Unclassified **AGR/CA/APM/CFS/MD/RD(2006)7**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development **07-Mar-2006**

English text only

DIRECTORATE FOR FOOD, AGRICULTURE AND FISHERIES
COMMITTEE FOR AGRICULTURE

AGR/CA/APM/CFS/MD/RD(2006)7
Unclassified

Group on Cereals, Animal Feeds and Sugar and Group on Meat and Dairy Products of the Working Party on Agricultural Policies and Markets

THE IMPLICATIONS OF CHANGING MARKET STRUCTURES IN THE POULTRY INDUSTRY

27-28 March 2006

This document is presented to the Joint Session under Item 7 of the draft agenda.

Contact: Linda Fulponi (e-mail: linda.fulponi@oecd.org)

JT03205122

English text only

(Note by the Secretariat)

This document examines the changing structure of the poultry industry and highlights some of the important policy implications which arise from these. Using data from selected OECD countries and results reported in the literature, it finds that the poultry industry has undergone the most significant structural changes of any agro-food sector: being transformed from a minor farm activity into highly specialised, large-scale agribusiness, which is vertically coordinated. In this economic setting the implications of policies for continued sectoral development is discussed and specific attention is given to those which deal with wider issues of policy such as, food safety, grading and competition.

This document is presented to the joint meeting of the Working Groups on Cereals, Animal Feeds and Sugar and on Meat and Dairy Products for information and discussion. The report will not be published as such but will provide background information to ongoing work in the Directorate on buying behaviours and structural change. This report was prepared by a consultant, Mrs. Odette Vaughan.

PUBLIC POLICY IMPLICATIONS OF CHANGING STRUCTURE AND FIRM BEHAVIOUR: THE CHICKEN SUPPLY CHAIN

Introduction

1. This report examines the policy implications of the changing structure and firm behaviour in the agro-food sector with a focus on the chicken supply chain.[1] Among the issues addressed is how increasing industry concentration and closer vertical coordination are influencing the supply chain and in particular chicken farmers.

2. To the extent possible, there is an attempt to give an international perspective to the analysis including some comparisons between developed and developing countries. Information is largely drawn from readily available public sources, and the analysis is descriptive in nature. The countries covered in somewhat more detail, mainly due to availability of information, are the United States, Canada, the European Union (including the Netherlands, France and the United Kingdom), Brazil and Thailand.

3. Existing studies on chicken industry structure tend to be country-specific and ad hoc. As far as the author is aware, while chicken and other agri-food products are covered extensively in terms of international trade and market analyses, there are no comprehensive cross-country studies on the chicken or other agri-food sectors that address issues of industry structure and public policy.[2]

4. One issue is that even on a national basis, agri-food industry concentration statistics seem to be available for only some developed countries, and comparing these statistics across countries can be done only in a general sense since definitions can vary. Another issue is the lack of national statistics on vertical coordination in agri-food sectors. It appears that only the United States publishes comprehensive, official statistics on vertical ownership and contracting arrangements in agri-food sectors.

5. It is possible to draw some general conclusions about directions of change in the structure of chicken supplies chains. Consolidation has been occurring at all stages throughout the chicken supply chain and concentration at the processing level is still considered somewhat moderate (CR4 is usually not above 50 percent). However, concentration at the processing stage could increase since there are significant economies of scale in this industry. Furthermore, vertical integration is perhaps more widespread in the chicken industry than in any other agri-food sector. Many chicken supply chains worldwide are now vertically integrated from feed mills to hatcheries, chicken farming, and processing and further processing. Often, large processors own feed mills and hatcheries, and contract the raising of chickens with farmers. While market concentration does not tend to be very high in chicken processing, dominant chicken processing companies can have a fairly high degree of influence on the supply chain through vertical coordination. In the United States, 95 percent of US chicken is produced under vertical farmer contract with less than 40 agribusiness firms.

---

1 While the chicken meat industry is the focus of this report, in a few instances, information is presented in terms of poultry meat since disaggregated information is not always available. Poultry meat includes chicken, turkey, ducks and geese. Poultry in general may also include eggs, however poultry meat information is usually given separately from eggs.

2 However, there are apparently a limited number of papers that contain case studies, for instance a study by Hobbs and Young(2001) on vertical linkages in agri-food supply chains in Canada and the United States, and the OECD (2005a) study on changes in retail buying behaviour and the impact on structure and returns in agriculture that covers a few different countries.

6. A number of policy implications could be discussed in relation to the changes occurring in the chicken industry. The issue of buyer purchasing power is relevant, and hence a role for competition regulation is identified. Collective bargaining and legislation that gives farmers the right to organize are also potential means of addressing processor purchasing power. There could be a role for government in providing information and advice to farmers regarding vertical contracts. Governments may also have a role in facilitating the efficiency and competitiveness of supply chains by reducing transaction costs resulting from information asymmetry. Other issues are related to the decline in small family farms as well as intensive animal and poultry production and its influence on the environment and animal welfare.

7. This report comprises 7 sections. Following this introduction is an overview of the international chicken market in section 2 which situates the production and trade of countries globally. The evolution of the structure of the chicken industry is discussed in section 3, including farm consolidation and concentration in processing and its impact on farmers. Section 4 covers the significance and motivation of vertical coordination in the chicken supply chain. Changes in the food retail sector and their impact on the supply chain are discussed in section 5. Policy implications of the changing supply chain structure are presented in section 6. Finally, concluding comments are provided in section 7.

Market Overview[3]

8. Chicken markets have evolved into some of the largest meat markets nationally and internationally, fuelled by a high rate of chicken meat consumption due in part to its price relative to beef, pork and other meats. Globally, chicken is the second most important meat after pig meat, accounting for about 30 percent of total meat production. However chicken meat production has been growing steadily worldwide since the early 1990s and this growth has outpaced that of all other meats. This has been attributed in particular to very strong growth in developing country production, especially Brazil and China and to a lesser extent Thailand. Even the more mature markets such as the United States and EU have continued to experience relatively marked growth in chicken production.

9. Chicken production is widespread throughout the world given its ease of production relative to other livestock. However production is dominated by the United States, EU-25, China and Brazil, and combined these countries account for about 65 percent of world production (FAO). The United States is the world's leading producer, accounting for at least 25 percent of global output. It has state-of-the-art, large scale production systems that benefit significantly from economies of scale –the ability to reduce production costs by becoming larger.

10. During the 1990s, China's chicken production surpassed that of the EU. In 2003, China's production represented about 15 percent of global production and the EU-25 about 13 percent. While the EU chicken industry has been consolidating, it has not achieved the economies of scale observed in the United States. Domestic production in China has been rising in response to increased domestic demand, resulting in particular from rising incomes, as well as the development of export markets such as Japan. China has been developing modern, large scale, vertically coordinated systems with a focus on exports. China's low feed and labour costs and proximity to the Japanese market have also attracted foreign investment to its poultry industry.

11. Brazil's chicken production is now close to that of the EU-25. While it has a substantial domestic market, Brazil has become a leading world exporter along with the United States. Brazil is considered the

[3] The Avian Influenza could have important implications for world chicken markets, however these implications are not discussed here. This overview is intended instead to give a broad sense of the current market situation.

lowest cost producer in the world and benefits from low cost domestically-grown feed, low labour costs and favourable climatic conditions (MLC Economics, 2000). It has invested in modern, intensive production and market-oriented processing, and its two leading chicken companies are strongly oriented toward the export market.

12. Thailand has been an important world chicken producer and exporter as a result of large investments in modern, intensive production and processing. However it does not have the same level of international price competitiveness as previously due in part to changes in its relative labour costs. Thailand is adjusting to the international market situation by shifting into higher value-added activity and by investing in foreign poultry markets such as China (ibid).

13. International trade in chicken meat is a small proportion of total world production. This is largely because of the local market structure which tends to be based on live or fresh poultry products, whereas traded chicken is mainly frozen whole, in parts, or in further-processed products. Trade will continue to grow, though, as countries such as Japan have difficulty meeting domestic demand as a result of relatively high production costs and problems associated with land use and environmental considerations.

14. While world chicken export markets were traditionally dominated by the United States and other developed countries, in recent years, developing countries, predominantly Brazil, have made important inroads into international markets. The United States and Brazil are by far the two top international chicken exporters, accounting for over half of world exports. While Brazil exported only one-third the amount of chicken as the United States in the 1990s, Brazil's export levels now roughly match those of the United States.

15. There are several destinations for world imports, all of which are relatively developed regions, primarily: Russia imports frozen chicken parts and whole frozen chicken; the Middle East imports relatively low priced, whole frozen chicken; the EU imports higher priced, frozen breast meat for the institutional market; and Japan imports frozen leg meat, from bone-in to fully processed higher value products (Henry and Rothwell, 2000). An emerging market is developing in the area of high-value pre-packaged, branded, pre-cooked or frozen products.

16. Despite a high degree of mechanization achieved in processing frozen whole chickens, the EU will have difficulty exporting significant volumes to its primary export markets, including the Middle East, as export restitutions are reduced under multilateral trade negotiations (ibid). EU nonfeed input costs are high relative to those of the developing countries with which it competes; whereas productively advantages in the EU might not be sustainable as the industry structure of developing countries evolves.

17. International competitiveness is strongly linked to the availability of low cost feed grains. This is a particularly important factor for developing countries where meat industries tend to compete more with grains used for direct human consumption. Relative to other meats, however, chicken has a more efficient feed conversion which gives it a natural advantage even in developing countries. Labour costs, climate and industry structure are also important factors in international competitiveness. Meeting levels of best industry practice of developed countries is also important in terms of the ability of developing countries to compete with more developed countries.

18. Product differentiation has become an important feature of competitive advantage in the chicken industry. Companies are becoming extremely successful at targeting branded products. As per capita income increases and markets become more developed, demand becomes less homogeneous and consumers are offered a greater variety of products. Opportunities exist for chicken companies to increase margins by responding to changes in consumer demand and by providing quality products and service to the distribution system. Efficient logistics has also become a feature of competition among chicken

companies. Indeed some companies have become pioneers in the application of computer systems for the continuous control of production and marketing activities including electronic data interchange.

19. The chicken sector is expected to continue growing at a good pace, particularly in developing regions such as Latin America and Asia. Many countries have considerable scope for further gains in efficiency and scale economies in chicken production and processing. This will be facilitated by investments in larger-scale, intensive production as well as vertically coordinated supply chains.

Chicken Industry Structural Evolution

20. During the 20th century, the chicken industry worldwide underwent perhaps the greatest structural change of any agri-food industry. The chicken industry has transformed from a minor sideline activity into one of the most specialized, large-scale agri-businesses and vertically coordinated supply chains. The commercial chicken industry of today developed from countless small backyard flocks of rural and small town families. Until the 1940s, chicken meat was largely a by-product of egg production, where unproductive hens were culled for meat from the laying flock. Egg production was common on most farms and production was for home use and local markets (Perry *et al*, 1999).

21. Agricultural research, primarily in the United States and Europe, then began to offer new chicken breeds and from this new technology commercial "broiler" production started to emerge as a separate year-round industry, where broiler chickens were raised specifically for their meat and sold at 6 to 8 weeks. Modern breeding techniques have been based on genetic selection that has aimed to produce birds that grow quickly, yield high quality meat and possess characteristics that meet processor and market demands such as more uniform and meatier birds. Other technological innovations that have spearheaded the evolution of the industry include better feed and nutrition, more advanced disease control, and better management of confined birds including ventilation and automated feeding, watering and temperature control.

22. From mid-century, as new technologies became incorporated into poultry farming and as chicken demand increased and the structure of the chicken supply chain became increasingly coordinated, the industry transformed from millions of backyard producers into many fewer, specialized and separate broiler farms for meat consumption and hatcheries for egg production. Broilers were sold primarily for table consumption whereas spent laying hens were typically used as input into certain processed products such as meat pies.

23. Over the years, the chicken industry has displayed strong performance. New technologies such as more automated equipment and more productive birds, etc have had an enormous influence on production efficiency, costs and output. Martinez (1999) points out, for instance, that the broiler industry in the United States produced 43 percent more meat from a ton of feed in 1990 than in 1955; farm labour productivity improved with about 100 pounds of broiler produced in 5 hours in the 1940s and the same amount produced in only 0.1 hours by the late 1970s; during the 1950s and 1960s, production costs dropped by about a half; and production efficiency gains resulted in a five-fold increase in broiler output between 1946 and 1957 and another five-fold increase between 1957 and 1997.

24. Compared to other US livestock industries such as beef and pork, the US chicken industry has experienced the greatest increase in production efficiency, in terms of cost, feed efficiency and output per worker. It has shown the greatest decline in real cost to consumers, it has gained a greater market share and growing per capita consumption over the past 30 or so years, and it is the strongest livestock sector in terms of international trade (Lotterman, 1998a).

25. Governments also became involved in promoting the quality of poultry products. Inspection programs were offered to processing plants for product wholesomeness, and in many countries these programs became mandatory by the 1960s. Now, mandatory Hazard Analysis and Critical Control Points (HACCP) programs for poultry processing plants are common in developed countries with the aim of further increasing food safety; the United States, European Union and Japan among others have mandated HACCP programs.[4]

26. The major structural characteristic that has evolved in the chicken industry is the degree of vertical coordination among supply chain participants from feed mills, hatcheries, and farmers, to processors. For chicken farmers, coordination is now often in the form of production contracts with processors. There is a general trend towards this structure and other agri-food industries have become vertically coordinated through ownership, contracts and other vertical ties, however none is apparently as coordinated as the chicken supply chain. Vertical coordination is discussed in more detail in Section 4.

27. Horizontal consolidation is also an important feature of the food system from farm inputs to farming through to retailing, and in the case of the chicken industry, a significant shift to fewer and larger operations throughout the supply chain has occurred. The chicken processing sector is now fairly concentrated in many countries. In the United States, where the structure of the chicken industry has transformed perhaps the most rapidly and extensively, 95 percent of US chicken is produced under contract with less than 40 agribusiness firms (Heffernan et al, 1999). Chicken products are also very much marketed as differentiated, value-added products, and in the United States, for instance, 95 percent of retail chicken sales carry a manufacturer's brand name or retailer's private label (National Chicken Council, 2002).

28. The dramatic evolution of this industry has occurred across developed countries and chicken industries of many developing countries have also more recently experienced similar structural changes. Many developing regions, notably Latin America and Asia, are following in the footsteps of developed countries towards large, coordinated structures, with the adoption of innovations and intensive poultry technology.

29. Brazil has increased its chicken meat output three times over between 1980 and 1995. It now has two of the world's largest and most modern chicken producers and most of its farmers contract with feed producers or processors (Silva, 2005). Brazil has emerged at the top with the United States as one of the two dominant competitors in international markets. Chicken production also increased significantly in Thailand and other Asian countries since the 1980s, and many of these operations have become vertically coordinated (Tisdell *et al*, 1997).

Farm Consolidation

30. Consolidation of farms is a phenomenon that has been occurring to a greater or lesser extent across countries and agriculture sectors. With the decline in the number of farms, the average size of farms is increasing, and a greater proportion of overall production is now concentrated on a smaller number of large farms. These trends are observed throughout agri-food supply chains, although consolidation and increased concentration has been more significant among firms after the farm gate in food processing and retailing.

[4] Unlike the traditional food safety strategy of inspecting the final product, HACCP identifies where in the system contamination can occur and be reduced. HACCP became the internationally preferred strategy for prevention of foodborne hazards.

31. The overall number of farms in US agriculture, for example, peaked at 6.8 million in 1935 and fell to 1.9 million in 1997 (MacDonald et al 2000). The decline was quite dramatic during the 1940s, 1950s and 1960s, reflecting strong growth in farm productivity and increased nonfarm employment opportunities at that time. Higher productivity led to excess capacity, farm consolidation, and farmers shifting to the nonfarm economy.

32. Chicken farming has undergone notable consolidation over the century, and particularly during the post-WWII period. In the United Stated, for instance, from 1910 to about mid-century the number of farms with chickens declined from about 90 percent to 80 percent, and then from about 1955 to 1992, farms with chickens fell precipitously from around 70 percent to only 6 percent (Perry et al, 1999). This decline was accompanied by a significant increase in national farm cash receipts for chicken. Growth in receipts was in part related to the increase in chicken production in response to the growing demand for chicken meat. US chicken consumption surpassed that of pork in 1985 and beef in 1992 (NASS) –indeed similar trends in consumption have been observed in many countries worldwide. Supermarkets began to replace specialty meat markets and often used chickens as price leaders since they sold at lower prices than other meats. Consumers developed a perception of broilers as good value and this played a role in the expansion in broiler consumption (Martinez, 2002).

33. The technological innovations that occurred in chicken production during mid-century led to larger sized production units that allowed producers to achieve economies of scale, and resulted in the substitution of capital for labour. In 1954, in the United States, for instance, farms selling 100,000 or more broilers did not exist, and by 1964, some 13 percent of farms were of this size.[5] The number of large US chicken farms continued to grow significantly, after vertical contracting of farm production had been adopted by a large majority of chicken farmers. Between 1978 and 1997, the percentage of chickens raised on US farms of more than 500,000 birds increased from 12 percent to almost 48 percent, and the percentage of chickens raised on smaller farms (fewer than 200,000 birds) fell significantly (Warner).

34. Concentration of agricultural production has been underway for at least a century. For US agriculture overall, for example, about half of all farm sales were accounted for by 17 percent of farms in 1900 and only 2 percent in 1997. The farms that make up this 2 percent have extremely high sales levels (between USD 500 000 and USD 1 000 000); despite this level of concentration, however, there is still a rather large number of farms −46,100 operations− in this group. This level of overall concentration, in terms of the share of largest farms in all agriculture accounting for a certain level of output, would not be considered high. The concern is whether individual farmers can gain market power.[6] Hoppe and Korb (2005) point out that this many farmers would be too many for any one to behave uncompetitively, and that for most industries, concentration is not considered a policy issue until the market is dominated by some two to four firms. At the commodity level, however, concentration has approached levels that may be of concern in agriculture; for example, in 1997, the 18 largest US hog producers accounted for almost one-fourth of all hog marketings in the United States (ibid).

35. While chicken production has become concentrated on large farms, it appears that the number of chicken farms categorized as smaller is still not insignificant in many countries. In the United States for instance, between 1959 and 1982, the share of chicken sales accounted for by large chicken farms (more than 100,000 birds) increased from 29 to 89 percent.[7] And in terms of value of production, by 1995,

5 Reimund, Martin and Moore (1980) from MacDonald et al (2004).

6 Market power is the ability of a small number of enterprises in a market to affect prices (eg, the ability of buyers to lower price or sellers to raise price from the competitive price) or other terms of trade.

7 Lasley et al (1988) from Martinez (2002).

smaller US poultry farms (USD 100 000 or less sales) accounted for 54 percent of all US farms in their group but produced only 12 percent of the value of production; by contrast, 3 percent of the top US poultry farms (USD 1 000 000 or more sales) accounted for one-third of sales (Perry *et al,* 1999). When poultry is compared to other US livestock sectors, small farms in hog production account for even fewer sales, whereas they still contribute fairly significantly to overall beef cattle production.

36. In Canada, increasing consolidation and concentration in poultry farming and processing have been occurring. Vertical coordination exists in the Canadian poultry meat industry, however apparently to a much smaller extent than compared to the United States and other countries. While Canada's primary poultry production has been operating within a supply management system since the 1970s, a shift to fewer, larger and more specialized production is also present in this country. Supply management developed from marketing boards that were introduced to provide farmers with some bargaining power when dealing with a small number of buyers,[8] and as overproduction became a major concern this system was put in place (Fulton and Tang, 1999). Within the supply management system, production quotas are allocated to each province. Production and imports are regulated so that the supply closely matches domestic demand. Producer prices and incomes have been relatively stable under this system, and are not supported by government financial assistance. The system is based on three main elements: tariff rate quotas are in place to control imports; provincial marketing boards set producer prices based on market conditions and a cost-of-production formula; and farmers, processors, further processors and the restaurant trade together set farm production.

37. The number of farms in Canada with poultry declined by 43 percent between 1981 and 2001, and during this period the average number of chickens produced per poultry farm more than tripled (Mwansa, 2004). In the past decade, Canadian chicken farms increased their average production in live weight by 45 percent from 315,000 kg in 1990 to 460,000 kg in 2004 (AAFC, 2005). An increasing portion of production has concentrated among Canada's largest chicken producers: in 1981, the top 1 percent of chicken farms, which included 49 farms, produced 13 percent of all Canadian production, and by 2001 the top 1 percent, then 22 farms, produced 17 percent of all output.

38. In the Netherlands, the number of farms involved in meat production has been decreasing rapidly. From 1990 to 2004, the number of poultry farms fell by 45 percent, cattle farms by up to 55 percent and hog farms by as much as 75 percent. With the exception of poultry, the number of animals also fell, though to a lesser extent than the decline in farms. Due to MacSharry reforms of the Common Agriculture Policy, cattle for beef production fell dramatically, by more than 60 percent over the period. The number of dairy cows and hogs fell by 20 to 25 percent, but the poultry population grew by a modest 8 percent. It should be noted however that the Avian Influenza of 2002 had a particularly negative effect on farm and chicken numbers: between 2002 and 2004, the number of chicken farms decreased by 30 percent and the number of birds by 20 percent. Given these changes, farm sizes overall have been increasing. There is also a wide dispersion in farm size. For instance, about 17 percent of the largest pig producers (> 1,000 pigs) produce 55 percent of national production.

Processing Concentration

39. Chicken processing worldwide has tended to be concentrated among vertically coordinated enterprises with very large production plants, using modern technology and business practices. The relatively concentrated structure has been motivated in large part by cost advantages of large production units and more consistent product quality. The high level of investment required to achieve the minimum efficient size in poultry processing is a significant barrier to entry. For instance, in 1985, the cost of

[8] Agriculture Canada (1986) from Fulton and Tang (1999).

establishing a 1 million bird-per-week integrated operation in the United States was estimated at USD 75 million.[9]

40. Henry and Rothwell (1995) have observed that there is no consistent pattern to the number of chicken meat firms that operate in any market. However, in countries where the industry is relatively developed one firm tends to emerge on the top and is generally about twice as large as the second largest firm. Examples of this exist in the United States (Tyson Foods), France (Doux), Netherlands (Plukon), UK (Grampian, after acquiring Hillsdown), Germany (Lohmann-Wesjohann), Australia (Inghams), Brazil (Sadia), and Thailand (Charoen-Pokphand).

41. In countries where a modern chicken industry is still developing, major players are emerging that could also take a dominant position – for example, China (Shanghai Daijang, Zucheng), Hungary (Babolna), and Turkey (Koy Tur). In these situations, there is often strong competition between a second-tier of firms, as well as a third-tier group of small family-based companies that uses relatively less sophisticated technology and supplies a localized market (ibid).

42. In some situations, small enterprises may enter the processing sector on a partly integrated basis by forming an association with a large integrated processor. The integrator may provide chicks or live birds for slaughter to the smaller processor. The extra scale in production can benefit the processor who may also yield a certain amount of influence over the smaller operator.

Concentration in North America and Europe

43. Concentration data are often readily available for US food industries, however as Connor (2003) notes, these data tend to be difficult to obtain for the EU: an OECD (1983) study found that food processing industries of five large EU member countries were experiencing increases in sales concentration, and more recent data shown by Cotterill (1999a) for EU food industries appear to confirm earlier patterns. Connor also points out that for both the United States and EU, the most concentrated food industries tend to be baby foods, soups, coffee, chocolate confectionery, tea, and breakfast cereals.

44. Some ad hoc case studies on EU chicken processing industries provide a certain amount of information regarding concentration levels in these countries. With these data, some structural comparisons can be made between the EU and North American chicken industries. Chicken processing has been consolidating in the EU, however the level of concentration in this region tends to be lower than in the United States. This suggests that EU chicken processing is not benefiting from economies of scale to the extent that US chicken processing has been. In the United States, as well as in Canada, the top four chicken processors account for roughly 50 percent of the national markets; so far, there appears to be no cross-border integration between US and Canadian chicken industries in terms of mergers, acquisitions or greenfield investments (details for each country are below). For EU countries, the top five (not four) chicken processors tend to account for approximately 50 percent of national output

45. Some economists have proposed a rule of thumb that if the four largest firms in an industry have around 40 to 50 percent of their industry's market share, they may become involved in pricing behaviour that could lower purchase prices (to farmers) or raise selling prices (to consumers) from competitive levels. The four-firm concentration ratio (CR4) for instance, is the measure of the share of industry output by the four largest producers.

46. A somewhat higher CR4, closer to 50 percent, might be considered for smaller countries, whereas a lower ratio of 40 to 45 percent could be a more appropriate benchmark for very populated

[9] Barton (1985) from Henry and Rothwell (1995).

countries that tend to have larger markets. Connor (2003) has observed that in general the smaller the size of a national market, the higher the level of food industry concentration.

47. Gordon and Hazledine (1996) suggest that when the four top firms control more than about half of a relevant market, they may display interdependent or oligopolistic pricing behaviour and, to the extent possible, coordinate pricing so as to obtain the maximum profit possible from the market. However they also point out that many other factors in addition to concentration can be involved in determining profit margins and pricing behaviour. For example, the level of import competition, capital intensity and ease of entry into the market, the nature of the product and product differentiation, and alternative options available to farmers are also factors to consider.

48. The chicken processing industries of the United States, Canada, the EU including the Netherlands, and Brazil are discussed here in some detail. The discussion is rather limited to concentration ratios and is therefore intended more as a description of industry structure than a comment on pricing behaviour per se. Most of these countries are discussed again, along with others including France and Thailand, in Section 4.0 in terms of their structure and vertical coordination.

United States

49. In 1992, a typical US poultry processing plant produced about five times as much output as in 1967. While chicken processing in the United States has been consolidating, its level of firm concentration is still considered somewhat moderate compared to that of some other food industries. By the early 1990s, the CR4 for chicken slaughter was just over 40 percent and 46 percent for further processing of chicken (Ollinger et al, 2000a). The recent share of overall industry output by top poultry processing firms has not changed significantly from previous years; in 2002, the CR3 was 40 percent and the CR5 was 55 percent (Thorton, 2003).

50. By comparison, the CR4 for cattle slaughtering rose dramatically from 36 percent in 1980 to 72 percent in 1990, and again to 78 percent in 1997; this was the sharpest increase in manufacturing concentration ever recorded by the US Census Bureau (MacDonald et al, 1999). In 2000, one firm (IBP) accounted for about one-third of the cattle slaughter market. The hog slaughter CR4 rose quickly in the last two decades and is somewhat higher than that of poultry slaughter – 54 percent in 1997. In the past few years, there has also been consolidation among the top US livestock processing firms: Tyson, the largest US poultry processor accounting for about 25 percent of the poultry market, acquired IBP which was the largest cattle processor and second largest hog processor (Carstensen, 2003).

51. The growth in the size of US poultry processing plants has been more dramatic than that of firm concentration. In 1972, large plants with over 400 employees accounted for about one-quarter of chicken and turkey output, and by 1992, the share of these plants had increased to over 80 percent (Ollinger et al). This shift to larger plants suggests that scale economies are important in poultry processing, as is the case with poultry farming.

52. Ollinger et al estimate that in chicken and turkey slaughter plants, there are substantial unexploited scale economies. The doubling of US chicken consumption in the past 30 years and increase in exports dampened the pressure to consolidate. However if growth in demand and production are weak, the industry could move toward yet fewer and larger poultry plants in the future.

Canada

53. The number of poultry processing firms and plants in Canada has been declining while the average size of plants has increased (Fulton and Tang, 1999). In 2004, there were 75 federally inspected poultry slaughter plants. The largest 11 plants (> 30,000 tonnes eviscerated per plant) processed 52 percent

of total national output, the 19 mid-sized plants (between 10,000 and 30,000 tonnes) accounted for 40 percent of output, and the 45 small plants (< 10,000 tonnes) processed the remaining 8 percent (Statistics Canada, 2005). There are also some 350 further poultry processing plants.

54. The five largest chicken processors represent about 55 percent of chickens slaughtered in Canada, and the CR4 is approximately 50 percent. Concentration could be higher when assessed by region since these enterprises appear to be dominant regionally, with plants in no more than three provinces: la Coopérative fédérée de Québec (three plants in Quebec), Lilydale Poultry Cooperative (one plant in British Columbia, three in Alberta and one in Saskatchewan), Maple Leaf Poultry (two plants in Ontario, one in Alberta and one in Nova Scotia), Exceldor Coopérative Avicole (two plants in Quebec) and Maple Lodge Farms (one plant in Ontario) (AAFC, 2005).

55. The largest multi-plant poultry firms in Canada have been specializing into separate primary chicken, turkey, and further processing operations so that individual plants can benefit from longer production runs and lower production costs. Primary processors are also expanding more into further processing and this has put some pressure on non-integrated further processors (AAFC, 2004).

56. The Canadian beef and hog processing industries have become much more concentrated. In western Canada, the three major packers account for at least 95 percent of western Canada's slaughter capacity, and are vertically integrated into feedlot operations; two of these firms account for some 75 percent of Canadian federally inspected slaughter capacity. About 74 percent of total Canadian federally inspected hog slaughter capacity is accounted for by the 3 largest firms; and in the western provinces, hog packing is more concentrated with a CR4 of an estimated 87 percent. Gordon and Hazledine estimate that the CR4 for most manufacturing industries in Canada is at least 50 percent. They also point out that Canadian concentration ratios are typically higher than US ratios for like industries, which is generally believed to reflect the much larger size of US markets.

57. The study of Canada's chicken industry by Fulton and Tang shows that from 1966 to 1996 retail prices for chicken increased nearly five times, while processors prices rose three and a half times and farm prices did not quite triple. They suggest that higher retail prices in Canada are not entirely due to the restriction of supply at the farm level under the supply management system, and that a departure from competition in either (or both) chicken processing or retailing is also likely to result in the higher retail prices.

European Union

58. While in EU countries the top five (not four) chicken processors tend to account for about 50 percent of national output, levels vary across countries and are often higher in northern EU countries −around 60 percent − and somewhat lower in major southern EU countries such as Italy and Spain (MLC Economics, 2000). Concentration in the UK is now particularly high: the top four chicken processors account for about 70 percent of total output. There has been limited cross-border integration in the EU, with a notable exception of France's two top poultry processors Doux and Bourgoin which have expanded into other EU countries such as Spain and Germany. These two French firms are also the largest chicken processors in the EU and account for about 12 percent of EU output. The top five EU chicken processors (including Doux and Bourgoin) account for less than 25 percent of the Union's total output −which is considerably less than the comparable figure of 55 percent for the United States.

The Netherlands[10]

59. Concentration in Dutch meat slaughtering is high for hog and cattle and somewhat less so for poultry. In 2002, there were a moderate number of slaughter plants: 18 poultry plants, 16 hog plants and 7 cattle plants. The top 3 cattle slaughtering plants produce 75 percent of national production and the largest 8 hog slaughtering plants account for 70 percent. Of the 18 poultry slaughter plants, 5 large plants (> 40,000 tonnes) produce 47 percent of national output, 3 mid-sized plants (30,000 to 40,000 tonnes) account for 17 percent and the 10 small plants (10,000 to 30,000 tonnes) account for the remaining 36 percent. Since some firms own more than one slaughter plants, firm level concentration is yet higher. The CR4 for poultry slaughter firms was about 40 percent of Dutch production. The two top pork slaughter plants account for about 75 percent of production and the three largest beef slaughterers represent about 56 percent of the market. Concentration in further meat processing is relatively low, with about 300 further poultry packers.

Brazil

60. Large investments in Brazil's chicken production and processing have resulted in a modern, intensive, vertically coordinated supply chain. The top two producer/processors have a combined market share of 20 percent, and the top five account for about 35 percent of total sales. The industry is expected to become more concentrated and the number of smaller processors will likely decline. France's largest poultry meat company, Doux, has purchased Brazil's fourth largest, Frangosul.

Impacts of Concentration

61. The increasing size of large food processors and the increasing concentration of industry sales among large processors have two major impacts: firms can gain economies of scale and they can also gain market power. When processors increase in size and gain production and marketing efficiencies, the benefits of lower costs can stay with the processor and they can also be passed on to others in the supply chain –farmers and consumers. However, large firms may use their size to exert control over markets and influence prices to increase their profits: they may be able to pay farmers less for products (or charge more for inputs) or charge more to consumers. Increasing industry consolidation and concentration will decrease marketing margins if the impact of scale economies exceeds that of market power. Studies of the livestock and poultry industries have shown that cost-reducing advantages of concentration have exceeded market power effects and that marketing margins have been reduced by concentration.[11] However, the studies also indicate that the benefits of lower marketing margins have been passed on to consumers rather than to farmers.

Significance of Vertical Coordination

62. More and more, chicken supply chains worldwide are becoming characterized by a high degree of vertical coordination, and indeed many agri-food supply chains are moving away from traditional forms of open market exchange toward greater vertical coordination. While this is a relatively new phenomenon for some industries, the chicken industry is notable for starting to engage in vertical coordination in the Unites States by the 1950s.

63. Vertical coordination can take on many forms ranging from spot market transactions such as auctions, where price is the only means of coordination between parties, to full ownership integration,

---

10 This section is provided by Bunte et al (2003/5).

11 Tweeten (2001) cites work by Persaud (2000) for poultry, beef, and pork.

where a single party owns and manages two or more stages of the marketing system. Between the two extremes are a great variety of different arrangements including contracts, strategic alliances and joint ventures. The movement away from commodity spot markets toward more formal vertical supply chain linkages has been driven by various technological, financial and regulatory developments. Changes in consumer demand for certain product attributes, such as quality and food safety, are also contributing factors.

64. Over the years, farmers have become less dependent on open spot markets and vertical contracting arrangements have become a more common business practice. For instance, the USDA reports that in 1998 more than 1 in 10 US farms had income from contract arrangements and these contracts accounted for about 35 percent of the value of national agriculture production (Perry and Banker, 2002).[12]

65. In the chicken industry, full ownership integration is seen in some countries and it typically involves processor ownership and operation of the chicken farm. However, the more common form of vertical coordination is contracting between processors and chicken farmers, whereby farmers agree to deliver products of a specified quality and quantity at specified times under a certain payment agreement. Contracts contain incentives for farmers to manage their farms so that processors may maximize their returns, and at the same time farmers aim to maximize their returns given the constraints of the contract.

66. There are two basic kinds of vertical contracts in agriculture: production contracts and marketing contracts. Production contracts are more extensive and are the dominant kind of contract in the chicken industry, whereas marketing contracts are used more often in other industries such as crops and fruits and vegetables. This difference may be related to greater capital investments required in chicken production as well as more demanding quality and food safety requirements in the chicken industry. Within each of the two kinds of contracts, there are numerous possible arrangements in terms of pricing, credit, quality, storage, transportation, etc.

67. Market contracts are agreements that specify quality, price and an outlet and delivery time for a certain quantity of product. The farmer retains ownership of the product during the production process and is responsible for most management decisions. The farmer assumes all production risks but the contractor shares the price risk (Perry *et al,* 1997).

68. Production contracts also specify quantity and quality, however the contractor pays for and provides inputs (or reimburses the farmer for expenses) and may own the product throughout production, while the farmer receives a predetermined fee rather than a share of sales. The fee received by the farmer is typically for providing labour, facilities and equipment. Production contractors often assume a large portion of production and price risk, yet receive most of the net income from the sale.

69. The category of production contracts can be further divided into resource-providing contracts and production-management contracts. Resource-providing contracts represent the highest level of vertical coordination among contracts. The contractor-processor supplies most inputs (chicks, feed, veterinary supplies and services, transportation) and has extensive control over production management, whereas farmers provide land, housing facilities and labour and are compensated for their services more than for their entrepreneurial abilities. With production-management contracts, processors participate in production

[12] Contracting has been a growing part of US agriculture since the 1960s and was present there for many years before that. US retailers have been contracting directly with farmers since the early 1900s: A&P developed a national buying organization to purchase fruit and vegetables as early as the 1920s, and Safeway and Kroger contracted with farmers and cooperative for milk for processing in their own plants before WWII. After the war, US retailers grew larger and increased direct buying from farmers (Perry et al, 1997).

management and decisions (e.g. flock size, genetic characteristics of birds, feed and nutrition) and provide economic incentives for quality and quantity, while farmers provide most inputs and retain title.

70. In the United States and possibly elsewhere, almost all chicken industry contracts are of a resource-providing nature. US chicken production contracts often contain three kinds of payments to farmers: a base payment, a performance (incentive) payment, and a payment to offset losses due to natural disasters. In 1993, US farmers paid about 11 percent of cash expenses on a production contract chicken operation (ibid).

71. Chicken industries also may be integrated beyond the farmer and processor, upstream to include hatcheries, breeding facilities and feed mills and downstream to further processing. For instance, some integrated chicken systems involve processor ownership of feed mills and hatcheries along with ownership or contracting of chicken growing. Further processing facilities are becoming more prevalent as processors attempt to add margin to their operations. Integration is not common, however, with sophisticated genetic development or grain production. On the other hand, integration is taking place between distributors and processors. In the UK, for instance, five major supermarket retailers account for about 65 percent of total poultry meat sales, and poultry processors need to be locked into supplying these major retailers unless they are able to supply small niche markets (MLC Economics, 2000).

72. There is little systematic statistical information available on vertical coordination, even on a national basis. It appears that the United States is the only country that publishes formal data on this subject for the agriculture and food sector; the ERS/USDA provides extensive information on US vertical contracting and ownership by agriculture sector. An informal description of the vertical coordination of the chicken industries of a small group of countries is given here (United States, Canada, EU including the Netherlands, UK and France, New Zealand, Brazil and Thailand), based on published information. While the descriptions are intended to be brief, some are quite limited given the apparent lack of readily available information.

United States

73. Much of the early US commercial chicken production was provided by independent farmers who bought feed from a dealer, chicks from a hatchery, and sold to those processors who offered the highest price. As new technologies and production expanded, capital requirements increased, and chicken prices became unstable and started to decline. While chicken farmers were faced with increased risk, feed companies saw the potential for growth of the chicken industry and a larger market for their feed. As a consequence, in the 1950s, feed dealer credit evolved into production contracts to help chicken farmers reduce income risk and to provide incentives to farmers to produce efficiently. Management responsibilities were also increasingly shifted to feed companies (Perry *et al,* 1999).

74. In 1950, 95 percent of US chicken farmers were independent. By 1955, only 10 percent of total chicken production was produced by independent farmers, 88 percent was produced under contract, and 2 percent was produced in company-owned chicken facilities (Martinez, 1999). Towards the end of the 1950s, there was a rapid increase in supply which caused a drop in the live chicken prices. Many hatcheries and feed companies experienced considerable losses because of the overproduction and depressed chicken prices. In order to coordinate production capacity at each stage, feed companies became more directly involved in the chicken business.

75. During the 1960s, integrated feed dealers-farmers expanded into chicken processing by purchasing or building slaughtering plants. By integrating with the processing stage, feed companies came in closer contact with the chicken market and could more closely coordinate chicken supplies with the consumer market. As feed companies increased their processing operations, independent processors and

farmers found themselves with fewer markets for buying and selling chickens. As a consequence, independent processors established their own contracts with feed companies to obtain birds or with farmers to produce the birds.

76. In the 1970s, many US feed companies left the chicken industry because of depressed chicken prices and high input costs. Processors took control over almost all stages to gain efficiencies from improved coordination. The role of the processor as integrator was influenced by the significant economies of scale in chicken processing and the large proportion of value added in processing. Major integrators also expanded into broiler stock breeding.

77. Now, most major US processors control all vertical stages from breeders to further processing through vertical ownership and production contracts with farmers. Processor-integrators provide chicks, feed, veterinary services and advice under contract to the farmer. The farmer provides the chicken houses and labour to raise the chicks. The contract specifies a payment per pound of live chicken depending on the farmer's relative performance. This is referred to as tournament pricing, whereby a minimum price is paid per bird and superior performance compared to the average is rewarded with premiums. Restaurants have established long-term contracts with processors or distributors in order to ensure more stable menu prices. With a marketing system integrated from input supplies through to processing and distribution, there are now few interfaces between supply and demand where visible prices exist (Martinez, 1999).

78. In 1998, about 95 percent of all US chickens were raised by farmers under production contracts and most of the remaining were raised by fully integrated poultry firms themselves. While vertical contracts in the hog and cattle industries have been less prevalent, contracting in the hog industry in particular has been increasing.[13] Poultry accounts for more than half (55 percent) of the total value of US agriculture under production contracts, and hogs and cattle account for most of the remainder (36 percent) (Perry and Banker, 2000).

Canada

79. Vertical integration in the Canadian chicken industry is taking place, however it is relatively limited in comparison to many developed countries. Given the supply management system, allocation of quota for producing poultry is by province, and slaughter and processing take place within the same province. Liu et al (2005) note that this has raised some concerns about flexibility, production location and coordination for poultry processors. Some large processors have become involved in poultry farming in recent years, reflecting an interest by processors in taking advantage of potential efficiencies in the supply chain.[14]

European Union

80. Throughout the European Union, poultry meat production is highly integrated back into feed milling and breeding/hatchery operations. As well, processors generally contract with farmers and cooperatives to produce live birds, especially in France, Italy and Scandinavia (MLC Economics, 2000). Contracting is becoming less common in the UK, where processors have increasingly fully integrated into poultry growing operations. Similar to the United States, the EU poultry supply chain is more vertically integrated than the beef and hog supply chains.

---

[13] Comparisons of motivations for vertical coordination in chicken, beef and hog industries are discussed by Martinez (1999, 2000 and 2002a,b) and Ward (1997).

[14] In the province of Newfoundland, 20 chicken farmers have developed a vertically integrated operation with investments in feed milling and processing operations (Selby, 1998).

Netherlands

81. There is a high degree of vertical coordination in the Dutch poultry industry, however little as yet in the pork and beef supply chains. It is common for poultry processing firms to own hatcheries and feed companies and to have contracts with chicken farms that specify price and the amount and time of delivery (Bunte et al, 2003/5).

United Kingdom

82. UK chicken production and processing have consolidated to an extremely high degree. It is also characterized as highly vertically coordinated, with processor ownership of feed manufacture, breeding, chicks, slaughter and processing. Bird production is undertaken by farmers under contract with processors, however this has been declining (MLC Economics, 2000). Four companies not only process more than 70 percent of all UK production, but also raise almost half of those chickens themselves on company-owned farms (Sheppard, 2004). Most of remaining UK chicken production is farmer-owned but typically contracted to produce for one of those companies or for one of eleven other processors.

France[15]

83. The French poultry industry is very concentrated and the average size of firms has been increasing significantly. Three major enterprises account for about 50 percent of poultry meat production in France (Doux, Bourgoin and Unicops). However, the industry is also characterized as being highly fragmented, with a significant number of small, local firms and a wider variety of poultry meats (chicken, duck, geese guinea fowl and quail, etc) in the marketplace than typically found in developed countries. One of the most interesting of the quality-driven, branded products in poultry is perhaps France's *Label Rouge* products which are basically free-range, produced under strict guidelines for quality maintenance, tied to consumer preferences, and command significant price premiums. The umbrella label, *Label Rouge*, represents some169 labels among the various species, which are offered by about 30 groups called *Organisms Certificateurs*. Westgren notes that this system developed in the 1960s in response to consumer reaction to "factory food" and has had notable commercial success. The average growing period and feed conversion ratio are higher for *Label Rouge* chickens than for standard broilers, and therefore their cost of production is higher. Despite this, *Label Rouge* chickens have been able to gain a significant market share in France. The French poultry industry is vertically coordinated through both contracts and full integration. More than 75 percent of chicken production is contracted between farmers and processors. A variety of contract arrangements exists, including production-type contracts whereby processors provide various inputs.

New Zealand

84. The New Zealand poultry meat industry is extremely concentrated and integrated, with three companies supplying about 90 percent of the country's chicken meat. These companies own most stages of production including feed mills, hatcheries, breeding farms, and processing plants. Chickens are raised by farmers contracted by processing companies to grow company-owned chickens (MAF, 2005).

Brazil

85. The Brazil chicken industry has achieved an extremely high level of international competitiveness within the past few decades. While its comparative advantages in terms of feed and labour

[15] Westgren (1994) provides a case study of France's poultry supply chain; while his study was done a decade ago, the information is still relevant today. A brief summary of Westgren's study is given here.

input costs and climate have been important to its success, Silva (2005) suggests that the coordination between chicken farmers and processors has been a key element of the industry's strong performance. Different forms of contracting are used and a common arrangement is one whereby the processor provides inputs such as the chicks and technical assistance and farmers are guaranteed a market outlet and remunerated according to their efficiency. Vertical coordination between processors and chicken farmers started in the 1970s and 1980s when agricultural modernization in general took place in Brazil. One aspect of the modernization was the development of soy and corn production, which contributed to the growth of the commercial livestock industry. While independent chicken farmers started to sell to small processors in the 1940s, it was during the period of modernization that large-scale, intensive chicken processing began in earnest and attention became more focused on standardization and quality. While agreements between processors and chicken farmers appear to be the most common form of vertical coordination, processor ownership of chicken production also occurs as well as farmers selling to processors on the open spot market. Silva comments that the larger scale operations tend to be those involved in vertical contracting.

Thailand

86. Concentration in Thailand's chicken processing industry is modest. Its largest poultry meat company, Charoen Pokphand, accounts for about 15 percent of industry sales, and the CR5 is some 50 percent. Thailand produced principally backyard chickens until the early 1970s. There was a significant expansion of the industry in the 1970s as a few large private companies established contracts with farmers, built modern slaughterhouses and began to export to Japan (Tisdell et al, 1997). Estimates show that in 1985, while some 99 percent of all chicken farmers were still backyard farmers, this group accounted for only about one-third of production. Now, backyard farmers account for less than one-quarter of production as a result of growth in commercial production. The average flock of backyard farms is about 70 birds and more than half of these farms raise fewer than 20 birds. A group of independent Thai commercial chicken farmers tends to be quite experienced and often engages in contract farming with smaller farmers, however the number of independents is declining given their size and cost disadvantages relative to larger contracted farmers. A number of large companies now engage in contracts with farmers and contracted farmers in Thailand have become common and widespread.

Motivations for Vertical Coordination[16]

87. The high degree of vertical coordination observed in chicken supply chains appears to be related to four factors in particular: (1) economies of scale and supply assurance (2) control of transaction costs (3) minimizing price and quantity risk and (4) control of quality, food safety, and brands.

88. The principle motivation for vertical coordination in the chicken industry appears to be the significant gains in efficiencies and cost savings that can be achieved by very large scale modern, capital intensive production, and reductions in transaction costs that are incurred in business exchanges. However other factors are important in today's consumer-driven economy, especially ensuring that public and private standards related to food safety and quality are met and that suppliers can best exploit assets such as branded products. These factors can be inter-related and, depending on the country, the relative importance of these and any other factors could vary. The notion of market power advantages as a motivation for vertical coordination is also discussed.

[16] Hobbs and Young (2001) provides a synthesis of theoretical approaches to the analysis of vertical coordination in agri-food sectors. The summary given here is specific to the chicken supply system.

Economies of scale & Supply assurance

89. Given the significant economies of scale in technologically-advanced chicken production, there is a great deal of motivation to invest significant amounts of capital in large scale, modern facilities throughout the supply chain from inputs (feed and chicks) to farm production and processing. Chicken farmers have often lacked access to the large capital requirements for investing in such enterprises, and firms in the supply chain have seized on the opportunity to either enter into arrangements with farmers in terms of providing capital and other inputs, or invest in farm production themselves.

90. With growing chicken markets and the opportunity to increase revenues, there is particular incentive to increase production and invest in large, cost efficient, state-of-the-art facilities. The ability to assure timely deliveries of large supplies of competitively priced chicken in order to capture a share of the food retail and restaurant markets provides strong incentive for vertical coordination. Also, given that there are large fixed costs with modern processing facilities, it is important to control quantity and scheduling of live birds in order to avoid costly overuse or under use of processing operations.[17]

***Transaction costs minimization*[18]**

91. Business transactions are not without their costs. Transaction costs are those costs associated with trading, apart from the price. They arise for instance when seeking buyers and sellers, obtaining price information, negotiating contracts, monitoring and enforcing contracts, and relaying information.[19] Contracting and vertical integration offer incentives for reducing transaction costs. A supply chain that functions more efficiently offers benefits such as lower costs of processing, packing, grading and distribution

92. Product pricing is a key competitive tool in the chicken industry, which in turn results in pressure to control costs and margins. As such, vertical coordination has become an important strategic means of competing in this industry.

93. The following is drawn from Martinez (1999) who provides an analysis of the US chicken industry in terms of various concepts, including asset specificity, opportunism and information asymmetry, that underpin transaction cost analysis.

94. Asset specificity is very significant in the chicken industry in three ways. Its physical assets (hatcheries, chicken houses, feed facilities and processing plants) have unique characteristics and few alternative uses. The sites of these physical assets are specific since they are typically located as close as possible (in clusters) in order to lower transportation costs of feed, chicks and grown chicken. And the industry has a high level of temporal specificity because the product is perishable.

95. Significant asset specificity in chicken supply chains means it is important for suppliers and purchasers to have reliable exchange relationships. Opportunistic, self-interested behaviour may lead one party to take advantage of another since the other party's assets have few alternative uses or outlets. Martinez gives the example that processors prefer to obtain chickens from within a 20 mile radius, and

---

17 Barkema and Drabenstot (1990) point out that with modern processing facilities designed to operate optimally at a stable output level, costs rise quickly when output is highly variable (from Martinez, 1999).

18 Seminal work is provided by Coase on transaction cost theory of the firm and Williamson has developed this literature in terms of vertical coordination.

19 Hobbs (1996) provides a discussion of transaction cost analysis and its application to supply chain management.

therefore farmers are usually situated close to processors and have few alternative markets. Contracts between farmers and processors in this case can reduce the chance that processors will act opportunistically by offering lower prices to a captive supplier.

96. When traders have different market or product information (asymmetric information) there can be difficulties in determining whether your partner is behaving efficiently. Information asymmetry in chicken supply chains can lead to measuring and sorting costs associated with quality attributes. These costs can be reduced by contracting between farmers and processors or through vertical integration. When farmers have more accurate information pertaining to the quality of their chicken and this information is costly to obtain, farmers may attempt to sell chicken of low and high quality at the same price. To avoid purchasing low quality chicken at an uncompetitive price, processors may need to incur measuring and sorting costs to determine the real value of different chicken. Contracts that specify quality attributes, or full vertical integration, may reduce the need to incur measuring costs.

97. Westgren (1994) states that the more idiosyncratic the assets and the more closely tied to a specific strategy (such as product differentiation), the more likely the parties will not invest in an exchange unless there is a strong bond between them.

Price and quantity risk

98. Farmers can experience significant fluctuations in market prices and production due to factors such as weather and disease, which can cause highly variable incomes. Contracts can shift price risk for live chicken from farmers to the contractor–processor if the payment for birds is independent of chicken market prices and input prices such as feed. Contracts can include a performance payment that depends on the farmer's performance relative to others; when the performance of all farmers is affected due to, say, weather, individual payments remain unchanged.

Control of quality, food safety and brands

99. Contracts benefit processors in a variety of ways: they foster greater product quality, help ease inventory management difficulties and increase predictability to better meet downstream retailer and consumer demands.

100. Vertical contracts and integration are used to control numerous quality attributes such as size and uniformity in order to meet requirements of processing facilities and the preferences of consumers. Feed ingredients and genetics can also have an important effect on bird quality, and therefore backward coordination can be used to enhance control over these inputs. Vertical coordination from breeding to processing better enables the supply chain to standardize production and produce uniform chickens with specific attributes for further processing and branding.

101. The more stringent the standard, differentiated the product, or complex the production process, the greater the level of coordination that may result between parties. For instance, markets that require specific technology or capital investment for production, special management skills, particular quality attributes, or involve perishable products tend to be more vertically coordinated in order for parties to protect their investments and enhance revenues by best meeting consumer demands.

102. Contracting or vertical integration can be critical for suppliers producing valuable, branded products. Control over inputs and production processes can be critical to exploit market opportunities and protect firm reputations associated with name brands. There are standards related to quality assurance for instance that may be better met and consumer-oriented attributes, such as animal- and environmental-friendly production, that may be better obtained when under the control of the firm rather than produced at arm's length. Product differentiation has become very important in the chicken industry as a means of

competing on a nonprice basis, and vertical coordination has facilitated these further processing and branding efforts.

103. Likewise, food safety concerns motivate vertical coordination. Control of bacterial contaminants such as salmonella, campylobacter and E. coli with the implementation of a consistent hygiene control policy throughout the different levels of vertically coordinated system can help prevent significant financial losses to a firm. Vertical coordination can also provide a means for tracing animals back to the farm of origin.

104. As the food system becomes more and more consumer driven, vertical coordination as a business strategy has become increasingly important as it allows all supply chain participants to better manage and customize their businesses according to market needs.

Market power advantages

105. Bhuyan (2005) provides a survey of the industrial organization literature with respect to vertical integration and market power. He notes that the question whether vertical integration can increase market power is an issue that is very much debated. On one side, it is argued that if vertical mergers displace open transactions, this can foreclose the market and rivals can be excluded.[20] And the other view is that vertical mergers cannot transfer market power from one level to another. Whereas empirical studies of US food manufacturing industries have suggested market power exists, apparently no empirical work exists that examines whether vertical integration increases market power. Bhuyan indicates that while the effects of vertical integration on market power are ambiguous in theory, it may influence competition in practice.[21]

Food Retailing Evolution[22]

106. In the past few decades, food supply chains have experienced an enormous shift in power and influence from food processors to retailers. One of the main factors leading to this change in supply chain dynamics has been the consolidation within food retailing and procurement markets. Increased food retailer consolidation and concentration may be more developed country phenomena, however they are occurring worldwide.

107. Cotterill (1999a) suggests that US national market concentration and concentration in the EU could still increase significantly if leading chains were to merge and form truly national or pan European grocery chains. He further notes that the evolution of the global food system will depend on the strategic positions of major world food manufacturers and retailers as well as public policies and antitrust enforcement in particular.

108. While food processors once had significant influence on food distribution, especially the giants with strong brand-name products, using wholesalers and retailers to market products, a more consolidated

---

20 Sheperd and Shepard (2004), from Bhuyan (2005).

21 Martinez (1999) gives Tyson's acquisition of the Cobb Company as an example of a firm that vertically integrated to prevent competitors from monopolizing the Cobb 500 strain of birds with large, uniform breast meat that is easily deboned.

22 This section draws, in particular, from OECD (2005a), Dobson et al (2001), and Dobson and Waterson (1999).

retail food sector is now often the dominant player in supplier-retail relations.[23] Many large food retailers have integrated the wholesale function into their operations, and in doing so they have implemented state-of-the-art logistics systems based on regionalized warehousing (distribution centres) to serve their outlets. Food retailers are also manufacturing own-label products that compete directly with manufacturer brands.

109. Retailers are benefiting at the expense of food processors from changing consumer preferences and increasing incomes. Supermarkets are shifting from selling the traditional brand-name packaged products to selling fresh meat and seafood, fresh and fresh-cut produce, store-baked products and fresh prepared foods which are less branded and have higher markups than packaged products produced by food manufacturers.[24] Food retailers are better gauging demand using Electronic Point of Sale data. They have become more involved in sourcing product to meet consumer's demands and they expect suppliers to provide products that meet specific consumer requirements.

110. Retail selling and buying remains primarily a national activity, in part due to consumer preferences for local products, however retailers have begun to source more internationally. 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.

111. One concern that has arisen as a result of food retailer consolidation is whether larger retailers may possess greater bargaining power and reduce prices and margins received by food processors and farmers. There are few studies in the literature investigating buyer concentration and the impact of possible uncompetitive retail food buying behaviour on food suppliers.[25]

112. Villa-Boas (2003) finds that for several stores in a US city, wholesale yogurt prices are driven close to marginal cost and that retailers display pricing power in these supply chains. In a report by the UK Competition Commission, it is shown that suppliers of all sizes give larger discounts to large supermarkets than to most other buyers in the UK, and that this cannot be explained in full by efficiencies such as those that arise from full truck loads and central warehousing.[26]

113. There is a large literature, however, that has studied price linkages among farm, manufacturing (wholesale) and retail markets. The OECD (2005b) review of this literature indicates that while market power is often perceived as a primary potential cause of asymmetric price transmission, the main alternative explanations for asymmetry are adjustment costs that are high enough to inhibit market adjustments to price changes as well as the presence of government interventions. Empirical results of this OECD study show significant asymmetries in the US chicken, beef and egg markets in response to positive and negative price shocks.

114. In a related literature, a study by London Economics (2004) of 15 agriculture sectors (including chicken, beef, pork, lamb, flour, bread, and several fruit and vegetables) in eight EU countries, shows no

---

23 For example, in Mexico where Wal-Mart is the country's leading food retailer, the multinational US retailer withdrew the well known brand-name Danone yogurt from its shelves for several months because of a dispute over pricing (Smith, 2002 in Busch and Bain, 2004).

24 Martinez and Davis (2002).

25 Empirical studies of market concentration have focused more on the impact of selling behaviour. For instance, Cotterill's (1986,1999b) analyses of various local US retail food markets provide evidence that consumer prices can be higher in more concentrated markets.

26 UK Competition Commission (2000, p432) from OECD (2004).

systematic trend between 1990 and 2002 in the farm share of consumer expenditure. For 15 country-product combinations the farm share decreased, for 9 country-product combinations it increased, and for the remaining 41 country-product combinations the change was negligible. In the case of chicken, for instance, covering Austria, France, Germany, Italy, the Netherlands, and the UK, the change in farm share of consumer expenditure over the period was negligible.

115. In addition to being able to negotiate volume discounts, large retailers may use price mechanisms other than unit prices, such as buyback requirements and charging suppliers slotting fees for access to shelf space, that can shift profits from suppliers to retailers. Smaller food suppliers in particular may have difficulty competing with large suppliers of branded products for retailers' valuable shelf space. Marion (1998) points out that there has been a dramatic increase in slotting fees in the US since the 1980s, and that they are considered a significant entry barrier for small- and medium-sized food manufacturers.

116. While developments in retailer-supplier pricing arrangements are very important, other aspects of changes to supply chain management also have implications for suppliers. Major food retailers are selecting preferred suppliers throughout the supply chain which raises the question as to the availability of alternative options for de-listed products of farmers and food processors. Food retailers are also expecting suppliers to enter into medium- and long-term contractual arrangements that may cover numerous conditions related to, for instance, traceability, food safety and various product attributes. Conditions under these private contracts are often more stringent than comparable government laws and regulations.

117. Martinez and Davis (2002) note that farmers have raised concern with the shift away from spot markets to contracting spot market prices. As public markets become thinner, spot prices reflect only the prices of the uncontracted products; these prices may become suspect and volatile and may not be appropriate to use as a basis for contracts between farmers and retailers.

118. Consolidation is occurring throughout the supply chain. Concentration can be high in food processing and, though agricultural production does not tend to be very concentrated, farmers often belong to a marketing association or cooperative which may augment their ability to negotiate better terms of sale. Therefore the countervailing effect of higher concentration along the supply chain should be considered when analyzing the impact of buyer concentration on supplier returns. Suppliers of branded products or products with attributes that distinguish them from others and have developed strong consumer demand have greater leverage in countering large retail buyers.

A brief description of the changing structure of the food retail sectors of the United States, Canada and European Union is given here.

United States[27]

119. The US food retailing industry has been consolidating over the years, however recently the size of the mergers and acquisitions in the sector has been unprecedented. Most notable are the mergers and acquisitions taking place among the largest US food retailers seeking to maintain leading positions and capture efficiency gains. For instance, in 1998, Albertson's (fourth largest grocery retailer) merged with American Stores (second largest) and Kroger Company (ranked first) acquired Fred Meyer (sixth largest). The top five US food retailers are now: Kroger-Fred Meyer, American Stores-Albertson's, Safeway, Ahold USA and Wal-Mart.

120. The widespread consolidation taking place in the US has had a significant effect on the largest food retailers' share of total grocery sales. The share of national grocery sales accounted for by the four

[27] See Kaufman (2000a and 2000b) for more detailed information on consolidation in US food retailing.

largest food retailers increased from about 16 percent in 1992 to almost 30 percent in 1998; over the same period, the share of the eight largest food retailers increased from about 25 percent to 40 percent. While consolidation has brought together food retailers from across the country and many food retailers operate in numerous regions, none is currently nationwide. Local and regional concentration is still significantly higher than that for the nation as a whole. For instance, for 94 large US cities, the four-firm concentration ratio was estimated to be about 65 percent in 1987 and 75 percent in 1998 (Cotterill, 1999).

121. Slow growth in grocery sales, largely due to greater spending for food away from home and competition from mass-merchandisers, has been motivating retailers to expand their operations. General merchandisers, such as Wal-Mart, and warehouse club stores, such as Costco, have introduced and expanded supermarket sections within their stores; this has resulted in an notable increase in mass-merchandisers' share of total retail food sales, from about 3 percent in 1988 to 8 percent in 1998.

122. To compete with restaurants and respond to changing consumer demands, US food retailers have been investing more in higher-value, convenience products such as prepared foods and salad bars, as well as in at-home internet shopping services. The trend toward consolidation has allowed food retailers to gain efficiencies and offset costs related to developing their businesses in areas that provide the modern consumer with the kinds of products and services they desire.

123. US food retailers that are consolidating indicate they can reduce costs and remain more price competitive with general merchandisers by achieving greater efficiencies throughout their businesses from procurement to operations, marketing and distribution. For instance, purchasing efficiencies can be gained when higher volumes of supplies are purchased at lower prices.

124. US food suppliers, however, have raised concerns about lower prices resulting from greater retailer purchasing power. About half of US food sales are accounted for by large, self-distributing retailers that operate their own ware-houses, transportation, and buying offices which allow them to negotiate directly with grocery suppliers. Combined buying offices and larger orders may also allow retailers to obtain concessions that reduce the price received by suppliers, such as slotting allowances and fees for advertising.

125. Smaller food suppliers may choose to enhance their bargaining positions vis-à-vis retailers by forming joint ventures or cooperatives, or by supplying niche products such as specialty or organically grown products. Internet-based marketplaces are now being developed in the US and may provide smaller food suppliers greater access to buyers and the opportunity to better meet the buying requirements of large food retailers. Examples of such sites originating in the US are Buyproduce.com, which is a virtual site open to all buyers and sellers, and Farmconnect.com which represents a US farm cooperative that offers various value-added commodities.

Canada[28]

126. The food retail industry in Canada is the most concentrated among all major Canadian retail segments. The two largest food retailers account for about 40 percent of national food sales, and the top five account for 90 percent. Loblaw dominants the Canadian supermarket industry, followed by Sobeys, Safeway, the Metro Group and A&P; except for US-owned Safeway, these are domestically-owned food retailers.

127. Wal-Mart, one of the world's largest firms, is becoming an important player in Canada's general merchandise and food retailing. This is putting pressure on prices and already thin profit margins in the

[28] Burt and Poulin (2005) of the Conference Board of Canada provide information presented here.

Canadian retail food market. However, whereas Wal-Mart is a major competitor in the US, its subsidiaries in Canada have not gained such dominance for a few reasons. There are a number of large, encumbant food retailers in Canada including the nation's supermarket giant Loblaw. The effect of Wal-Mart on the Canadian market may also be reduced due to the higher rate of unionization in this country. Union certification has already taken place or is being considered in several Canadian Wal-Mart stores.

128. As large general merchandise retailers have been moving into the food business, many Canadian 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.

129. Despite consolidation through mergers and acquisitions and high levels of concentration in Canadian food retail segments, retail profit margins remain very low –only 2 percent on average for total retailing. Retail margins are pressured on both the product-price side and the input-cost side. While grocery retailers are attempting to add value to their products and meet the modern consumer's demands, consumers want affordable prices which can limit their ability to raise prices. Furthermore, competition with other food distributors for the consumer food dollar is strong.

130. On the cost side, while consolidation may contribute to cost-savings for food retailers, the large physical size of Canada and its relatively small, dispersed population make it more difficult for companies to achieve economies of scale within the country's borders. Canadian food retailers have been making significant efforts to invest in cost-saving, productivity-enhancing technologies such as improved inventory management systems, and radio frequency identification technology to help reduce the need for cashiers. Food retailers are undertaking large-scale investments and have become the most capital-intensive retail segment. Investment as a share of revenue in food retailing now stands at the highest among major retail segments.

131. An important concern of food retailers is the cost of grocery supplies. These costs represent the largest portion of overall industry costs –equivalent to about 65 percent of total revenues. Therefore, gaining greater purchasing power vis-à-vis suppliers in the food chain has possibly been a motivating factor for consolidation in Canadian food retailing.

European Union[29]

132. Food retailing across all EU countries has been consolidating to a greater or lesser extent. It has shifted from a largely fragmented sector to one that displays high levels of concentration at the national and EU-wide levels. The market share accounted for by the five leading food retailers in grocery and daily goods is estimated as follows: Sweden 78%, Finland 68%, Portugal 63%, UK 63%, Austria 60%, Belgium and Luxembourg 60%, Ireland 58%, Denmark 56%, France 56%, Netherlands 56%, Germany 44%, Spain 40%, Greece 27% and Italy 18%. The weighted average CR5 for the EU-15 is about 50 percent. These seller ratios can be higher depending on the definition of the relevant market. Moreover, buyer concentration ratios for these countries are typically higher.

133. The merger of France's Carrefour with Promodes consolidated its dominant position in France and Spain and created Europe's largest and the world's second largest retailer. The other top ten EU retailers have been increasing their dominance within and beyond their national borders, namely France's Intermarche, Auchan and Leclerc, Germany's Rewe, Metro, Aldi and Edeka, and the UK's Tesco and Sainsbury. Traditionally, investment from outside the EU has not been significant in food and general

29 This section is largely based on information provided by Dobson (2003).

merchandise retailing; however US-owned Wal-Mart has become a major player in Europe given its acquisitions in the UK and Germany.

134. Further to these developments, retail procurement markets faced by suppliers are also evolving and becoming more concentrated, as many EU countries now have collective buyers that represent groups of retailers and whose aim is to acquire purchasing discounts. In addition to national buying groups, cross-border buying alliances with very large turnovers have started to emerge.

135. The balance of power in EU supplier-retailer relations has been significantly influenced by the evolution of the Union's food retail sector, including heavy investments in expanding the scale and scope of operations, and it is believed that retailers are now able to dictate to a large extent the terms and conditions of purchases vis-à-vis food processors and farmers.

Implications for Public Policy

136. While agriculture in many developed countries has seen a shift away from government intervention, such as price support and regulated transportation rates, the question of the role of government in the agri-food sector remains important. Blandford sees public policy for food and agriculture continuing to facilitate social adjustment to economic change, and supporting research and development to improve agriculture efficiency. However he also sees policy likely centering more on concerns with health and food safety, competition, animal welfare, and the effect of agriculture on the environment and agriculture sustainability.

137. There are many potential implications for public policy resulting from structural changes occurring in the agri-food industry. The attempt here is to identify areas where the question of market failure is relevant in the chicken industry and briefly comment on what role government might play in addressing these issues. Some of the policy issues of relevance to this industry that are highlighted here relate to information asymmetry, vertical contracts, and market power. Other issues are related to the decline in small family farms as well as intensive animal and poultry production and its influence on the environment and animal welfare.

138. A comment is made first regarding food safety, since governments and the private sector have made important decisions in this area in the recent past, and this attribute is keenly important to the chicken industry. This comment is rather in terms of how regulation in this area has adapted, and the influence this has had on industry structure. Consumer expectation for safer food products has had an impact on government regulation of food safety. Public concern with food safety due to a number of incidents related to pathogens in meat and poultry products perhaps has had the greatest influence on changes to policies related to food safety. The industrialization and commercial success of the chicken industry may be related to the increased incidents of foodborne diseases in the past decades. While governments continue to play a role in the regulatory environment for food safety, many countries have shifted from a framework of government inspection of meat for detection of hazards using organoleptic techniques (sight, smell and touch) to a system where private sector meat processing plants implement and follow HACCP procedures to reduce hazards and do testing themselves. The expectation has been that these new, more preventative-type procedures, along with the shift of responsibility to the private sector for monitoring, can create efficiencies and better serve society.

139. HACCP has been widely adopted in many countries, even in those where it is not government mandated. Downstream retailers and further processors are making it a requirement of their suppliers, leading to greater vertical coordination, and it has become critical for access to international markets. Another case where regulatory change itself has led to greater vertical coordination was with the 1990 UK

Food Safety Act. As it increased the legal liability of downstream firms for the safety of food sold, retailers reduced their risk by auditing upstream suppliers more carefully.[30]

140. Significant information asymmetry can exist in vertically coordinated agri-food sectors that may impede efficient supply chain coordination and affect the competitiveness of the sector. For instance, as open market coordination becomes replaced with contracts and vertical integration, there are fewer market prices determined through the interactions of buyers and sellers in the free marketplace (a so-called "thin market" situation). With little reliable price information readily available in a closely coordinated vertical supply chain, buyers and sellers face costs in setting and evaluating prices. Transactions may not happen if these costs are sufficiently high.

141. The traditional role of governments to provide price reporting is less feasible in cases of vertically coordinated supply chains (due to thin markets). There is now a heightened need among buyers and sellers for information regarding differentiated products such as quality attributes, and this suggests a changing role for governments. Hobbs and Young point out that there may be a role for government as a third party in reducing information asymmetry, by providing (1) information about quality and (2) accreditation of quality assurance schemes.

1. While government grading schemes may help reduce information and negotiation costs, they tend to be based on broad commodity attributes. When agri-food products become more differentiated, as in the case of chicken products, much more detailed information about product attributes needs to be exchanged between buyers and sellers in order to reduce information asymmetry and strengthen the efficiency of the supply chain. Hobbs and Young suggest there can be a role for government in supporting R&D in technologies that reduce quality measurement costs for experience and credence attributes. Experience attributes are discovered after consumption (such as taste and texture of meat), whereas credence attributes cannot be determined even after consumption (such as whether the product is safe, processed in an environmentally-friendly manner or to certain animal welfare standards, or if there is an absence or presence of GMOs). While some attributes can remain only credence, such as whether an animal is raised according to a certain standard, technological developments can transform some experience and credence attributes into search attributes (ie those that consumers can assess before buying) −for example, the ability to detect GMOs in processed products.

2. Governments may also play a role in verifying that there are enough supply chain audits to assure the presence or absence of credence attributes. However, Hobbs and Young point out that this function can be provided by independent private sector third parties, and that some quality assurance schemes incorporate verification or audits by independent private firms. They suggest, though, a continued role for governments in establishing industry standards for providing information and accreditation, and facilitating the development of quality assurance schemes.

142. Vertical contracts in the chicken industry can be complicated and choosing among buyers-processors in a vertically coordinated supply chain can be challenging. Farmers must have a certain set of skills related to negotiation as well as contract evaluation in terms of assessing risk and performance. The question is whether there is a role for government in supporting education and advice to farmers, or alternatively whether this support could be provided by others such as commodity groups. In addition to the role of government in providing contract information and advice, there is a question of the regulation of vertical contracts between farmers and processors, particularly related to the right of farmers to organize, and requirements to increase the transparency and adequacy of contracts (Hobbs and Young).

[30] Hobbs and Kerr (1992) from Hobbs and Young (2001).

143. While there are efficiency gains to industry consolidation and increased vertical coordination, there is the possibility that large, dominant food processors and retailers could use purchasing power to depress prices for chicken or make other contractual conditions disadvantageous for farmers. Concern with the growing concentration in agriculture input markets, food processing industries, and food retailers is now commonly raised and discussed. Chicken processing industries are not typically as concentrated as their beef and hog counterparts, however major chicken processors appear to be maintaining and increasing their market share of chicken output and expanding their influence on chicken supply chains, apparently more than in any other industry, through ownership of input supply businesses (feed and chicks) and contractual production arrangements with farmers. While the market structure of chicken industries varies from country to country, there is apparently a tendency toward a relatively concentrated and tightly coordinated supply chain that may put chicken farmers in some countries in at a relative bargaining disadvantage.[31]

144. Continuing concentration and vertical coordination in agri-food sectors in general suggest there is an important role for competition and anti-trust regulations in these sectors. The issue of thin markets and lack of price information in vertically coordinated supply chains does complicate the role of regulators. Another means of addressing potential processor purchasing power is collective bargaining. Hobbs and Young provide a discussion of collective bargaining and legislation in the United States and Canada that provides farmers the right to organize, as another means of addressing potential processor purchasing power.

Conclusions

145. It is especially timely to investigate the policy implications for farmers and rural communities of structural changes occurring in agri-food supply chains given the significant consolidation and increased concentration taking place at the input supply stage and post farm gate stages. Consolidation has been occurring for decades in agriculture and food processing and distribution, and consequently some levels of concentration are now quite high.

146. Concentration in chicken processing is still considered relatively moderate and while it varies from country to country, the CR4 is usually not above 50 percent. However, consolidation and concentration will most likely increase in chicken processing as there are significant economies of scale in this industry.

147. As production and distribution are horizontally consolidating, businesses at different stages of the supply chain are vertically integrating through ownership and business arrangements. Vertical integration has become common in many agri-food supply chains, and it is perhaps more widespread in the chicken industry than in any other agri-food sector. Many chicken supply chains worldwide are now vertically integrated from feed mills to hatcheries, chicken farming, and processing and further processing. Often, large processors own feed mills and hatcheries, and contract the raising of chickens with farmers.

148. Food retailing consolidation is contributing to the enormous shift in influence from food processors to retailers. While chicken farmers do not typically supply directly to retailers, they could be indirectly affected by the changing processor-retailer dynamics. Pressure on processor margins from downstream retailers may influence how processors transact with chicken farmers and suppliers in general.

[31] In the case of the UK, Sheppard (2004) notes a concern at both the farm and consumer level with respect to the commercial power in the chicken processing industry that is heavily dominated by a small number of large vertical integrators. The CR4 is at least 70 percent and these processors have significant vertical ownership in chicken production.

149. A number of policy implications arise in relation to structural changes occurring in the chicken supply chain. There is a role for competition regulations in food industries in general. Collective bargaining and legislation that gives farmers the right to organize are also potential means of addressing processor purchasing power. There could be a role for government in providing information and advice to farmers regarding vertical contracts.

150. Governments may also have a role in facilitating the efficiency and competitiveness of supply chains in general by reducing transaction costs resulting from information asymmetry: for example, by supporting R&D in technologies that reduce quality measurement costs for experience and credence attributes, such as technology that would allow for detection of GMOs in processed products; and verifying that there are enough supply chain audits to assure the presence or absence of credence attributes.

REFERENCES

Agriculture and Agri-food Canada (2005) *Poultry Marketplace*, Industry Profile, Chapter 3, Food Value Chain Bureau, Web site http://www.agr.gc.ca/misb/aisd/poultry/prindc3_e.htm

Agriculture and Agri-food Canada (2004) *The Canadian Poultry Meat Processing Industry*, Food Value Chain Bureau, Web site http://www.agr.gc.ca/misb/fb-ba/index_e.php?s1=proc-trans&s2=prof&page=poul-vol

Agriculture Canada (1986) *Marketing Board Statistics*, Ottawa, Canada.

Baines, Richard N., Paul J. Ryan and W. Paul Davies (2004) "HACCP at the Farm Level – The Missing Link in Food Safety and Security," presented at Conference of International Food and Agribusiness Management Association, http://www.ifama.org/conferences/2004Conference/Papers/Baines1095.pdf

Banker, David and James MacDonald eds (2005) Structural and Financial Characteristics of US Farms, *Agriculture Information Bulletin, No. 797*, ERS/USDA, http://www.ers.usda.gov/publications/aib797/aib797.pdf

Banker, David and Janet Perry (1999) "Farm Structure: More Farmers Contracting to Manage Risk," *Agricultural Outlook, Jan-Feb*, ERS/USDA, http://usda.mannlib.cornell.edu/reports/erssor/economics/ao-bb/1998/ao258.pdf

Barton, L. (1985) *The Integrated Poultry Industry*, University of Arkansas, Cooperative Extension Service.

Bastian, Chris et al (1997) Today's Changing Meat Industry: Implications for tomorrow's Beef Sector, Managing for Today's Cattle Market and Beyond, http://agecon.uwyo.edu/Marketing/mngtcmkt/CngMtInd.pdf

Bunte, F.H.J., W.E. Kuiper, M.A. van Galen, S.T. Goddijn, Macht en prijsvorming in de agrofoodketens, Den Haag : LEI, 2003, report 5.03.01 CBS/LEI, Land- en tuinbouwcijfers, Den Haag, LEI, PR.05.03. PVE, Annual report, 2005.

Bhuyan, Sanjib (2005) "Does Vertical Integration Effect Market Power? Evidence from U.S. Food Manufacturing Industries," *Journal of Agricultural and Applied Economics*, April,

http://www.findarticles.com/p/articles/mi_qa4051/is_200504/ai_n13635252

Blandford, David "A highly sophisticated food and agricultural system has evolved in developed market economies: The functioning of Agriculture and Agribusiness in Developed Market Economies," posted on web site 2005, http://dblandford.aers.psu.edu/research.htm

Burt, Michael and Valerie Poulin (2005) Canada's Retail Trade Industry: Industrial Outlook, Canadian Industrial Outlook Spring 2005, Conference Board of Canada.

Busch, Lawrence and Carmen Bain (2004) "New! Improved? The Transformation of the Global Agrifood System," *Rural Sociology*, Vol. 69, No. 3, pp 321-346.

Carstensen, Peter C. (2003) "The Roles of Antitrust and Market Regulation Law in Markets for Agricultural Products," paper prepared for Meeting of the Organization for Competitive Markets, Missouri, http://www.agribusinessaccountability.org/pdfs//286_Antitrust%20and%20Market%20Regulation%20Law.pdf

Connor, John (2003) "The Changing Structure of Global Food Markets: Dimensions, Effects and Policy Implications", paper presented at the OECD and the Netherlands Ministry of Agriculture, Nature Management and Fisheries conference: The Changing Dimensions of the Food Economy – Exploring the Policy Issues, http://webdomino1.oecd.org/comnet/agr/foodeco.nsf/viewHtml/index/$FILE/ConnorPaper.pdf

Costales, Achilles (2004) "A Review of the Thailand Poultry Sector," Livestock Sector Report Thailand, FAO, http://www.fao.org/docs/eims/upload/154042/lsr_THA.pdf

Cotterill, Ronald (1999a) "Continuing Concentration in Food Industries Globally: Strategic Challenges to an Unstable Status Quo," *Research Report Series*, Research Report No. 49, October, University of Connecticut.

Cotterill, Ronald (1999b) "Measuring Market Power in the Demsetz Quality Critique in the Retail Food Industry," 15 Agribusiness 101.

Cotterill, Ronald (1986) "Market Power in the Retail Food Industry: Evidence from Vermont," *Review of Economics and Statistics*, Vol. 68, No. 3, pp 379-386.

Dobson, Paul W. (2003) "Buyer Power in Food Retailing: the European Experience," paper presented at the OECD and the Netherlands Ministry of Agriculture, Nature Management and Fisheries conference: The Changing Dimensions of the Food Economy – Exploring the Policy Issues, The Hague, Netherlands.

Dobson, Paul W., Roger Clarke, Stephen Davies and Michael Waterson (2001) "Buyer Power and its Impact on Competition in the Food Retail Distribution Sector of the European Union", *Journal of Industry, Competition and Trade*, Vol. 1, No. 3, pp 247-281.

Dobson, Paul W. and Michael Waterson (1999) "Retailer Power: recent developments and policy implications," *Economic Policy*, Vol. 28, pp 134-64.

Food and Agriculture Organization (FAO), United Nations, production, trade and consumption statistics.

Fulton, Murray and Yongmei Tang (1999) "Testing the Competitiveness of a Multistage Food Marketing System: The Canadian Chicken Industry," *Canadian Journal of Agricultural Economics*, Vol. 47, pp 225-250.

Gordon, Daniel V. and Tim Hazledine (1996) "Modelling Farm-Retail Price Linkage for Eight Agricultural Commodities," *Technical Report No. 1/96*, prepared for Policy Branch, Agriculture and Agri-Food Canada.

Harris, J. Michael, Phil R. Kaufman, Steve W. Martinez and Charlene Price (2002) The U.S. Food Marketing System: Competition, Coordination, and Technological Innovations into the 21st Century, *Agricultural Economic Report No. 811*, http://www.ers.usda.gov/publications/aer811/aer811.pdf

Harrison, Darryl and James Rude (2004) "Measuring industry concentration in Canada's food processing sectors," Agriculture and Rural Working Paper Series, *Working Paper No. 70*, Agriculture Division, Statistics Canada.

Harkin, Tom (2004) Economic Concentration and Structural Change in the Food and Agriculture Sector : Trends, Consequences and Policy Options, prepared by the Democratic Staff of the Committee on Agriculture, Nutrition, and Forestry, United States Senate, http://harkin.senate.gov/agriculture/CommStaffConcentrationPaper.pdf

Harwood, Joy, et al, Managing Risk in Farming: Concepts, Research and Analysis, Agricultural Economic Report No. 774, ERS/USDA, http://www.ers.usda.gov/publications/aer774/aer774.pdf

Heffernan, William, Mary Hendrickson and Robert Gronski (1999) Consolidation in the Food and Agriculture System, Report to the National Farmers Union.

Henry, Richard and Graeme Rothwell (1995) *The World Poultry Industry*, Global Agribusiness Series, International Finance Corporation, World Bank, Washington, D.C.

Hobbs, Jill E. (1996) "A transaction cost approach to supply chain management," *Supply Chain Management, Vol. 1, No. 2*, pp. 15-27.

Hobbs, Jill E. and Linda M. Young (2001) Vertical Linkages in Agri-food Supply Chains in Canada and the United States, report prepared for the Research and Analysis Directorate, Strategic Policy Branch, Agriculture and Agri-Food Canada.

Hoppe, Robert A. and Penni Korb (2005) "Large and Small Farms: Trends and Characteristics," Structural and Financial Characteristics of US Farms, Chapter 1, *Agriculture Information Bulletin, No. 797*, D. Banker and J. MacDonald eds, ERS/USDA, http://www.ers.usda.gov/publications/aib797/aib797.pdf

Kaufman, Phil R. (2000a) "Grocery Retailers Demonstrate Urge to Merge," Structural Change in the US Food Industry, *FoodReview, Volume 23, Issue 2,*

Kaufman, Phil R. (2000b) "Consolidation in Food Retailing: Prospects for Consumers and Grocery Suppliers," Special Article, *Agricultural Outlook*, August, ERS/USDA.

Kester, Warren (2003) "Bigger and Fewer," *Beef*, 1 April, http://beef-mag.com/mag/beef_bigger_fewer/

Kinsey, Jean (2003) "Emerging Trends in the New Food Economy: Consumers, Firms and Science," paper presented at the OECD and the Netherlands Ministry of Agriculture, Nature Management and Fisheries conference: The Changing Dimensions of the Food Economy – Exploring the Policy

Issues, http://webdomino1.oecd.org/comnet/agr/foodeco.nsf/viewHtml/index/$FILE/KinseyPaper.pdf

Lasley, Floyd A., Harold B. Jones Jr., Edward H. Easterling and Lee A. Christensen (1988) *The US Broiler Industry*, Agricultural Economic Report No. 591, ERS/USDA.

Liu, Hao, John C. Henning, Paul J. Thomassin and Laurie Baker (2005) The Competitiveness of Canada's Poultry Processing Industry, Research Paper, Agriculture and Rural Working Paper Series, Catalogue no. 21-601-MIE – No. 075, Agriculture Division, Statistics Canada.

London Economics (2004) *Investigation of the determinants of farm-retail price spreads*, Final report to DEFRA, UK.

Lopez, Rigoberto A., Azzam M. Azzeddine and Carmen Liron-Espana (2002) "Market Power and/or Efficiency: A Structural Approach," *Review of Industrial Organization*, Vol. 20, I. 2, pp 115-126.

Lotterman, Edward (1998a) "Poultry: A quiet success story. Geography and vertical integration are key factors in poultry industry's development," *fedgazette*, http://minneapolisfed.org/pubs/fedgaz/98-04/poultry.cfm

Lotterman, Edward (1998b) "Broilers of the world, unite," *fedgazette*, http://minneapolisfed.org/pubs/fedgaz/98-04/broilers.cfm

Lotterman, Edward (1998c) "Why no one mourns the loss of the family chicken farm: A short history of poultry in the Ninth District," *fedgazette*, http://minneapolisfed.org/pubs/fedgaz/98-04/chicken.cfm

Luiz da Silva, Christian, Nogueira, Antonia C.L. and Maria S.M. Saes (2005) "Coexistence of Governance Structures in the Broiler Chicken Industry: A Comparative Analysis of Two Brazilian States," presented at Conference of International Food and Agribusiness Management Association, http://www.ifama.org/conferences/2005Conference/Papers&Discussions/1052_Paper_Final.pdf

MacDonald, James and Penni Korb (2006) "Agricultural Contracting Update: Contracts in 2003," Economic Information Bulletin No. (EIB9), ERS/USDA, http://www.ers.usda.gov/Publications/EIB9/

MacDonald, James, et al (2004) "Contracts, markets and prices: Organizing the production and use of agricultural commodities," *AER-837*, ERS/USDA, http://www.ers.usda.gov/Publications/aer837/

MacDonald, James (2000) Where are Concentration and Linkages Problematic?, Presentation at the AAEA preconference Workshop: Policy Issues in the Changing Structure of the Food System, http://www.farmfoundation.org/changing-structure.htm

MacDonald, James (1999) "Concentration and Competition in the U.S. Food and Agricultural Industries," *Agricultural Outlook 261*, http://www.ers.usda.gov/publications/agoutlook/may1999/ao261e.pdf

MacDonald, James, Michael Ollinger, Kenneth E. Nelson, Charles R. Handy (1999) "Consolidation in U.S. Meatpacking," Agricultural Economics Report No. 785, ERS/USDA, http://www.ers.usda.gov/Publications/aer785/

MacDonald, James M., Michael E. Ollinger, Kenneth R. Nelson and Charles R. Handy, Structural Change in Meat Industries: Implications for Food Safety Regulation, *American Journal of Agricultural Economics*,

Marion, Bruce W. (1998) Changing Power Relationships in US Food Industry: Brokerage Agreements for Private Label Products," *Agribusiness* 14(2), pp 85-94.

Martinez, Steve W. and Hayden Stewart (2003) "From Supply Push to Demand Pull: Agribusiness Strategies for Today's Consumers," *Amber Waves*, Vol. 1, Issue 5, http://www.ers.usda.gov/amberwaves/november03/pdf/supplypush.pdf

Martinez, Steve W. (2002a) Vertical Coordination of Marketing Systems: Lessons from the Poultry, Egg and Pork Industries, *Agricultural Economic Report No. 807*, http://www.ers.usda.gov/publications/aer807/

Martinez, Steve W. (2002b) "A Comparison of Vertical Coordination in the US Poultry, Egg and Pork Industries," *Agriculture Information Bulletin No. 747-05*, ERS/USDA, http://www.ers.usda.gov/publications/aib747/aib74705.pdf

Martinez, Steve W. and David E. Davis (2002) "Farm Business Practices Coordinate Production with Consumer Preferences," *FoodReview*, Vol. 25, Issue 1, http://www.ers.usda.gov/publications/FoodReview/May2002/frvol25i1g.pdf

Martinez, Steve W. (2000) "Price and Quality of Pork and Broiler Products: What's the role of Vertical Coordination?" *Agriculture Information Bulletin No. 747-02*, ERS/USDA, http://www.ers.usda.gov/publications/aib747/aib74702.pdf

Martinez, Steve W. (1999) "Vertical Coordination in the Pork and Broiler Industries: Implications for Pork and Chicken Products," *Agricultural Economic Report 777*, ERS/USDA, Washington, D.C. http://www.ers.usda.gov/publications/aer777/

Martinez, S. and A. Reed (1996) From farmers to consumers: Vertical coordination in the food industry, *AIB-720*, ERS/USDA, http://www.ers.usda.gov/Publications/summaries/vertical.htm

Meat and Livestock Commission (MLC) Economics (2000) The International Poultry Meat Market, United Kingdom.

Ministry of Agriculture and Fisheries (MAF), The New Zealand Poultry Industry, Web site 2005, http://www.maf.govt.nz/mafnet/rural-nz/overview/nzoverview011.htm

Mwansa, Pius B. (2004) "Growing dominance of a few large poultry farms – a continuing legacy," *Canadian Agriculture at a Glance*, Statistics Canada, Catalogue no. 96-325-XPB, http://www.statcan.ca/english/research/96-328-MIE/2004038/96-328-MIE2004038.pdf

NASS/USDA, Trends in US Agriculture, Broiler Industry, http://www.usda.gov/nass/pubs/trends/broiler.htm

NASS/USDA, US Broiler Industry Structure, http://usda.mannlib.cornell.edu/reports/nassr/poultry/industry-structure/specpo02.pdf

National Chicken Council (2002) About the Chicken Industry, web site http://www.nationalchickencouncil.com/aboutIndustry/detail.cfm?id=16

OECD (2005a) "Changes in Retail Buying Behaviour and the Impact on Structure and Returns in Agriculture," AGR/CA/APM(2005)25, Internal note by the Secretariat, Directorate for Food, Agriculture and Fisheries, Paris.

OECD (2005b) "Analysis of Price Transmission Along the Food Chain," AGR/CA/APM(2005)29, Internal note by the Secretariat, Directorate for Food, Agriculture and Fisheries, Paris.

OECD (2004) "Competition and Regulation in Agriculture: Monopsony Buying and Joint Selling," DAFFE/COMP/WP2(2004)2, Internal note by Secretariat, Directorate for Financial, Fiscal and Enterprise Affairs, Paris.

OECD (2001) "Market concentration in the agro-food sector: selected economic issues," AGR/CA/APM(2001)18, Internal note by Secretariat, Directorate for Food, Agriculture and Fisheries, Paris.

OECD (1983) *OECD Food Industries in the 1980s*, Paris.

Oklahoma Cooperative Extension Service (2005) Beef, Pork and Poultry Industry Coordination, Division of Agricultural Sciences and Natural Resources, Oklahoma State University, http://www.thepoultrysite.com/FeaturedArticle/FATopic.asp?AREA=Markets&Display=270

Ollinger, Michael, Sang V. Nguyen, Donald Blayney, Bill Chambers and Ken Nelson (2005) Structural Change in the Meat, Poultry, Dairy and Grain Processing Industries, Economic Research Report 3, USDA, http://www.ers.usda.gov/publications/err3/err3.pdf

Ollinger, Michael, James MacDonald and Milton Madison (2000a) Structural Change in US Chicken and Turkey Slaughter, *AER-787*, ERS/USDA, http://www.ers.usda.gov/publications/aer787/aer787.pdf

Ollinger, Michael, James MacDonald and Milton Madison (2000b) "Poultry Plants Lowering Production Costs and Increasing Variety," Structural Change in the US Food Industry, *FoodReview, Volume 23, Issue 2,* http://www.ers.usda.gov/publications/foodreview/may2000/may2000a.pdf

Ollinger, Michael, James M. MacDonald, Charles R. Handy and Kenneth E. Nelson (1997) Structural Change in the US Meat and Poultry Industries, paper presented at the NE-165 Conference: Strategy and Policy in the Food System – Emerging Issues,

Perry, Janet and David Banker (2000) "Contracting Changes How Farms do Business," Agriculture and the Rural Economy, *Rural Conditions and Trends, Vol. 10, No. 2*, ERS/USDA, http://www.ers.usda.gov/publications/rcat/rcat102/rcat102j.pdf

Perry, Janet, David Banker and Robert Green (1999) "Broiler Farms' Organization, Management and Performance," *Agriculture Information Bulletin No. 748*, ERS/USDA, http://www.ers.usda.gov/Publications/aib748/

Perry, Janet, Mitch Morehart, David Banker and Jim Johnson (1997) "Contracting – A Business Option for Many Farmers," *Agricultural Outlook*, May, ERS/USDA, http://www.ers.usda.gov/publications/agoutlook/may1997/ao240b.pdf

Persaud, Suresb (2000) *Investigating Market Power and Asymmetries in the Retail-to Food and Farm-to-Retail Price Transmission Effects,* PhD Dissertation, Department of Agricultural, Environmental, and Development Economics, Ohio State University.

Reardon, T, J-M.Cordon, L. Busch, J. Bingen and C. Harris (1999) "Strategic Roles of Food and Agricultural Standards for Agrifood Industries", presented at Conference of International Food and Agribusiness Management Association (IAMA), http://www.ifama.org/conferences/9/1999/1999%20Congress/Forum%20Papers_Proposals/Codron_Jean-Marie.PDF

Rehber, Erkan (2000) Vertical Coordination in the Agro-food Industry and Contract Farming: A comparative study of Turkey and the USA, Food Marketing Policy Center, Research Report No. 52, http://www.fmpc.uconn.edu/publications/rr/rr52.pdf

Reimund, Donn, A., J.R. Martin and C.V. Moore (1980) Structural Change in Agriculture: The Experience for Broilers, Fed Cattle, and Processing Vegetables, Technical Bulletin No. 1648, Economics and Statistics Service, USDA.

Selby, Christina (1998) "Harry's Flock on the Rock," *Farm and Country, Vol. 63, No. 5*, November 2nd, http://www.agpub.on.ca/text/nov98/cover2.htm

Sexton, Richard and Nathalie Lavoie (2001) Food processing and distribution: An industrial organization approach, Chapter 15, *Handbook of Agricultural Economics, Volume 1, Part 2,* pp 863-932.

Sexton, R. (2000) "Industrialisation and Consolidation in the US Food Sector: Implications for Competition and Welfare," *American Journal of Agricultural Economics*, Vol. 82, No. 5, pp 1087-1104.

Shepherd, W.G. and J.M. Shepherd (2004) The Economics of Industrial Organization, 5th ed., Long Grove, IL, Waveland Press, 2004.

Sheppard, Andrew (2004) The Structure and Economics of Broiler Production in England, Special Studies in Agricultural Economics, No. 59, Centre for Rural Research, University of Exeter, http://statistics.defra.gov.uk/esg/reports/Brreport.pdf

Silva, Joao F. (2005) Brazil Poultry and Products: Annual Poultry Report, Global Agriculture Information Network Report No. BR5620, Foreign Agriculture Service, USDA, http://www.fas.usda.gov/gainfiles/200508/146130627.pdf

Sommer, Judith E., Robert A. Hoppe, Robert C. Green and Penelope J Korb ( ) "Structural and Financial Characteristics of US Farms, 1995: 20th Annual Family Farm Report to the Congress," Agriculture Information Bulletin No. 746, ERS/USDA, http://www.ers.usda.gov/publications/aib746/aib746.pdf

Statistics Canada (2005) Poultry and Egg Statistics, Catalogue no. 23-015.

Swinnen, Johan F.M. (2005) When the Market Comes to You – or Not: The Dynamics of Vertical Coordination in Agri-food Chains in Transition, World Bank, http://lnweb18.worldbank.org/ECA/ECSSD.nsf/0/84d9aba9fd13e32085256fb300519c4f/$FILE/VC%20version%20%2024%20Feb%202005.pdf

Tisdell, C. T. Murphy and T. Kehren (1997) Characteristics of Thailand's Commercial Pig and Poultry Industries with International Comparisons, World Animal Review 89-1997/2, FAO Corporate Document Repository, http://www.fao.org/documents/show_cdr.asp?url_file=//docrep/W6437T/w6437t02.htm

Thorton, Gary (2003) "Turbulent 2002 leads to rationalization," Broilers, *WATT PoultryUSA* ,http://www.nationalchickencouncil.com/files/WattPoultryRank_01-03.pdf

Tweeten, Luther (2001) Agribusiness Concentration Implications for Farmers and Consumers, Grain Inspection, Packers and Stockyards Administration, USDA, http://151.121.3.117/psp/issues/millennium/tweeten.htm

UK Competition Commission (2000) *Supermarkets: A report on the supply of groceries from multiple stores in the United Kingdom*.

Villa-Boas, Sofia (2003) *Vertical contracts between manufacturers and retailers: An empirical analysis*, University of California, Berkeley.

Vukina, Tomislav (2001) Vertical Integration and Contracting in the US Poultry Sector, Journal of Food Distribution Research, Vol. 32, No. 2, pp 30-38, http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=12527&ftype=.pdf

Ward, Clement E. (1997) "Vertical Integration Comparison: Beef, Pork and Poultry" Selected paper submitted to the Western Agricultural Economics Association, http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2001/F-552web.pdf

Warner, Mellie L., *The Changing Structure of Animal Agriculture*, Clemson University, http://cherokee.agecon.clemson.edu/structure.pdf

Westgren, R.E. (1994) "Case Studies of Market Concentration in the Poultry Industries," *Canadian Journal of Agricultural Economics*, Vol. 42, pp. 565-575.

Westgren, R.E. (1999) "Delivering Food Safety, Food Quality, and Sustainable Production Practices: The Label Rouge Poultry System in France," *American Journal of Agricultural Economics*, Vol. 81, No. 5, pp 1107-1111.

Wu, S. (2003). Regulating agricultural contracts: What are the tradeoffs? *Choices*, *18*(1), 19-22. http://www.choicesmagazine.org/2003-1/2003-1-05.htm

Yakovleva, Natalia and Andrew Flynn (2004) Innovation and the Food Supply Chain: A Case Study of Chicken, Centre for Business Relationships, Accountability, Sustainability and Society, Working Paper Series No. 20, Cardiff University, UK.

Zachariasse, Vinus and Frank Bunte (2003) "How are Farmers Farming in the Changing Balance of Power along the Food Chain?" paper presented at the OECD and the Netherlands Ministry of Agriculture, Nature Management and Fisheries conference: The Changing Dimensions of the Food Economy –

Exploring the Policy Issues,
http://webdomino1.oecd.org/comnet/agr/foodeco.nsf/viewHtml/index/$FILE/ZachariassePaper.pdf