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## **Dimensions of Competitiveness: Lessons from the Danish Pork Industry**

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### **The Issue**

Conventional evaluations of industry competitiveness tend to focus on a narrow range of production cost variables. Using these criteria, we would expect industries such as the Danish pork industry to be uncompetitive relative to the pork industries of Canada and the United States, given relatively high input costs and legislative limits on farm size for environmental reasons. Yet Denmark accounts for 25 to 30 percent of global pork exports. To explain this apparent paradox, a broader conception of what is meant by “competitiveness” is required. Included in this broader perspective are the effects of transaction costs, vertical supply chain linkages, the policy environment, and competitive pressures, along with traditional measures of production costs and efficiencies. The Danish pork industry provides a useful case study. Recent merger activity within the Danish pork sector has the potential to alter its relative competitiveness.

### **Implications and Conclusions**

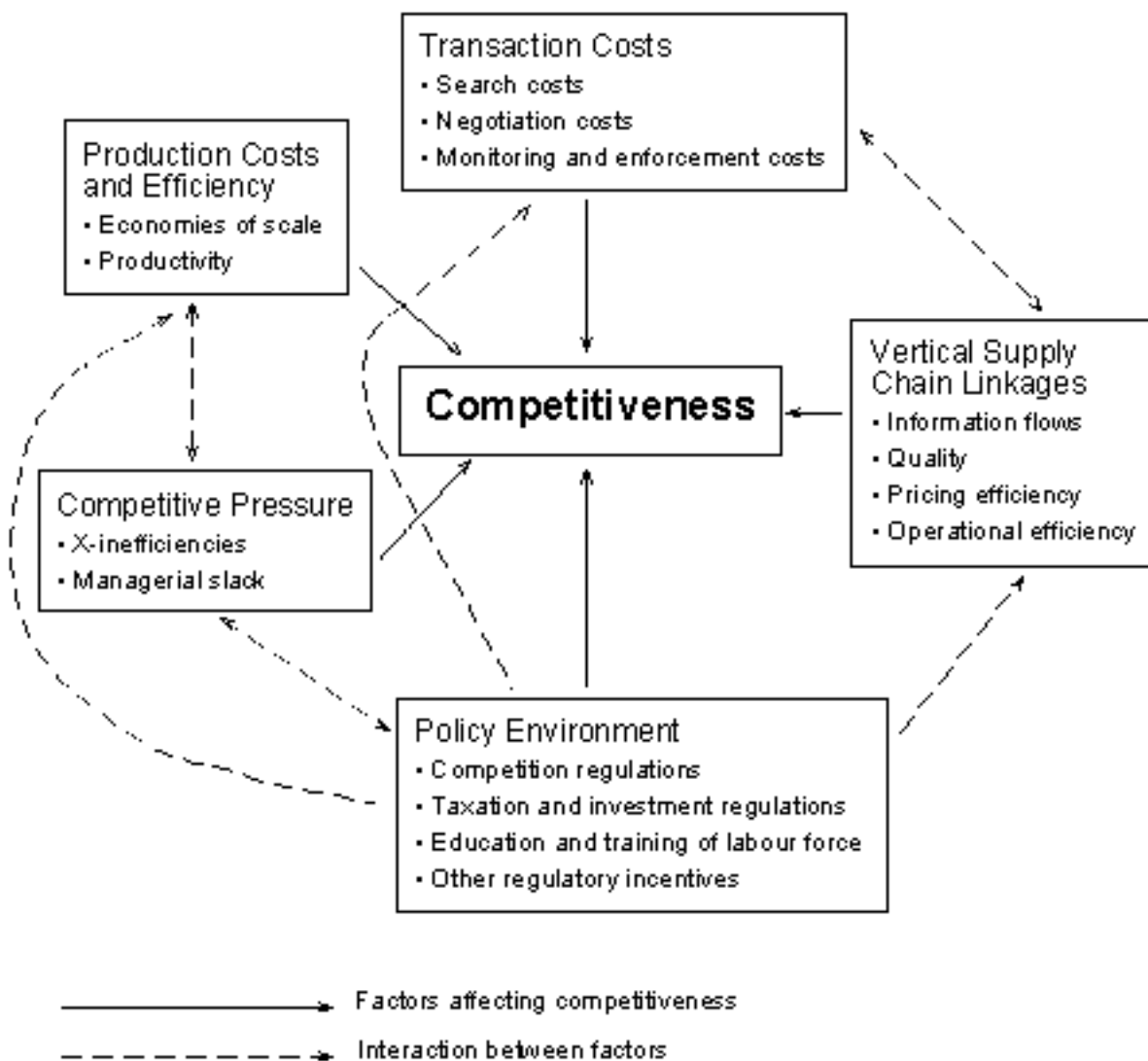
The unique structure of the Danish industry has long been a source of competitive advantage. Recent industry-wide initiatives, including on-farm quality assurance, traceability, food safety, and market-specific contracts continue to enhance the industry’s competitiveness in international markets. A merger between two of the largest processing co-operatives has substantially altered the structure of the industry and has divergent implications for industry competitiveness. The Danish case shows that economists need to look beyond conventional cost-of-production measures when evaluating competitiveness to also include qualitative assessments of transaction costs, vertical industry linkages, the policy environment, and the degree of competitive pressure facing an industry.

## What is Competitiveness?

Figure 1 presents a conceptual framework describing the factors that affect industry competitiveness.

### *Production Costs and Efficiency*

Previous research into competitiveness has emphasised relative costs of production, retail and wholesale price comparisons, and various ratios of value-added to sales, value-added per worker, and value-added to labour costs (see for example, Martin et al. [1991]; Jensen et al. [1995]). While these measures capture important elements of an industry's competitiveness, they ignore the potential impacts of industry organisation and vertical co-ordination.



**Figure 1** Factors affecting competitiveness

### ***Transaction Costs***

Relative transaction costs may also be important in determining competitiveness. These include: *ex ante* search or information costs arising prior to a transaction to search out information about products, prices, trading partners, etc.; costs of physically negotiating and carrying out a transaction; and the *ex post* monitoring and enforcement costs of ensuring that the terms of a transaction are adhered to (Hobbs, 1996a). Transaction costs affect competitiveness because they influence the efficiency with which price and quality information flow along a supply chain, the incentives for investing in specific assets, and the nature of vertical linkages between producers, processors and distributors.

### ***Vertical Supply Chain Linkages***

The closer the vertical supply chain linkages, the more the industry is able to respond to the quality needs of different markets, enhancing pricing efficiency and operational efficiency. “Pricing efficiency” refers to the effectiveness with which price signals are transmitted from consumers back to producers and the extent to which, in response to these signals, the market system efficiently allocates resources and co-ordinates production and marketing. “Operational efficiency” refers to the cost-effectiveness of the marketing and supply chain activities involved in moving products from producers to consumers (Kohls and Uhl, 1990).

### ***Policy Environment***

The policy environment influences competitiveness through competition regulations, taxation and investment regulations, education and training of the labour force, etc.

### ***Competitive Pressure***

In the absence of strong competitive pressure from other firms or industries, X-inefficiencies can arise in the form of “managerial slack” (Leibenstein, 1966). In the long run this can harm the competitiveness of an industry vis-à-vis existing or potential competitors.

The solid arrows in Figure 1 represent direct impacts on competitiveness. Production costs and efficiencies, transaction costs, vertical supply chain linkages, the policy environment, and competitive pressure all affect competitiveness directly. The dashed arrows indicate potential interdependencies between these factors. Transaction costs and the policy environment affect the vertical linkages that emerge (Hobbs, 1996a). The policy environment influences the degree of competitive pressure and production efficiencies. The remainder of this paper assesses the Danish pork industry within this framework.

## **The Danish Pork Industry: A Synopsis**

The Danish pork industry is highly export-dependent, with 80 percent of production going for export. While Germany is the most important export market by volume, followed by the UK, Japan is the most important market by value. Denmark competes directly with Canada in the U.S. market, accounting for 15 percent by volume of U.S. pork imports

in 1999. Danish hog production has been increasing steadily, reaching just over 22.5 million hogs in 1999. In a trend similar to that experienced in other major hog producing countries, herd size has been increasing, while the number of farms raising hogs has shown a downward trend. Approximately 90 percent of hog production is slaughtered through three farmer-owned co-operatives. Recent merger activity between two of the largest co-ops has resulted in one co-op, Danish Crown, accounting for almost 80 percent of co-operative hog slaughtering. The two smaller co-ops, Steff-Houlberg and Tican, have 16 percent and 6 percent shares respectively.

All three co-ops belong to “Danske Slagterier” (DS), an umbrella organisation. DS represents the Danish pork industry in consultations and negotiations with outside bodies, formulates industry-wide strategies, conducts market research, and co-ordinates this market research with breeding, technological, and product quality research to provide the industry with information on the requirements of different markets. Danske Slagterier plays a pivotal role in encouraging close co-operation vertically among all stages of the hog production, processing, and distribution chain. (For a more detailed discussion of the Danish pork industry see Hobbs et al. [1998] and Hobbs [1996b].)

## **Explaining the Danish Competitiveness Paradox**

### ***Production Costs and Efficiencies***

On a conventional cost-of-production basis, the Danish industry would appear to be at a competitive disadvantage relative to its major competitors in international markets, including Canada and the United States. Land is scarce and relatively high priced, feed prices are inflated by the effects of the European Union (EU) Common Agricultural Policy, farm size is restricted by Danish environmental regulations, and labour costs in the processing sector are two to three times as high as those in Canada (Hobbs, 1996b).

Herd structure in Denmark is similar to that in the Netherlands (the other major EU hog producer) and Belgium. In 1997, approximately 88 percent of Danish hogs were produced in herds of over 400 head, representing 41.3 percent of hog farms; within this group 34.8 percent of hogs were produced on the largest farms (those with 2000 pigs or more)—representing 6.3 percent of all hog farms (Danske Slagterier, 2000). This structure is not dissimilar to herd structure in Canada in the recent past. In 1996, 84 percent of Canadian hogs were produced in herds of 528 or more, representing 38 percent of hog farms; within this group 25 percent of hogs were reared on farms with more than 2,653 hogs, representing 3.6 percent of all hog farms (Canadian Pork Council).<sup>1</sup> In contrast, hog production in the United States is much more concentrated. In 1997, 37 percent of U.S. hogs were produced by operations marketing over 50,000 head per year, representing 0.2 percent of producers (National Pork Producers Council, 2000).

A comparison of herd-productivity measures suggests that the Danish industry is competitive with the United States and Canada in terms of production efficiency. In 1997, the average numbers of pigs weaned per litter in Denmark was 10, compared with 8.96 in the United States and 9.29 in Canada, while the average number of litters per sow was 2.26 in Denmark, 2.07 in the United States and 2.26 in Canada. Average daily gain for finishers was estimated at 778g in Denmark, 715g in the United States and 727g in Canada in 1997 (National Committee for Pig Production, 2000; PigCHAMP, 1997). Anyone in Denmark wishing to purchase a farm of more than 30 hectares is required to take a series of courses at an agricultural college over a three-to-four-year period. In terms of competitiveness, this improves managerial skills and the ability to adopt new technology, thereby enhancing production efficiency (Hobbs, 1996b).

Jensen et al. (1995) provide empirical evidence of the wholesale price advantage held by the U.S. and Canadian pork industries over the Danish pork industry. They suggest that in a liberalised trade environment the United States and Canada should be exporting pork to Denmark given their apparent relative cost advantage. While a simple comparison of production costs or wholesale prices might lead to this conclusion, in reality there are other factors that appear to outweigh the production cost disadvantages of the Danish pork industry, explaining its competitiveness. The analysis by Jensen et al. does not taken into account any quality differences that may exist between Danish products and those of the United States or Canada.

### ***Horizontal and Vertical Industry Initiatives***

The effect of close vertical co-ordination on the competitive success of the Danish industry, and the role of Danske Slagterier in facilitating this co-ordination, have been explored elsewhere (Hobbs, 1996b; Hobbs et al., 1998). More recently, Danske Slagterier has encouraged a number of new horizontal and vertical industry initiatives that enhance the quality of Danish pork and tailor products to different markets (Hobbs, 2001).

#### Quality Assurance and Food Safety

Prompted by the demands of international markets and by changes in the domestic ***policy environment***, the Danish industry adopted an on-farm quality assurance scheme covering traceability, transportation, housing, feed, use of veterinary products, environmental standards, animal welfare, and food safety. Although it was not a legislative requirement, the Danish co-operatives, working through DS, decided to ban the use of artificial growth promoters in all Danish hog production. This decision followed vocal public debate over the issue. There is an agreement with feed manufacturers not to use antibiotic-resistant growth promoters in feed. Danske Slagterier has identified Salmonella DT104 as a priority for eradication in Danish pork production. This is not a legislative requirement but the industry has decided that its eradication is necessary to protect market share and to maintain and enhance the image of

Danish pork in both the domestic and export markets. These steps reduce **transaction costs** for downstream export market customers by reducing monitoring and enforcement costs.

#### Traceability

Danske Slagterier has co-ordinated the introduction of a traceability system for Danish hogs. All animals carry an ear-tag number that identifies the farm of origin. The objective of this system is to allow all potentially infected hogs to be traced and isolated in the event of a disease outbreak. At slaughter, the carcass grade and any veterinary marks are electronically connected with the producer ID number and the information is sent to the farmer. It is therefore possible to trace each carcass from the chilling room back to the farm. Once the carcass is cut up, however, final cuts cannot be traced back to the farm of origin. The boxed meat products are identified with a lot identification number and production date; thus, it is possible to trace cuts of meat to an approximate slaughter time. (See Hobbs [1996b] for a more detailed discussion of this system.)

While retroactive traceability is important in order to trace products to their origin in the event of a problem, proactive information provision which lowers search costs for consumers and downstream food distribution firms is more valuable. Information provision could be a value-adding process in itself because it lowers **transaction costs**. Danish Crown recently test marketed beef cuts in the domestic market with a far more sophisticated traceability system. The products were labelled with an electronic bar-code which the consumer in the retail store could “swipe” under a bar-code reader to obtain information about the farm of origin, the production methods used on that farm, etc. (Tinggaard, 2000). This development is important because it has the potential to move the meat industry to the next level of traceability, that is, forward traceability, or the provision of information on “credence” attributes of products that the consumer cannot detect even after having consumed the product. Examples include animal welfare practices used on the farm, whether the farming methods are environmentally friendly, or whether the product contains additives that are not detectable by consumers. Being able to signal to consumers the presence (or absence) of these attributes offers additional ways for the agri-food industry to differentiate its products and capture more of the consumers’ willingness to pay for these new attributes.

#### Market-specific Contracts

Danske Slagterier recently developed a set of production standards for so-called “Special Pigs” reared for the UK market. The hogs are reared under contract following specific production practices that conform to the unique animal welfare and food safety requirements of the UK market. Farms are audited to verify that the correct practices are being followed. There is an additional external “audit of the auditors” to ensure that the system is being implemented uniformly in all areas. Farmers are paid a premium for these hogs. Heavier hogs are also

produced under contract for the German and Italian markets. Between 15 and 20 percent of Danish production is reared under market-specific contracts (Moesgaard).

Why are contracts used for the production of UK Special Pigs and heavy pigs when the co-operatives are required to purchase all hogs produced by their members? The contracts enable a co-operative to assure its customers that the hogs are being reared according to the specifications of a particular market. Danske Slagterier developed a set of specifications in response to the needs of the UK market. The double auditing system, administered by DS, verifies that these practices are being followed; it reduces **transaction costs** for the co-operative slaughterhouses and for downstream customers in export markets by reducing their monitoring and enforcement costs. The contracting system reduces search costs for co-operatives, who need to be assured of a supply of the right quality of hogs at the right times to meet their commitments in the UK and German export markets. Farmers producing for these markets incur higher production costs and may incur higher production risks. Without a contract with guaranteed premiums, the investment in hogs for these markets may be “held up” due to the asset-specific nature of this investment. A guaranteed market premium is necessary to entice farmers to make the investment necessary to produce for these specialised markets.

### **Implications of the Merger**

While the vertical and horizontal co-ordination initiatives discussed above enhance the competitiveness of the Danish industry, the recent merger between two of the largest pork processing co-operatives has changed the organisation of downstream exporting activities within the industry. It may also have altered the competitive pressures facing the co-operatives and has implications for the long-run competitiveness of the Danish pork industry.

The merger may allow the dominant co-op, Danish Crown, to reap enhanced **production cost efficiencies** due to economies of scale that arise from the rationalisation of slaughter, processing, and distribution functions. If these efficiencies are present and are manifest through lower wholesale prices for Danish pork, the industry should be more competitive in international markets.

The **policy environment** was significant in allowing the merger to go ahead, subject to certain restrictions. While there were no domestic legislative barriers to the merger, it was the subject of a European Commission competition investigation because it created dominant positions for Danish Crown and Steff-Houlberg in the Danish market for the purchase of live slaughter hogs and in the domestic retail market for pork. Despite this, the Commission ruled in favour of the merger, subject to a number of conditions which were intended to “solve the competition problems” identified in the domestic market (European Commission, 1999, p.1).

The conditions include a requirement that the merged co-operative partially relinquish its exclusive supply requirement for members by allowing farmers to supply up to 15 percent of their weekly production to other slaughterhouses. The period of notice for leaving the co-oper-

ative was shortened from two years to one year. Given the regional domination of the two large co-operatives in Denmark, Danish Crown on Jylland (Jutland) and Steff-Houlberg on Sjælland (Zeeland), however, it is questionable whether this creates a realistic alternative for farmers.

The Commission also required that the industry abandon its weekly price quotation for slaughter hogs in which base prices (before premiums and deductions for carcass quality) were set by a weekly price committee consisting of representatives from all of the slaughter co-operatives. The Commission deemed this activity to be anti-competitive and required the three remaining co-operatives to price hogs independently. In practice, Danish Crown acts as the “price leader”, setting the base hog price each week which the two smaller co-ops follow (Moesgaard).

Third, the co-ops were required to dissolve their joint ownership of ESS-Food, a downstream export trading company. Previously, a major portion of export marketing and distribution activities for all of the co-ops had been channelled through ESS-Food. Danish Crown is now the sole owner of ESS-Food. One of the Commission’s fears may have been that Danish Crown’s dominant ownership stake in ESS-Food could be used to pressure the other two co-operatives and might enable Danish Crown to abuse its dominant position in the market to the detriment of competition. Given that ESS-Food operates only in export markets, however, it is not clear how dissolving the joint ownership of this company improves the level of competition between the co-operatives in their *domestic* pork market. The sole focus of the European Commission investigation was on the effect of the new duopsony/duopoly in the Danish domestic markets for hogs and for retail pork. It did not concern itself with the impact in export markets. As a result of this decision, the two smaller co-ops have had to establish their own sales networks and, in some cases, brand identities, in export markets in which they had previously channelled products through ESS-Food. Danish Crown almost certainly gains the competitive edge in those export markets because it can continue to use the existing exporting infrastructure of ESS-Food and, importantly, the ESS-Food name and reputation.

It is clear that industry consolidation has reduced farmers’ flexibility in the choice of market outlets for slaughter hogs. Each co-op has a board of directors which is dominated by elected farmer members; however, the one member–one vote principle has meant that some larger farmers feel under-represented in the co-operative system. Regardless of the organisational form, ***lack of competitive pressure*** can breed inefficiencies. Is there a strong enough efficiency incentive for the management teams of the two remaining dominant co-ops? The co-ops may face a greater problem of divergence between the objectives of the owners (i.e., the farmer members) and those in day-to-day control (i.e., the management team) than was previously the case. The much larger size of the new organisation and the reduced competitive pressure from other Danish co-ops compound this problem. For farmers disgruntled with the activities of their co-op, or who may feel under-represented, few, if any, alternative marketing channels



are available to them at the current time. As long as Danish Crown and Steff-Houlberg continue to be successful in international markets and are able to provide their farmer-members with an acceptable return, then there may not be a problem. However, the industry is now significantly less competitive at the producer-processing interface—a fact highlighted by the European Commission competition ruling requiring that the processors abandon their weekly price committee for setting hog prices. Instead, Danish Crown has emerged as the effective price leader. Thus we have a curious mixture: despite the processing and downstream supply chain activities being performed by farmer-owned organisations, there remain concerns over the effects on producers of concentration in the industry.

In the past, the majority of the industry's general marketing activities and broad (not product-specific) international market research activities have been carried out by Danske Slagterier. The emergence of Danish Crown as the dominant co-operative almost certainly changes the relationship between Danish Crown and DS. It may be that Danish Crown will be reluctant to continue committing resources to the market research activities undertaken by DS if a portion of the benefits from this research flow to their competitors, Steff-Houlberg and Tican. One of the strengths of the Danish industry in the past has been its sound understanding of the requirements of different markets and close vertical co-ordination along the supply chain to respond to those market needs. Danske Slagterier has played a pivotal role in co-ordinating market research, breeding and genetics research, etc., thereby reducing **transaction costs** for the industry players. A reduced role for DS may mean that these activities become internalised within the vertically integrated structure of Danish Crown. Whether this change will occur and, if it does, the subsequent effect on the competitive position of the Danish industry in world markets are not yet clear.

## **Lessons**

**W**hat lessons can be learned from this overview of the Danish pork industry? The industry is competitive in global pork markets despite its apparent production cost disadvantages primarily because of the structure of the industry. Through close vertical and horizontal co-ordination, the industry is able to reduce transaction costs, increase efficiency, and enhance the quality of its products. It is able to tailor products to specific market needs and to respond to the evolving demands of a range of different markets. The industry's co-operative structure helps in achieving these goals by putting in place the vertical supply chain relationships necessary to facilitate the flow of information between various stages of breeding, production, slaughter, and processing.

The vertical and horizontal industry initiatives co-ordinated by DS have credibility in the marketplace because they were developed by a recognised and representative industry-wide body, thereby reducing the need for export market customers to undertake their own monitoring activities. Similar initiatives are also being undertaken in other countries, for example,

the Canadian pork industry has been developing an on-farm quality assurance scheme. Several industries are introducing livestock identification schemes to facilitate the traceback of livestock in the event of health or food safety problems. The development of an industry-wide standard such as the UK Special Pig program in Denmark is a little more unusual. In most cases, individual processors in Canada might develop their own set of production guidelines for producers to follow under contract if they wished to meet the specifications of particular markets. Perhaps the advantage of the Danish approach is that a credible third party verifies that the production system is sound and is being followed. Individual slaughter companies can then “bolt on” their own additional quality standards to meet the needs of specific buyers.

It remains to be seen whether the recent merger activity enhances the competitiveness of the Danish pork industry or hampers it in the long run by weakening the role of Danske Slagterier as a co-ordinating institution. Competitiveness is a multifaceted concept. In addition to looking at conventional cost-of-production comparisons when analysing competitiveness, economists should also consider the effects of transaction costs, vertical and horizontal co-ordination, the policy environment, and the degree of competitive pressure facing an industry.

### ***Endnotes***

1. Differences in data collation between the two sources preclude a more exact comparison of size classes. Hog production has since become more concentrated in Canada, with 2000 statistics showing that 91 percent of hogs were produced by farms with more than 528 head, representing 49 percent of hog farms. The largest category (over 2,653 head) included 7 percent of farms but 35 percent of hogs. Comparable Danish statistics for 2000 were not available. The largest category reported in the Canadian statistics (over 2,653 head) likely masks the size of large-scale hog production, which would be considerably higher than this.

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