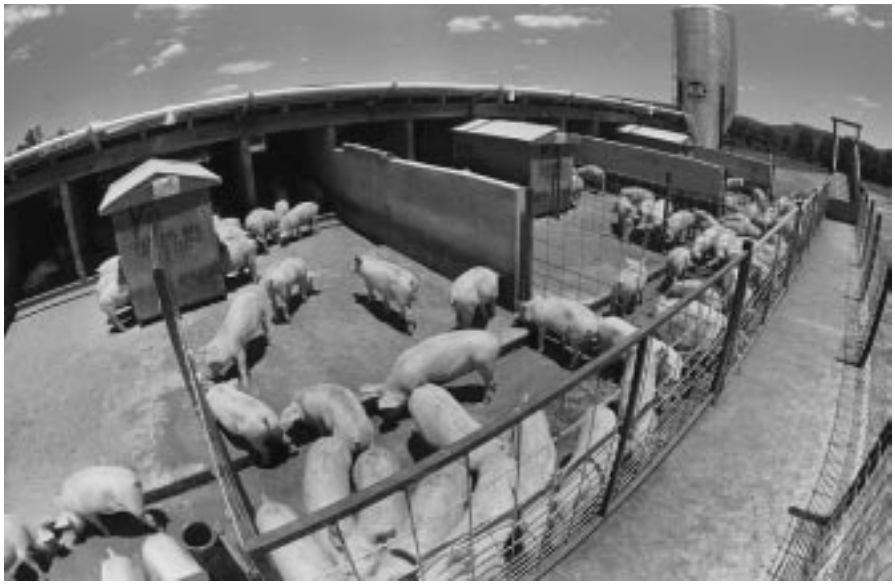


World Hog Production: Constrained by Environmental Concerns?

International trade in pork has risen significantly in recent years. Exports of the major pork exporting countries grew at an annual rate of 4 percent during 1989-97 as a result of bilateral and multilateral trade agreements, income growth, and technological innovations in transport and shelf-life extension. There is little doubt that as incomes continue to grow, markets continue to liberalize, and science finds new ways to extend the shelf life of fresh meat over longer periods, international trade in pork will increase further. USDA's baseline projection indicates continuing growth in international pork trade into the next century.

U.S. agriculture, as a major exporter of grain and meats, will need the answers to several important questions about future growth in international pork trade: Which countries are likely to be the leading exporters in the next century? Will the exporting countries that now dominate international pork markets still dominate in 2006? What factors can help identify countries that might become or remain leading pork exporters?

In 1997, four countries—the U.S., Canada, Denmark, and Taiwan—accounted for about 60 percent of pork exported by the major pork exporting countries. The U.S., a recent player in the world pork market, accounted for 20 percent, with primary export markets in Japan, Canada, Mexico, and Russia. Canada accounted for 19 percent with important markets in the U.S. and Japan. Denmark, which has a long history as a pork exporter, accounted for 17 percent. Denmark's most important markets outside the European Union (EU) are Japan, South Korea, and the U.S.

Taiwan is a recent entrant to the world pork market, with over 95 percent of its 1996 exports going to Japan. In early 1997, however, Taiwan's hog herd became infected with foot-and-mouth disease (FMD). As a result, Japan and most other pork importing countries banned imports of Taiwanese pork. USDA expects that Taiwan will eventually overcome the effects of FMD and resume exports to Japan, perhaps within 5 years. In the meantime, Japan's demand for pork is being met primarily by the U.S., Denmark, and Canada.

The extent to which these four leading exporting countries will be able to meet forecast export growth will be determined largely by the ability of their pork industries to produce more hogs. Expansion of a country's hog production capacity is limited by its resource base. Of the three key hog production resources—land, labor, and capital—land is most likely to constrain future growth in pork production in these four countries.

Land is the key resource in pork production because of its multiple functions: land is, of course, necessary to house the animals. Hog feed supplies are frequently drawn from the domestic land base, as in the U.S. and Canada. However, the land requirement for animal housing facilities is relatively minimal, and the absence of a land base adequate to supply feed can be mitigated by importing feed, as is done by both Denmark and Taiwan.

Where land is a nonsubstitutable input into the hog production process is in manure utilization. An adequate land base for spreading manure residues is essential, simply because no other economically viable means of manure utilization currently exists. Indeed, manure utilization accounts for most of the land needs of a hog operation.

Manure is typically stored in a tank or a lagoon facility, which allows the water content to evaporate. The storage facility's manure residuals are later spread, usually over fields where the soil and crops draw fertilizing nutrients (primarily nitrogen and phosphorus) from the manure residues. When manure residue is applied at rates above the nutrient-absorption rates of the soil and crops, the danger of runoff and subsequent groundwater pollution increases.

Until recently, land requirements for manure utilization on expanding hog production facilities were usually met by a combination of two methods: increasing application rates (i.e., applying greater quantities of manure to a fixed quantity of land) and increasing the area of application (i.e., applying manure at the same rate to a greater land area). Expanding hog facilities in the U.S. and Canada—countries with relatively large land endowments when viewed at the national level—typically have leaned toward expanding application area, while facilities in

Denmark and Taiwan—countries with small land endowments—have more typically increased manure application rates.

Recent expansion of large, intensive hog production facilities has made manure utilization a topic of public debate in each of the four leading exporting countries. In view of the relatively high densities of hog inventories and the human population in Denmark and Taiwan, public concerns are perhaps predictable.

Less predictable has been public debate in the U.S. and Canada, where land is apparently plentiful. But in the U.S., for example, there are hundreds of counties where nutrients available from animal manures exceed 100 percent of crop system needs. In these areas, the public debate becomes acute concerning any type of livestock operation expansion.

Thus, despite large bases of sparsely populated land, public demands for stricter governmental regulation of hog industry expansion and manure disposal have risen to a level that may constrain hog production in the U.S. and Canada. Indeed, expansion constraints in all four countries may limit export growth rates to below those expected in response to projected growth in international pork demand.

U.S. Responds to Public Environmental Concerns

In the U.S., concerns are aimed primarily at large, intensive hog operations and the threats they pose to the environment and to the public's "quality of life." Although small, the risk of water pollution via manure lagoon leakages or spills, and the odor that accompanies large, intensive livestock operations, have induced citizens at local, county, state, and Federal levels to advocate more strict regulation of existing and proposed operations. In some states, as well, environmental concerns and efforts to restrict structural changes in the livestock industry—especially increasing size and concentration of operations—have become politically linked, bringing further pressure to bear on hog industry expansion.

Citizens close to new or expanded intensive hog production facilities have articulated a broad range of proposals for regulation, from heightened scrutiny by local zoning boards to statewide moratoria on new hog production facilities. Because these and similar measures have implications for the ability of the U.S. hog industry to expand, the level of environmental regulation may become a key determinant of the future scale of the U.S. pork export industry. These new measures may also have a lasting effect on the structure and distribution of the U.S. hog herd.

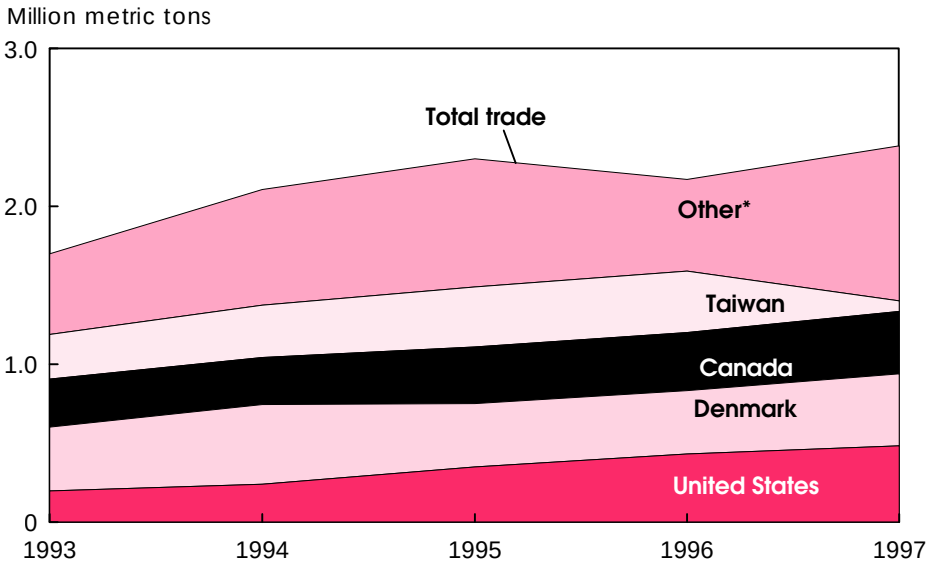
For example, in late August 1997, North Carolina—the second largest hog producing state in the U.S.—instituted a statewide moratorium on new or expanding hog operations. Effective retroactively from March 1, 1997, through March 1, 1999, the moratorium applies to operations of 250 head or more. Exempt from the moratorium are operations that rely on manure management systems other than lagoons.

In addition to the moratorium, the law restored the right of county governments to zone hog operations larger than 4,000 head on feed. The law also imposed setbacks (i.e., mandated distances between hog production operations and other structures, such as houses, churches, schools, and hospitals) and restrictions on manure spreading. The law directs the North Carolina Department of Agriculture to plan a phase-out of anaerobic lagoons and spray fields as primary manure utilization methods.

A 90-day moratorium on new or expanding hog operations was imposed by executive order in Kentucky in July 1997 to allow the state sufficient time to formulate and issue emergency regulations to specify set-backs and to limit the size of lagoons. In Minnesota, zoning authorities in three counties have imposed temporary moratoria on hog production, while a fourth county imposed a permanent moratorium on expansion. Moratoria on new and expanded hog operations have also been proposed in Mississippi and Nebraska.

In Iowa, the Humboldt County Board of Supervisors proposed ordinances in 1995 that would require county approval of new or expanding hog facilities, require financial assurance bonds to indemnify potential cleanup costs of abandoned facilities, and regulate manure application. Although the Iowa Supreme Court suspended enforcement of the ordinances in June 1997 pending judicial review, the Humboldt County ordinances appear to have effectively framed the terms of the

International Pork Trade Grows, As Share Supplied By Four Leading Exporters Falls



*Inlcudes China, South Korea, and other Asia; France, Germany, and other EU; Eastern Europe; Brazil; Mexico; and Australia.

Economic Research Service, USDA

expansion debate in Iowa. Broadly, the key question is whether the right to zone land use resides with the state or with counties. Since counties have demonstrated a tendency to regulate agricultural land use more strictly than the state government, operators of large, intensive hog production facilities tend to favor state land-use laws that are uniform across counties.

In South Dakota, the expansion debate revolves around the South Dakota Family Farm Act (a 1974 law that restricts corporate farming) and the use of zoning restrictions to limit expansion efforts that the act currently allows. A 1995 interpretation of the law encouraged large, corporate hog producers to explore production opportunities in South Dakota. In response to a proposal by Tyson Foods to raise 500,000 slaughter hogs per year in Hyde County, voters there passed an ordinance imposing 4-mile set-backs from neighboring properties. Since set-backs of this magnitude make large hog operations nearly impossible, corporate hog producers like Tyson Foods are effectively locked out of Hyde County.

Moreover, a current effort to amend South Dakota's constitution would prohibit corporations and syndicates from owning or maintaining livestock. Cooperatives and family farm corporations in which family members own a majority interest and on which at least one family member lives would be exempt. The amendment would effectively prohibit contract hog production, as practiced by large hog producers such as Murphy Family Farms, Carroll's Family Farms, and Tyson Foods.

Kansas and Nebraska also restrict corporate farming in favor of small family-owned operations. Currently, these laws are being challenged in both states by large hog producers attempting to expand their operations. In Kansas, Murphy Family Farms has applied for an operations permit as a family farm to raise more than 260,000 sows. In Nebraska, a North Dakota corporation is attempting to set up operations to produce 500,000 hogs per year. The corporation maintains that by managing the operations but not owning the hogs, it is exempt from Nebraska's 1982 law banning corporate farming.

Because of its relatively sparse population and its hot, dry climate that facilitates manure utilization, Oklahoma has seen its hog numbers increase almost seven-fold from 1991 to 1997. Public concerns related to potential water and air pollution from intensive livestock production led to the Oklahoma Concentrated Animal Feeding Operations Act, signed into law in June 1997. The law requires licensing for animal confinement operations of more than 5,000 head built after September 1, 1997, requires liquid waste storage facilities, establishes set-backs based on operation size and location within the state, and sets minimum distances between the base of manure lagoons and local water tables. Further, the new law requires financial assurances for waste cleanups, and 3-year environmental histories of all license applicants.

In addition to the debate taking place at the state level, Federal legislation to regulate hog operations is under consideration. The Animal Agriculture Reform Act, introduced in Congress in late October, would require livestock operations raising more than 1,330 hogs, 57,000 chickens, 270 dairy cattle, or 530 slaughter cattle to submit a manure handling plan to USDA for approval.

The legislation would prohibit spreading manure at rates above crop nutrient requirements; for levels beyond those allowable for fertilizer, the plan would identify ways of handling, storing, applying, transporting, and disposing of animal manure. The legislation was conceived in order to set national environmental standards for large livestock producers, thus preventing competition between states that might include reductions in pollution standards as incentives to large operations.

The Administration's recently released Clean Water Action Plan will also focus attention on livestock operations and land application of manures, together with resources and actions to help protect water quality and the environment.

As the struggle for consensus between the U.S. hog production industry and the public continues, the economics of the trade-offs between expansion of low-cost intensive production operations and public demands for environmental quality are becoming more clearly defined. Increased environmental regulation increases the costs of producing hogs in the U.S., leading to production of fewer hogs than without the new restrictions/regulations. If U.S. consumer demand and the other major exporting countries' production costs remain constant, imposing higher costs on the use of land resources for the U.S. hog industry will increase domestic pork prices and may reduce U.S. competitiveness in international pork markets.

The extent to which a more heavily regulated U.S. hog production industry can retain its international competitiveness will depend in part on how governments in other pork producing countries choose to respond to their own citizens' environmental concerns. As in the U.S., when foreign governments impose land-use restrictions and other regulations on hog confinement operations, the international competitiveness of their pork products may be reduced. Thus, the relative costs of additional environmental regulation in the U.S. and the other major exporting countries will be an important determinant of international competitiveness.

In Canada, large intensive hog operations face challenges similar to those facing U.S. hog producers. In Denmark, hog producers have maintained international competitiveness despite relatively heavy environmental regulation at both the national level and from the EU. In Taiwan, public concerns about the environmental effects of intensive hog operations have been overshadowed by the outbreak of FMD.

Hog Producers Face Regulation in Canada ...

Although the Canadian hog inventory is only about one-fifth of the U.S. herd, producers in Canada are subject to similar market forces that are driving the U.S. hog industry to restructure into fewer, larger, vertically coordinated operations. As in the U.S., public concerns about environmental consequences accompany the Canadian hog industry's new production structure and practices.

Many residents who live near expanding or proposed hog production facilities, particularly in Ontario and Manitoba, have expressed concerns regarding the

potential for water and air (odor) pollution from large production facilities. Consequently, restrictions similar to those being imposed in the U.S. are appearing in Canada as well.

For example, expansion permits to build new or existing facilities have been contested and/or blocked in Rondeau Bay and East Hawkesbury, Ontario. In Usburne Township, Ontario, a recently enacted regulation requires expanding hog producers to file professionally prepared nutrient management plans; Turnberry Township, Ontario, enacted such a requirement for operations larger than 150 animal units. In June 1997, Councillors for the municipality of Douglas, Manitoba, rejected an application for construction of a new 3,000-sow facility on the basis of public concerns about odor, well pollution, and lower property values.

Provincial governments in Saskatchewan and Alberta also appear to be viewing growth of intensive hog operations with caution. A court in Saskatoon, Saskatchewan, ruled in October 1997 that an environmental assessment was necessary before construction could begin on a planned large hog operation. In Alberta, the provincial government recently announced that a study will be conducted to assess the environmental impact of intensive crop and livestock production.

Canadian hog enterprise budgets published by the Ontario Ministry of Agriculture, Food, and Rural Affairs indicate that Canadian producers already pay more than U.S. producers for manure treatment. Thus, the key to enhancing the international competitiveness of Canadian pork products will hinge in part on whether the increasing returns to scale generated by current structural adjustments are enough to compensate for the increasing costs of environmental regulation.

The Administration's Clean Water Action Plan and related documents are available on the internet at http://www.nhq.nrcs.usda.gov/cleanwater/

... & in Denmark & Taiwan

Several EU member states have set up environmental regulation programs either to improve water quality or to improve the quality of coastal waters for tourism or fisheries, as in Denmark. Danish legislation effectively limits the expansion of hog production by restricting the level of nitrate pollution from agriculture. Prompted by high water pollution from animal waste in the mid-1980's, Denmark set out in the early 1990's to reduce agricultural nitrogen leaching through several programs directed at manure storage/spreading and at fertilizer management.

Danish livestock farms must possess a manure storage capacity equivalent to production for 6-10 months, depending upon the number of animals held. Hog farmers must limit the amount of nitrogen in manure that will be spread per hectare to 1.7 livestock units. Farms exceeding this density may comply with the standards by spreading their excess manure on neighboring farms. Set-aside land is not counted as part of the livestock base area and therefore cannot be used for manure spreading. No manure may be spread on frozen ground or on nonvegetated soil from after harvest to November 1. Manure must be worked into the soil within 12 hours of spreading.

The Danish Agricultural Act of 1994 has encouraged a shift to less intensive livestock production by stipulating that livestock farmers must own certain percentages of the area needed to meet manure spreading requirements, depending on the number of animal units on the farm. For example, operations with up to 120 units must own at least 25 percent of the land required to spread the manure produced; those with 250 animal units must own at least 60 percent; and those with over 500 units must own 100 percent of the required land. To expand livestock capacity, farmers must own or purchase the required amount of land for additional manure spreading. Previously, producers were permitted to rent land.

Farms larger than 25 acres are required to maintain a fertilizer management plan and balance sheet, and may not exceed the official standards for fertilizer application without risking a fine. To reduce nitrate leaching from bare soil during the winter months, farmers are encouraged to keep a green cover on 65 percent of cultivated area.

Hog operations in Denmark must also comply with national regulations developed in response to EU directives. In December 1991, the European Community (EC, now the EU) issued the EC Nitrate Directive to prevent and reduce nitrate pollution of waters from agricultural sources within the EC. The Directive set the maximum nitrate concentration allowed in water at 50 mg per liter, in line with the safe level recommended by the World Health Organization and other EC directives concerning drinking water quality.

The EC Nitrate Directive also set standards and procedures with which member states must comply in order to manage nitrate problems. Member states were required by December 1993 to identify vulnerable zones where agricultural pollutants affected the aquatic environment and to establish a Code of Good Agricultural Practice to prevent further unnecessary agricultural nitrogen emission. By December 1995, member states were expected to design an action program based on the Code of Good Agricultural Practice for handling chemical fertilizers and manure in the identified zones. These programs are to be fully implemented by December 1999.

The Nitrate Directive stipulates that the action program must limit the application of animal manure to 153 pounds of nitrogen per acre, including manure from grazing livestock. However, to help member states in regions of intensive livestock production comply with the Directive, the nitrogen limit may be extended to allow up to 189 pounds per acre from 1996 to 1999. Member states may set different levels of nitrogen if justified by criteria such as long growing seasons, crops with high nitrogen uptake, or high net precipitation, provided the objectives of the Nitrate Directive are not violated.

Member states must also set up a monitoring system to evaluate their action program and ensure it adequately fulfills the objectives of the Code of Good Agricultural Practice. Corrective measures must

be taken if the program fails to meet their objectives. The program must be reviewed at least once every 4 years.

Under both national and EU regulations, Danish hog producers have been dealing since the early 1990's with the kinds of restrictions that challenge U.S. producers today. Despite higher production costs caused in part by environmental regulation, high-value Danish pork products remain competitive in many markets outside the EU. Among the factors that compensate for higher production costs and thus contribute to maintenance of international competitiveness are the vertically coordinated production and processing structure of the Danish pork industry and a strong emphasis on marketing.

Taiwan's hog inventory grew by 600 percent from 1960 to 1995, largely a reflection of the development of Taiwanese pork exports to Japan. Prior to the outbreak of foot-and-mouth disease in late March 1997, Taiwan exported 95 percent of its pork production to Japan.

The juxtaposition of Taiwan's population density with a large, intensive livestock industry prompted its government to propose a 6-year plan in 1991 to reduce hog production by one-third. However, high hog prices from an expanding Japanese export market reduced producer incentive to meet government objectives.

At the same time, the Water Pollution Control Act, which became law in Taiwan in May 1991, set standards for hog waste treatment. Restrictions on hog waste treatment were tightened in 1993, but implementation was not complete at the time of the FMD outbreak.

Reports from Taiwan indicate that before resuming production, operators will be required to meet standards for hygiene, land use, and environmental protection, suggesting that smaller, less capitalized operators may be forced out of business. Indeed, the Government of Taiwan announced a new 6-year production program in April 1997 that will encourage 80 percent of hog producers with fewer than 2,000 head of hogs to exit the industry. The official announcement cited Taiwan's imminent accession to the World Trade Organization (WTO) as justification for the structural change. WTO membership will likely be accompanied by expanded access to Taiwan's pork markets, necessitating the development of a competitive domestic pork industry to compete with imports.

Increased regulation of hog production in Taiwan and the prospects of pork market liberalization will likely form an effective ceiling on hog production, and the FMD outbreak makes such an outcome even more likely, for three reasons. First, after the easing of environmental effects from intensive hog production brought about by the FMD-related reduction in hog numbers, Taiwanese citizens are likely to exert considerable pressure on an increasingly responsive government for enforcement of existing environmental regulation.

Second, many smaller production operations will likely not survive the FMD outbreak because of the high costs of restarting hog production and of compliance with more strongly enforced environmental restrictions. Third, the FMD outbreak provided an incentive for many large Taiwanese hog producing interests to relocate some of their production facilities outside Taiwan. Now, rather than depending solely on facilities in Taiwan, export income is being generated by Taiwanese-owned hog production operations in other countries such as Canada. Together, these factors point to a permanently smaller hog herd in Taiwan.

New Exporters May Enter International Pork Markets

Increased public regulation of the risks of environmental pollution implies two non-exclusive sets of conclusions: one for pork exporting countries with small land endowments (Denmark and Taiwan), and another for countries with relatively large land endowments (the U.S. and Canada). For countries with small land endowments, increased environmental regulation implies a ceiling on inventory numbers, such as the stringent regulation of manure spreading in Denmark. In Taiwan, the costs of compliance with environmental restrictions, together with trade competition and disease factors, will likely hold the Taiwanese herd below its pre-FMD level of 12 million head.

Limitations on inventories, however, do not necessarily imply a limitation on the potential profitability of the hog export sectors, as Denmark has shown. Future profitability for the pork industries in exporting countries with small land endowments will probably result more from technological innovations and cost reductions than from expansion. This suggests that while Danish and Taiwanese shares of the expanding world market may decline, industry profitability may actually increase.

With virtually insurmountable land constraints in the small, densely populated countries of Taiwan and Denmark, the U.S. and Canada, with relatively large land endowments and much less dense populations, had seemed most likely of the major exporting countries to expand production and meet expected increases in world demand for pork. For the U.S. and Canada, increased regulation of environmental risks implies fewer hogs produced at higher per-head costs, leading to higher domestic prices for pork.

With environmental constraints on land use in all four leading pork exporting nations, world pork prices could increase more sharply than otherwise as demand increases over time. A higher cost structure brought about by environmental regulation, coupled with higher world pork prices, may stimulate development of hog industries in countries that currently import pork, as well as in countries with relatively low-cost resources. Nations with large land endowments, good feed supplies, and low levels of regulation may develop pork export capacities. Mexico, Brazil, Argentina, and Uruguay could be strong candidates as major pork exporters if their disease control efforts are successful.

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