgian pork and beef production (2001-2002)

		Reference population	High quality producers		
			No label	Generic label	Specific label
Pork	Number of farms	191	8	11	5
	Average number of animals	679	1 007	938	212
	Average income per animal (euro)	58	67	60	69
	Average farm income (euro)	39 531	67 519	56 271	14 673
Beef	Number of farms	65	6	22	7
	Average number of animals	51	60	105	104
	Average income per animal (euro)	503	493	507	624
	Average farm income (euro)	48 056	47 387	56 397	57 035

Source: Bosmans, Verbeke and Van Gysel (2005).

Grower associations in Dutch horticulture

In Dutch horticulture, product-specific grower associations emerged during the 1990s alongside the old multi-product marketing co-operatives. Growers founded product-specific associations performing a range of marketing activities, usually in direct co-operation with wholesale and retail traders. The new grower associations establish their own brands, set up quality mechanisms meeting retail standards, negotiate prices and other transaction conditions and offer a range of services, such as packaging, storage and other logistic services. Many of the new product-specific grower associations are independent from the old multi-product marketing co-operatives, but not all of them. Moreover, not all growers are affiliated to one of the new grower associations. This raises a number of questions. What kinds of growers are associated with the new grower organisations? What kinds of growers are still associated with the old marketing co-operatives? How do the various types of growers perform in terms of their marketing strategies and their returns?

At this stage, the Secretariat had conflicting evidence from two sources. Table I.11 compares independent growers and growers within independent grower organisations on the one hand[27] with growers within the old marketing co-operatives on the other hand on the basis of Dutch FADN data. Generally, growers within the independent organisations are more advanced in their marketing strategies, in particular their collaboration with retailers (Van der Kroon *et al.,* 2002). However, because the data do not distinguish precisely which growers collaborate with retailers, either on their own or through a grower association, strong conclusions with respect to possible retail power abuse are not possible. The table suggests that there is no significant difference in terms of grower size and returns between growers selling through independent grower associations and growers selling otherwise. On average, the growers belonging to the independent grower associations are somewhat bigger and have somewhat higher returns.

Table I.11. Structure and returns in Dutch horticulture (2003)

		Independent growers and growers within independent producer organizations	Growers associated with marketing co-operatives	Statistical significance of differences
Averages of absolute values 2003	Number of growers	19	21	
	Total assets (Euro)	2 138 519	1 972 974	No
	Total revenues (Euro)	1 035 226	1 005 970	No
	Grower income (Euro)	189 069	161618	No
	Grower income as a share of total revenues (%)	17.3	16.6	No
Averages of per cent changes 2002-2003	Number of growers	11	15	
	Size (NGE)	11.0	-11.0	No
	Total assets (Euro)	26.7	19.5	No
	Total revenues (Euro)	47.3	28.4	No

Source: LEI. Calculations: OECD. NGE = Dutch Size units.

On the basis of aggregate data, however, Annex A points out that grower size and marketing activities do depend on the type of association growers are associated with. Annex A shows that the old marketing co-operatives lose market share and that the average size of their growers is relatively low. Moreover, the average size of growers associated with the largest marketing co-operative, The Greenery, does not really grow. Apparently, the sample from FADN is too small to establish differences between growers within and outside the old marketing co-operatives

Production contracts in European meat supply chains

The FADN records whether livestock producers operate under production contracts or not. Under production contracts farmers do not assume the risk of rearing or fattening animals.[28] Production contracts are one of the tightest vertical co-ordination mechanisms the meat processing industry (and the feed industry) uses to tie their suppliers (or their customers). There are other vertical co-ordination mechanisms as well, but the FADN does not contain data on other mechanisms. The FADN data may be used to analyse whether the importance of production contracts is growing and whether farmers employing these contracts are bigger than farmers who do not. In theory, one may investigate farm returns as well, but this is not straightforward given the fact that farmers with production contracts do not assume economic risk, at least for the animals under contract.

Table I.12 shows that production contracts are becoming more important throughout the EU, although there are exceptions. Moreover, contracting is not only substantial in the most tightly vertically organised supply chain (poultry) but also in the pig supply chain and to a lesser extent the specialised beef supply chains (calves and heifers). The data in Table I.12 are particularly noteworthy, since they refer to population data, *i.e.* all farmers. Table I.12 also shows that production contracts are predominant in the US poultry supply chain and that their importance is rapidly increasing in the US pork supply chain.[29] Table I.13 shows that farmers with production contracts are bigger than farmers without in the poultry and specialised beef supply chains, but not in the pork supply chain, at least not in all countries. Contrary to Table I.12 Table I.13 refers to sample data. Combining both results, one may conclude that with production contracts becoming more important farm size may be expected to grow in the future. It also holds for the US that farms under production (or marketing) contracts are large on average than farms without contracts (ERS 2004).

The analysis in this part shows that the available micro-level databases available in OECD countries may be used to trace the impact of certain developments in the supply chain on farm size, marketing strategies and returns. In order to do so properly, (limited) additional questionnaires are necessary. Moreover, the number of observations per industry may need further attention.

Table I.12. Farms with production contracts (Percentage of all farms)

	Cattle		Calves and heifers for beef		Pigs		Poultry	
	1990	2002	1990	2002	1990	2002	1990	2002
Belgium	3.3%	5.8%	9.8%	10.4%	7.7%	15.7%	18.6%	11.7%
Germany *	2.5%	2.2%	3.9%	2.5%	1.3%	2.2%	3.6%	5.1%
Spain	0.8%	1.4%	0.2%	n.a.	2.3%	11.1%	13.1%	25.4%
France	1.9%	4.8%	4.2%	10.3%	5.8%	18.9%	6.7%	17.7%
Italy	0.1%	0.9%	0.1%	0.6%	0.1%	1.9%	0.1%	9.3%
Netherlands	5.0%	14.4%	6.6%	34.8%	4.9%	15.5%	5.2%	9.4%
United Kingdom	2.2%	3.0%	1.4%	1.2%	4.5%	30.8%	11.2%	30.6%
United States	14.7%	17.7%	n.a.	n.a.	28.7%	53.4%	81.2%	81.3%

na = not available. German data refer to 1995 and 2002 rather than 1990 and 2002. US data refer to 1994-1995 and 2001.

Source: EU, ERS (2004); processing OECD.

Table I.13. Average size of farms with and without production contracts (LU; Livestock Units)

	Cattle		Calves and heifers for beef		Pigs		Poultry	
	Contract	No contract	Contract	No contract	Contract	No contract	Contract	No contract
Belgium	56	82	n.a.	n.a.	173	212	n.a	n.a.
Germany	70	69	n.a.	n.a.	75	88	n.a	n.a.
Spain	38	34	n.a.	n.a.	340	104	370	163
France	70	70	32	5	124	173	329	98
Italy	96	34	67	4	153	76	282	77
Netherlands	80	85	145	15	160	286	n.a.	n.a.
UK	58	101	n.a.	n.a.	200	309	474	180

n.a. = not available. LU = Livestock Units, a EU scale weighting all possible livestock activities.

Source: EU; processing OECD.

Endnotes

1. An overview of recent OECD studies on market structure and market power can be found in Box I.1.

2. www.auchan.fr and www.tesco.com

3. It would be good to elaborate this fact for food supply chains. What does addressing inefficiencies in supply mean for a sector in which lags in production and uncertainties in demand and supply are important? The literature makes a difference between "produce-to-order" and "produce-to-stock" models. The change in retailer logistics satisfies the demands of the 'produce-to-order' model. However, in agriculture, the 'produce-to-stock' model is to some extent inherent to the production technology (Carlton and Perloff, 2005).

4. USDA defines "captive supplies" of cattle to be cattle owned by packers more than 14 days before delivery and those committed to a packer under a forward contract or marketing agreement at least 14 days before slaughter (ERS 2004).

5. Retail concentration has not increased in Brazil in the 1990s (Farina *et al.* 2005). On the contrary, independent retailers gained market share.

6. An industry may be considered concentrated when the top 4 suppliers control say at least 40% of supply (Shepherd 1997).

7. Note, however, that farm income depends on both revenues and expenses.

8. The farm-to-retail price spread is an imperfect indicator of farm returns. Farm returns are more properly assessed, when farm income is compared with the amount of capital and labour employed in agricultural production. The farm-to-retail price spread rises, if farm prices fall or retail prices rise. An increase in the farm-to-retail price spread does not affect farm returns if the rise of the price spread is caused by an increase in retail prices and both farm prices and the inputs used in farming are unchanged. An increase in the farm-to-retail price spread also does not affect farm returns if the rise in the price spread is caused by a decrease in farm prices and if this decrease is attended with a decrease in the amount of capital or labour employed in agriculture. Changes in factor productivity may indeed cause a simultaneous decrease in both farm prices and the amount of capital and labour employed in agriculture. Long-run developments in the farm-to-retail price spread are primarily explained by differences in productivity developments between the subsequent stages of the supply chain and by changes in consumer demand [see Zachariasse and Bunte (2003) for a more detailed discussion].

9. Note that numbers in Table I.8 refer to beef, pork and poultry processing separately, while numbers in Table I.2 refer to all meat processing.

10. The meat processing industry has other less important and profitable distribution channels for meat and side products (*e.g.* leather) as well, such as the pet food and the clothing industry.

11. Retail competition is more likely to differ from one local market to the other, if marketing decisions are tailored to local markets rather than decided upon at national levels. This depends on the way decision making processes within retail companies are institutionalised. There are wide differences within these institutions.

12. Recently Carrefour pulled out of the Czech food retail market.

13. For the Netherlands and Japan, there are also data on the prices of other inputs for part of the period analysed. However, the variation in the prices recorded is too low to consider extending the analysis to these inputs.

14. The estimates of the market power estimate for beef in Japan and Canada are much lower when the wage development is included in the estimations (Chapter 3). The Secretariat does not have data on Czech wage development over the period concerned as yet.

15. In economics, a product is categorised as being necessary if the income elasticity is below 1 and as being luxury if the income elasticity is above 1. The budget elasticities found in the analysis indicate that beef is the luxury item within meat and that pork and poultry are the necessary items. However, hamburger meat is often used as a loss leader in North America, so beef as a whole is not a luxury item but rather the high quality cuts.

16. This result depends on the shape of the demand and supply functions, more in particular on the fact that consumer demand is a downward sloping function and that supply is an upward sloping function. Both conditions reflect a static rather than a dynamic view of price competition, but as such they are not restrictive.

17. The latter argument is often mentioned in popular discussions and assessed in the literature. One may wonder to what extent the argument is valid. If consumers value low prices more than they value product quality and variety, low price strategies satisfy consumer needs.

18. When using aggregate data, product differentiation and economies of scale are not taken into account. Moreover, retailers are not differentiated in terms of size and product assortment and simplifying assumptions are made with respect to retailer expectations with respect to rival behaviour.

19. The empirical analysis was carried out in co-operation with Professor Barry Goodwin of North Carolina State University.

20. Farm to wholesale price transmission analyses the impact of a price shock at the farm level on prices at the wholesale level (taking price dynamics throughout the entire supply chain into account).

21. Frey and Manera (2005) note that among 83 estimated models considered in their survey only 11 models show no evidence of any kind of asymmetry. Peltzman (2000) argues that asymmetric price transmission is prevalent in the majority of producer and consumer markets.

22. Interestingly, price transmission is quite different in case of retail to wholesale price transmission. In this case, contrary to wholesale to retail price transmission, price changes are better transmitted in the poultry supply chain compared to the beef and pork supply chains.

23. For example, studying the impact of different degrees of vertical integration on price transmission would require substantial analytical and data collection efforts. *A priori*, it could be expected that the use of contracts may create certain inertia in the supply

chain: prices may be fixed in contracts. On the other hand, the visible hand of the fully integrated supply chain may be expected to transmit price signals more rapidly. Integrations can take price decisions for more than one level in the supply chain.

24.   Farm Accountancy Data Network.

25.   The study identifies farmers as being high-quality producers if they participate in any (at least partially) private initiative implying product standards such as supermarket prescriptions (private standards) or organic farming.

26.   In 1999 and 2000, beef producers selling under no label had a lower farm income per animal than producers selling under retail label and the reference population did.

27.   The data for 2003 do not allow a subdivision between independent growers and growers within independent grower associations. Data for 2005 will. By the way, some of the grower associations that are independent from the old marketing co-operatives may actually group growers delivering fresh produce to large retailers such as Albert Heijn.

28.   To be more precise, farmers do not assume the economic risks associated with buying and selling livestock. Livestock is owned by the contractor, usually the processor and/or the feed company, and the farmer is rewarded for providing labour and other services. Farmers do face economic risks and still go bankrupt, *e.g.* if they are not able to cover their expenses or if their customer goes bankrupt.

29.   US data refer to a broader definition of production contracts.

CHAPTER 2.

THE MEAT SUPPLY CHAIN[1]

This chapter provides an extensive description of the supply chain structure for beef, pork and poultry in the four case countries: Canada, the Czech Republic, Japan and the Netherlands. The description is provided as background material for the analysis of pricing behaviour within the respective supply chains. In a later stage, possible differences in pricing behaviour may be related to differences in supply chain structure. This chapter focuses on elements which may influence the bargaining position of actors in the supply chain, such as market definition, concentration and vertical co-ordination.

Canada

The Canadian beef and pork supply chains are well integrated into the North-American market. The supply managed poultry supply chain on the other hand is somewhat sheltered from US competition. Canada's meat and meat products industry is the largest food manufacturing industry in Canada and accounts for 15% of national agri-food exports. Concentration is substantially higher in Canadian processing and retailing than it is in the Czech Republic and Japan. Farm size increases rapidly as it does in Japan and the Netherlands.

The supply chain

The Canadian beef and pork supply chains and to a lesser extent the poultry (chicken and turkey) supply chain are economically integrated with those of the United States. Canada exports 30% of its cattle and 50% of its beef and 25% of its pigs and 50% of its pork, primarily to the US (Figures II.1-II.3). The 1989 Canada-US Free Trade Agreement (CUSTA) played a major role in this integration. Under CUSTA, any tariffs or quotas on two-way trade of cattle, beef, hogs and pork have been phased out.

The supply-managed poultry supply chain is an exception. Canadian poultry farmers operate under a system of supply management which is managed at the provincial level. Within this system, production levels are set to meet domestic market requirements of processors, further-processors, and restaurants. As a result, producer prices and incomes are relatively stable. Canadian imports of poultry are regulated by tariff-rate quotas. Over-quota tariffs are high enough to control imports to the agreed-to NAFTA access levels. Canada hardly exports poultry and actually is a net importer of poultry.

North-American trade patterns are to a large extent explained by the geographic location of production and consumption. In Canada, beef cattle farming is concentrated in western Canada (about 75% of the herd), away from the main consumption centres of the country in eastern Canada. This has as a consequence for Canadian-US trade that Canada

ships beef from western Canada to western US, while US mid-western packers export their beef to eastern Canada. A similar pattern may be observed for pork.

These trade patterns are influenced by recent changes in trade and agricultural policies. The elimination of the Western Grain Transportation Act (WGTA) in 1995 had a large impact on agricultural production in Canada. Without the WGTA, grain produced in western Canada could no longer be transported to export ports at subsidized freight rates and this created a strong incentive for western grain farmers to diversify into mixed farms such as grain-cattle farms and pig production.

Figure II.1. Canadian pork supply chain (2004)
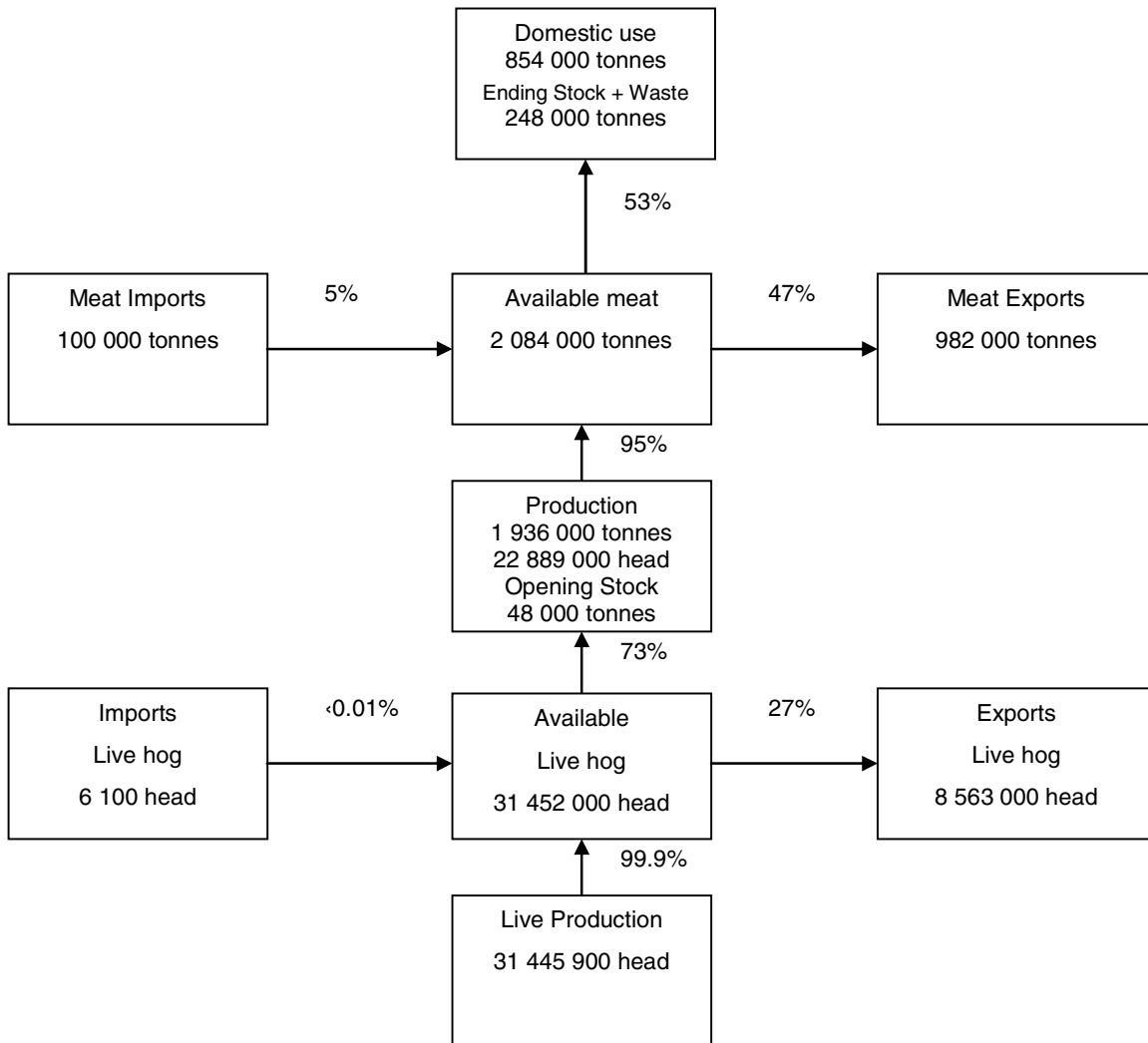
atalogue no. 23-012-XIE

**Figure II.2. Canadian beef supply chain (2002 – pre-BSE),
carcass weight equivalent (includes veal)**

```
                        ┌─────────────────────┐
                        │   Domestic use      │
                        │   994 000 tonnes    │
                        │                     │
                        │   Ending Stock      │
                        │   33 000 tonnes     │
                        └─────────────────────┘
                                  ↑
                                 63%

┌─────────────────┐          ┌─────────────────────┐    37%    ┌─────────────────┐
│  Meat Imports   │   20%    │   Available meat    │  ──────▶  │  Meat Exports   │
│ 315 000 tonnes  │ ──────▶  │  1 642 000 tonnes   │           │ 615 000 tonnes  │
└─────────────────┘          └─────────────────────┘           └─────────────────┘
                                  ↑
                                 80%
                        ┌─────────────────────┐
                        │   Production        │
                        │  1 294 000 tonnes   │
                        │  3 836 700 head     │
                        └─────────────────────┘
                                  ↑
                                 70%

┌─────────────────┐          ┌─────────────────────┐    30%    ┌─────────────────┐
│    Imports      │   2%     │  Available animals  │  ──────▶  │    Exports      │
│ 124 700 head    │ ──────▶  │   5 524 800 head    │           │ 1 688 100 head  │
└─────────────────┘          └─────────────────────┘           └─────────────────┘
                                  ↑
                                 98%
                        ┌─────────────────────┐
                        │   Production        │
                        │   5 400 100 head    │
                        └─────────────────────┘
```
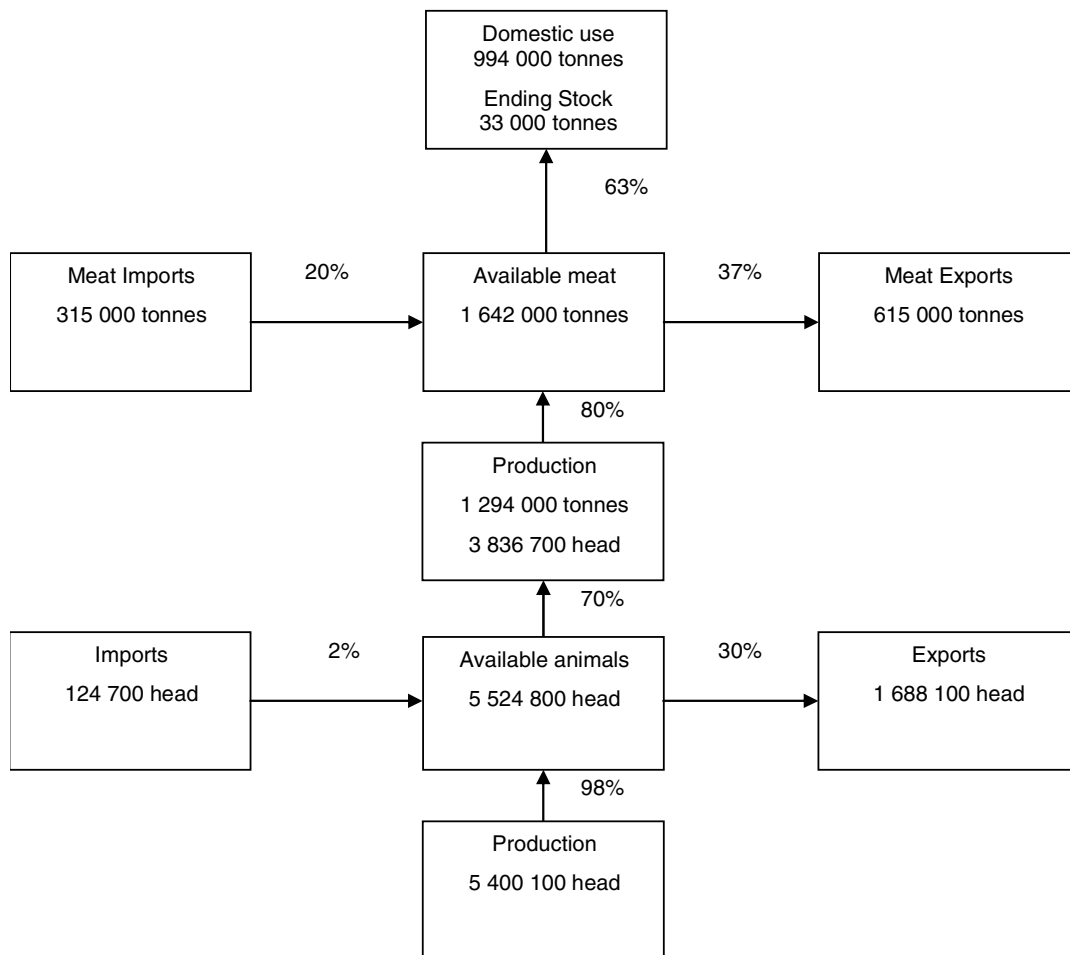
Source: Based on Statistics Canada, Catalogue no. 23-012- XIE, Statistics Canada, AAFC

Figure II.3. Canadian poultry supply chain (2003), eviscerated weight
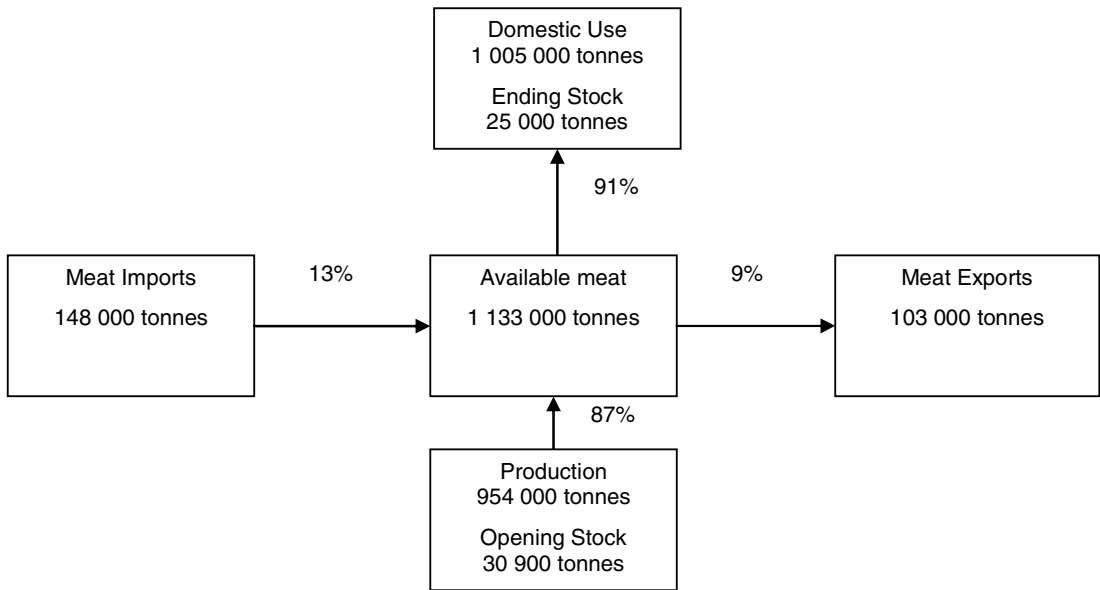
Source: based on Statistics Canada Catalogue no. 23-015.

Animal production

Animal production still takes place on small-size farms. There are still 68 060 cattle farms in Canada as well as 6 165 pig farms and 2 850 chicken farms (Statistics Canada). Most cattle farms are cow-calve farms. Concentration in feedlots is substantially higher. For instance, in 2004 there were only 212 feedlots in Alberta. Nevertheless, the number of farms falls rapidly. For instance, the number of pig farms decreased from 55 000 to 6 165 over the last twenty years. Chicken production is the exception. The number of Canadian chicken farmers has increased by about 20% since the early 1990s, from 2 394 producers in 1990 to 2 850 in 2002, among other things due to the growth in poultry consumption and production.

Table II.1. Farms structure and production in Canada (2004)

	Number of farms	Production	
		Tonnes	Change 1990-2004
Cattle	68 060	1 494 000	32%
Pig farms	6 165	2 292 000	94%
Chicken farms	2 850	1 115 000	54%

Source: Statistics Canada, AGLINK.

Canadian animal production has grown significantly since 1990. Beef production increased with a third, pork production almost doubled and poultry production increased with more than 50%. This growth is due to, among other things, to the elimination of the WGTA and to the growth of poultry consumption.

Given the decrease in the number of farms and the growth in production, farm size increases rapidly. Cow-calf operations almost doubled in size from 1976 to 2001 from 27 heads to 51 heads. In pig production, average farms size grew from 177 to 905 pigs from 1981 to 2001. In pig production, 90% of Canadian production is accounted for by mid- and larger-sized hog farms (528 heads and more), and there is continuing trend towards farms of this size. Consolidation of pig production has been motivated by the need for greater efficiency achieved by larger-scale operations. In addition to the cost benefits of larger farms, a factor in this structural change is the expectation of consumers for high quality standards. Larger pig producers can be better positioned to meet demands for uniform size, fat-to-meat ratios and other quality standards. As well, processors' preference for coordinating with fewer large producers than many smaller ones may be influencing this structural change.

The processing industry

Concentration in Canadian meat packing is substantial, among other things because there are substantial economies of scale in meat packing (Table II.2). The two largest Canadian beef packers (Cargill and Tyson)[2] account for some 75% of Canadian federally inspected slaughter capacity. In western Canada, both companies plus a third one (XL Beef) account for at least 95% of western Canada's slaughter capacity. In pork processing, 74% of total Canadian federally inspected slaughter capacity is accounted for by the three largest firms (Olymel, Maple Leaf and Quality Meat Packers). In the western provinces, the packing sector is more concentrated and the four largest firms have an estimated 87% of capacity in the region. In poultry processing, concentration is somewhat lower, probably due to the provincially arranged system of supply management. The five largest chicken processors in Canada (Coopérative fédérée de Québec, Lilydale Poultry Co-operative, Maple Leaf Poultry, Exceldor and Maple Lodge Farms) process about 55% of chickens slaughtered in Canada.

The role of the Canadian meat packing industry in the North American meat supply chain can only be assessed when its competitive position relative to the US meat packing industry is taken into account. This holds in particular for the Canadian hog packing industry. US packers have been contracting more with hog producers to secure a steady and uniform supply of high quality hogs. Access to a more steady supply has encouraged the US processing sector to modernize plants and use slaughter capacity more intensively. Large US packers have cost advantages that allow them to pay higher prices for hogs, and draw Canadian slaughter hogs to the US. The stock of hogs in the US is about four times that of Canada, and processing plants in the US are large relative to those in Canada. In 1996, only three of the 37 US plants had capacities less than Canada's largest plant, and Canada's largest plant is less than half the size of 13 US plants.

Vertical integration is predominant in the poultry supply chain, but also occurs in the beef and pork supply chains. Vertical integration is applied in order to secure constant supplies to the processing industry as well as in order to guarantee product quality. Although beef packers are vertically integrated into feedlot operations, cash sales are still the primary means of marketing slaughter cattle. In the pork supply chain, contracts are being used to provide price stability and to coordinate the supplies of hogs to processors. However, some pig producers also use the futures market or forward pricing mechanisms to reduce price variation.

**Table II.2. Number and shares of slaughterhouses in Canada
(federally inspected plants)**

2004

	Cattle			Pork			Poultry	
Slaughters per slaughter house	Number of slaughter houses	Shares	Slaughters per slaughter house	Number of slaughter houses	Shares	Slaughters per slaughter house(t)	Number of slaughter houses	Shares
10 000-25 000	10	0.0	100 000-500 000	27	14.1	< 10 000	45	8.4
25 000-75 000	13	6.5	500 000-1 000 000	10	32.3	10 000-30 000	19	39.8
> 75 000	6	93.5	> 1 000 000	6	53.6	30 000-40 000	4	12.9
						> 40 000	7	38.9
Total	29	100.0	Total	43	100.0	Total	75	100.0

Source: Statistics Canada.

Consumption and retail

Canadians currently consume approximately 78 kg of meat annually (carcass weight basis). Since the 1970s, there is persistent shift from beef to poultry consumption. Beef consumption has declined with more one third from 36 to 22 kilos since 1975, while poultry consumption has doubled in the same period to 36 kilos. Pork consumption has been more or less constant at 20 kilos.

Although most poultry is distributed through retail outlets (62%), the share of food service is significant (38%). Within food service fast food is the main distribution channel (23%) followed by full service restaurants (9%) and hotels and institutions (6%). Chicken consumption by full service restaurants and hotels and institutions has changed little in the past several years while fast food and retail consumption have been increasing.

The food and beverage segment of the Canadian retail sector represents about one-fifth of national retail sales, and is the most concentrated among the major retail segments. The five largest supermarket chains account for about 90% of total supermarket retail sales. Loblaws dominates the supermarket industry, followed by Sobeys, Safeway, the Metro Group, and A&P. Wal-Mart is becoming an important retailer in the Canadian market; this is reducing prices and margins in the food segment and is also a factor in the significant structural changes occurring among traditional supermarkets. As large general merchandise retailers have been moving into the food business, many supermarkets are likewise diversifying into a broader range of products including higher-value, prepared foods, pharmaceuticals, and various household items. While Canadian supermarkets have experienced sales growth from this diversification, it is expected that this could wane as competitors such as general merchandisers and warehouse stores capture more of the market for food sales.

The Czech Republic

The Czech meat supply chain differs in important respects from the meat supply chains in Canada, Japan and the Netherlands. International trade was relatively less important until 2000, but has been growing rapidly ever since. Industry concentration levels differ from the levels in the other three countries studied. Farm size is relatively big. Food processing and retail on the other hand are less concentrated than in the other three countries studied. Both facts are related to the centrally-planned economic structure which was maintained until 1989 and the transformation to a market economy in the period afterwards.

The supply chains

Up to 2004, the Czech Republic imported and exported relatively little live animals and meat. Imports make up 10-20% of domestic supply and exports make up 7-23% of domestic supply (Figures II.4-II.6). The Czech meat supply chain has been primarily oriented to its home market, but this may change since both imports and exports are growing rapidly (Table II.3). At the import side, meat imports are more important than the import of live animals. At the export side, the export of live animals exceeds meat exports. The Czech Republic's main trading partners are the EU, the non-EU Central European countries and Brazil (poultry).

Table II.3. Exports and imports of live animals and meat in the Czech Republic (units)

	Exports		Imports	
	2000	**2004**	**2000**	**2004**
Beef and veal live	8 811	25 758	5 063	2 261
Pork live	2 328	55 239	55	569
Poultry live	3 731	26 433	600	3 702
Beef and veal meat	1 476	10 891	3 939	8 910
Pork meat	4 054	14 479	13 526	62 989
Poultry meat	7 479	25 040	16 253	54 876

Source: VUZE Czech Republic.

**Figure II.4. Czech beef supply chain
(2004)**
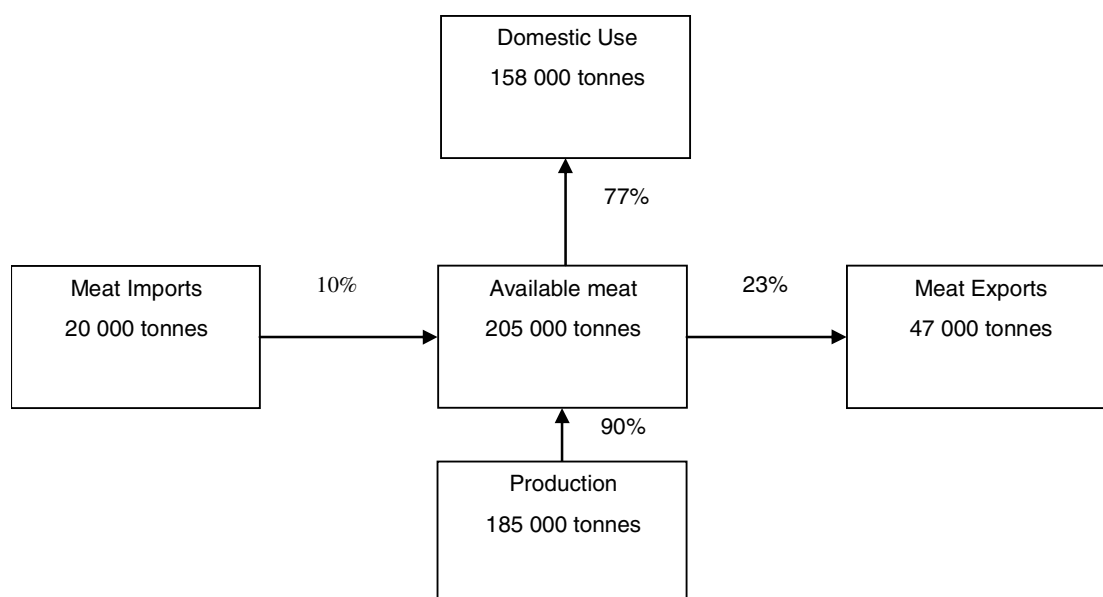
**Figure II.5. Czech pork supply chain
(2004)**

```
                         ┌─────────────────┐
                         │  Domestic Use   │
                         │ 595 000 tonnes  │
                         └─────────────────┘
                                  ▲
                                 93%

┌─────────────────┐           ┌─────────────────┐           ┌─────────────────┐
│     Imports     │   15%     │  Available meat │    7%     │  Meat Exports   │
│  93 000 tonnes  │ ───────▶  │  640 000 tonnes │ ───────▶  │  45 000 tonnes  │
└─────────────────┘           └─────────────────┘           └─────────────────┘
                                  ▲
                                 85%
                         ┌─────────────────┐
                         │   Production    │
                         │ 547 000 tonnes  │
                         └─────────────────┘
```
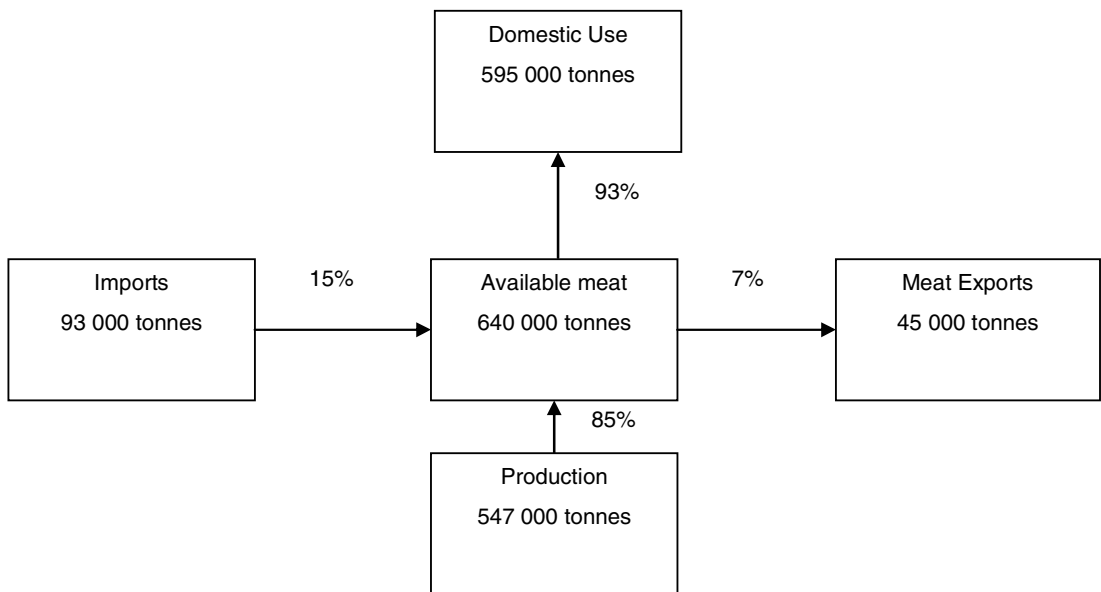
**Figure II.6. Czech poultry supply chain
(2004)**

```
                         ┌─────────────────┐
                         │  Domestic Use   │
                         │ 335 500 tonnes  │
                         └─────────────────┘
                                  ▲
                                 87%

┌─────────────────┐           ┌─────────────────┐           ┌─────────────────┐
│     Imports     │   20%     │  Available meat │   13%     │     Exports     │
│  76 500 tonnes  │ ───────▶  │  386 500 tonnes │ ───────▶  │  51 000 tonnes  │
└─────────────────┘           └─────────────────┘           └─────────────────┘
                                  ▲
                                 80%
                         ┌─────────────────┐
                         │   Production    │
                         │ 310 000 tonnes  │
                         └─────────────────┘
```
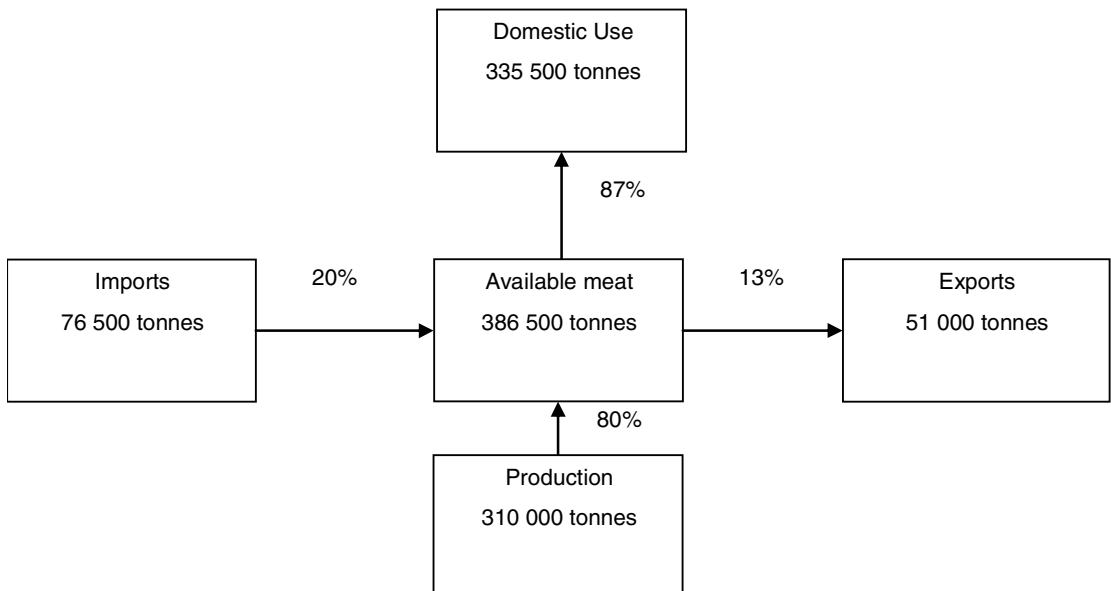
Animal production

Since 1989, the agricultural sector in the Czech Republic has undergone a difficult path of transformation. This is particularly true for meat production. Restructuring has led to a significant reduction of livestock. In the 1990s, the amount of cattle fell to 63% of their 1992 level, the number of dairy cows fell to 53% of their 1992 level and the number of pigs fell to 78% of their 1992 level. On the other hand, poultry production has increased by more than 70% over this period. Nevertheless, pork production remains the second most important agricultural sector with 16.1% of total agricultural output, far exceeding beef (7.5% of output value) and poultry (4.6% of output value).

The privatization of Czech agriculture, which in the pre-transition period was dominated by large-scale collective and state farms, has led to the emergence of predominantly three new forms of farming: the transformed cooperatives, other companies (joint stock or limited liability) and individual farms (family or otherwise). In dairy and beef production, cooperatives are still predominant. They control 40% of Czech beef and veal production. Joint-stock and limited-liability companies control 35% the production and privately managed (family) farms only 18% (CSO, 2001). In poultry and pork production, co-operatives are far less important. Joint-stock and limited liability companies on the other hand control 75% of Czech production.

Animal production still takes place on large-size farms. In the case of beef, two-thirds of all cattle are kept in enterprises with more than 1 000 hectares and only 12% in companies with less than 100 hectares. In the case of pork, about 60% of all pig production is carried out in barns with a stocking capacity of more than 2 000 animals. The concentration of production is steadily increasing and currently about 50 piggeries supply one-third of all slaughter animals. In poultry production, units with capacity of 20 to 25 thousand chicken are continuously being replaced by much larger operations. Currently the majority of production is realised on farms with capacity between 50-100 thousand chickens.

Vertical integration becomes more important in the pork and poultry supply chains. Pork production is increasingly specialized and there are many companies focusing on either pig production or pig feeding. Producers of piglets have typically long term supply contracts with producers of slaughter pigs. Poultry producers usually have one year contracts with poultry processors. Vertical integration not only refers to producers and processors, but also to suppliers of one-day old chicks and suppliers of feed.

Meat Processing

The Czech food industry accounts for around 13% of the sales of the national processing industry. Within the food industry, meat and meat products have a share of 22% and belong to the most important food parts of the industry. As in agriculture, the transformation to the market economy required significant restructuring in Czech food and meat processing. The restructuring was further enhanced by the accession conditions agreed upon with the European Union. Accession led to the exit of many meat processing plants, since they were not able to meet the EU regulations. A substantial part of Czech meat processors is still not allowed to export to other EU countries (Table II.4). Following the privatisation process, there is a dual industry structure with very small operations on one hand and some large operations on the other hand. Meat processing in the Czech Republic remains relatively unconcentrated. For example, the ten largest

slaughter pigs processing plants account for only 27% of total production. Poultry meat processing is much more concentrated with five plants producing 58% of the total.

Table II.4. Number of meat processors in Czech Republic (2005)

Name	Approved by the EU	Approved for the domestic market
Fresh meat: slaughter houses	110	165
Fresh poultry meat: slaughter houses	24	20
Meat products	154	284

Source: Czech Republic.

Consumption and distribution

The share of food in the total expenditures has declined from 26% in 1993 to 19% in 2004. The share of per capita meat and meat products expenditures in total food expenditures has remained relatively stable, but decreased somewhat from 29.5% in 1993 to 28% in 2004. The fall in pork and in particular beef consumption has been compensated by an increase in spending on poultry, fish and meat products. Czech consumers are rapidly adopting western style diets and habits. There is a continuous trend towards healthier products, such as fruit, vegetables, fish and poultry, away from red meat. In addition, people have more disposable income but less time to go shopping, so that frozen and ready-made meals are growing in popularity together with a once-a-week food shopping habits.

The most profound changes in the Czech food supply chain have taken place at the retail level. The retail industry concentrates and consolidates rapidly and continues to do so. The top four retailers control 33% of retail sales and the top ten nearly 60% which is substantial for Central European standards. There is also a lot of dynamics in the market shares of the respective distribution channels. The market share of hypermarkets increases rapidly at the cost of small retailers. The latter saw their market share shrink from 49% in 1997 to 24% in 2001.

Just like food retail, the food service sector is also likely to accelerate its development. About 80% of restaurants and institutions still prepare meals themselves and buy ingredients from suppliers without the delivery or other service option (cash and carry suppliers). There is very limited wholesale sector specialising in the food service sector. It could be expected that with growth in tourism and per capita disposable income in the Czech Republic, the food service sector will become increasingly important part of the meat supply chain.

Japan

The Japanese meat supply chain depends more than the other three described in this chapter on imports. Although Japanese meat consumption is low, the imports of beef and pork account for 50% of Japanese demand. As a consequence, Japanese production is relatively low, also because Japan exports little meat. Issues related to food safety probably have a more profound effect on Japanese demand than they do in Canada, the Czech Republic and the Netherlands. Food safety scares may lead to dramatic changes in consumer behaviour and import patterns, also due to import policy.

The supply chain

Figures II.7-II.9 illustrate that the Japanese meat supply chain is not export oriented and meat imports are substantial, in particular beef and pork imports. There is little trade in live animals, among other things due to import restrictions and because Japan does not have many trade partners with a comparable state of development, *e.g* OECD countries, in its neighbourhood.

Veterinary crises in the 2000s led to significant changes in Japan's import sourcing policy. Because of BSE in American beef, the import of beef from the US was banned in December 2003. Japan switched from US to Australian beef. Due to Aviary Influenza in 2004, Japan switched its poultry sourcing from Thailand and Chine to Brazil.

In reaction to the veterinary crises, Japanese consumption patterns changed significantly as well. The Japanese decreased their beef and poultry consumption by 26% and 8% respectively and increased their pork consumption by 13%.

Figure II.7. Pork supply chain in Japan (2003)
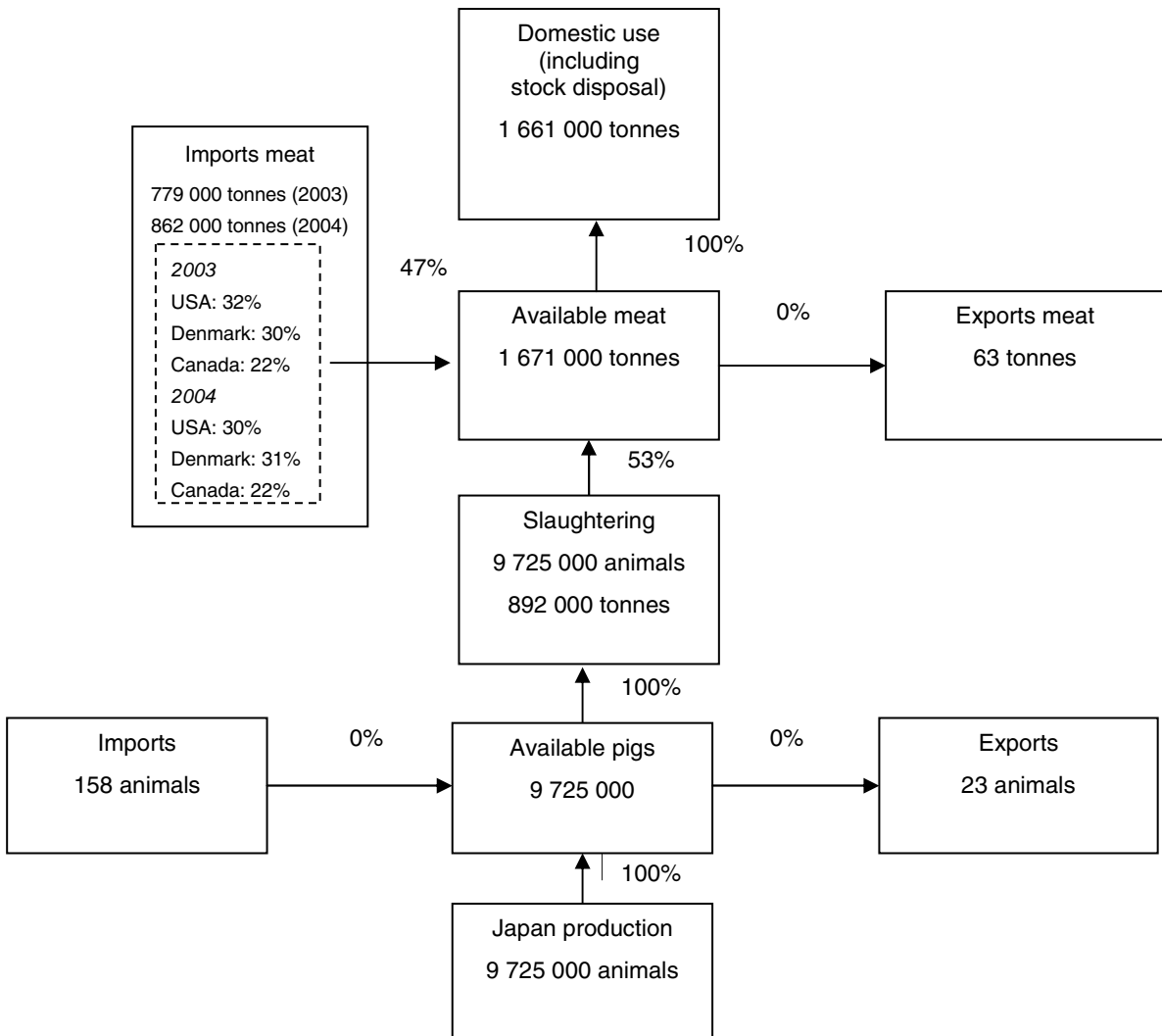
**Figure II.8. Beef supply chain in Japan
(2003)**
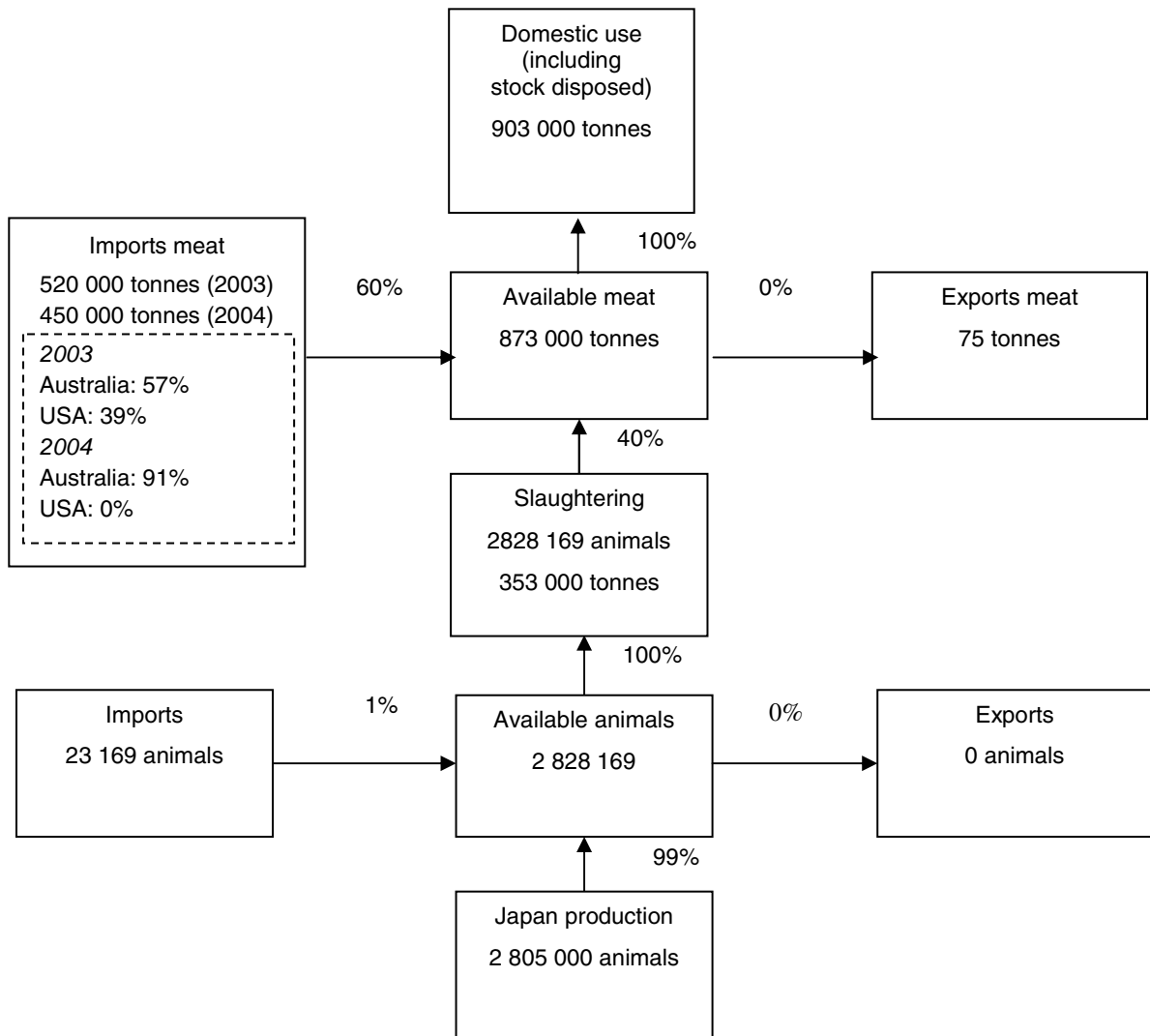
**Figure II.9. Poultry supply chain in Japan
(2003)**

Domestic use
(including
stock disposed)

1 706 000 tonnes

Imports meat

442 000 tonnes (2003)

371 000 tonnes (2004)

2003
Brasil: 45%
USA: 10%
Thailand: 34%
China: 10%
2004
Brasil: 88%
USA: 9%
Thailand: 0%
China: 0%

26%

100%

Available meat

1 681 000 tonnes

0%

Exports meat

2 848 tonnes

74%

Slaughtering

1 239 000 tonnes

100%

Imports

955 890 animals

1%

Available broilers

104 684 890 animals

0%

Exports

0 animals

99%

Japan production

103 729 000
animals

Animal production

Japanese animal production is carried out on small-scale farms. This holds especially for beef production (Table II.5). However, the number of farms involved in meat production falls rapidly. From 1991 to 2004, the number of farms dropped with 50% for poultry, with 60% for cattle and even with 75% for hogs. Animal production is more stable. The amount of cattle for beef production has risen slightly from 1990 to 2004; the number of hogs diminished with 14%. The number of chickens has shown a more dramatic decrease in that period (30%). However, the number of poultry shipments has fallen with only 18% because the feeding period has been reduced. The recent incidents of Aviary Influenza (January 2004) had no significant impact on the poultry population.

In line with these developments, farm size rises rapidly. In 2004, the 27.2% largest producers of fattened pigs (more than 1 000 pigs) produced 74.7% of all fattened pigs. In addition, the 57.1 % largest producers of poultry (more than 100 000 animals) produced 89.0% of all poultry.

Table II.5. Farm structure and production

	Number of farms			Number of animals		
	1991	**2004**	**%Change (91-2004)**	**1991**	**2004**	**% Change (90-2004)**
Cattle						
Dairy production	59 800	28 800	-51.84	2 068 000	1 690 000	-18.28
Beef production	232 200	93 900	-59.56	2 702 000	2 788 000	3.18
Hogs	36 000	8 880	-75.33	11 335 000	9 724 000	-14.21
Farms with sows	31 500	7 700	-75.56	1 111 000	918 000	-17.37
Farms with fattening pigs	23 00	7 420	-68.15	9 246000	8 052 000	-12.91
Poultry (broilers)	5529	2 778	-49.76	150 445	104 950	-30.24

Source: Ministry of Agriculture, Forestry and Fisheries.

Processing

In Japan, slaughtering is performed by a relatively large number of slaughter houses (Table II.6). Most slaughter houses for cattle and pigs are owned by either local authorities or co-operatives (69%). Corporate companies account for a minor part of the total amount of slaughter houses (14%). So, concentration in Japanese processing seems low at the processing level. However, it may be high at the regional level, especially if farmers are tied to one or a limited number of processors. Concentration in the meat products industry is high. Concentration is also low at the national level in poultry processing. The top three processors control 17% of poultry supply. Contrary to cattle and pig slaughtering, local authorities play a minor role in poultry processing. The top five companies (Nippon Meat Packers, Itoham Foods, Prima Meat Packers, Marudai Food and

Starzen) have a joint market share of more than 55%. These companies are also vertically integrated in feed production and slaughter houses.

Table II.6. Number and market shares of slaughterhouses in Japan

Cattle			Pork		
Slaughters per slaughter house	Number of slaughter houses	%	Slaughters per slaughter house	Number of slaughter houses	%
< 1 000	41	1	<20 000	48	1
1 000-5 000	38	9	20 000-50 000	31	7
5 000-10 000	43	25	50 000-100 000	32	14
> 10 000	43	64	> 100 000	64	78
Total	165	100	Total	175	100

Source: Ministry of Agriculture, Forestry and Fisheries.

Consumption and distribution

The Japanese consumer eats about 50 kilos of fresh meat and meat products on a yearly basis, which is substantially less than in the other case countries (80-85 kilos). Half of Japanese meat and meat productions consumption refers to pork, one fifth to beef and one fourth to poultry. The other 7% refers to Mixed Ground Meat and Other Fresh Meat. Japanese households spend approximately JPY 75 000 on meat: about Y 60 000 on fresh meat and nearly JPY 15 000 on meat products. Most expenditure on beef and poultry is being done in food service (55%). Food service' share in pork consumption is less important, but still substantial (30%). Food service has increased its market share in meat distribution substantially over the last years. Beef trade liberalization and the appreciation of the yen enabled food service companies to follow aggressive low-price strategies and to gain market share.

As a result of the import prohibition of US beef in December 2003, the consumption of fresh beef decreased from 10 kilos to 7 kilos and its percentage of consumer spending dropped from 20% to 15%. Especially the consumption of beef tongue dramatically reduced because its import decreased by 75% after the import prohibition. The US had a market share of nearly 80% in beef tongue market. There were not enough substitutes for US beef tongue from other countries such as Australia and New Zealand. On the other hand, the consumption of fresh poultry did not changed dramatically in spite of the incident of Aviary Influenza in the west Japan in January 2004. The sustained domestic production and increased import from Brazil made it possible to avoid the drastic decrease of poultry consumption.

Within food retail most consumer expenditure takes place in supermarkets and related outlets such as department stores and discounters (89%). However, supermarkets typically are small – less than 1 000 square meters – and more independent than in Canada and the Netherlands.

Netherlands

The Dutch meat supply chain is an integral part of the European meat supply chain. The Netherlands have a large relatively large livestock, the products of which are

exported to European markets and to some extent beyond. Cattle are primarily hold to produce milk. Since Dutch beef production is relatively small and low-quality, the Netherlands is a net importer of beef. Dutch production of pork and poultry is primarily export oriented, but also serves the home market.

The supply chain

Figures 1.10 to 1.12 illustrate that the Dutch meat supply chain is integrated into a wider geographical setting: exports and imports are substantial. There is little trade in live animals with the exception of pigs: 30% of the domestic supply of pigs is exported to other European countries, predominantly Germany. There is substantial trade in meat. Exports amount to 40-65% of domestic supply. Imports are substantially smaller with the exception of beef. Since Dutch beef production is small and more importantly of low-quality, due to the prevalence of dairy cows, beef imports are substantial. This fact may be further illustrated by the fact that the major Dutch supermarket chain, Ahold hold Albert Heijn, imports most of its beef from Ireland. Since there are important quality differences with respect to domestically produced, imported and exported beef, there may also be wide price divergences between these types of beef.

Figures II.10 to II.12 depict the three main stages of the meat supply chain: production, processing and distribution (international trade and domestic distribution). However, this picture greatly simplifies the meat supply chain. Meat production and distribution typically involves a more elaborate labour division throughout the supply chain. Animal production is preceded by feed production. Production and processing are split in successive stages. Moreover, the meat supply chain supplies a wide range of products ranging from fresh meat, meat products and pet food. There are two major distribution channels for meat: retail and food service, both in a wide variety of formulas ranging from specialty stores to different types of chain outlets.

Figure II.10. Pork supply chain in the Netherlands (2004)
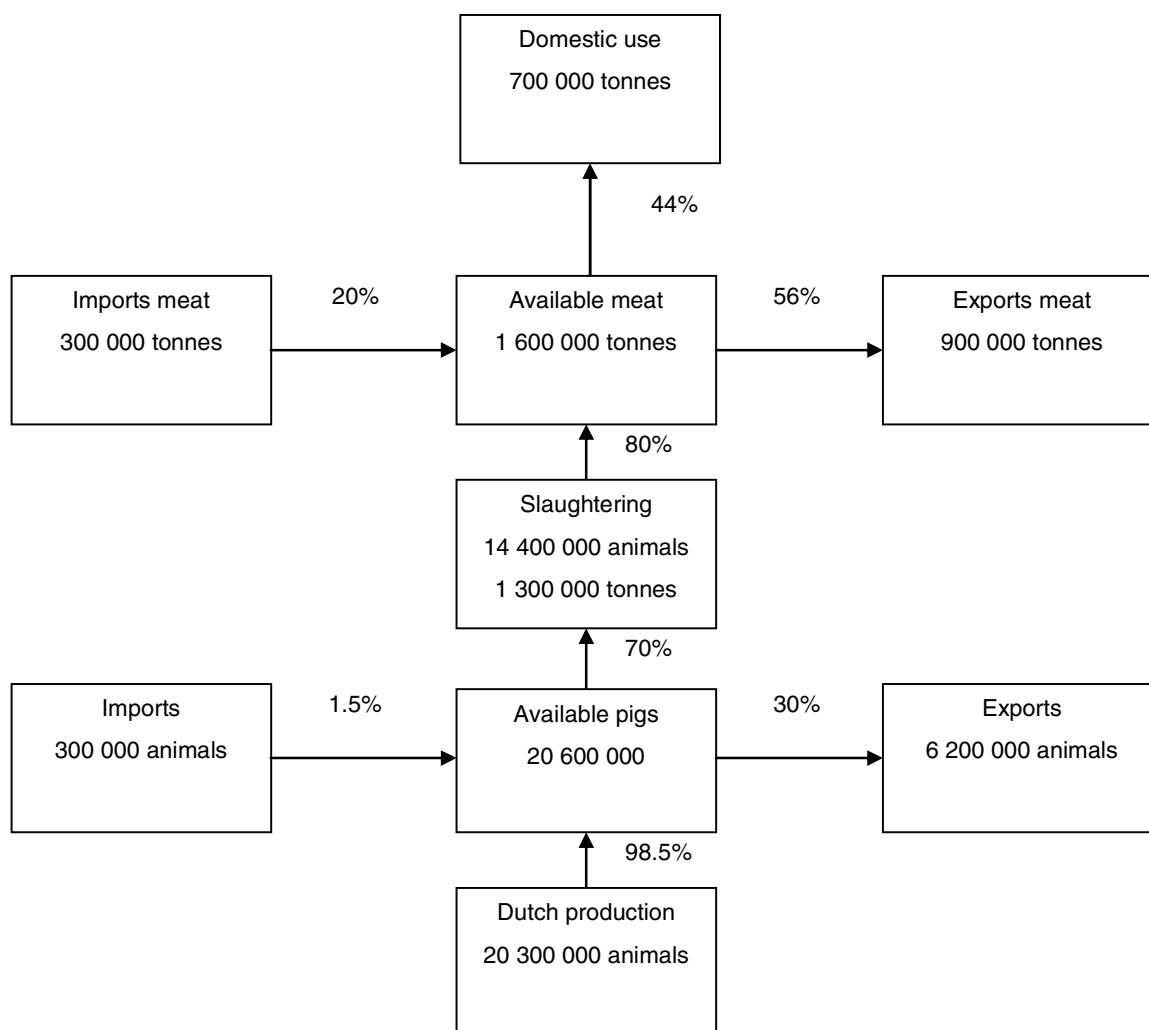
Figure II.11. Beef supply chain in the Netherlands (2004)
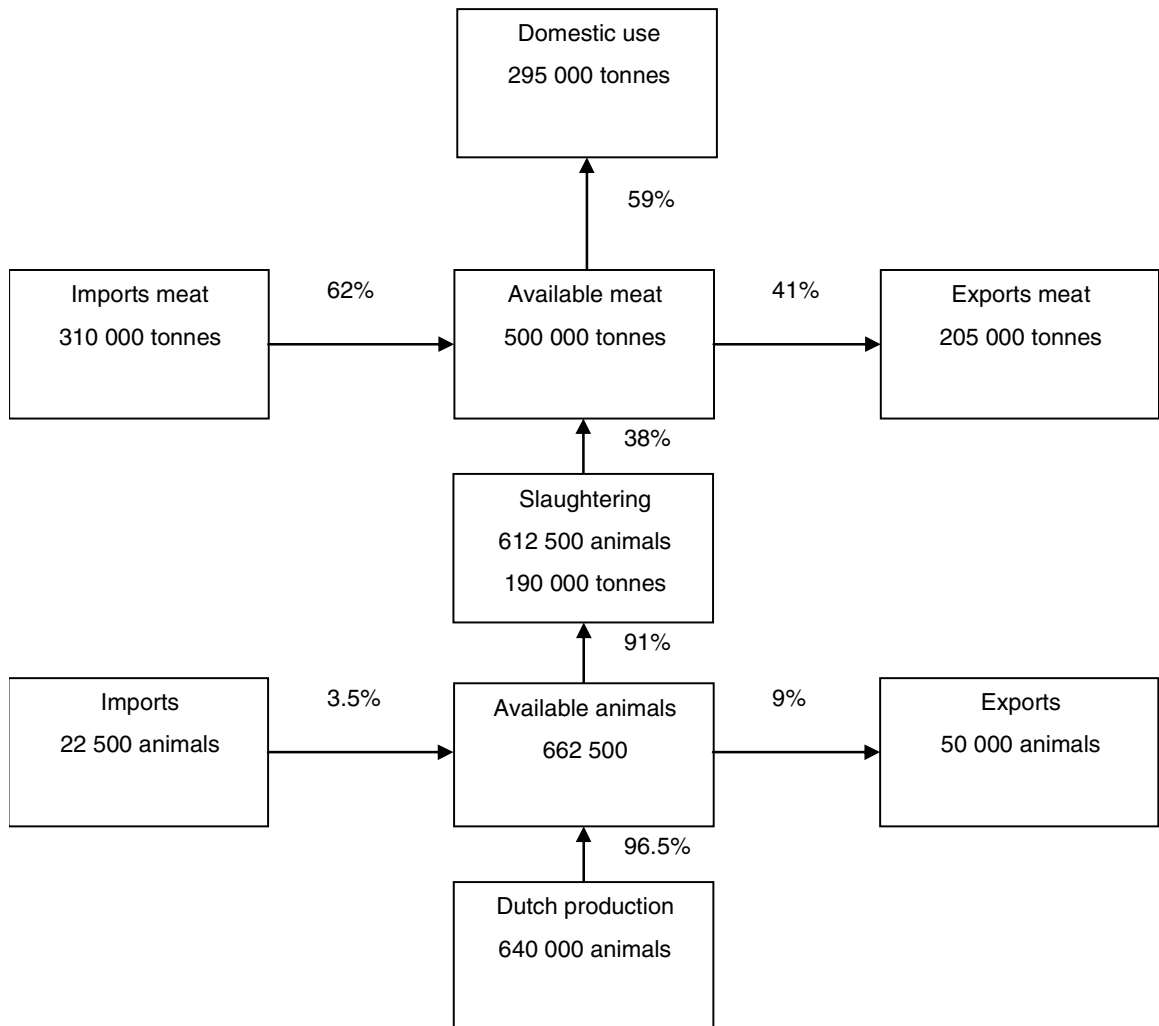
Figure II.12. Poultry supply chain in the Netherlands (2004)

```
                        ┌─────────────────┐
                        │  Domestic use   │
                        │ 281 500 tonnes  │
                        └─────────────────┘
                                 ▲
                                33%
┌─────────────────┐  30%  ┌─────────────────┐  67%  ┌─────────────────┐
│  Imports meat   │──────▶│ Available meat  │──────▶│  Exports meat   │
│ 251 500 tonnes  │       │ 843 000 tonnes  │       │ 561 500 tonnes  │
└─────────────────┘       └─────────────────┘       └─────────────────┘
                                 ▲
                                70%
                        ┌─────────────────┐
                        │   Slaughtering  │
                        │ 591 500 tonnes  │
                        └─────────────────┘
                                 ▲
                               98.5%
┌─────────────────┐  12%  ┌─────────────────┐  1.5% ┌─────────────────┐
│     Imports     │──────▶│Available broilers│─────▶│    Exports      │
│  73 000 tonnes  │       │ 600 000 tonnes  │       │  8 500 tonnes   │
└─────────────────┘       └─────────────────┘       └─────────────────┘
                                 ▲
                                88%
                        ┌─────────────────┐
                        │ Dutch production│
                        │ 527 000 tonnes  │
                        └─────────────────┘
```
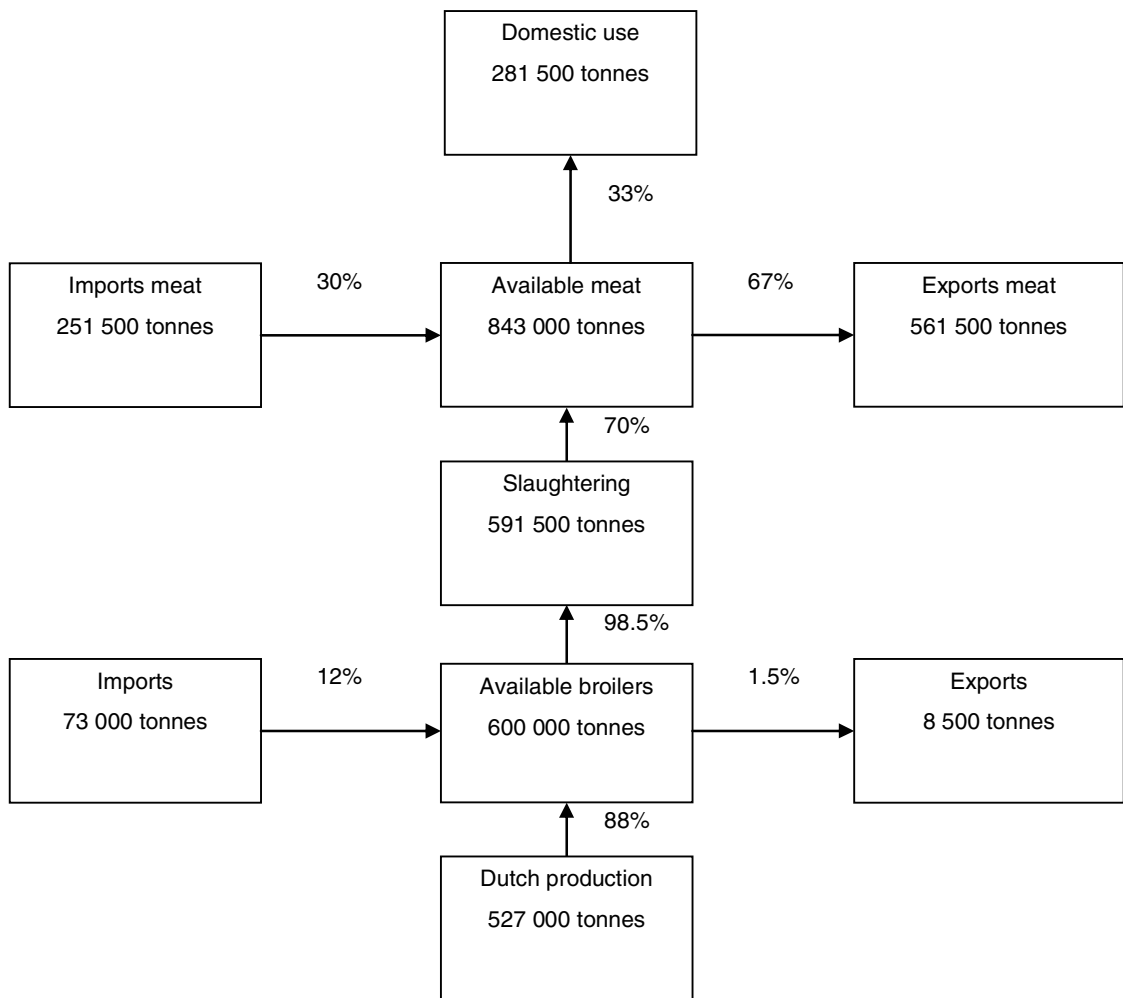
Animal production

Dutch meat production is still carried out on thousands of farms (Table II.7). However, the number of farms involved in meat production decreased rapidly. From 1990 to 2004, the number of farms dropped with 45% for poultry, with 50-55% for cattle and even with 65-75% for hogs. The number of animals hold in the Netherlands has fallen less dramatically. The number of dairy cows and hogs has fallen with 20-25% between 1990 and 2004. Due to the MacSharry reforms, cattle for beef production, decreased with roughly two-thirds from 1990 to 2004. The poultry population has grown slightly. However, one should take into account that Avian Influenza in 2002 had a particularly negative effect on the number of farms and chickens in the Netherlands. From 2002 to 2004, the number of broiler farmers decreased with 30% and the number of animals with 20%.

In line with these developments, farm size rises rapidly. Moreover, there is a wide dispersion in farm size. In 2004, the 17.5% largest producers of fattened pigs (more than 1 000 pigs) produced 55% of all fattened pigs.

Table II.7. Farm structure and production

	Number of farms			Number of animals		
	1990	2004	% Change	1990	2004	% Change
Cattle	65 423	38 361	-41.4	4 926 000	3 767 000	-23.5
Dairy production	46 977	24 332	-48.2	1 878 000	1 471 000	-21.7
Beef production	24 691	10 837	-56.1	598 000	221 000	-63.0
Hogs	29 211	10 039	-65.6	8 522 600	6 508 700	-23.6
Farms with sows	4 930	1 113	-77.4	1 497 600	1 125 700	-24.8
Farms with fattening pigs	15 820	5 766	-63.6	7 025 000	5 383 000	-23.4
Combinations	8 461	3 160	-62.7			
Poultry (broilers)	1 413	771	-45.4	41 172 000	44 262 000	7.5

Source: LEI (2005).

There is substantial labour division in the production phase, notably for poultry, but also for hogs. In order to produce poultry, one needs eggs. And in order to produce eggs, one needs chickens. Multiplication farms produce eggs which are hatched at hatcheries. The resulting chicks are raised at broiler farms. The hens producing eggs at multiplication farms are delivered by specialised hatcheries. Since there is substantial labour division in poultry production and since there are substantial economies involved in co-ordinating supplies to poultry slaughterhouses, the poultry supply chain is characterised by a high degree of vertical co-ordination. The slaughter companies own hatcheries and feed companies and have contracts with multiplication and broiler farms specifying delivery quantities and time. Prices are also contracted. There is little vertical integration in the pork and beef supply chains.

With respect to hog production, there is labour division between pig production and pig fattening. Both production phases are typically not combined in the Netherlands. Buyer-seller relations between pig producers and pig fatteners have become tighter after the veterinary crises in 1997 and 2001 (swine fever and food and mouth disease). Both crises induced more-or-less fixed buyer-seller relationships between a limited number of pig producers and pig fatteners due to changes in legal requirements and farmer receptions with respect to risk. Tight relationships are further promoted by farmer preferences for certain pig breeds, discount premiums by slaughterhouses and the fact that slaughterhouses take care of transports between farms.

Processing

Meat processing is split between slaughtering and further processing. Meat is further processed by wholesale traders who combine traditional wholesale tasks (logistics, assortment policies and storage) with processing tasks (cutting, packaging and processing to meat products). Currently, slaughterhouses try to integrate into subsequent stages of meat processing.

Concentration in slaughtering is high. Slaughtering is performed by a limited number of slaughter houses (Table II.8). Concentration is even higher than Table II.8 suggests,

since some slaughter companies own more than one slaughter houses. In 2002, the two largest pork slaughterhouses (Dumeco and Hendrix Meat Group) controlled 75% of Dutch production. In beef, the three largest beef slaughterers (Dumeco, Weyl and Brada) had a cumulative market share of 56%. In poultry, the top four companies had a joint market share of 40%. Competition between slaughterhouses tends to be fierce, since there is overcapacity in slaughtering, especially for pork and beef, among other things due to the decrease in the number of animals and production (Table II.7). Slaughterhouses try to bind pork farmers using premiums dependent upon the number of supplies. However, switching buyers is not uncommon in the pork supply chain.

When assessing market shares, one should take into account that the Netherlands may not be the relevant geographical market. Foreign slaughterhouses may process Dutch animals as well. This is true for pigs where exports of live animals are substantial. Thirty per cent of Dutch pigs are exported to neighbouring countries. Export of live animals is rare for cattle (dairy cows) and chickens. Chickens are not transported over long distances, because they suffer too much from transport. For dairy cows, exports are not likely because farmers sell them in limited numbers on an irregular basis. The transaction costs of exporting dairy cows are too high. Most dairy cows are sold through intermediaries selling cattle to the slaughterhouses. Cattle markets have a less important role as a market place for selling and buying cattle, after the Ministry of Agriculture has strengthened sanitary requirements after the Foot and Mouth Disease of 2001.

Table II.8. Number and size of slaughterhouses

Cattle			Pork			Poultry		
Slaughters per slaughter house	Number of slaughter houses	Market shares	Slaughters per slaughter house	Number of slaughter houses	Market shares	Slaughters (tonnes)	Number of slaughter houses	Market shares
10 000-25 000	1	5.2	100 000-500 000	4	6.9	10 000-30 000	10	36.2
25 000-75 000	3	19.8	500 000-1 000 000	4	21.3	30 000-40 000	3	16.5
> 75 000	3	75.0	> 1 000 000	8	71.8	> 40 000	5	47.3
Total	7	100.0	Total	16	100.0	Total	18	100.0

Source: PVE (2005).

Consumption and distribution

Meat consumption refers to fresh meat, meat products and pet food. Consumers buy meat and meat products predominantly at retail and food service outlets. Dutch people eat 86 kg of fresh meat and meat products on a yearly basis. Half of Dutch meat and meat products consumption refers to pork, one fifth to beef and one quarter to poultry. The other 5% refers primarily to veal and lamb. Dutch households spend EUR 552 on meat: EUR 334 on fresh meat and EUR 218 on meat products. Dutch households spend EUR 1 264 on food for out-of-home consumption. The meat supply chain also sells to alternative channels such as the pet food industry.

The supermarket channel is the most important channel for distributing meat and meat products and its share still grows. However, there is an important difference between the distribution of meat and meat products. For meat, the supermarkets' share amounts to 55%, while for meat products it amounts to 78%. For meat, food service is an important and growing alternative (36%). The importance of butchers and other channels is minor and declining (10%).

Within the supermarket channel, concentration is high. In 2002, the top four supermarket chains had a 70% market share of supermarket sales. Concentration in buying even amounts to 90% (LEI, 2003). Most supermarket chains are owned by two conglomerate holdings (Ahold and Laurus) with a joint market share of 60%. However, buying and selling decisions are often carried out independently by the supermarket chains within the conglomerates. Being big also does not imply having power. Both Albert Heijn (Ahold) and Laurus have major problems in sustaining market share and profits.

When assessing retail concentration at the selling and the buying side, one should take into account that market delimitation matters. At the buying side, the market is international (or at least European). At the selling side, the market is local (rather than national). Retail price policy in the Netherlands is predominantly national. You pay the same price for a certain product in each Albert Heijn outlet (of a certain type). This fact validates analysis on basis of national data. Dutch retailers engage more and more in long terms relationships with suppliers. Product specifications are important in this respect. However, long term relationships in terms of prices, supplies and time are uncommon.

Endnotes

1.   A first draft of the parts on Canada, the Czech Republic and Japan have been provided by Odette Vaughn (Canadian Ministry of Agriculture), Jirina Slaisova (VUZE, Czech Republic) and Kojima Yasumoto (Japan Society for the Promotion of Science, affiliated with the Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries), respectively.

2.   Cargill and Tyson are major export-oriented US multinationals that benefit from information on and market networks in the US, Japan, Mexico and other importing countries.

CHAPTER 3.

MEASURING RETAIL BUYER AND SELLER POWER

Theory

This section derives a general relation between retailer profitability and their buying and selling behaviour for estimations based on aggregate data. With aggregate data, one has to assume that products are not differentiated: there is one consumer price and one wholesale price for every national food supply chain. Further assumptions are made in this chapter.

Retailer profits are modelled as follows. There are M retailers in the retail industry purchasing and selling I products. The profit maximisation problem equals:

$$\pi_m = \sum_{i=1}^{I} p^i q_m^i - \sum_{i=1}^{I} w^i q_m^i - C_m\left(\mathbf{q}_m^i, \boldsymbol{\omega}_m\right). \tag{1}$$

where

π_m = profits of retailer m;

p^i = consumer price of product i;

q_m^i = quantity of product i bought and sold by retailer m;

$\mathbf{q}_m^i$ = a vector of q_m^i;

w^i = wholesale price of product i;

C_m = distribution costs for retailer m;

$\boldsymbol{\omega}_m$ = a vector with the input prices of all inputs employed by retailer m.

Retailer profits depend on sales: consumer prices p times the quantities sold q, purchases: wholesale prices w times the quantities bought q and distribution costs C. Aggregate quantities are defined as follows.

$$Q^i = \sum_{m=1}^{M} q_m^i \tag{2}$$

where

Q^i = aggregate sales of product i.

Consumer prices depend on the aggregate sales of all products considered:

$$p^i = p^i\left(Q^1,...,Q^i,...,Q^I\right) \tag{3}$$

This relation embodies substitutability and complementarity between the I products. We do not assume substitutability and complementarity on the supply side:

$$w^i = w^i\left(Q^i\right). \tag{4}$$

Retailer pricing behaviour and industry profits may be obtained from the first order conditions, *i.e.* by maximising retailer profits with respect to the quantities sold.

$$\frac{\partial \pi_m}{\partial q_m^i} = p^i + \sum_{j=1}^{I} \frac{\partial p^j}{\partial Q^i}\frac{\partial Q^i}{\partial q_m^i}q_m^j - w^i - \frac{\partial w^i}{\partial Q^i}\frac{\partial Q^i}{\partial q_m^i}q_m^i - \frac{\partial C_m}{\partial q_m^i} = 0 \tag{5}$$

We may rewrite this equation as follows:

$$p^i - w^i - mc_m^i = -\sum_{j=1}^{I} \frac{\partial p^j}{\partial Q^i}\frac{\partial Q^i}{\partial q_m^i}q_m^j + \frac{\partial w^i}{\partial Q^i}\frac{\partial Q^i}{\partial q_m^i}q_m^i \Leftrightarrow$$

$$p^i - w^i - mc_m^i = -\sum_{j=1}^{I} \frac{\partial p^j}{\partial Q^i}\frac{\partial Q^i}{\partial q_m^i}\frac{Q^i}{Q^i}\frac{q_m^i}{q_m^i}\frac{p^j}{p^j}q_m^j + \frac{\partial w^i}{\partial Q^i}\frac{\partial Q^i}{\partial q_m^i}\frac{Q^i}{Q^i}\frac{w^i}{w^i}q_m^i \tag{6}$$

Substituting the (cross) price elasticity of demand $\varepsilon^{ij} = \dfrac{\partial Q^i}{\partial p^j}\dfrac{p^j}{Q^i}$, the price elasticity of

supply $\eta^i = \dfrac{\partial Q^i}{\partial w^i}\dfrac{w^i}{Q^i}$ and the elasticity of the conjectural variation $\theta_m^i = \dfrac{\partial Q^i}{\partial q_m^i}\dfrac{q_m^i}{Q^i}$ into

this equation gives the following expression.

$$p^i - w^i - mc_m^i = -\sum_{j=1}^{I} \frac{\theta_m^i}{\varepsilon^{ij}}\frac{q_m^j}{q_m^i}p^j + \frac{\theta_m^i}{\eta^i}w^i \Leftrightarrow \tag{7a}$$

$$L_m^i = \frac{p^i - w^i - mc_m^i}{p^i} = -\sum_{j=1}^{I} \frac{\theta_m^i}{\varepsilon^{ij}}\frac{q_m^j}{q_m^i}\frac{p^j}{p^i} + \frac{\theta_m^i}{\eta^i}\frac{w^i}{p^i} = -\sum_{j=1}^{M} \frac{\theta_m^i}{\varepsilon^{ij}}\frac{s_m^j}{s_m^i} + \frac{\theta_m^i}{\eta^i}\frac{w^i}{p^i} \tag{7b}$$

where L_m^i is the Lerner index and $s_m^j = p^j.q_m^j$, the sales of product j by retailer m.

The Lerner index gives the retail profit margin as a percentage of the consumer price.[1] The Lerner index is an important concept from a theoretical point of view because it relates industry profitability to the factors influencing profitability, in particular the price elasticities of demand and supply, conduct and – if equation (7b) is rewritten a little – industry structure. Moreover, the Lerner index is also important from an empirical point of view because its specification allows the indirect measurement of either profitability or the factors influencing profitability. If you know all variables but one, you may estimate the last variable.

In the empirical analysis below market power is measured by measuring market power parameter θ. This parameter measures market power on a scale from 0 to 1 with 0

indicating perfect competition and 1 indicating a perfect monopoly or cartel. Negative values seem at odds with theory at first sight. After all, prices would be below marginal costs. However, prices may be below marginal costs in at least two cases. First, in a multi-product case retailers may have losses on some products in order to attract consumers and to make profits on other items. Second, retailers may suffer losses on some or even all products if they expect to make profits in the future. Retailers may, for example, expect to be able to drive rival retailers out of the market and to make profits afterwards.

Empirical specifications

Following Hyde and Perloff (1998) and Gohin and Guymard (2001) we estimate retail buyer and seller power using a simple structural model made up of consumer demand, meat processors' supply and retail pricing behaviour. This part lays down the empirical specifications chosen for the demand and supply equations.

Consumer demand

Demand is modelled using the Almost Ideal Demand System (AID) specification (Deaton and Muelbauer, 1980; Hyde And Perloff, 1998). Our AID demand system consists of J budget-share equations, where the budget share for product i equals $s_i = p_i q_i / X$ where p_i and q_i are the consumer price and the amount bought of good i respectively, and X is total expenditure on all products analysed. The demand equations are:

$$s_i = \alpha_i + \sum_{j=1}^{J} \gamma_{ij} \ln p_j + \beta_i \ln(X/P) \tag{8}$$

where α_i, β_i and γ_{ij} are parameters and P is a price index defined by

$$\ln P = \alpha_0 + \sum_{i=1}^{J} \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^{J} \sum_{j=1}^{J} \gamma_{ij} \ln p_i \ln p_j$$

For the moment, the price index will be approximated using Stone's geometric approximation:

$$\ln P = \sum_{i=1}^{J} s_i \ln p_i$$

The demand system will be subjected to the adding up, the homogeneity and the symmetry conditions:

$$\sum_{j=1}^{J} \gamma_{ij} = \sum_{i=1}^{J} \gamma_{ij} = \sum_{i=1}^{J} \beta_i = 0 \tag{9a}$$

$$\sum_{i=1}^{J} \alpha_i = 1 \tag{9b}$$

$$\gamma_{ij} = \gamma_{ji} \tag{9c}$$

When analysing price behaviour, the price elasticity of demand for product i with respect to price j will be used to capture retailers' demand side considerations:

$$\varepsilon_{ij} = \frac{\partial q_i}{\partial p_j}\frac{p_j}{q_i} = -\delta_{ij} + \frac{\gamma_{ij}}{s_i} - \beta_i\frac{s_j}{s_i}$$

where δ_{ij} refers to the Kronecker delta δ.[2]

Supply

Following Gohin and Guyomard (2000) the price elasticity of supply is measured by specifying the following log-linear supply function:

$$\ln\!\left(Q_S^i\right) = \nu_0 + \nu_1\ln\!\left(w^i\right) + \varepsilon_S \tag{10a}$$

where Q_S^i represents industry supply of product i, ν_0 and ν_1 are the parameters to be estimated and ε_S is the error term. Estimation of equation (10a) without taking retail demand into account leads to biased estimates of the price elasticity of supply, since observations of Q_S^i and w^i depend on interactions of meat industry supply and retail demand. After all, equation (10a) may be interpreted as a demand equation as well. For this reason, meat industry supply is measured as part of a system of meat industry supply and retail demand (rather than consumer demand):[3]

$$\ln\!\left(Q_S^i\right) = \nu_0 + \nu_1\ln\!\left(w^i\right) + \varepsilon_S \tag{10a}$$

$$\ln\!\left(Q_D^i\right) = \mu_0 + \mu_1\ln\!\left(w^i\right) + \mu_2\ln\!\left(p^i\right) + \mu_3\ln\!\left(p^j\right) + \mu_4\ln\!\left(p^k\right) + \mu_5\ln(X) + \varepsilon_D \tag{10b}$$

where Q_D^i represents retail demand for product i, μ_j are the parameters to be estimated and ε_D is the error term of the demand equation. Equation (10a) is measured using two stage least squares (2SLS). The exogenous variables in the demand equation are used to measure an instrumental variable for the wholesale price in equation (10a) (Gujarati 1988).

Retail pricing

Retail pricing is measured using the pricing equations derived in Chapter 1.

$$p^i - w^i - mc_m^i = -\sum_{j=1}^{I}\frac{\theta_m^i}{\varepsilon^{ji}}\frac{q_m^j}{q_m^i}p^j + \frac{\theta_m^i}{\eta^i}w^i \iff \tag{7a}$$

$$p^i = \left[\frac{\varepsilon_{ii}}{\varepsilon_{ii} + \theta_m^i}\right]\left[\left(\frac{\eta_i + \theta_m^i}{\eta_i}\right)w_i + mc_m^i - \sum_{i\neq j}^{I}\frac{\theta_m^i}{\varepsilon^{ij}}\frac{q_m^j}{q_m^i}p^j\right] \tag{7c}$$

Retail market power as represented by θ is measured using equation (7c), (8), (9) and (10). The market power parameter is known as the conjectural variation in Industrial Organisation theory. The parameter estimates to what extent retailers lower sales in order to raise consumer prices above and to lower supplier prices below their respective competitive levels. Since retailers buy the quantities they sell, the conjectural variation is the same at the buyer and at the selling side (Tirole, 1988).

Empirical analysis

This part describes the estimations performed to measure retail pricing behaviour with respect to meat for Canada, the Czech Republic, Japan and the Netherlands. The estimations are carried out in three stages. First, the demand system is estimated in order to derive the structural parameters in the demand equations. Second, the supply equations are estimated in order to derive the price elasticities of supply. Third, the price equations are measured in order to estimate the conjectural variations taking the price elasticities of demand and supply as given.

Canada

Canadian data refer to annual data for the period 1979-2004. For this period, we have data on consumer prices and the consumption of pork, beef and poultry as well as wholesale prices. The consumption data were provided to the OECD by the Canadian Ministry of Agriculture. Data on consumer and wholesale prices were obtained from Statistics Canada. Supply balance information available in AGLINK was used to estimate the supply equations.

Table III.1 presents the descriptive statistics of the data. Most meat consumption in Canada refers to poultry (39%), followed by beef (33%) and pork (28%). However, from 1979 onwards there has been a major shift in meat consumption from beef to poultry. Poultry consumption in 2004 (36 kg) is actually higher than Table III.1 suggests and beef consumption lower (22 kg). In terms of expenditure, beef (51%) has been far more important than poultry (31%) and pork (18%). In 2004, however, expenditure on poultry (39%) approached expenditure on beef (46%). Pork consumption has been relatively stable. Unit prices are highest for beef (CAD 11.46 per kilo in 2004), followed by pork (CAD 10.13) and poultry (CAD 5.32).

Table III.1. Descriptive statistics of annual data for Canada

	Unit	Period	Mean	Standard Deviation	Min	Max
Share beef	%	1979-2004	0.5145	0.0558	0.4499	0.6211
Share pork	%	1979-2004	0.1801	0.0110	0.1454	0.1910
Share poultry	%	1979-2004	0.3053	0.0582	0.2061	0.3859
Consumer price beef	Index	1979-2004	0.7750	0.1472	0.5367	1.0796
Consumer price pork	Index	1979-2004	0.8110	0.1576	0.4755	1.0270
Consumer price poultry	Index	1979-2004	0.8126	0.1685	0.4809	1.1319
Beef consumption	Kilo per capita	1979-2004	25.25	2.58	22.23	29.49
Pork consumption	Kilo per capita	1979-2004	21.47	1.35	19.10	24.77
Poultry consumption	Kilo per capita	1979-2004	28.87	4.95	22.11	36.71
Wholesale price beef	Index	1979-2004	1.0160	0.0817	0.8841	1.1513
Wholesale price pork	Index	1979-2004	0.6704	0.2240	0.3743	1.0609
Wholesale price poultry	Index	1979-2004	0.8694	0.1019	0.6113	1.0000

1. Prices are indexed prices.

Stage 1: Demand

Consumer demand has been estimated using Seemingly Unrelated Regressions. Because demand is characterised by habit formation and the error term exhibits autocorrelation, the estimations have been complicated by two factors. First, lagged values of the dependent variable have been incorporated into the demand equations as an explanatory variable in order to capture habit formation. Second, correcting for autocorrelation in equations with a lagged dependent variable requires special treatment. We applied Hatanaka's (1974) two-stage least squares approach to correct for autocorrelation. The lagged dependent variable s_{t-1} is replaced by an instrumental variable based on all other exogenous variables in the model, more in particular their values in period t-1 and t-2. The demand equations are subsequently estimated with the instrumental variable replacing the lagged dependent variable. Subsequently, the demand equations are re-estimated by applying the Cochrane-Orcutt transformation to the variables and by including lagged values of the error terms into the demand equation. Seemingly Unrelated Regression has been applied to all three demand equations after adapting them for autocorrelation (Parks, 1967; Kmenta and Gilbert, 1970).[4] In the final estimation, we included a trend variable to take the shift from beef to poultry consumption into account.

Tables III.2 presents the final results of the demand estimations. The expenditure variable is only significant in the poultry equation. Seven out of the nine γ (price) coefficients are significant at the 5% significance level. This result is very good (Deaton and Muellbauer, 1980). The lagged dependent variable is significant at the 5% significance level for all three products and the trend variable for beef and poultry. The estimates of the price and expenditure elasticities are as may be expected. The expenditure elasticity[5] is higher than 1 for beef and lower than 1 for poultry. The own price elasticities of demand are well below 1 for all three meat types. A price change does not have a substantial impact on the consumption of the product concerned. There are also no major cross price patterns in meat consumption: income effects dominate over substitution effects. The estimates explain 92% of the variance in demand.

Table III.2A. Parameter estimates of the demand equation for Canada

	α_i	β_i	$\gamma_{i,pork}$	$\gamma_{i,beef}$	$\gamma_{i,poultry}$	Lag	Trend	R^2	DW
Pork	0.059	0.002	0.052*	-0.048*	-0.004	0.531**	0.000	91.6	1.62
Beef	-0.120	0.118	-0.048*	0.153**	-0.105**	0.385**	-0.002**		2.22
Poultry	0.435	-0.149*	-0.004	-0.105**	0.110**	0.284*	0.002**		2.13

*Significant at the 5% level; **significant at the 1% level.

Table III.2B. Price and expenditure elasticities of Canadian demand for meat

	Pork price	**Beef price**	**Poultry price**	**Expenditure**
Pork	**-0.39**	-0.58	-0.06	1.03
Beef	-0.22	**-0.71**	-0.45	1.37
Poultry	0.10	-0.13	**-0.29**	0.32

Stage 2: Supply

We estimated the supply functions for beef and poultry using 2SLS (see above). For beef we used consumer prices and expenditure, beef exports and a one-year lagged value of the wholesale price to determine an instrumental variable for the wholesale price. For poultry we used the one-year lagged value of the wholesale price only. A trend variable has been incorporated in the final equations to take the production growth of both beef and poultry into account. For pork we have not found a plausible solution, a positive price elasticity of supply.

Table III.3A presents the results of the estimations of the supply functions for beef and poultry. The fit of the model is not bad, but this is due to the trend variable. The relation between meat supply and wholesale prices is weak. Canadian meat supply has been subject to supply chain management over (parts of) the period investigated. This fact is likely to have influenced the values found and also implies that the values found may not simply be carried over to the future, since, for example, supply chain management does no longer apply to beef and pork production. This fact may explain, together with a limited number of observations, the weak relationship between supply and wholesale prices established. The price elasticities found correspond with those found for Japan and the Netherlands.

Table III.3A. Parameter estimates of the supply equation for Canada

	v_0	v_1	Trend	R^2	DW
Beef	1.92	0.49	0.01[**]	54.1	2.35
Poultry	3.72[*]	0.21	0.03[**]	97.2	1.22

*Significant at the 5% level; **significant at the 1% level.

Table III.3B. Price elasticities of Canadian meat supply

	Price elasticity
Pork	-
Beef	0.49
Poultry	0.21

Stage 3: Pricing

We applied non-linear three-stage least squares analysis to the pricing equations given by equation (7c). The results of the analysis are given in Table III.4. All three estimates of the market power parameter (θ) differ significantly from zero. The estimate is relatively high for beef indicating that retail margins on beef may be substantial. The wage parameter is positive and significant as well. Cost factors such as labour may explain the major part of the retail-wholesale price gap. Estimation of the price equations without taking wages into account leads to a higher estimate of the market power parameter for beef ($\theta = 0.16$). Apparently, the large retail-wholesale price gap for beef may be explained by developments in the costs of other inputs such as labour. Table III.4B shows that retail net profit margins on beef are high to the disadvantage of suppliers and even more to consumers. Retail profits on beef amount to 13.4% of consumer prices: 10% of the profit margin at the expense of suppliers and 90% at the expense of consumers. One may make some qualifications with respect to these results. First, the results in Table III.4B are not based on accounting and provide only rough measures of retail

profitability. Second, this result depends to a large extent on the low price elasticities of supply found in the previous stage of the analysis. The final section on interpretation, however, suggests that the results found are robust to changes in the price elasticity of supply. Third, the estimations include the development of only one major input price (wages). Developments in the costs of other inputs at the retail level such as labour are not included. So, we may have left out important factors explaining the retail-industry price gap.

Table III.4A. Parameters of the price equations for Canada

Parameter	Estimate	t Value
θ_{beef}	0.09	28.22
θ_{pork}	0.01	8.35
$\theta_{poultry}$	-0.02	-4.99
δ_{wages}	0.04	28.91

Table III.4B. Market power estimates for Canada: retail margins as a percentage of consumer prices

	Buyer power	Seller power
Pork	0.4%	2.0%
Beef	1.2%	12.2%
Poultry	-1.9%	-5.8%

Czech Republic

Czech data refer to quarterly data the period 1995-2004. For this period, we have data on consumer prices and the consumption of pork, beef and poultry as well as wholesale prices. The consumption data were provided to the OECD by the Czech Ministry of Agriculture. Table III.5 presents the descriptive statistics of the data. The Czech spent their meat budget predominantly on poultry (42%) and pork (41%). Unit prices are highest for beef (CZK 129 per kilo) and pork (CZK 120) and substantially lower for poultry (CZK 55). Meat consumption is substantially higher in the fourth quarter of the year.

Table III.5. Descriptive statistics of quarterly data for the Czech Republic

	Unit	Period	Mean	Std. Dev.	Min	Max
Expenditure share pork	%	1995-2004	0.41	0.025	0.34	0.47
Expenditure share beef	%	1995-2004	0.17	0.035	0.10	0.24
Expenditure share poultry	%	1995-2004	0.42	0.029	0.35	0.47
Consumer price beef	Index	1995-2004	1.01	0.089	0.84	1.16
Consumer price pork	Index	1995-2004	1.15	0.080	0.97	1.29
Consumer price poultry	Index	1995-2004	1.18	0.165	0.95	1.50
Wholesale price beef	Index	1995-2004	0.99	0.080	0.84	1.16
Wholesale price pork	Index	1995-2004	0.99	0.085	0.84	1.16
Wholesale price poultry	Index	1995-2004	1.16	0.172	0.91	1.55

1. Prices are indexed prices.
2. The expenditure share is the share of meat in the total expenditures on pork, beef and poultry.

Stage 1: Demand

Consumer demand has been estimated following the same method described above for Canada. For the Czech Republic we did not incorporate a trend term in the demand equation, but rather three dummies for Spring, Summer and Autumn.

Table III.5 presents the final results of the demand estimations. The expenditure and the price variables are not significant in any equation, even at the 5% significance level. This result may seem disappointing, but the variables do have an important contribution to the fit of the model. The lagged dependent variable is significant at the 1% significance level for all three products. The expenditure elasticity is higher than 1 for poultry rather than for beef which seems a little counter-intuitive. The estimates of the price elasticities are reasonable. In the Czech Republic, the own price elasticities of demand are well above 1 for all three meat types. Czech consumers are more price sensitive than their counterparts in the other countries studied. Substitution effects are important. Consumers switch from one type of meat to another if the price of one type of meat rises: substitution effects dominate income effects (except for beef-poultry). The estimates explain 69% of the variance in demand.

Table III.6A Parameter estimates of the demand equation for the Czech Republic

	α_i	β_i	$\gamma_{i,pork}$	$\gamma_{i.beef}$	$\gamma_{i,poultry}$	Lag	δ_{Spring}	δ_{Summer}	Autumn	R^2	DW
Pork	0.283	-0.036	-0.059	0.031	0.028	0.876**	-0.023*	-0.026*	-0.045**	69	2.06
Beef	0.066	-0.012	0.031	-0.014	-0.017	0.680**	0.025*	0.012	0.014		1.55
Poultry	-0.092	0.033	0.028	-0.017	-0.011	0.754**	0.002	0.012	0.028*		1.87

*Significant at the 5% level; **significant at the 1% level.

Table III.6B. Price and expenditure elasticities of Czech demand for meat

	Pork price	Beef price	Poultry price	Expenditure
Pork	**-1.86**	0.73	0.83	0.30
Beef	0.67	**-1.23**	-0.22	0.78
Poultry	0.14	-.22	**-1.24**	1.32

Stage 2: Supply

Since our estimations of Czech meat supply resulted in significantly negative price elasticities of supply for all three products, the Secretariat decided to make use of the estimates used in the Czech PEM. These estimates are given in Table III.7.

Table III.7. Price elasticities of Czech meat supply

	Price elasticity
Pork	0.9
Beef	2.6
Poultry	2.1

Stage 3 Pricing

We applied non-linear three stage least squares analysis to the pricing equations given by equation (7c). The results of the analysis are given in Table III.8. All three estimates of the conjectural variation, the market power variable, differ significantly from zero. What is striking about the results is the fact that the conjectural variation is negative for pork and to a lesser extent for poultry. This suggests that Czech retailing uses pork and to a lesser extent poultry as loss leaders in its marketing strategy. The estimates suggest that losses on pork are substantial and benefit both suppliers and consumers (Table III.8B): retailers grant a subsidy of about 55% of the consumer price to suppliers and consumers. Czech retailing either makes profits on other products such as beef or expects to make profits in the future. The qualifications made with respect to the Canadian results also hold to some extent to the Czech results. First, the results in Table III.8B are not based on accounting and should be interpreted cautiously. Second, other factors explaining the retail-industry price gap have been left out of the analysis. Third, the results may be sensitive to the elasticities found and employed. In the final section on interpretation shows that this is the case, but in qualitative terms this leaves the results unchanged.

Table III.8A. Parameters of the price equations for the Czech Republic

Parameter	Estimate	t Value
θ_{beef}	0.06	29.81
θ_{pork}	-0.38	-10.39
$\theta_{poultry}$	-0.04	-15.65

Table III.8B. Market power estimates for the Czech Republic: retail margins as a percentage of consumer prices

	Buyer power	Seller power
Pork	-35.7%	-20.6%
Beef	0.9%	4.7%
Poultry	-1.6%	-3.6%

Japan

For Japan, the Secretariat has the disposal of monthly data over the period 1980-2004. For this period, the OECD has data on consumer prices and meat consumption. The OECD has data on wholesale prices over the period 1993-2004. The consumption data were provided to the Secretariat by Kojima Yasutomo of the Japan Society for the Promotion of Science, affiliated with Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries. The Japanese data set is by far the most extensive data set available for the analysis.

Table III.9 presents the descriptive statistics of the data. Japanese demand for meat is substantially lower than it is in the Netherlands and Canada. Most meat consumption refers to pork (1.45 kg per month per capita) followed by poultry (1.08 kg) and beef (0.85 kg). The Japanese consumer spends his meat budget predominantly on beef (45%) and pork (37%). Unit prices are highest for beef (JPY 2 955 per kg in 2004) and substantially lower for pork (JPY 1 352) and poultry (JPY 929). Graphical analysis shows very slow shifts in meat consumption in Japan from beef to pork and *vice versa*. Poultry consumption is more stable. In 2001, beef consumption dropped after the incidence of BSE in American beef.

Table III.9. Descriptive statistics of monthly data for Japan

Variable	Unit	Period	Mean	Stand. Dev.	Max	Min
Expenditure share pork	%	Jan 1980 – Dec 2004	0.37	0.039	0.26	0.53
Expenditure share beef	%	Jan 1980 – Dec 2004	0.45	0.050	0.21	0.57
Expenditure share poultry	%	Jan 1980 – Dec 2004	0.19	0.016	0.15	0.26
Quantity pork	Kilo / Household	Jan 1980 – Dec 2004	1.45	0.14	1.22	1.92
Quantity beef	Kilo / Household	Jan 1980 – Dec 2004	0.85	0.14	0.35	1.38
Quantity poultry	Kilo / Household	Jan 1980 – Dec 2004	1.08	0.17	0.78	1.75
Consumer price pork	Index, 1980 = 1	Jan 1980 – Dec 2004	1.04	0.049	0.96	1.16
Consumer price beef	Index, 1980 = 1	Jan 1980 – Dec 2004	0.94	0.090	0.76	1.17
Consumer price poultry	Index, 1980 = 1	Jan 1980 – Dec 2004	0.97	0.049	0.88	1.08
Wholesale price pork	Index, 1993 = 1	Jan 1993 – Dec 2004	1.02	0.13	0.76	1.36
Wholesale price beef	Index, 1993 = 1	Jan 1993 – Dec 2004	1.00	0.15	0.35	1.27
Wholesale price poultry	Index, 1993 = 1	Jan 1993 – Dec 2004	1.12	0.13	0.86	1.43

1. Prices are indexed prices.

Consumer demand has been estimated following the same method described above for Canada. For Japan, we incorporated dummies for all months with the exception of January. The parameter estimates for the months are not presented.

Table III.10 presents the final results of the demand estimations. All expenditure and seven of the nine price parameters are significant at the 5% significance level. This again is a very good result. The lagged dependent variable is significant at the 1% significance level for all three products. The estimates explain 85% of the variance in demand. The expenditure elasticity is higher than 1 for beef and below 1 for pork and poultry. Within the meat nest, beef is the luxury variety. The estimates of the price elasticities are reasonable. Demand for pork and beef is price elastic. There is substitution between both types of meat in case of price changes: substitution effects dominate income effects. Demand for poultry is more autonomous.

Table III.10A. Parameter estimates of the demand equation for Japan

	α_i	β_i	$\gamma_{i,pork}$	$\gamma_{i.beef}$	$\gamma_{i,poultry}$	Lag	R^2	DW
Pork	0.180**	-0.159**	-0.147**	0.179**	-0.032**	0.329**	84.7	2.15
Beef	-0.173**	0.199**	0.179**	-0.164**	-0.015	0.313**		1.97
Poultry	0.143**	-0.040**	-0.032**	-0.015	0.048*	0.389**		1.52

*Significant at the 5% level; *significant at the 1% level.

Table III.10B. Price and expenditure elasticities of Japanese demand for meat

	Pork price	**Beef price**	**Poultry price**	**Expenditure**
Pork	**-1.32**	0.92	-0.01	0.40
Beef	0.35	**-1.87**	-0.19	1.70
Poultry	-0.14	0.01	**-0.53**	0.66

Stage 2: Supply

The supply equations have been estimates using two stage least squares (2SLS). The instrumental variable has been estimated on basis of lagged values of wholesale prices, consumer prices and consumer expenditure. For pork we used wholesale prices only to determine the instrumental variable. The lags used differ from one product to the other, among other things because of the use of monthly data.

Table III.11 provides the results of the supply functions estimates. The relationship between supply and wholesale prices is poor, especially for pork. For beef and poultry, this result may be due to the large price and supply shocks in Japanese wholesale and consumer markets because of the incidence of BSE in the US and avian flue in Japan. The fit of the model may be low; the price elasticity of supply (v_1) is significant at the 1% level for beef and poultry. The elasticities found are in line with those found for the Netherlands and by Gohin and Guyomard (2000).

Table III.11A. Parameter estimates of the supply equation for Japan

	v_0	v_1	R^2	DW
Pork	-0.140**	0.120	1.0	1.89
Beef	0.015	0.343**	4.7	2.41
Poultry	-0.190	0.312**	6.2	2.03

*Significant at the 5% level; **significant at the 1% level.

Table III.11B. Price elasticities of Japanese meat supply

	Price elasticity
Pork	0.12
Beef	0.34
Poultry	0.31

Stage 3: Pricing

In the third stage, we applied non-linear three stage least squares to estimate the parameters of the three optimality equations. The equations include wages and a dummy for the December month. We assumed wage costs at the retail level in yen per kilo to be the same for all meat. Data refer to 1998-2004. The market power parameter is significantly positive for beef and poultry and significantly negative for pork. The wage parameter is positive and significant as well. Retailers seem to exert market power with respect to beef. However, cost factors such as labour may explain the major part of the retail-wholesale price gap. Estimation of the price equations without taking wages into account leads to a very high estimate of the market power parameter for beef ($\theta = 0.41$). Apparently, the large retail-wholesale price gap for beef in Japan may be explained by developments in the costs of other inputs such as labour. Table III.12B suggests that retail profit margins on beef are substantial. Again, these estimations do not involve accounting and should be interpreted as an indication rather than a precise estimate. The Japanese case stresses the importance of one the qualifications made above: the inclusion of other factors possibly explaining the divergence between retail and wholesale prices matters. Moreover, the final section on interpretation shows that the results for beef in Japan are sensitive to changes in the price elasticity if supply employed.

Table III.12A. Parameters of the price equations for Japan

Beef			Pork			Poultry		
Para-meter	Estimate	t Value	Para-meter	Estimate	t Value	Para-meter	Estimate	t Value
θ	0.102	5.19	θ	-0.003	-4.26	θ	0.005	11.7
$\delta_{December}$	39.211	3.46	$\delta_{December}$	10.180	2.90	$\delta_{December}$	-2.904	-0.31
δ_{Wages}	1.195	18.03	δ_{Wages}	1.195	18.03	δ_{Wages}	1.195	18.03

**Table III.12B Market power estimates for Japan: retail margins
as a percentage of consumer prices**

	Buyer power	Seller power
Pork	-0.9%	-0.2%
Beef	12.0%	5.5%
Poultry	1.0%	0.9%

Netherlands

The Dutch case refers to retail meat sales over the period January 2000 – June 2005. For this period, we have data on consumer sales and prices with respect to pork, beef and poultry for every four week period within each year. For the same period, we also have monthly data on wholesale prices as well as the hourly wage rate within Dutch retail. These data have been adapted to come to 13 periods within each year. Consumption data are retail scanner data provided to LEI by the Dutch Product Board for Meat and Eggs (PVE). Wholesale prices and wage data are available at the Dutch Bureau of Statistics.

Table III.13 presents the descriptive statistics of the data. Most meat consumption in the Netherlands refers to pork (46%) followed by poultry (35%). Unit prices are lowest for poultry (EUR 5.30 per kilo in 2004), followed by pork (EUR 6.25) and beef (EUR 8.30). The difference between poultry and beef prices is relatively low, *e.g.* in comparison with Japan. Meat consumption follows a seasonal pattern with consumption being low in the summer months and high in the winter months.

Table III.13 Descriptive statistics: Netherlands

Variable	Unit	Period	Mean	Stand. Dev.	Max	Min
Expenditure share pork	%	Jan 2000 –Jul 2005	0.46	0.015	0.43	0.49
Expenditure share beef	%	Jan 2000 –Jul 2005	0.24	0.017	0.21	0.28
Expenditure share poultry	%	Jan 2000 –Jul 2005	0.30	0.021	0.25	0.34
Quantity pork	1 000 kilo	Jan 2000 –Jul 2005	8 231	655	6 833	9 846
Quantity beef	1 000 kilo	Jan 2000 –Jul 2005	3 279	445	2 376	4 085
Quantity poultry	1 000 kilo	Jan 2000 –Jul 2005	6 365	397	5 579	7 391
Consumer price pork	Index, 2000 = 1	Jan 2000 –Jul 2005	1.10	0.072	0.91	1.27
Consumer price beef	Index, 2000 = 1	Jan 2000 –Jul 2005	1.02	0.030	0.93	1.08
Consumer price poultry	Index, 2000 = 1	Jan 2000 –Jul 2005	1.09	0.061	0.95	1.24
Wage	Index, 2000 =1	Jan 2000 –Jul 2005	1.08	0.047	0.99	1.13
Wholesale price pork	Index, 1995 = 1	Jan 2000 –Jul 2005	1.10	0.128	0.94	1.58
Wholesale price beef	Index, 1995 = 1	Jan 2000 –Jul 2005	0.90	0.043	0.82	1.02
Wholesale price poultry	Index, 1995 = 1	Jan 2000 –Jul 2005	1.11	0.048	1.00	1.18

1. Prices are indexed prices.

Stage 1 Demand

Contrary to the other three countries, estimation of the Dutch demand system is not plagued by autocorrelation of the error terms. For the Netherlands demand has been

estimated using Seemingly Unrelated Regressions without the corrections for autocorrelation. The demand system is completed with a trend component and three seasonal components: a dummy for the last period in the year (Christmas and New Year shopping) and a trigonometric specification to capture seasonality. The demand system is extended with three variables capturing seasonality. The poultry equation has not been estimated in order to prevent singularity due to the adding up constraint.

Table III.14 presents the results of the estimations of the demand system. The expenditure and the price parameters are not significant at the 5% significance level with one exception. On the other hand, the fit of the demand system is high (72%) and the error terms are well-behaved. Price and expenditure elasticities are as expected. The expenditure elasticity is above 1 for beef and below 1 for pork and poultry. Price elasticities are around -1 and cross effects are negligible. If prices rise, the Dutch simply cut back on the consumption of the product concerned leaving the budget shares the same as before.

Table III.14A. Parameter estimates of the demand equation for the Netherlands

	α_i	β_i	$\gamma_{i,pork}$	$\gamma_{i,beef}$	$\gamma_{i,poultry}$	δ_{Trend}	δ_{13}	δ_{cos}	δ_{Sin}	R^2	DW
Pork	1.193	-0.062	-0.055	0.030	0.025	-0.000[**]	0.0191[**]	0.0012	-0.001	72.1	1.73
Beef	-0.557	0.069	0.030	0.035	-0.064[*]	0.000	0.0041	0.0129[**]	0.001		1.83

*Significant at the 5% level; **significant at the 1% level.

Table III.14B. Price and expenditure elasticities of Dutch meat demand

	Pork	**Beef**	**Poultry**	**Expenditure**
Pork	**-1.06**	0.10	0.10	0.86
Beef	-0.01	**-0.93**	-0.35	1.29
Poultry	0.09	-0.21	**-0.86**	0.98

Stage 2 Supply

The supply equations have been estimates using two stage least squares (2SLS). Lagged values of the wholesale price have been used to estimate the instrumental variable. Inclusion of demand variables did not improve estimation of the instrumental variable. The lags used differ, among other things because of the use of monthly data. Table III.15 provides the results of the supply functions estimates. Again, the relationship between supply and wholesale prices is poor, especially for pork. This result may be partly due to the large shocks in price and supply due to animal diseases in the period concerned: food and mouth disease and avian flue. The price elasticity of supply (v_1) is significant at the 1% level for beef and at the 5% level for poultry. The elasticities found are in line with those found for Japan and by Gohin and Guyomard (2000). The price elasticity for poultry is rather high.

Table III.15A Parameter estimates of the supply equation for the Netherlands

	v_0	v_1	R^2	DW
Pork	6.24	0.30	2.3	1.99
Beef	5.16**	0.52**	10.9	2.01
Poultry	5.48**	1.54*	7.9	2.28

*Significant at the 5% level; **significant at the 1% level.

Table III.15B. Price elasticities of Dutch meat supply

	Price elasticity
Pork	0.30
Beef	0.52
Poultry	1.54

Stage 3: Price behaviour

In the third stage, we applied non-linear three stage least squares to estimate the parameters of the three optimality equations. All parameters are significant at the 5% significance level except the market power estimate for pork. The conjectural variation is positive for beef, but negative for poultry (and pork) indicating that retailers make some profits on beef, but make a net loss on poultry. Table III.16B expresses retail profits and losses as a percentage of the consumer price. So, for beef retailers make a net profit margin equal to 1.8% at the expense of their suppliers (buyer power) and of 0.3% at the expense of consumers (selling power). The introduction of wages into the pricing equations has a less profound effect on the model results than in Japan. The estimates of the market parameters would be slightly higher in absolute terms without changing the signs and the significance.

Table III.16A .Parameters of the price equations for the Netherlands

Beef			Pork			Poultry		
Parameter	Estimate	t value	Parameter	Estimate	t value	Parameter	Estimate	t value
θ	0.0029	11.24	θ	-0.0160	-1.65	θ	-0.0166	-6.87
δ_{wages}	0.0230	7.41	δ_{wages}	0.0294	4.30	δ_{wages}	0.0299	22.61

Table III.16B. Market power estimates for the Netherlands: retail margins as a percentage of consumer prices

	Buyer power	Seller power
Pork	-1.7%	-1.5%
Beef	0.2%	0.3%
Poultry	-0.3%	-1.9%

Interpretation

The first sections of Chapter 3 provides estimates of the market power parameter and the implied estimates of retail margins. In this section, we interpret and classify the results of the analysis. The market power parameter assesses whether pricing is competitive versus monopolistic on a scale of 0 to 1. Retail pricing is competitive if the market power parameter is 0; in a monopoly or a perfect cartel, the parameter equals 1. Intermediate values point to some oligopolistic or oligopsonistic market power. In general, the market power parameter is expected not to be smaller than 0. However, in a multi-product and in a multi-period setting, this is very well possible. Retailers may make losses on some products to make profits on other products. Retailers may also make losses in a certain period in the expectation to make profits somewhere in the future.

In general, the estimates of the market power parameter found are significant but small. They are closer to 0 than to 1. This implies that in general retail market power seems limited. However, given the low price elasticities of demand and supply found, the impact on prices and margins may be considerable. This holds in particular for beef in Canada and Japan, pork in the Czech Republic and poultry in Canada.

In the main text, we use the market power estimates to classify retail pricing behaviour in qualitative terms. We identify three regimes with respect to retail pricing:

Competitive pricing:	retail prices more or less equal retail costs
Possible market power:	retail prices are above retail costs
Cut-throat competition:	retail prices are below retail costs

We use the following boundaries to classify the three regimes identified. If the market power parameter is insignificant or small ($|\theta| < 0.1$), retail pricing behaviour is considered to be competitive. If the market power parameter is significantly positive and relatively large ($\theta > 0.1$), retail pricing behaviour is possibly characterised by market power. If the market power is significantly negative ($\theta < -0.1$), retail pricing is considered to be characterised by cut-throat competition. Retailers price below marginal costs. Using this classification, Table III.17 may be derived.

Table III.17. Retail pricing with respect to meat

	Pork	Beef	Poultry
Canada	Competitive	Competitive	Competitive
Czech Republic	Cut-throat competition	Competitive	Competitive
Japan	Competitive	Possible market power	Competitive
Netherlands	Competitive	Competitive	Competitive

The estimates of the market power parameter may be sensitive to changes in the values of the price elasticities of demand and supply found. This is especially a problem if the estimates of the demand and supply elasticities are not very robust themselves. Taking the poor explanatory power of the supply equations into account this problem may very well arise with respect to the price elasticity of supply.

For this reason, the sensitivity of the results is tested by doubling the parameter values of the price elasticity of supply found. Table III.18 shows the estimates of the market

power parameter for the price elasticities found in scenario I above and for twice the price elasticities of supply found in scenario II above. The results show that some estimates of the market power parameter indeed are sensitive to the price elasticity of supply used; other estimates are less sensitive. Note that especially the large estimates of the market power parameter seem to be sensitive to changes in the price elasticity of supply. The impact of changes in the price elasticity of supply on the market power parameter is high for beef in Japan and pork in the Czech Republic.[6] Market power with respect to beef would slowly disappear in Japan, since the market power estimate tends to 0. Czech retailers would still make large losses on pork, although the estimate of the losses made would be reduced substantially. The results for Canada and the Netherlands on the other hand seem robust.

Table III.18. Sensitivity of the market power parameter to changes in the price elasticity of supply

	Beef		Pork		Poultry	
	Scenario I	Scenario II	Scenario I	Scenario II	Scenario I	Scenario II
Canada	0.09	0.09	0.01	0.01	-0.02	-0.02
Czech Republic	0.06	0.06	-0.38	-0.19	-0.04	-0.04
Japan	0.10	0.05	0.00	0.00	0.01	0.01
Netherlands	0.00	0.00	-0.02	-0.02	-0.02	-0.02

ENDNOTES

1. Note that the Lerner index is evaluated at marginal rather than average costs.

2. The Kronecker delta is 1 for $i = j$ and 0 otherwise ($i \neq j$).

3. The specification of equation (10a) and (10b) is somewhat ad hoc compared to the system specified for consumer demand. We merely specified log-linear relations for industry supply and retail demand.

4. The budget shares do not sum up to 1, since the autocorrelation correction differs per demand equation.

5. The expenditure elasticity refers to the expenditure of the three commodities considered only.

6. Note that the price elasticities of supply used for the Czech Republic were already high, while they were very low for Japan.

CHAPTER 4.

ESTIMATION OF VERTICAL PRICE TRANSMISSION

Estimation procedure

This chapter presents the procedure adopted for the estimation of vertical price transmissions in this study. The procedure follows the method advanced by Goodwin and Holt (1999), Goodwin and Harper (2000) and Goodwin and Piggott (2001). The method implements a threshold vector error correction model (TVEC). The theoretical consideration related to estimation of vertical price transmission and detailed description of the threshold vector error correction is available in OECD (2005). The general theoretical underpinning of the econometric estimation using time series data could be found in Hamilton (1994), Maddala and Kim (1998) and Enders (2004).

For the analysis, monthly price data for farm, wholesale, and retail markets were collected for beef, pork and poultry for Canada, the Czech Republic, Japan and the Netherlands. The price data definitions differ by country and product. The time period for each market is determined by the shortest price series available for each market (a brief description of the data for individual countries is presented in the last section of this chapter). A logarithmic transformation of variables is applied for all prices, such that results may be interpreted in percentage change terms.

The estimation strategy for TVEC model can be briefly summarized as follows: the general two-step approach of Engle and Granger (1987) is applied to the transformed data and a co-integrating relationship among the variables is estimated by ordinary least squares (OLS). The error correction model is then specified by using lagged residuals from the co-integrating regression as error correction terms. A two-dimensional grid search is then conducted to define two thresholds. The procedure searches for the first threshold between 1% and 99% of the largest (in absolute value) negative error correction term. In like fashion, it searches for the second threshold between 1% and 99% of the largest positive error correction term. The error correction model is then estimated conditional on the threshold parameters.

As parameter estimates for non-structural models of this sort are typically of limited interest in and of themselves, it is common to use impulse responses or dynamic multipliers to evaluate short-run and long-run effects of shocks. In contrast to the linear model case, the response to a shock in a non-linear model is dependent upon the history of the series. In addition, the possibly asymmetric nature of responses implies that the size, timing, and sign of the shock will influence the nature of the response. In this light, there are many different possible impulse response functions. It is typical to choose a single observation or, alternatively, to calculate impulses at all observations and present the average or some other summary of the responses. The nonlinear impulse response

function approach of Potter (1995) is used in this study. It should also be noted that, in light of the non-stationary nature of most price data and the error correction properties of a system of equations, shocks may elicit either transitory or permanent responses. In particular, non-stationary implies that shocks may permanently alter the time path of variables.

Empirical estimation and evaluation

Currently, standard statistical software packages do not yet contain programmed procedures to estimate asymmetric price transmission with thresholds. The TVEC model procedure was programmed by Professor Barry Goodwin of North Carolina State University. The code has been written in the IML language of SAS. The actual estimation of the TVEC model was preceded by several time series diagnostic procedures. Augmented Dickey-Fuller and Phillips-Perron unit root tests were applied to test for stationary in the price series while Johansen tests were used to evaluate the presence of co-integration. It should be noted that, to the extent the data are characterized by thresholds or other nonlinearities, these test results may not be fully reliable. However, these tests are useful for the purposes of putting the results into the context of the larger body of literature that has used such tests to consider price linkages. These basic time series tests indicate that most data series are non-stationary, although majority of price series for individual meat markets are found to be co-integrated.

The OLS estimates of the co-integrating relationship regressions tables, normalized on the retail price, are presented in the following section by individual countries. The results are surprising in that the coefficients on farm prices are sometimes negative or generally very small and insignificant. The results indicate that when both prices, farm and wholesale, are taken into the account in the retail price regression, the farm price has a very limited explanatory power with regard to the movements in a retail price. In other words, the changes in retail prices are primarily explained by changes in wholesale prices. This is true for all countries except Japan where, both farm and wholesale prices were found to have a limited explanatory power in the retail price regressions.

A two-dimensional grid search is then conducted and maximum likelihood (ML) method used to choose the thresholds. The grid search that uses the ML criteria is equivalent to a sup(LR) Chow test approach, where the largest test statistic is used to define a break (threshold). A Hansen's test is conducted to test the null hypothesis of no thresholds, and thus determine the significance of threshold effects. The summary statistics for TVEC Models tables are presented for individual countries in the following section. Reported p-values smaller than 0.1 indicate a rejection of null hypothesis of no threshold. In other words, a small p-value implies a significant presence of thresholds. The test p-values obtained from Hansen test imply statistically significant differences in parameters over the alternative regimes for beef and pork markets with the exception of Japan pork market. On the other hand, statistically significant thresholds were not found for poultry markets with the exception of Canada.

As noted above in this type of nonlinear, non-structural models, the large number of coefficients typically have little meaning in and of themselves. Thus, perhaps the best way to interpret the implications of the models for patterns of price transmission, speed of adjustment and asymmetries, is to consider the time paths of prices after exogenous shocks; in other words, impulse responses. The impulse responses represent percentage changes in prices to a certain percentage shock in one of the prices. The shock (impulse)

that initiates the responses represents a one-time, permanent change in the variable being shocked.

The nonlinear character of the model implies that the nature of the response is dependent upon the timing, direction, and size of the shock which may move the pattern of adjustment across different regimes. In the estimation, shocks equivalent to the 0.75 of a unit value are applied to the last observation in each market. That is, each level of a particular market (*i.e.* retail price) is shocked producing impulse responses reflecting the adjustment in the shocked price as well as in prices at the other levels of the supply chain (wholesale, farm level). This generates a relatively large amount of responses for three meat markets and four countries analysis.[1]

To facilitate the interpretation of numerous graphical response functions in a consistent way across countries and products, a simple and transparent, albeit rather arbitrary, algorithm was adopted to measure the extent, speed and asymmetry of the adjustments. The main tendencies discerned from the impulse response functions are summarised in tables in the following section for individual countries and markets. The tables show the transmission of a shock to a certain level (*i.e.* retail) from another level (*i.e.* farm). The extent of price transmission was characterised as full, partial and weak depending whether the average response to a shock was equal (or larger) to the initial shocks or where the adjustment appears relative to the half of the value of the initial shock. Thus, in the tables, F stands for the full transmission, P stands for the partial transmission between 50-100% and W stands for weak price transmission with adjustment below 50%.

The time of adjustment is measured by a simple algorithm which determines the completion of the adjustment process when the changes between periods reach and remain with plus/minus 25% of the final period (the last period after the shock). To the extent that these impulses differ from one another, asymmetries are implied. That is, the differences in transmission and time of adjustment, as well as differences in dynamic of adjustments elicit the extent of asymmetry in the price transmission. In the table, Y stands for presence of symmetrical response while N indicates no symmetry alias asymmetric response.

There are numerous limitations of the time series analysis, in particular when highly aggregated national data used. Another important issue in this type of analysis concerns the timing of the relationships under consideration. If one believes that adjustments to shocks take place within a month, the use of monthly data may not reveal the important dynamics of interest and the price relationships may be more accurately modelled using weekly rather than monthly price data. Weekly price data are rare and thus one must balance data availability issues against modelling considerations. Although caution is required in interpreting and drawing conclusion from the results, this type of analysis could be a useful supplement to the analysis of structural models.

Finally, the programming code used in this empirical exercise is fully transportable and can be applied to a vector error correction model of any dimension. The code uses SAS macro language to the greatest extent possible to modularize the estimation and inference process and to provide code that automatically adjusts to the dimension of the VEC model and the size of the dataset thus making the relatively complex estimation procedure a relatively more accessible. The procedure and the computer program used in the estimation are made available to member countries.

Results for individual countries

This section presents the data description and main results of the price transmission estimation organized by individual countries. The first table shows the data period, number of observations used in the analysis, arithmetical mean, units and brief description of the price variables. The second table illustrates the OLS estimates of the co-integrating relationship regression. The dependent variable is in each case the retail price. The third table presents the summary statistics for TVEC Models and the fourth table summarises the main results in the fashion as explained above. To briefly recapitulate: F stands for the full transmission, P for partial transmission, W for weak price transmission, Y stands for the presence of symmetry, while N indicates no symmetry (asymmetry).

Canada

Monthly price index data for farm, wholesale, and retail markets were collected for beef, pork and poultry from Statistics Canada.

Table IV.1. Price data series description — Canada

Variable	Data period	Number of obser-vations	Mean	Description
Beef retail price	1/1981 – 8/2005	296	102.73	Index of prices – base 1992=100 (2001= basket content)
Beef wholesale price	1/1981 – 8/2005	296	103.41	Index of prices – base 1997=100
Beef farm gate price	1/1981 – 8/2005	296	101.93	Index of prices – base 1997=100
Pork retail price	1/1981 – 8/2005	296	103.29	Index of prices – base 1992=100 (2001= basket content)
Pork wholesale price	1/1981 – 8/2005	296	69.93	Index of prices – base 1997=100
Pork farm gate price	1/1981 – 8/2005	296	82.95	Index of prices – base 1997=100
Poultry retail price	1/1981– 8/2005	296	98.85	Index of prices – base 1992=100 (2001= basket content)
Poultry wholesale price	1/1981 – 8/2005	296	89.08	Index of prices – base 1997=100
Poultry farm gate price	1/1981 – 8/2005	296	92.35	Index of prices – base 1997=100

Table IV.2. OLS estimates of the co-integrating relationship regression — Canada

	Beef		Pork		Poultry	
Variable	Estimate	t –value	Estimate	t -value	Estimate	t -value
Farm gate price	-0.35562	-4.45	-0.09053	-2.90	-0.14900	-0.66
Wholesale price	2.18814	19.53	0.48483	28.14	1.79208	12.74

Table IV.3. Summary Statistics for Threshold Vector Error Correction Models — Canada

Variable	Beef	Pork	Chicken
sup(LR) Test	203.89	168.81	61.128
Test p-value	0.0001	0.0001	0.008
Lower Threshold (c1)	-0.109	-0.013	-0.047
Upper Threshold (c2)	0.090	0.009	0.005

Table IV.4. Estimation Results for Threshold Vector Error Correction Models — Canada

Product	Price (To)	Price (From)	Price Adjustment		Symmetry	Time of adjustment	
			Positive shock	Negative shock		Positive shock	Negative shock
Beef	Retail	Wholesale	W	P	Y	17	19
	Retail	Farm	W	P	N	15	10
	Wholesale	Retail	P	W	N	4	24
	Wholesale	Farm	W	F	Y	17	8
	Farm	Retail	W	W	Y	10	9
	Farm	Wholesale	W	W	Y	10	14
Pork	Retail	Wholesale	W	P	N	46	18
	Retail	Farm	P	F	Y	25	18
	Wholesale	Retail	W	W	N	15	30
	Wholesale	Farm	W	W	N	31	32
	Farm	Retail	W	W	Y	23	41
	Farm	Wholesale	W	W	Y	4	6
Chicken	Retail	Wholesale	W	W	Y	34	20
	Retail	Farm	W	W	Y	30	10
	Wholesale	Retail	P	W	N	12	40
	Wholesale	Farm	W	W	N	23	29
	Farm	Retail	W	W	Y	3	3
	Farm	Wholesale	W	W	Y	3	3

Czech Republic

Monthly price level data for farm, wholesale, and retail markets were collected for beef, pork and poultry from the Czech Statistical Office – Archive VUZE, Prague, Czech Republic.[2]

Table IV.5. Price data series description — Czech Republic

Variable	Data Period	Number of obser-vations	Mean	Description
Beef retail price	1/1993 – 9/2005	153	123.27	Prices in levels – Kc/kg. Weighted average of retail prices of front and back boneless parts of the animal.
Beef wholesale price	1/1993 – 9/2005	153	99.90	Prices in levels – Kc/kg. Weighted average of wholesale prices of front and back boneless parts.
Beef farm gate price	1/1993 – 9/2005	153	56.53	Prices in levels – Kc/kg. Weighted average of producer prices for bulls, cows and heifers (carcass meat).
Pork retail price	1/1993 – 9/2005	153	115.64	Prices in levels – Kc/kg. Weighted average of retail prices of roast and leg.
Pork wholesale price	1/1993 – 9/2005	153	97.51	Prices in levels – Kc/kg. Weighted average of wholesale prices of roast and leg.
Pork farm gate price	1/1993 – 9/2005	153	40.30	Prices in levels – Kc/kg. Producer prices (carcass meat).
Poultry retail price	1/1993 – 8/2005	152	54.37	Prices in levels – Kc/kg. Chicken drawn.
Poultry wholesale price	1/1993 – 8/2005	152	44.23	Prices in levels – Kc/kg. Chicken drawn.
Poultry farm gate price	1/1993 – 8/2005	152	31.30	Prices in levels – Kc/kg. Producer prices (carcass meat).

Table IV.6. OLS estimates of the co-integrating relationship regression — Czech Republic

Variable	Beef		Pork		Poultry	
	Estimate	t -value	Estimate	t -value	Estimate	t -value
Farm gate price	-0.05674	-1.54	0.19737	7.37	0.09442	1.33
Wholesale price	1.07348	45.01	0.82073	25.47	0.83232	17.13

Table IV.7. Summary Statistics for Threshold Vector Error Correction Models — Czech Republic

Variable	Beef	Pork	Chicken
sup(LR) Test	52.29	74.03	24.85
Test p-value	0.06	0.0001	0.999
Lower Threshold (c1)	-0.025	-0.005	-0.019
Upper Threshold (c2)	0.001	0.026	0.005

Table IV.8. Estimation Results for Threshold Vector Error Correction Models — Czech Republic

Product	Price (To)	Price (From)	Price Adjustment		Symmetry	Time of adjustment	
			Positive shock	Negative shock		Positive shock	Negative shock
Beef	Retail	Wholesale	F	F	N	37	20
	Retail	Farm	P	F	N	36	23
	Wholesale	Retail	F	W	N	17	46
	Wholesale	Farm	F	W	N	21	42
	Farm	Retail	F	P	N	5	25
	Farm	Wholesale	F	P	N	3	26
Pork	Retail	Wholesale	W	F	N	27	6
	Retail	Farm	P	F	N	26	7
	Wholesale	Retail	P	W	N	8	9
	Wholesale	Farm	F	F	N	6	15
	Farm	Retail	P	W	N	5	18
	Farm	Wholesale	W	W	N	5	29
Chicken	Retail	Wholesale	F	P	N	15	46
	Retail	Farm	W	W	Y	18	43
	Wholesale	Retail	F	F	Y	5	9
	Wholesale	Farm	W	P	Y	9	10
	Farm	Retail	P	P	Y	45	41
	Farm	Wholesale	P	P	Y	47	40

Japan

Monthly price level data for farm, wholesale and retail markets were collected for beef, pork and poultry. The retail data are from the Annual Report on the retail Price Survey, Japan. The farm and wholesale data are from the Ministry of Agriculture, Forestry and Fisheries, Japan.[3]

Table IV.9. Price data series description – Japan

Variable	Data Period	Number of obser-vations	Mean	Description
Beef retail price	1/1988 – 2/2005	206	4014.03	Prices in levels – yen/kg, (Tokyo), Beef retail (Medium grade)
Beef wholesale price	1/1988 – 2/2005	206	537.09	Prices in levels – yen/kg, (Tokyo), Wholesale Carcass Price, (B2-B3 grade of steer)
Beef farm gate price	1/1988 – 2/2005	206	1088.17	Prices in levels – yen/kg, (Tokyo), Live Cattle Price (Dairy steer)
Pork retail price	1/1985 – 2/2005	242	308.92	Prices in levels – yen/kg, (Tokyo), Pork retail (Medium grade)
Pork wholesale price	1/1985 – 2/2005	242	486.15	Prices in levels – yen/kg, (Tokyo), Wholesale Carcass Price, (Excellent grade)
Pork farm gate price	1/1985 – 2/2005	242	1565.79	Prices in levels – yen/kg, (Tokyo), Live Pig Price.
Poultry retail price	10/1992 – 2/2005	149	173.94	Prices in levels – yen/kg, (Tokyo), Chicken retail (Boneless broilers).
Poultry wholesale price	10/1992 – 2/2005	149	1156.31	Prices in levels – yen/kg, (Tokyo), Wholesale Chicken Price(Class A small).
Poultry farm gate price	10/1992 – 2/2005	149	589.60	Prices in levels – yen/kg, (Tokyo), Live Chicken Price.

Table IV.10. OLS estimates of the co-integrating relationship regression - Japan

Variable	Beef		Pork		Poultry	
	Estimate	t -value	Estimate	t -value	Estimate	t -value
Farm gate price	-0.28962	-17.54	0.02349	0.43	-0.59091	-9.64
Wholesale price	0.25074	10.18	-0.05483	-1.05	0.18492	6.89

Table IV.11. Summary Statistics for Threshold Vector Error Correction Models - Japan

Variable	Beef	Pork	Chicken
Sup(LR) Test	132.53	39.61	38.91
Test p-value	0.0001	0.984	0.552
Lower Threshold (c1)	-0.023	-0.017	-0.001
Upper Threshold (c2)	0.033	0.001	0.019

Table IV.12. Estimation Results for Threshold Vector Error Correction Models - Japan

Product	Price (To)	Price (From)	Price Adjustment		Symmetry	Time of adjustment	
			Positive shock	Negative shock		Positive shock	Negative shock
Beef	Retail	Wholesale	F	W	N	14	38
	Retail	Farm	W	P	N	29	17
	Wholesale	Retail	W	W	Y	3	12
	Wholesale	Farm	P	W	N	5	41
	Farm	Retail	W	W	Y	10	7
	Farm	Wholesale	W	P	Y	16	25
Pork	Retail	Wholesale	F	F	N	15	39
	Retail	Farm	F	P	N	16	39
	Wholesale	Retail	W	W	Y	19	29
	Wholesale	Farm	W	W	Y	32	11
	Farm	Retail	W	W	Y	47	19
	Farm	Wholesale	F	W	N	38	26
Chicken	Retail	Wholesale	W	W	N	42	46
	Retail	Farm	P	W	N	15	38
	Wholesale	Retail	W	W	Y	20	7
	Wholesale	Farm	W	W	Y	18	5
	Farm	Retail	W	W	N	19	25
	Farm	Wholesale	W	P	N	37	27

Netherlands

Monthly price index data for farm, wholesale, and retail markets were collected for beef, pork and poultry from the CBS / Statistics Netherlands.

Table IV.13. Price data series description – Netherlands

Variable	Data Period	Number of obser- vations	Mean	Description
Beef retail price	1/1996 – 4/2005	112	81.75	Index of prices – base 1995 =100
Beef wholesale price	1/1996 – 4/2005	112	104.57	Index of prices – base 1995=100 Wholesale all sale
Beef farm gate price	1/1996 – 4/2005	112	102.41	Index of prices – base 1995=100
Pork retail price	1/1996 – 4/2005	112	114.44	Index of prices – base 1995 =100
Pork wholesale price	1/1996 – 4/2005	112	107.95	Index of prices – base 1995=100 Wholesale all sale
Pork farm gate price	1/1996 – 4/2005	112	94.88	Index of prices – base 1995=100
Poultry retail price	1/1996 – 4/2005	112	106.46	Index of prices – base 1995 =100
Poultry wholesale price	1/1996 – 4/2005	112	100.84	Index of prices – base 1995=100 Wholesale all sale
Poultry farm gate price	1/1996 – 4/2005	112	99.90	Index of prices – base 1995=100

Table IV.14. OLS estimates of the co-integrating relationship regression - Netherlands

	Beef		Pork		Poultry	
Variable	Estimate	t -value	Estimate	t -value	Estimate	t -value
Farm gate price	-0.19686	-13.15	-0.74422	-13.49	-0.42511	-9.77
Wholesale price	0.13349	4.95	1.01128	14.16	1.10359	10.84

Table IV.15. Summary Statistics for Threshold Vector Error Correction Models — Netherlands

Variable	Beef	Pork	Chicken
sup(LR) Test	58.78	64.50	34.73
Test p-value	0.012	0.012	0.684
Lower Threshold (c1)	-0.004	-0.010	-0.011
Upper Threshold (c2)	0.019	0.014	0.018

Table IV.16. Estimation Results for Threshold Vector Error Correction Models — Netherlands

Product	Price (To)	Price (From)	Price Adjustment		Symmetry	Time of adjustment	
			Positive shock	Negative shock		Positive shock	Negative shock
Beef	Retail	Wholesale	F	F	N	16	10
	Retail	Farm	F	P	N	5	5
	Wholesale	Retail	W	W	Y	9	12
	Wholesale	Farm	W	F	N	5	8
	Farm	Retail	W	W	Y	6	9
	Farm	Wholesale	F	P	N	7	4
Pork	Retail	Wholesale	F	F	N	45	5
	Retail	Farm	F	F	N	46	4
	Wholesale	Retail	P	W	Y	8	44
	Wholesale	Farm	F	F	N	3	30
	Farm	Retail	W	W	Y	47	10
	Farm	Wholesale	F	P	N	37	4
Chicken	Retail	Wholesale	W	W	Y	8	31
	Retail	Farm	P	P	N	8	3
	Wholesale	Retail	P	F	N	4	9
	Wholesale	Farm	F	P	N	4	12
	Farm	Retail	W	W	Y	5	5
	Farm	Wholesale	W	W	Y	39	38

Endnotes

1. The printouts of the impulse response functions are available upon request from the OECD Directorate for Food, Agriculture and Fisheries (webmaster@oecd.org).

2. Jirina Slaisova (VUZE) provided an indispensable help in organizing the data collection.

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ANNEX A.

CASE STUDIES OF FARM MARKETING STRATEGIES

This annex presents three examples testing whether differences in farm marketing strategies cause differences in farm size and returns. The first example refers to labelling in the Belgian pork and beef supply chains. Bosmans, Verbeke and Van Gysel (2005) compared farm returns for farmers selling under retail label, specific labels or no label at all. The second example refers to grower associations within Dutch horticulture. The Secretariat compared the size and returns of growers associated with independent grower associations with the size and returns of growers associated with the "old" marketing co-operatives. The third example refers to vertical integration contracts in the meat supply chains of the seven largest European economies before the accession of ten new member countries in 2004. The data were provided by the European Union and interpreted by the Secretariat of the OECD.

Labelling in the Belgian pork and beef supply chains

Annex Table A.1 is an extended version of Table I.5 for pork. Annex Table A.1 illustrates that farm returns do not only depend on the label employed, but also on other factors, such as the number of animals sold, the fattening period, animal mortality, feed conversion and costs in general. The farmers with no label have a relatively high income per animal, because they pay a relatively low price for feed concentrate. Bosmans *et al.* (2005) further argue that income variability may be higher for farmers without a label than for farmers with either a retail or a specific label. In 2002, spot market prices were relatively high benefiting farmers without a label over those with a label.

Annex Table A.1. Labelling and returns in Belgian pork production (2002)

	Reference population	No label	Retail label	Specific label
Number of observations	191	8	11	5
Number of animals	679	1 007	938	212
Mortality (%)	4.3	3.9	3.1	6.8
Fattening period (days)	147	145	143	154
Feed conversion	3.11	3.25	3.05	3.32
Price feed per kilo (euro)	0.189	0.180	0.186	0.204
Cost per kilo (euro)	1.12	1.10	1.11	1.19
Revenue per kilo (euro)	1.33	1.34	1.33	1.47
Revenue per animal	216	228	218	239
Income per animal	58	67	60	69
Farm income	39 531	67 519	56 271	14 673

Source: Bosmans, Verbeke and Van Gysel (2005).

Grower associations in Dutch horticulture

In the Dutch vegetables supply chain, a new type of grower associations emerged during the 1990s alongside the "old" marketing co-operatives: Greenery and ZON. Growers founded product-specific associations performing a range of marketing activities, usually in direct co-operation with wholesale and retail traders. The new grower associations establish their own brands, set up quality mechanisms meeting retail standards, negotiate prices and other transaction conditions and offer a range of services, such as packaging, storage and other logistic services. Many grower associations are independent from the old marketing co-operatives (Greenery and ZON), but not all of them. Some of the independent grower associations combine their activities in new marketing co-operatives in order to offer a wide product variety to their customers. Moreover, not all growers are affiliated to one of the new grower associations.

Annex Tables A.2 shows the development of turnover and membership of the three largest marketing co-operatives in the Dutch fresh vegetables supply chain. The table includes data on the two 'old' marketing co-operatives: The Greenery and ZON and three new ones: FresQ, BGB and VDT. The table clearly shows that turnover and the number of members falls sharply at the old marketing co-operatives and rises rapidly at the new co-operatives. The table also shows that the growers in the new co-operatives tend to larger. The Greenery has as a specific problem that grower size does not really rise over the years.

Annex Table A.2a. Turnover of Dutch marketing co-operatives (mln Euro)

	1998	1999	2000	2001	2002	2003	2004	Annual change
The Greenery	2 263	2 332	1 520	1 523	1 515	1 570	1 426	-7.4
Veiling ZON	331	307	329	322	229	262	181	-9.6
FresQ			101	132	145	192	216	20.9
BGB					63	81	75	9.1
VDT					51	68	72	18.8

Annex Table A.2b. Number of members of Dutch marketing co-operatives

	1998	1999	2000	2001	2002	2003	2004	Annual change
The Greenery		6 500	5 000	4 500	4 150	4 150	na	-10.6
Veiling ZON		2 500	1 500	1 340	976	772	680	-22.9
FresQ				80	75	87	95	5.9
BGB						64	60	
VDT						71	98	

Annex Table A.2c. Turnover per member of Dutch marketing co-operatives (mln. Euro)

	1998	1999	2000	2001	2002	2003	2004	Annual change
The Greenery		0.36	0.30	0.34	0.37	0.38	na	1.3
Veiling ZON		0.12	0.22	0.24	0.23	0.34	0.27	16.7
FresQ				1.65	1.93	2.21	2.27	11.3
BGB						1.27	1.25	
VDT						0.96	0.73	

Source: Nationale Coöperative Raad. Processing: OECD.

ANNEX B.

PRICE PATTERNS IN THE NETHERLANDS AND CANADA

This Annex shows price developments in the meat supply chains of the Netherlands and Canada to illustrate two things. First, in the Netherlands, price developments at the wholesale level – import, export and domestic prices – are more or less the same for pork (and poultry), but not for beef. This may point to differences in quality, parts or stages of processing. Beef is not a homogenous product. Another observation one may make is the fact that the prices at which retailers buy in the Netherlands tended to rise faster from 1995 to 2005 than other wholesale prices. Second, price developments in Canada at the provincial level are more or less the same at the agricultural and the wholesale level, but not at the retail level. This may point to differences in the scope of geographical markets. At the agricultural and the wholesale level the national market may be well-integrated. At the retail level the provincial level may be a more relevant concept to study retail competition, in particular with respect to pricing. The divergence in price developments may point to market power in at least some provinces.
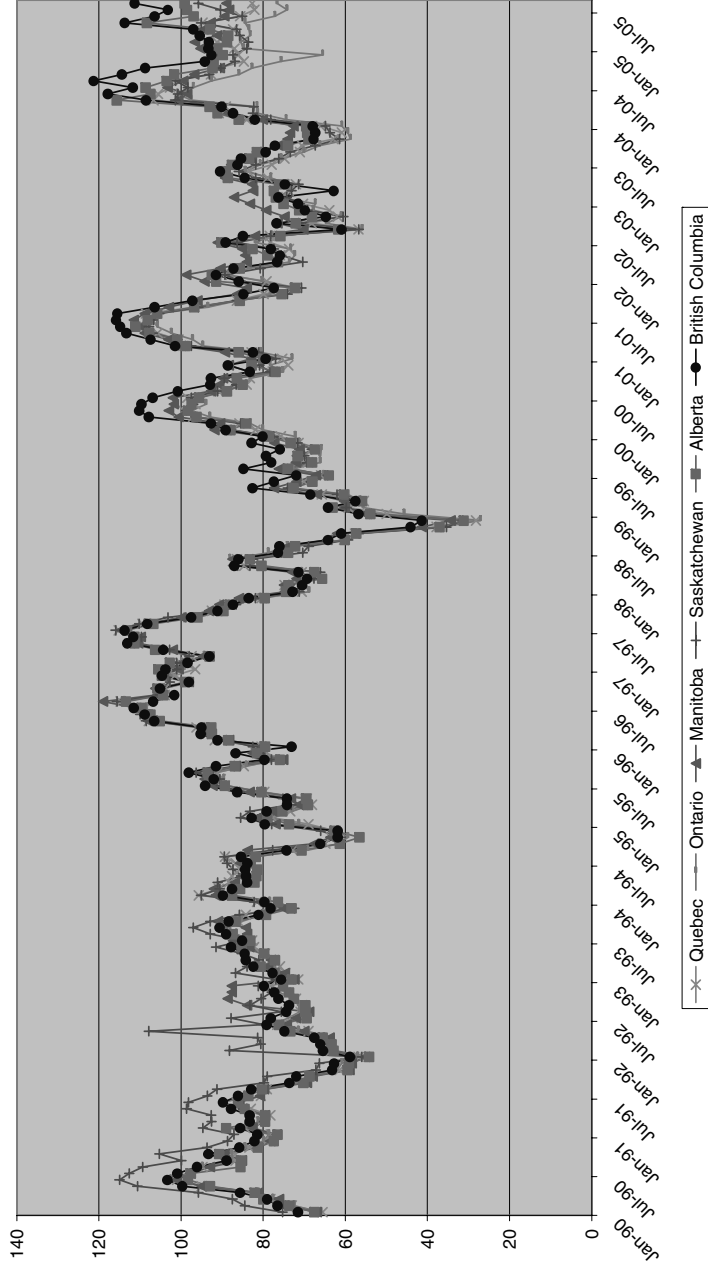
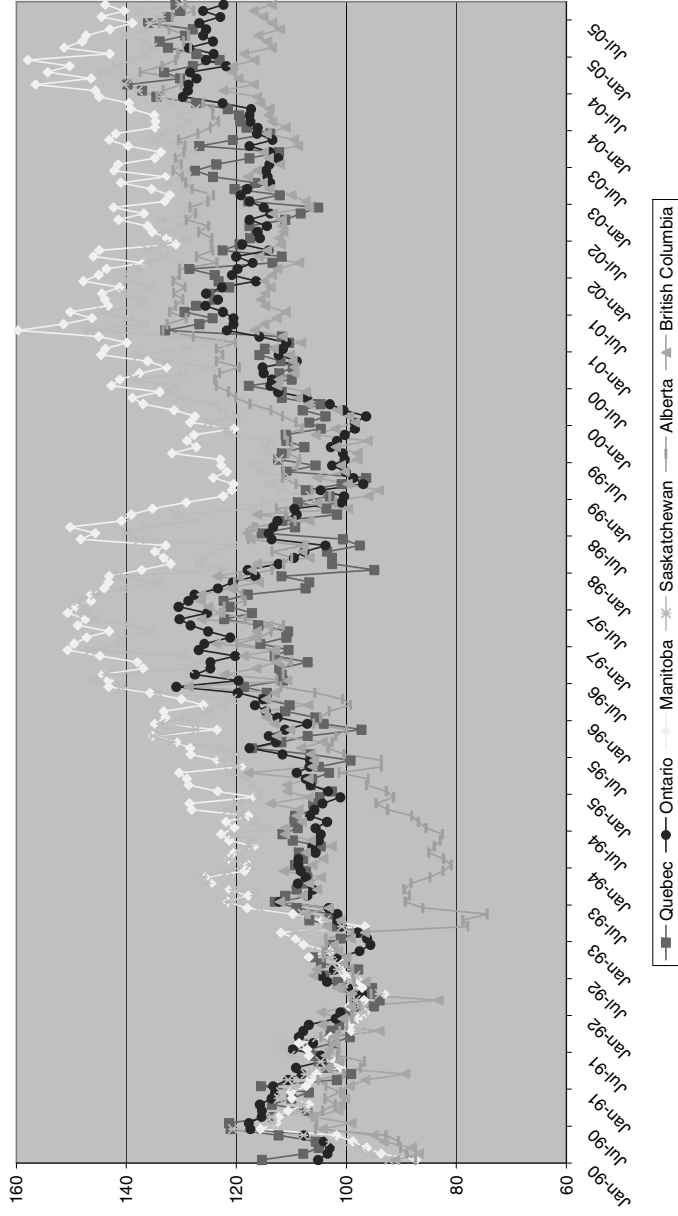**Beef wholesale prices in the Netherlands**
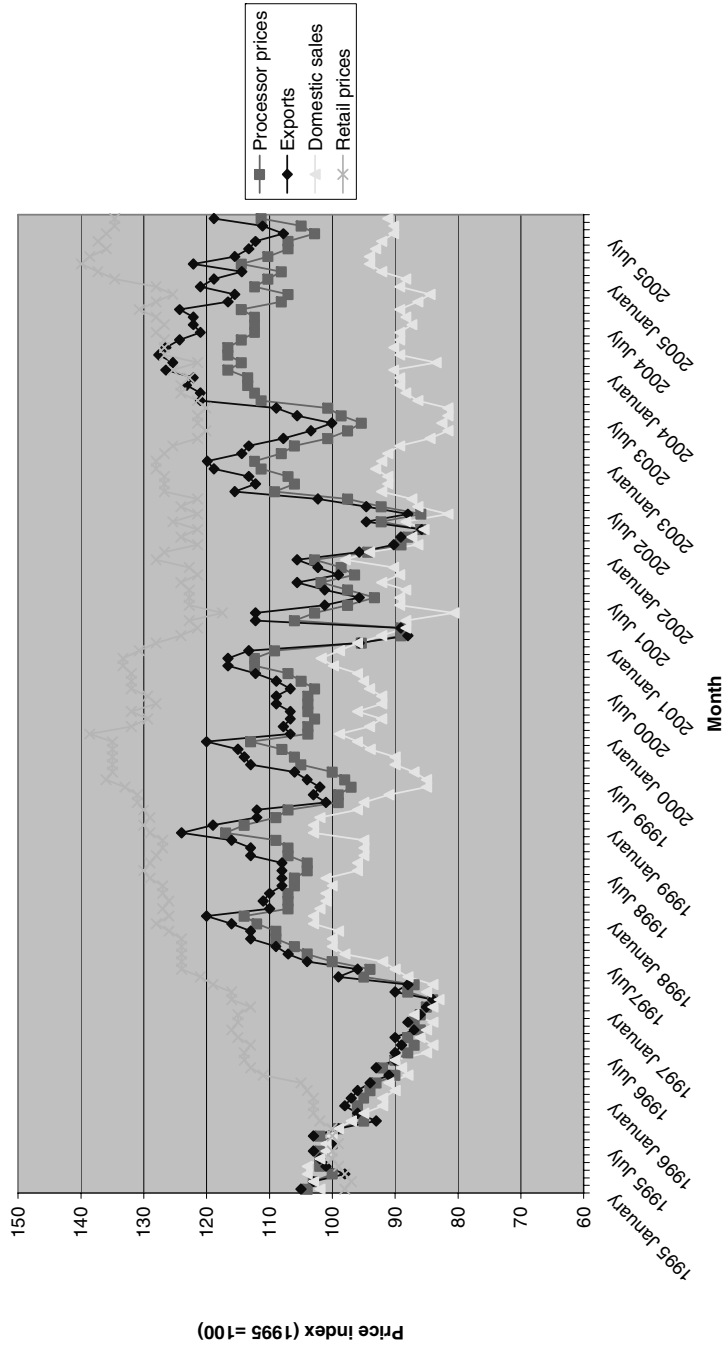
Pork wholesale prices in the Netherlands
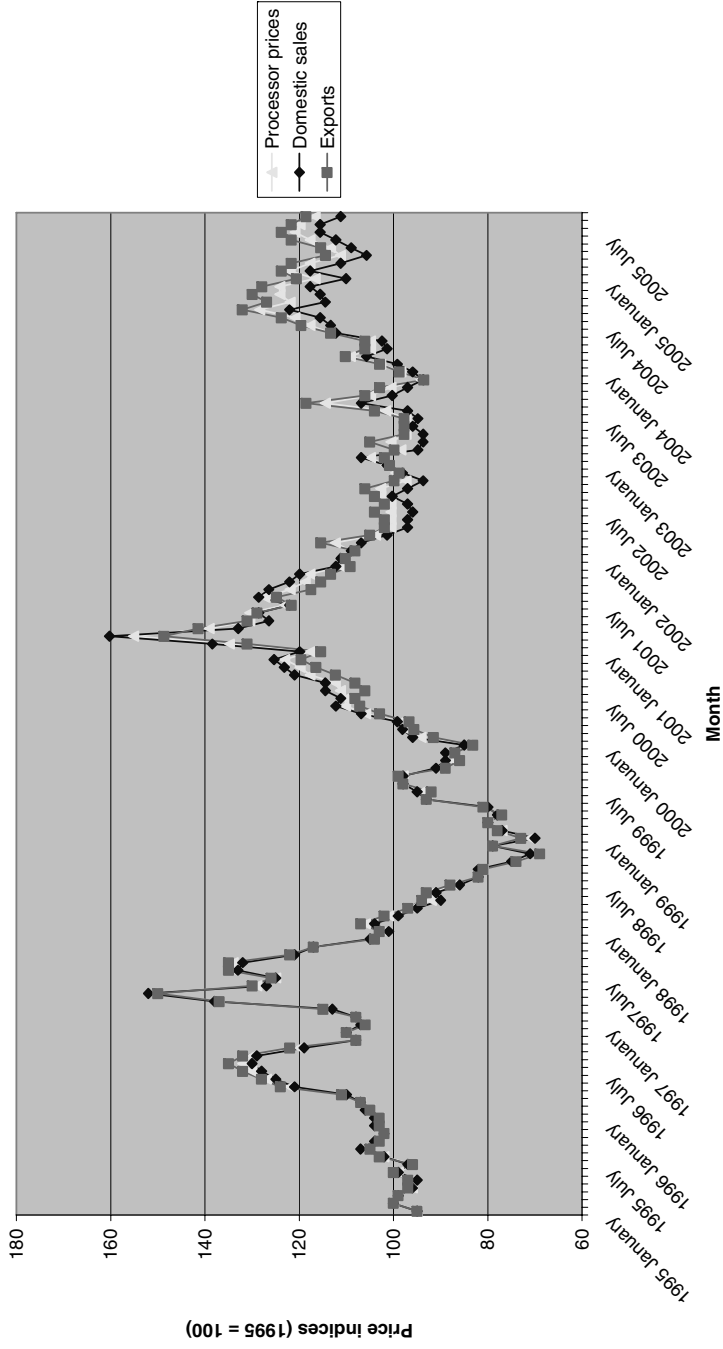
Provincial Agricultural Price Indices for Hogs in Canada

Quebec — Ontario — Manitoba — Saskatchewan — Alberta — British Columbia

Provincial Consumer Price Indices for Pork in Canada

ANNEX C.

RETAIL MARGINS

This Annex presents the estimates of retail margins based on the estimates of the market power parameter and the price elasticities of supply and demand. Retail margins are given as percentages of consumer prices. According to our estimates, Canadian retailers make net profits equal to 2.4% on pork. A small part of this profit is at the expense of buyers; the major part of this profit is at the expense of consumers. Retail margins on beef and poultry are even higher in Canada. Czech retailers make losses on pork according to our estimate. They give a subsidy equal to 56.3% of the consumer price to suppliers and consumers. Suppliers get the major part of the subsidy.

Retail profits are measured on basis of demand, supply and pricing equations. The estimations do not involve any accounting. This warrants some caution when interpreting the number. However, the estimates of retail margins together with the estimates of the market power parameters give an indication for which products retail pricing deviates from competitive pricing: beef and poultry in Canada, pork in the Czech Republic and possibly beef in Japan.

Annex Table C.1. Retail margins on meat
(Percentage of consumer price)

	Pork		Beef		Poultry	
	Buyer power	**Seller power**	**Buyer power**	**Seller power**	**Buyer power**	**Seller power**
Canada	0.4%	2.0%	1.2%	12.2%	1.9%	5.8%
Czech Republic	-35.7%	-20.6%	0.9%	4.7%	-1.6%	-3.6%
Japan	-0.9%	-0.2%	12.0%	5.5%	1.0%	0.9%
Netherlands	-1.7%	-1.5%	0.2%	0.3%	-0.3%	-1.9%

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Supermarkets and the Meat Supply Chain

THE ECONOMIC IMPACT OF FOOD RETAIL ON FARMERS, PROCESSORS AND CONSUMERS

This volume examines developments in the food economy, focusing on the economic impacts of increasing retailer concentration on consumers, processors and farmers. The document estimates retail market power and assesses price transmission in the beef, pork and poultry supply chains of Canada, the Czech Republic, Japan and the Netherlands. In addition, farm marketing strategies are examined in three case studies: retail versus other labelling in the Belgian pork and beef supply chains; producer organisation in Dutch horticulture; and contract rearing in livestock production in the EU.

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