



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

What Can the United States Learn from Spain's Pork Sector? Implications from a Comparative Economic Analysis

Sergio H. Lence

MATRIC Research Paper 05-MRP 12
September 2005

Midwest Agribusiness Trade Research and Information Center
Iowa State University
Ames, Iowa 50011-1070
www.matric.iastate.edu

Sergio Lence is a professor in the Department of Economics at Iowa State University.

This paper is available online on the MATRIC Web site: www.matric.iastate.edu. Permission is granted to reproduce this information with appropriate attribution to the authors.

Questions or comments about the contents of this paper should be directed to Sergio Lence, 368E Heady Hall, Iowa State University, Ames, IA 50011-1070; Ph: (515) 294-8960; Fax: (515) 294-0221; E-mail: shlence@iastate.edu.

MATRIC is supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement No. 92-34285-7175. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

Iowa State University does not discriminate on the basis of race, color, age, religion, national origin, sexual orientation, gender identity, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to the Director of Equal Opportunity and Diversity, 3680 Beardshear Hall, (515) 294-7612.

Abstract

This study provides a comparative economic analysis of the primary production of pork and its marketing channel in Spain and the United States. The focus on Spain is due to the profound growth and transformation of its pork sector over the last 20 years, compared with other major players in the world market for pig meat. The analysis reveals a number of similar characteristics but also important differences between the two countries. The significant expansion of Spain's pork production sector stemmed from a number of factors that apply, to a relatively large extent, to some U.S. states (in particular, North Carolina) but do not apply to the U.S. pork production sector as a whole. This implies that it is unlikely that the U.S. pork production sector as a whole will mimic an expansion driven by the same type of factors in the future. Likewise, it seems highly unlikely that the U.S. consumption of pig meat will expand in the future based on the same driving forces behind the sharp increase in Spain's domestic demand for pig meat over the last 20 years. The analysis also indicates that Spanish pig producers are currently being subjected to more stringent environmental and animal welfare regulations than their U.S. counterparts and that these regulations are becoming increasingly more restrictive. It would not be surprising to see similar trends emerging in the United States, leading to a substantially more restrictive regulatory environment for U.S. hog producers.

Keywords: comparative analysis, hog marketing channel, Spain pork industry, U.S. pork industry.

WHAT CAN THE UNITED STATES LEARN FROM SPAIN'S PORK SECTOR? IMPLICATIONS FROM A COMPARATIVE ECONOMIC ANALYSIS

1. Introduction

This study provides a comparative economic analysis of the pork industry in the United States and Spain. The study focuses on Spain's pork industry because, compared to pork sectors of other major players in the world market for pig meat over the last 20 years, it has experienced the most profound growth and transformation. Such transformations have occurred because of innovations in technology and contractual arrangements; changes in demographics and tastes; heightened concerns about health, nutrition, and the environment; and other forces affecting the workings of agricultural markets. Many of the same factors have also affected, to some extent, the U.S. pork sector. Hence, comparing the differential impacts on the industry in both countries should improve our understanding of the host of issues that have been helping shape the markets for hogs in particular and for agriculture in general.

Importantly, judging by (among other measures) the substantial increase in pig meat production, consumption, and exports, Spain's pork sector has proven to be remarkably successful in recent years. The question then arises as to whether lessons learned from pork industry developments in Spain could enhance the performance of the U.S. sector. Thus, a second major objective of the present study is to draw implications from the evolution of the industry in Spain for the United States.

In addition, the U.S. and Spanish pork industries are of major interest in their own right because the most consumed type of meat in the world is pig meat, and both countries play a major role in this sector. World pig meat consumption averaged 15.1 kg per capita per year over the period 2000-2002, accounting for about 39% of total meat consumption in the world (FAO n.d.). The United States and the European Union¹ (and, as discussed later, Spain within the European Union) play major roles in the world market for hogs. As shown in Figure 1a (all figures are given at the end of the paper), China is by

far the world's largest producer of pig meat, with about 47% of the world's total output. However, the European Union and the United States are the world's second- and third-largest producers of pig meat, respectively; the European Union accounts for approximately 19% of world production and the United States for an additional 9%. Spain is the European Union's second-largest pig meat producer behind Germany, with 3% of the world output and 16% of the E.U. production.² Importantly, the European Union is the world's main exporter and importer of pig meat, with a 61% share of the world's exports and a 52% share of the world's imports (see Figures 1b and 1c). Although a large part of such trade figures for the European Union comprises exports and imports among E.U. countries, the European Union is also the world's largest net exporter of pig meat. Spain's exports are sizeable but shadowed by other E.U. members such as Denmark and the Netherlands, whereas Spain's imports are of minor relevance. The United States is both a major importer and exporter of pig meat and on balance has large net exports.

The study proceeds by analyzing the different stages of the market channel for hogs in the United States and Spain in sequential order, from primary production through consumption and trade. This is followed by a discussion of government support and regulation in both countries, and the likely potential impact of the 2004 E.U. enlargement to 25 countries. The study concludes with a section focusing on the implications of Spain's pork sector experience for the U.S. pork industry.

2. Hog Production

The swine sector contributes significantly to the total value of agricultural output in both the United States and Spain. In 2002, hogs constituted 6.2% of the total value of the agricultural output sold by farmers in the United States (USDA-NASS n.d.), whereas the analogous figure for Spain was 11.2% (Eurostat n.d.). Figure 2 shows that pork production has been characterized by a steady and strong upward trend in both countries. In the United States, pork production increased by 35% between 1985 and 2003, from 6.7 million metric tons per year to 9.1 million metric tons per year. Over the same period, pork production in Spain experienced an even greater rate of growth, shooting up by 139%, from 1.4 million metric tons per year to 3.3 million metric tons per year. As a result of the surge in its production, Spain moved from being the fourth-largest producer of hogs

in the European Union in 1985 (behind Germany, France, and the Netherlands) to being the second-largest in 2003 (behind Germany). Figure 3 shows the location of hog inventories within the European Union as of 2000. Pig stocks tend to concentrate in areas close to ports, which allows for a less expensive and more reliable acquisition of feed inputs. Also, pig stocks are sometimes more concentrated where agronomic potential is poor and/or where land is relatively scarce (Vidal 2000).

The increasing relative importance of Spain's swine sector with respect to other countries in the European Union can be explained by several underlying factors. Prominent among them are the admission of Spain into the European Union in 1986, the adoption of technological innovations, changes in environmental regulations, and demographics. Spain's E.U. membership greatly amplified the effect of the other factors. When Spain became a member of the European Union, local producers were forced to either become more competitive vis-à-vis the leading producers in the European Union or risk being put out of business. This became even more evident with the creation of the E.U. single market in 1992. Producers who succeeded were the ones who adopted state-of-the-art technologies, became highly efficient in production, and implemented innovative approaches to firm organization and management (Colom Gorgues 2003).

The transformation of Spain's hog production sector was led by firms in the feed industry. In fact, the feed industry also experienced a substantial transformation following Spain's admission into the European Union, characterized by the consolidation into fewer and larger firms organized as either private corporations or cooperatives. The greater resources of these larger feeding firms allowed them to become "integrators," by arranging production contracts with producers. In such contracts, the "integrator" owns the animals and provides feed, technical assistance, veterinary services, and other inputs (e.g., financial capital), whereas the producer provides the facilities and raises the integrator-owned animals. These contractual arrangements gave integrators the required scale to reduce costs by negotiating better terms with input providers and to conduct breeding programs and perform related research profitably. Contract integration has become the predominant form of production in Spain. As of 1999, between 75% and 85% of the facilities in Catalonia (Spain's main production region) finished hogs under production contracts (Colom Gorgues 2003).

As per technological innovations, historically the technology used to produce hogs in Spain lagged behind that of other major E.U. producers like Germany, Denmark, and the Netherlands. Spain's share of E.U. hog output increased as the swine sector in Spain closed the technological gap, and the country became a technology leader within the European Union. Nowadays, over half of Spain's swine production is supplied by state-of-the-art facilities, some of which can house over 10,000 sows. At the same time, higher environmental concerns regarding intensive systems of swine production coupled with the high population density in major hog-producing regions of the European Union, such as Germany, Denmark, and the Netherlands triggered tighter regulations and discouraged new investment in those locations. Hog operations in these countries have faced higher costs of compliance with environmental regulations, leading many of them to either reduce herd sizes or quit business altogether. In relative terms, Spain's lower population density and less-demanding regulations provided a more nurturing background for new investments in hog production.

Along with other transformations that have taken place in Spain's swine sector over the last 20 years, the increased specialization of operations and the geographic specialization of production are worth noting (Colom Gorgues 2003). Regarding specialization of operations, specialized farrowing and finishing operations are now far more ubiquitous than farrow-to-finish operations. Census data from 1999 indicate finishing operations accounted for 45% of all hog operations in Catalonia, and farrowing operations constituted an additional 39%; in contrast, farrow-to-finish operations accounted for only 16% of the total.

Hog production has tended to concentrate in the regions of Catalonia, Castilla-Leon, and Aragon. Further, Catalonia and Aragon have specialized in finishing hogs, and Castilla-Leon has specialized in farrowing operations. The extent of geographic specialization can be gauged by the percentages of the stocks of finishing hogs and reproductive sows of each region relative to the total for Spain. As of December 2003, Catalonia, Aragon, and Castilla-Leon accounted for 25.3% (22.6%), 18.9% (14.4%), and 12.3% (16.5%) of Spain's stocks of finishing hogs (reproductive sows), respectively. One likely driver of Castilla-Leon's specialization into farrowing operations is its greater distance to ports (thus increasing the relative cost of imported feed). An important implication of the geographic specialization of farrowing and finishing operations is the increased traffic of

animals across regions. The trend toward greater geographic specialization in the future will probably be hampered by the advent of new E.U. rules regarding animal welfare during transportation (to be discussed in a later section) and more stringent sanitary regulations. This is true because animal welfare rules will increase the cost of transportation, and increased traffic makes sanitary controls more difficult.

Most of the new finishing hog operations in Spain are located in Catalonia, far from other livestock operations to avert environmental concerns and reduce disease problems. Further, dry and favorable year-round weather conditions, together with lower wages compared with other large E.U. hog producing countries and access to relatively inexpensive feed supplies (especially because of proximity to ports), have provided additional incentives to expand hog production in Spain, and more specifically in Catalonia. Catalonia accounted for 31.7% of the total hog production and 25.6% of the hog inventories in Spain in 2001, compared with 30.2% and 29.4%, respectively, in 1986 (DGA 2004). Catalonia's increased output share despite its reduced share of stocks reveals that its swine sector has become relatively more productive than the rest of Spain over the period 1986-2001.

Other contributors to the rapid pace of transformation of the hog sector in Spain were the outbreaks of classical swine fever in 1997 and 1998, and the discovery of mad cow disease in the United Kingdom in 1997. The classical swine fever outbreaks reduced supply because a substantial number of animals (over 0.8 million [Colom Gorgues 2003]) were culled in an attempt to eradicate the disease. At the same time, the reduction in beef consumption due to mad cow disease led to the substitution of pork for beef, which translated into an increased demand for pig meat. The lower supply and higher demand translated into a sizeable jump in hog prices (see Figure 4), which triggered a flurry of investments in new state-of-the-art production facilities. But, as the quantity supplied eventually increased when output from the new facilities entered the market, prices fell to record lows (see Figure 4). In turn, the low prices prompted the least profitable hog operations to exit rapidly. As the latter operations were the ones less technologically advanced, the outcome of the whole process was a swine sector consisting mostly of new operations with modern facilities and extremely efficient production practices.

Figure 5 illustrates the extent of the structural transformation incurred by the swine production sector in Spain. In 1990 there were 121,000 hog farms in Spain, averaging an

inventory of slightly less than 100 pigs per farm. Eleven years later, the number of hog farms had almost halved, to 69,000, but the average inventory had more than tripled to 344 pigs per farm. Small operations have virtually disappeared, and most medium-size operations have become associated either with cooperatives or with corporations that are integrated with feed suppliers or meat packers. The extent of concentration that has taken place is evident by the fact that, as of 2001, six cooperatives, six corporations, and two or three large producers controlled over 80% of the hog production in Spain (DGA 2001).

Much like in the European Union and Spain, hog production within the United States has experienced profound transformation. Operations have become larger and more specialized to achieve economies of scale in production. The total number of farms in the United States declined from 243,000 in 1987 to 82,000 in 2002. Over the same period, the average number of pigs per farm increased from 215 to 726 (see Figure 6).

Swine production is also highly concentrated geographically in the United States. Figure 7 shows the location of the pig inventories as of 2002. The map shows that hog inventories tend to be concentrated in the western Corn Belt states and in North Carolina. In 2002, the Corn Belt states of Iowa, Minnesota, Illinois, Indiana, Nebraska, and Missouri had 58.5% of U.S. pig inventories and 52.7% of U.S. production (USDA-NASS n.d.). Iowa had the largest inventory of hogs and the second-largest number of pigs sold in 2002, accounting for 25.6% and 22.2% of U.S. totals, respectively. North Carolina, on the other hand, had the largest number of pigs sold (22.7% of the U.S. total) and the second-largest number of pig inventories (16.4% of the U.S. total). The large number of pigs sold per inventory unit in North Carolina compared with the Corn Belt states is mainly due to the more modern and efficient operations that characterize North Carolina's swine production.

The Corn Belt has traditionally been the most concentrated region for U.S. swine operations. The main reason for this concentration was that the Corn Belt has had ample supplies of two key inputs for hog production, namely, feed and labor. Feed is relatively inexpensive in the Corn Belt, because most of the U.S. corn is produced there. The United States is the world's leading producer of corn, and 68.8% of its output over 2001-2004 was harvested in the Corn Belt states of Iowa, Minnesota, Illinois, Indiana, Nebraska, and Missouri. Second, the traditional farm in the Corn Belt was a medium- to small-size family operation involved in grain production, with most of the labor supplied

by the farmer and his family. Thus, raising hogs allowed a typical corn-soybean farmer to employ his own labor more efficiently and incorporate more value into his crop production. Further, swine production provided farmers with an alternative means to reduce their income risks.

Despite the aforementioned relative advantage of the Corn Belt for producing hogs, its relative importance has declined in the last two decades, largely because of the expansion of swine production in North Carolina. Thus, the Corn Belt's share of U.S. pig sales declined from 64.6% in 1987 to 52.7% in 2002, whereas the share for North Carolina increased from 9.9% to 22.7% over the same period. Despite facing higher feed costs than the Corn Belt states, swine production in North Carolina thrived because of changes in technology, including genetics, disease control, and improved feed rations. The emergence of North Carolina as a hog producing state was triggered by changes in consumer tastes in the late 1970s, in particular, the reduced demand for traditional pork with high fat content, and by changes in North Carolina's agricultural sector. The importance of tobacco, then one of the major agricultural activities in North Carolina, was diminishing at the time, so the state government, together with North Carolina State University and entrepreneurs, looked at swine production as an alternative activity to promote economic growth in the state (McBride and Key 2003). The result was the development of "supply chains" in the state by a few large "integrators," which provided a closer link among producers, packers, and consumers.

The U.S. "integrator" model was pioneered in North Carolina, and now is the dominant paradigm for swine production in the United States. The integrator is a large firm that owns the hogs and contracts out with many growers to raise them. The integrator pays growers a fee for raising the animals in the growers' facilities and usually provides growers with inputs and technical assistance. Integrators usually also arrange the marketing of their finished hogs through marketing contracts with processing plants (McBride and Key 2003).

The emergence of integrators induced substantial changes in the swine sector. They were the main force behind the "industrialization" of U.S. hog production. Integrators often provided capital to build state-of-the-art production facilities, specifically designed to attain maximum efficiency in the different phases of hog production. This facilitated the specialization of hog operations into one or a few of the production phases and ren-

dered the traditional “farrow-to-finish” operations obsolete. Integrators also promoted genetic advances to produce leaner and more homogeneous animals that would convert specialized rations as efficiently as possible. Although specialized rations are more expensive, integrators reduced their cost by obtaining discounts through their large volume of purchases. New developments in management techniques and disease control were also favorable to the emergence of integrators.

Figure 8 shows the shift in the location of U.S. hog inventories between 1997 and 2002. Over this period, the largest increase in inventories occurred in Iowa (+970,000 pigs), followed by Minnesota (+780,000 pigs), Oklahoma (+550,000 pigs), Utah (+380,000 pigs), and Texas (+340,000 pigs). Most of the net growth in inventories has taken place in areas where population is less dense, regulations are more lax, and/or waste management is easier. Largely, this pattern reflects increased concerns about the environment. U.S. citizens have become more aware of the potential environmental dangers posed by large-scale operations (e.g., due to accidental manure spills in streams). In response, legislation has been enacted to reduce the environmental hazards (McBride and Key 2003) at both the federal and local levels.

3. Procurement of and Price Discovery Process for Slaughter Animals

A major development in U.S. pork procurement methods has been the emergence of vertical coordination as the dominant form of procuring supplies. As a result, most packers acquire slaughter animals through marketing and production contracts and packer feeding operations, thus bypassing the spot markets. Processors’ acquisitions through spot markets declined from 62% of total purchases in 1994 to just 17% in 2001 (USDA-GIPSA 2002), whereas purchases by means of contractual agreements grew from 10% to 72% of the total purchases between 2001 and 2003 (Martinez 2002). Several reasons have been advanced to explain the substitution of vertical coordination for open markets in the U.S. hog industry, including the adoption of new production technologies, better quality control, and higher efficiency in the use of processing plants (Martinez 2002).

Typical large-firm marketing contracts specify the timing when the producer will deliver a certain number of hogs to the processor. The marketing contracts usually stipulate

pricing formulas, in which prices are calculated by reference to the spot price in a specific spot market, with premiums and discounts established according to the size and quality of the hogs delivered.

An alternative vertical coordination arrangement consists of production contracts where processors own the pigs and contract with growers to raise and finish the animals. Evidence of the relevance of this type of arrangement is that almost one-fourth of the hogs produced in the United States were packer-owned as of 2002 (Martinez 2002). In the case of packers' production contracts, processors own the animals and provide technical assistance and other inputs, whereas growers provide the feeding facilities and care for the animals. The production contract specifies a fixed payment for the grower, and stipulates premiums for achieving certain efficiency targets in production.

In many instances, hog contracts in the United States stipulate prices calculated from formulas that are based on some publicly reported spot market price, often the prices at the Minnesota/Iowa spot markets. In other instances, the price of reference is a futures market price or the price of a major feed ingredient (e.g., corn). There are also contracts in which the reference price is not publicly reported (e.g., the average price for the slaughter plant) (USDA-GIPSA 2002).

Even before the advent of contracting, the market for slaughter animals had become highly decentralized in the United States, meaning that animal sales were made directly between producers and packers, eliminating the intermediate shipment to terminal market facilities. For example, 90% of all slaughter pig sales consisted of direct (i.e., decentralized) sales in 1990, and this share increased to 97% by 1998 (Kohls and Uhl 2001). Much of the decline in sales through "terminal" (i.e., centralized) markets can be traced back to their higher costs compared with direct sales. The cost advantage of the latter has increased as production units have become larger and grading and standards have improved.

As mentioned in the previous section, most of the hogs in Spain are produced under contracts. Most of these contracts are production contracts whereby the owner of the animals is the integrator and the producer receives a fee for his labor and the use of the facilities. The integrators are typically the feeding firms. As in the United States, most of the procurement in Spain is done directly between producers and slaughterhouses, without sending the slaughter animals to central markets.

A major difference between Spain and the United States is the price discovery process. The United States has an institutional futures and futures-derivatives market—the Chicago Mercantile Exchange (CME)—for which there is no equivalent in Spain. At the CME, traders actively negotiate prices for pork-related products (lean live hogs and frozen pork bellies) to be delivered in the future. Also traded at the CME are call and put options on the corresponding futures contracts. Besides facilitating the price discovery process and providing a price of reference for many marketing contracts, the CME futures and options market is important because it gives U.S. producers, processors, and merchandisers a very flexible tool for managing their price risks.

In Spain, there are no spot or futures markets for hogs similar to the ones in the United States. The main institution for price discovery in Spain is the Mercolleida board situated in Catalonia. Unlike the CME, the Mercolleida board does not establish prices through actual transactions. Mercolleida uses a peculiar system to establish reference prices. Prices are negotiated by an equal number of designated major buyers and sellers of hogs in Spain. These buyers and sellers meet once a week behind closed doors with the purpose of establishing a price deemed representative of the current conditions affecting supply and demand, without actually conducting any trade at such a price. When the buyers and sellers cannot agree on a representative price, arbitrators from the Mercolleida board intervene to try to get them to agree. If this fails, the representative price is established by the arbitrators. The reference price established in Mercolleida is made available to the public immediately. Importantly, this price serves as the price of reference for 90% of the pig transactions (mostly through contracts) in Spain for the following week (Llotja Agropecuària Mercolleida S.A. 2004).

The increasing vertical integration in the marketing channel for hogs has caused mounting problems for the method used to establish reference prices in Mercolleida, because some of the major operators are represented on both the designated buyer and seller sides for slaughter hogs (e.g., Vall Companys and Campofrio corporations). Another shortcoming of Mercolleida relative to the CME is that, by not trading futures or options, Mercolleida does not provide marketing channel participants with tools to manage their price risks. Mercolleida has no plans to introduce actual trading in either spot or derivatives contracts. However, in a partial attempt to provide better information to decision-

makers, Mercolleida has hired a firm to build an econometric model of hog prices in Spain. Mercolleida's ultimate goal is to use the model to calculate price forecasts and release them to the public free of charge.

4. The Pork Processing Sector³

Most of the large-scale meat packing operations in Spain are vertically integrated. A trigger for the vertical integration was the outbreak of classical swine fever in 1997. The reduction in capacity utilization due to the slaughter of hogs to control the disease, together with the high prices that had to be paid for the pigs, led the largest meat packing firms to integrate with hog producers to ensure a steadier stream of animals for their operations. Some of them (e.g., Vall Company, Campofrio, and Guissona) integrated vertically downstream as well, establishing their own chains of retail shops (Colom Gorgues 2003). Much of the integration has taken the form of cooperatives, associations, and corporations. Some meat packers opted instead to establish their own hog production facilities to secure supplies.

Spain's meat processing sector is very atomistic. For the meat sector as a whole, there were about 900 slaughterhouses, 2,300 cold warehouses, 2,100 meatpacking plants, and 4,700 processing plants as of 2000 (DGA 2001).⁴ The top 10 (36) slaughterhouses accounted for 30% (60%) of the total number of pigs slaughtered in Spain in 2003 (MERCASA 2004).

In 2000, there were over 4,400 meat processing firms, and the top 10 firms in the industry accounted for only 25% of the domestic meat supply. Pork makes up about 60% of all meat supplies in Spain, and the industry tends to be somewhat more concentrated for pork meat than for other meats. The large number of processing plants stems from the substantial share (80%) of pork meat sold that is subject to some type of transformation (e.g., cured and cooked products) rather than being sold fresh. Still, there is evidence that meat processing plants are very inefficiently used; capacity utilization is estimated at less than 30%.⁵ In recent years, the processed pork market has experienced a major shift toward quality differentiation. To target the demand for higher-quality products, processors, together with producers and merchandisers, have started to implement traceability systems through the whole market channel for pig meat.

Catalonia is the region with the largest number of meat plants. This is not surprising, as this autonomous region is Spain's main livestock producer. Catalonia accounts for approximately 11% of the meat slaughterhouses and 20% of the meat processing establishments in Spain (excluding plants for poultry and rabbits) (DGA 2001). These shares are significantly smaller than Catalonia's share of meat production (see Section 1), suggesting that the region's meat plants are substantially larger and/or more efficiently utilized than the average meat plant in Spain.

In contrast to Spain, pork processing in the United States has been a highly concentrated industry for many years, with a steady trend toward even greater concentration. Between 1980 and 1999, the number of hog slaughter plants decreased from more than 500 to about 180 (Barkema, Drabenstott, and Novack 2001). Mirroring the trend toward fewer plants, the market share of the four largest pork processing firms also increased, from 34% in 1982 to 56% in 2000 (USDA-GIPSA 2002). Major forces underlying these trends have been the shifts in consumer demand and firms' drive to reduce costs by exploiting economies of scale to enhance their competitiveness. Strong competition from the poultry sector also forced pork processors to search for new ways to become more competitive. This took the form of newer and larger low-cost processing plants, owned by fewer firms. Although larger plants must procure animals from a larger geographic area, thereby increasing transportation costs, the latter have not been high enough to offset the lower per animal costs achieved through economies of scale.

The U.S. shift toward larger pork processing plants mostly happened because the new plants hired non-unionized labor, consisting mostly of low-paid immigrant workers. Until the early 1980s, most workers at large plants were unionized, which prevented the exploitation of potential economies of scale. Technological advances in the operation of large plants further tilted the balance in favor of larger plants.

Besides this difference between the United States and Spain in the extent of concentration of their respective hog packing sectors, there are two other dissimilarities that are worth mentioning. First, hog slaughter and processing per se are highly integrated operations in the United States, as virtually all meatpacking firms perform both activities. In Spain, it is common to have different firms perform slaughter and processing. For example, Spain's top pork processor (Campofrio) recently sold its slaughter operations to the

top slaughter firm (Proinserga). The other interesting difference between the top U.S. and Spanish meatpackers is in their forms of organization. In the United States, none of the top five hog packing firms (Smithfield, Tyson/IBP, Swift (ConAgra), Cargill/Excel, and Hormel) as of 2003 was a cooperative, and four of them (Smithfield, Tyson/IBP, Swift (ConAgra), and Hormel) were publicly traded corporations. In contrast, the second-largest meat processor in Spain as of 2003 (Guissona) was a cooperative, and three other firms among Spain's top 10 meat processing firms were agricultural associations of a socio-economic nature, namely, two cooperatives (Covap and Copaga) and one agricultural processing society (Fribin) (MERCASA 2004). Further, the only publicly traded corporation among Spain's top 10 processing firms was the largest one (Campofrio).

5. Wholesaling and Retailing of Pig Meat

Despite the increasing degree of vertical integration observed in Spain's marketing channel for pig meat, wholesale merchandising is still a significant component. Wholesalers provide pig meat to "traditional" retail stores (i.e., small butcheries), which still are the second-largest meat retail category in Spain (see Table 1). In contrast, wholesalers are usually bypassed altogether when pig meat is retailed through super/hypermarkets, as most of these have their own warehousing and distribution operations.

An important proportion of wholesale pig meat in Spain is commercialized through the network of central markets belonging to the state enterprise MERCASA. MERCASA has over 20 central markets in the biggest urban centers of Spain, focusing on agricultural products such as meats, fresh produce, fruit, and flowers. Pig meat commercialization through the MERCASA markets has also been on the rise. In addition, several of the MERCASA markets have slaughterhouses, which have also been significantly more active in recent years.

TABLE 1. Composition of meat retail sales in Spain (in percentage of total value of sales)

	Fresh Meat	Processed Meat
Supermarkets	36%	43%
Traditional stores	39%	28%
Hypermarkets	14%	19%
Others	11%	10%
Total	100%	100%

Source: MERCASA 2004.

In the United States, most of the fresh and processed pork is sold to final consumers through integrated retail chain stores, which control their own warehousing and distribution operations. As a result, the majority of meat goes directly from packers to the chain store warehouses, where it is shipped to the respective chain retail stores. Because of the negligible share of independent stores in meat retailing, independent wholesalers do not play any significant role in the commercialization channel for pig meat (Kohls and Uhl 2001).

Notwithstanding the lack of formal wholesale markets in the United States, there is an institutional derivatives market for frozen pork bellies at the CME that has no counterpart in Spain. The derivative contracts traded at the CME are futures and options on futures. Both types of instruments provide effective price risk management tools for U.S. processors and merchandisers. In addition, they serve as a price discovery mechanism for frozen pork bellies, allowing for the widespread dissemination of price information among those involved in the commercialization of pig meat.

Table 2 shows the composition of retail sales of pig meat in Spain and the United States. The data reveals some interesting similarities and differences between the two countries. Among the similarities worth mentioning are that the majority of sales of pig meat corresponds to processed products and for at-home consumption. The intersection of the two categories has the single largest share of retail pig meat sales in both countries, with

TABLE 2. Composition of pig meat retail sales in Spain and the United States (in percentage of total carcass-weight volume of domestic consumption)

a. Spain	Fresh Pig Meat	Processed Pig Meat	Total
For at home consumption	15%	62%	77%
Hotel, restaurants, and institutions	5%	18%	23%
Total	20%	80%	100%

Sources: MERCASA 2004 and DGDC 2004.

b. United States	Fresh Pig Meat	Processed Pig Meat	Total
For at home consumption	16%	42%	58%
Hotel, restaurants, and institutions	16%	26%	42%
Total	32%	68%	100%

Source: Pan and Kinsey 2002.

62% and 42% of the total in Spain and the United States, respectively. As for the differences, the most evident one is the ratio of sales for at-home consumption to sales through hotels, restaurants, and institutions (HRI). This ratio is significantly higher for Spain (3.5:1) than for the United States (1.4:1), but the gap has closed substantially in recent years. The diminishing gap largely is explained by many of the same factors that have been driving other retailing trends in Spain, which are discussed further in what follows.

Sales through supermarkets constitute the most important type of retail sales of meat in Spain.⁶ As shown in Table 1, supermarkets have the largest share of processed meat sales and the second-largest share of fresh meat sales, making up 43% and 36% of the total value of sales in the respective categories. Traditional stores, consisting of small butcher shops, are the second-largest retail category for meats, with 39% of the total value of fresh meat sales and 28% of the total value of sales of processed meats.

Importantly, the market share of traditional butcheries in Spain has declined sharply in recent years because of the strong competition from supermarkets and hypermarkets and the changing purchasing habits of Spanish consumers. Spaniards are making fewer of their pork purchases through traditional outlets and more through supermarkets and hypermarkets. Some of the demographic forces driving this trend include urbanization and a larger number of women in the workforce, both of which favor fewer trips per week to large supermarkets over traditional daily purchases. In addition, economic factors such as increasing purchasing power and the higher opportunity cost of time to prepare foods at home are also contributing to greater consumption of pre-cooked and ready-to-eat meat products.

In the United States, food sales for consumption away from home are almost half (47%) of the total food sales (Harris et al. 2002). As depicted in Figure 9, this share grew steadily until the late 1990s but has stagnated since then. Most of the away-from-home food sales occur through fast-food outlets and full-service restaurants; these account for 35% and 32%, respectively, of the sector's total sales. Regarding food sales for at-home consumption, supermarkets are the dominant type of retail store, with a market share of 70%. At a 5.3% market share, specialized food retail stores (e.g., meat stores) command little relevance in the U.S. retail food sector. Overall, it is apparent that the U.S. food retail sector started experiencing earlier many of the trends that have been recently observed in Spain.

6. Domestic Consumption of Pig Meat

At-home food expenditures account for 14.4% of total household expenditures in Spain; the analogous figure for the United States is 7.9% (see Table 3). The explanations for the larger proportion of income spent for at-home food in Spain compared with the United States are twofold. First, per-capita income is higher in the United States, and as income increases, people tend to spend a smaller share of it on food. Second, almost half of the food expenditures in the United States takes place away from home (e.g., in restaurants and other eating places), compared with less than 30% in Spain.

Meat outlays are the single largest item in the at-home food bill for both countries, as they involve almost one-fourth of at-home food expenditures in Spain, and slightly more than one-fifth in the United States (see Table 3). Figure 10 shows that per-capita meat consumption has been on the rise in both countries. However, the growth in meat consumption has been much more remarkable in Spain than in the United States. Between 1985 and 2002, annual per-capita meat consumption in Spain increased by more than 50%, from 77.9 kg to 118.5 kg. The increase over the same period was more modest in the United States (13.9%, from 109.6 kg per capita to 124.1 kg per capita), but with the caveat that meat consumption per capita in the United States was substantially larger than in Spain at the beginning of the period. Total meat consumption per capita in Spain is now almost the same as in the United States, whereas in 1985 it was substantially smaller.

Despite the similarity in the current levels of total meat consumption per capita in Spain and the United States, the composition of these levels exhibits important differences between the two countries. Figure 11 shows that since the mid-1980s, annual per-capita pork consumption in the United States has been stable at around 30 kg. Annual per-capita beef consumption in the United States declined until the early 1990s and has been stable since then at about 43 kg. As for poultry, its annual per-capita consumption

TABLE 3. Composition of household expenditures in Spain and the United States

	Spain	United States
At-home food expenditures as a percentage of total household expenditures	14.4%	7.9%
Meat as a percentage of total at-home food household expenditures	24.1%	21.6%

Sources: Eurostat database and MAPAE 2002 for Spain, BLS for U.S.

has increased substantially in the United States, overtaking beef in 1993 to make poultry the most popular type of meat. Because of the increased consumption of poultry meat, the contribution of pork to the overall U.S. meat consumption basket has displayed a small but consistently negative trend, decreasing from about 26.7% of all meat consumed in 1985 to 24.1% in 2002.

Total meat consumption in the United States has been spurred by several factors. Prominent among them are rising consumer incomes and the relatively low prices of meat (Putnam and Allshouse 1998). Indeed, inflation-adjusted meat prices often reached record lows during the 1990s. Meat consumption was also promoted by the proactive stance of the meat industry; the industry introduced innovative meat products that are more appealing to consumers (e.g., ready-to-eat products offering more convenience) and products specifically targeted to foodservice operators.

The stagnant-to-declining importance of pork in the U.S. diet is due in large part to the availability of relatively inexpensive and innovative poultry products and to the increased consumer concerns about fat and cholesterol (Putnam and Allshouse 1998). Poultry suppliers have been leaders in increasing production efficiency, enabling them to provide meat at very low prices, as well as in developing brand-name, value-added products that are more convenient to consumers and many products that cater to food-service operators. Consumers' higher awareness of fat and cholesterol are evidenced by the changes that occurred in production (raising leaner animals), meat cutting (closer trimming of outside fat on retail meat cuts), and marketing (offering a large number of lower-fat ground and processed meat products). On average, fresh pork in the early 2000s was 30% lower in fat and 30% lower in saturated fat than 20 years earlier (National Pork Board 2002). U.S. pork producers also tried to make pork more appealing to consumers by mounting a national advertising campaign, "Pork: The Other White Meat," beginning in 1987. These efforts by suppliers to adapt to the changes in consumer preferences are likely to have staved off a sharper decline in the relative importance of pork in U.S. meat consumption.

In contrast to the United States, pork is by far the most important meat in the diet of Spaniards, as it accounts for more than half of the consumption of all meats (see Figure 12). Further, the importance of pig meat in Spain's meat consumption basket has steadily increased over the last 15 years. Pork has been the meat with the largest growth in con-

sumption, in absolute as well as relative terms. The share of pig meat has depicted a clear upward trend, going from about 47% to 56% of all meat consumed between 1985 and 2002. More impressively yet, over the same period annual per-capita pork consumption almost doubled, from 36.5 kg to 66.6 kg. As a result of these developments, in 2003 Spaniards were ranked as the world's second-largest consumers of pig meat on a per-capita basis, behind Austrians (FAO n.d.).

The composition of pig meat consumption is also substantially different between Spain and the United States. In particular, Spaniards have a strong preference for cured products. On a per-capita basis, Spaniards are the world's largest consumers of cured ham, and cured products in general account for about half of the consumption of processed pig meat. In turn, processed meat makes up 80% of total pig meat consumption in Spain (see Table 2).

Spaniards' taste for cured products may partly explain the differences observed in the trends for pig meat consumption in the United States and Spain. Cured products are relatively expensive items and tend to be more responsive to increases in income. Thus, increasing income levels in Spain translated into higher demand for cured products such as "Serrano ham."

Consumption of cured products has also been stimulated by successful promotion efforts on the part of producers. Among other initiatives in this regard, Spanish producers have taken advantage of the E.U. legislation on geographic indications and traditional foods (CEU 2004). For example, for ham alone there were four "protected designations of origin" and one "traditional specialty guaranteed" as of 2002 (DGA 2002). The aggregate value of hams marketed as "protected designations of origin" increased by over 200% between 1991 and 2002 (DGA 2002). Evidence of the strong efforts by producers to promote high-quality cured products is also the E.U. recognition of "Serrano ham" as "traditional specialty guaranteed" in 2000 (DGA 2001). "Serrano ham" has been the typical type of ham consumed by Spaniards, but historically its commercialization was not strictly standardized in terms of quality. The recognition of "Serrano ham" as "traditional specialty guaranteed" changed this situation, by providing legal protection to the "Serrano ham" designation, and requiring stringent standardized production processes and quality norms for hams to be marketed under this designation. The market for

“Serrano ham” has increased at a significantly higher rate than the market for other pig meat products (DGA 2001).

7. International Trade

Both Spain and the United States changed from net importers to net exporters of pig meat in the mid-1990s (see Figure 13). The self-sufficiency ratio has increased more significantly in Spain, where domestic production satisfied only 96% of consumption in 1990 and grew to become 115% of consumption in 2002. As discussed next, even though both countries are net exporters of pig meat, their trade patterns exhibit important differences.

Spain averaged 450,000 metric tons of pig meat exports and 150,000 metric tons of pig meat imports over 2001-2003 (DGA 2004). The behavior of Spain's pig meat trade with other E.U. countries since 1994 is depicted in Figure 14. It can be seen that both imports from and exports to E.U. countries have displayed strong upward trends, as imports doubled and exports increased more than threefold between 1994 and 2003. Figure 15 shows the evolution of Spain's pig meat trade with non-E.U. countries. According to this graph, exports to and imports from non-E.U. countries have not exhibited clear trends in the last decade. Comparison of Figures 14 and 15 reveals that most of Spain's trade takes place within the European Union, as non-E.U. countries accounted for only 6% of Spain's imports and 14% of its exports over 2001-2003. Further, the importance of trade with other E.U. countries has increased significantly over time, in both relative as well as absolute terms.

Spain's pig meat imports have come from a handful of E.U. countries. Over 2001-2003, France and the Netherlands accounted for almost half of all imports, and Germany and Belgium for a further one-fourth (see Figure 16). The destination of Spain's pig meat exports is also highly concentrated in a few E.U. member countries (see Figure 17). The two neighboring countries, Portugal and France, absorb one-third and almost one-fourth, respectively, of Spain's shipments. Germany and Italy together purchase an additional one-fourth of Spain's sales to foreign countries.

Spain is an active trader of live pigs. The majority of Spain's live imports consist of 20 kg feeder pigs. As shown in Figure 18, live imports have not exhibited any clear trend over the last decade, other than a large drop in 1997 due to the outbreak of classical swine

fever in some of the trading partner countries (the Netherlands and Germany). Live exports, in contrast, consist mostly of finished pigs and have been characterized by remarkable growth, as they went from less than 200,000 head in 1992 to over 1.1 million head in 2002.

Shipments of live animals are usually more expensive than shipments of fresh and/or processed meat. From a sanitary standpoint, transportation of fresh and or/processed meat is also superior to transporting live animals. These facts, together with the large number of small processing plants with high levels of underutilized capacity, suggest that there are significant inefficiencies in Spain's pig meat processing sector. It appears likely that the processing sector is ripe for consolidation (see Section 4). It should also be pointed out that, given its large volume of trade in live animals, Spain will likely be affected by the adoption of animal welfare regulations regarding transportation in the European Union (see Section 9). These regulations will certainly make trading live animals more expensive in the future.

Figure 19 illustrates the evolution of the U.S. pig meat trade since 1992. Imports were stable during the first half of the period but increased substantially during the second half. Exports have exhibited sustained and strong growth, increasing from 165,000 metric tons in 1992 to 650,000 metric tons in 2002. Because of the higher growth in exports than in imports, the United States changed from a net importer to a net exporter of pig meat for the first time ever in 1995.

As shown in Figures 20 and 21, U.S. pig meat trade is extremely concentrated in a few countries. In the case of imports, Canada alone accounted for 82% of the total U.S. purchases during 2001-2003, and Denmark accounted for an additional 12% of shipments to the United States (see Figure 20). Historically, Canada's share of U.S. imports was much smaller (e.g., it was about 25% in the mid-1980s). However, Canada has become the paramount supplier of pig meat to the United States because of several developments. One of these developments was the signing of the North American Free Trade Agreement (NAFTA) in 1994, facilitating trade among the United States, Canada, and Mexico. The other important development was the significant expansion of the Canadian swine sector, partly motivated by the elimination in 1995 of the Canadian subsidies for grain transportation, which favored the local usage of grain for hog production in Canada's Western

provinces. Still other contributing factors were the relatively low transportation costs and the increased integration of the North American pork and food-service sectors through cross-border investments.

As for exports, Japan is the main buyer of U.S. pig meat, with almost half of all U.S. shipments over the 2001-2003 period (see Figure 21). About half of the shipments to Japan are in the form of higher-priced fresh cuts, while the rest consists of frozen pork cuts mostly used for processed pork products. Mexico and Canada were the destinations of an additional one-third of U.S. pig meat sales over the same period. NAFTA has greatly facilitated U.S. pig meat trade with both countries.

Similar to the trend in Spain, the United States has substantially increased its imports of live hogs, going from imports of 675,000 head in 1992 to 5.75 million head in 2002 (see Figure 22). Virtually all of the imported animals are from Canada. About two-thirds of the imported animals are feeder pigs to be fed and finished in the United States. Besides the significant expansion of the Canadian swine industry, a major factor behind the growth in live imports from Canada has been the lower agricultural subsidies provided by that country, which translated into lower U.S. countervailing duties on Canadian pig imports. Similar to Spain, the increase in the number of feeder pig imports also reflects the transformation of the U.S. swine industry, from traditional farrow-to-finish operations into specialized units concentrating in specific phases of pig production. Unlike Spain, however, U.S. exports of live animals are negligible. This difference between the two countries is partly due to the differences in their respective processing industries and transportation costs of live animals. Most U.S. live exports are slaughter hogs destined for Mexico.

8. Government Support Programs

Historically, producers of many major commodities in both the United States and, especially, the European Union have received government support in the form of direct payments. However, this has not been the case with swine producers in either the United States or Spain. Nonetheless, both countries have various policy instruments that provide some support to their respective swine industries. For example, both the United States and Spain assist in promoting pork products in their respective domestic markets and selling their pig meat products abroad.

For Spain's pork sector, the E.U. Common Agricultural Policy (CAP) stipulates provisions to stabilize markets, mainly based on the setup of a price system and the regulation of trade with non-E.U. countries.⁷ To cushion large price falls, the CAP price system allows the E.U. Commission to issue aid for the private storage and/or refunds for the export⁸ of pig meat products when prices drop below 103% of the "basic" price established by the European Union. The price system also lets the E.U. Commission authorize purchases of pig meat products by intervention agencies when prices fall substantially below the E.U. "basic" price. There has been no intervention in the E.U. pig meat market for at least two decades, but aids to private storage and export refunds have often been used (e.g., export refunds were given in 2003/04, and Spain aided private storage in 1995/96 and 1998/99). Imports of pig meat products from non-E.U. countries are subject to licenses and are taxed at the rates set in the common customs tariff. The CAP allows additional import duties to be levied when there is a risk that imports could destabilize the E.U. market.

The European Union also provides for special financial assistance in situations characterized by animal disease emergencies. To prevent the propagation of certain diseases like classical swine fever, the CAP forbids the movement of animals in the areas affected by the disease. Since those animals cannot be slaughtered, the CAP stipulates the purchase and destruction of animals in such areas. The operations are cofinanced by the European Commission and the member states. This type of financial assistance has proven to be very important for Spain, as an outbreak of classical swine fever in Catalonia in 1997 required the sacrifice of 0.8 million hogs (Colom Gorgues 2003).

It is important to point out that in 2003 the European Union announced a major reform of the CAP aimed, among other things, at shifting support to producers from direct payments to decoupled payments (i.e., from payments dependent upon output to payments not linked to the amounts produced). The CAP reform was to be phased in over several years, with the first 10 E.U. countries implementing it in 2005. Spain agreed to implement the CAP reform in 2006. It is widely believed that the CAP reform will have a negative impact on the quantities produced by the European Union for the commodities whose producers will experience a switch from direct payments to decoupled payments (see, e.g., OECD 2004). In the case of hogs, however, the impact of the CAP reform is

estimated to be minimal, as E.U. swine producers have not been recipients of direct payments. Some sources predict that E.U. swine producers may benefit indirectly from the CAP reform because it will reduce the price of feed grains (USDA-FAS 2005b). However, they argue that cheaper feed grains will most likely enhance the competitiveness of hog producers in the countries that joined the European Union in 2004, in particular Poland and Hungary. In summary, the overall impact of the CAP reform on Spain's hog producers will most likely be very small, and any minor indirect benefits from lower feed prices will probably be offset by stronger competition from the newly merged states.

In contrast to the E.U.'s CAP, U.S. farm policies do not contemplate direct intervention in the hog market. However, U.S. pig meat product exports are eligible for subsidies under the "export enhancement program," although these have been rarely used in recent years. An interesting feature of U.S. legislation is that it has allowed for the creation of the national pork check-off program, a privately funded institution devoted to fund research, promotion, and consumer information activities to increase the likelihood of success of pork products. The program was approved as a part of the Pork Promotion and Research Act of 1985. The program is funded by a mandatory 0.45% charge on all sales of pork by pork producers and importers and has been very active since its inception (National Pork Board 2002).

9. Environmental and Animal Welfare Regulations in Spain and the European Union

E.U. and national legislation have imposed ever stricter environmental regulations on pig producers (ECDGA 2004). Tight environmental regulations stem from the heavy concentration of E.U. pig production in specific regions, such as West Flanders in Belgium, Brittany in France, and Catalonia in Spain. The high geographic concentration of pig production has resulted in a very limited availability of land to dispose of the animal waste (e.g., as fertilizer), which has translated into increasing environmental concerns (e.g., due to run-off into watercourses).

The extent of the environmental regulations is evidenced by the fact that in some of the most affected regions/countries (e.g., Flanders and the Netherlands) inventories and output of pigs are being limited, and incentives are being provided to induce pig producers to quit

the business (ECDGA 2004). In Catalonia, new regulations have been approved regarding manure and slurry disposal. Such regulations require producers to follow strict rules to dispose of the manure/slurry from their operations, and to either have a minimum amount of land available per animal for waste disposal or invest in advanced manure-handling technologies. Pork producers in the areas with the heaviest concentration of production facilities in Catalonia are forming cooperatives to take advantage of E.U. subsidies for alternative sources of energy, by building waste-disposal plants that transform slurry into electricity and fertilizer. New regulations also restrict the maximum size of individual pig production facilities in Catalonia. Overall, environmental regulations are likely to reduce the future rate of growth of the pig production sector in Spain.

Animal welfare is also a major concern of the E.U. public, and this is increasingly reflected in legislation at both the E.U. and national levels. In 2001, the E.U. Council adopted a directive establishing new minimum animal welfare standards for pig production (CEU 2001). All pig production facilities built or rebuilt after January 2003 must comply with the new provisions, and all operations will have to meet them after January 1, 2013. Among other measures, the directive bans the use of individual stalls for pregnant sows and gilts and the use of tethers, increases the living space available for sows and gilts, requires sows and gilts to have permanent access to materials for rooting, calls for higher-quality flooring surfaces, and sets a higher level of training and competence on welfare issues for the stockmen and the personnel in charge of the animals (ECDGA 2004). The E.U. Commission adopted another directive in 2001 addressing the welfare of pigs, as well (CEC 2001). This directive sets a number of additional requirements for hog operations, including minimum light requirements, maximum noise levels, permanent access to materials for rooting and playing, permanent access to fresh water, additional restrictive conditions to carry out mutilations on pigs, and a minimum weaning age of four weeks (ECDGA 2004). The stricter animal welfare rules in the European Union are to be followed by more stringent controls in third countries exporting to the European Union, to ensure that E.U. welfare standards are met (ECDGA 2004).

The E.U. Council also approved new regulations in 2004 addressing the welfare of pigs during their transportation (CEU 2005). The regulations include strict rules for journeys of more than eight hours, requirements for drinking and feeding and a controlled

atmosphere, and significantly higher standards for vehicles used in the transportation of live animals. The regulations also involve checks on vehicles using satellite navigation systems. Transportation of pigs will have to meet the new standards after January 2007. Importantly, the E.U. Commission has agreed to propose new regulations before 2011 regarding maximum traveling times and animal stocking densities during transportation.

The stricter transportation regulations will increase the cost of moving pigs and will significantly reduce the feasibility of transportation of live animals across the European Union. This is expected to have a noticeable impact on Spain's swine industry, because the geographic specialization of its operations requires substantial movements of animals within the country (see Section 2), and Spain imports a large number of piglets from other E.U. countries while exporting a significant number of hogs for slaughter (see Section 7).

Additional evidence of the increasing concerns regarding animal welfare is the recent request by the E.U. Commission of an opinion from the European Food Safety Authority regarding the welfare of pigs at the time they are sacrificed (SPAHW 2004). The more demanding regulatory environment can be expected to limit the rate of growth of pig production in the European Union in general. However, new environmental and animal welfare rules will most likely be easier to implement in new production facilities built in countries that joined the European Union in 2004, providing them with a relative advantage over traditional producing regions in the EU-15.

10. Enlargement of the European Union in 2004

In May 2004, the European Union enlarged to 25 member countries (EU-25) by incorporating Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. From a supply standpoint, the 10 new member countries added 30.8 million pigs to the total EU-15 inventory as of December 2003, or about 25.4% of the existing inventories. Poland is by far the major pork producer among the new countries, with an inventory of 18.4 million head. However, Poland's pork production is quite atomized: almost 90% of its 1.6 million sows are distributed among approximately 1 million production facilities, and more than half of its hog farms have fewer than 10 pigs. Further, only 10 out of Poland's 3,000 pig slaughterhouses are authorized to export meat to the EU-15 (Colom Gorgues 2003). Thus, Poland's pork industry will need a major

transformation to be able to enter the EU-15 pork industry successfully and be competitive. Hungary has the second-largest inventory of pigs among the new E.U. members, with a total of 5.1 million head. About 20% of the stocks are in small family farms with facilities that are 25 years old on average, clearly indicating the need for large investments in the sector if Hungary is to become competitive with the major pork producers in the EU-15 (Colom Gorgues 2003).

The E.U. enlargement does not seem to pose a visible threat to Spain's pork production industry in the near future. In the longer run, however, some of the same forces that promoted pork production in Spain at the expense of other E.U. countries with higher labor costs and more stringent environmental regulations may favor relocation of pork production facilities into some of the new E.U. member countries. In addition, the competitiveness of hog producers in the countries that joined the European Union in 2004 is likely to be enhanced if the CAP reform leads to cheaper feed grains (USDA-FAS 2005b). Competitive feeding costs, lower environmental standards, and the proximity of large markets like Russia and Ukraine are expected to attract foreign investments (especially from Denmark, the Netherlands, and Germany) to the pig sectors in Poland, Hungary, and the Czech Republic (USDA-FAS 2005a). Counteracting the impact of such potential competition is the prospect for a substantial increase in pork consumption associated with the enlargement. As of 2004, the 10 new members had a total population of 74 million, all with a longstanding tradition of pig meat consumption. Even though the income levels in the new member countries are lower than in the EU-15, they are likely to increase at a relatively fast rate for the foreseeable future.

In summary, both production and consumption are likely to increase in the new member states following their accession (see, e.g., ECDGA 2004). The overall impact of the E.U. enlargement on Spain's pork sector will depend on the extent that the increased consumption associated with the enlargement is met by the new members' production sector. Importantly, the latter will require large investments in infrastructure to be able to compete successfully with established pork producers in the EU-15, such as Spain.

11. Implications of Spain's Pork Sector Developments for the U.S. Pork Industry

This study provides a comparative look at the primary production of pork and its marketing channel in Spain and the United States. The analysis reveals a number of similar characteristics but also points to some important differences between the two countries.

The sector has undergone profound transformations in Spain and the United States over the last 15 years. In both countries, primary pork production has become much more “industrialized” and efficient at transforming raw inputs into finished animals. Environmental regulations, population density, and other factors induced the relocation of production facilities in both Spain and the United States. Competitive forces and changing consumption habits have stimulated the vertical integration of the industry in the two countries as well. Changes in consumption habits were partly driven by changing demographics, favoring ready-to-cook pork products and consumption away from home. To a large extent, many of Spain's recent trends in consumption mimic the trends experienced earlier in the United States. In addition, over the period analyzed, both countries went from being net importers to becoming net exporters.

However, there are also important differences between the Spanish and U.S. pork sectors. Among the most noticeable of these differences is Spaniards' strong preference for pig meat relative to other meats in general, and for cured pork products in particular. Also worth mentioning are the low degree of concentration of the pork processing industry in Spain compared to the U.S. industry, the existence of thriving wholesale markets and the large proportion of retail sales made through butcheries in Spain (both virtually nonexistent in the United States), and the existence of institutional derivatives markets for live animals and pork products in the United States, which have no counterparts in Spain.

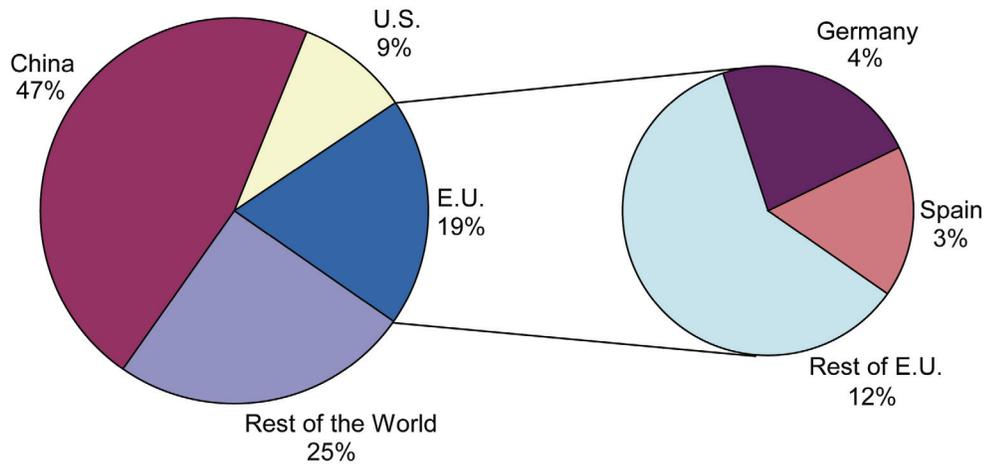
The present analysis suggests that the significant expansion of Spain's pork production sector stemmed from a number of factors that do largely apply to some states within the United States (in particular North Carolina) but do not apply to the U.S. pork production sector as a whole. The substantial increase of hog production in Spain was largely propelled by the country's E.U. membership in 1986. Spain's E.U. membership induced a relocation of hog operations within the European Union that favored Spain because of its lower labor and feeding costs, along with its lower population density

and more lax environmental regulations. Production in Spain was further enhanced by the specialization of the operations and the emergence of new forms of vertical coordination to exploit economies of scale in production. In short, the experience of Spain's production sector after joining the European Union had many similarities to that of North Carolina within the United States over the same period. For the U.S. pork production sector as a whole, however, further expansion driven by these same types of factors does not seem feasible in the future.

Likewise, it seems highly unlikely that U.S. consumption of pig meat will be able to expand in the future based on the same driving forces behind the sharp increase in Spain's domestic demand for pig meat over the last 20 years. The two major drivers of Spain's growth in pig meat consumption were the traditional taste of Spaniards for cured pork products and the significant rise in their income following Spain's E.U. membership in 1986. As Spaniards' purchasing power improved, they expressed their preferences for cured pork products, in particular cured ham, by substantially increasing their consumption. U.S. consumers do not have the strong preferences for cured pork products that Spaniards have, and they cannot expect the sizeable growth in income that Spaniards had following accession to the European Union. Hence, it seems unlikely that the United States will mimic the kind of growth in pork consumption experienced by Spain over the last two decades. It is important to note, however, that Spanish producers of cured pork products were highly proactive in the process, by effectively seizing their opportunities and offering products of higher appeal to consumers, for example, as reflected by the drive to obtain "protected designations of origin" for their products.

The analysis also indicates that Spanish pig producers are currently being subjected to more stringent environmental and animal welfare regulations than their U.S. counterparts. Further, such regulations have become much more restrictive in recent years in Spain, in response to heightened concerns by the E.U. public regarding environmental and animal welfare issues. It would not be surprising to see similar trends emerging in the United States, leading to a substantially more restrictive regulatory environment for hog producers. If that were the case, it would be useful to draw on the experience of Spanish producers to help U.S. producers better cope with such developments.

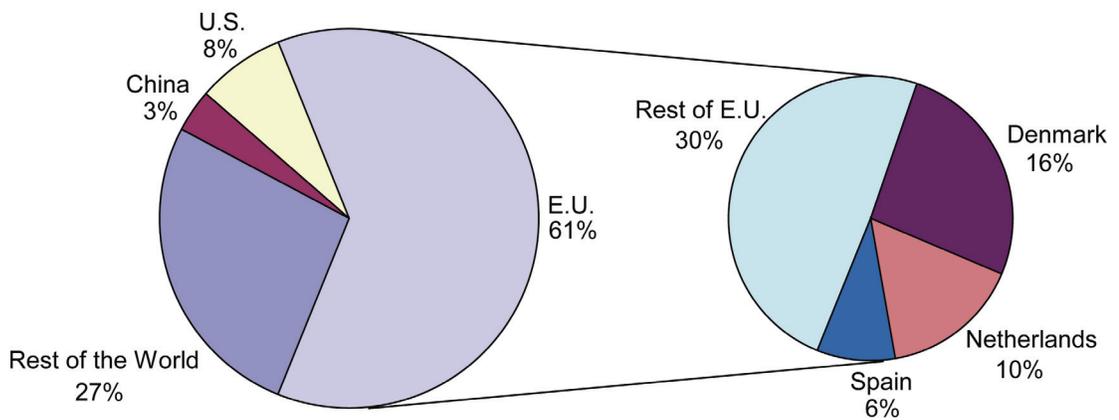
Figures



Source: FAOSTAT.

Note: Annual world pig meat production averaged 92.6 million metric tons in 2000-2002.

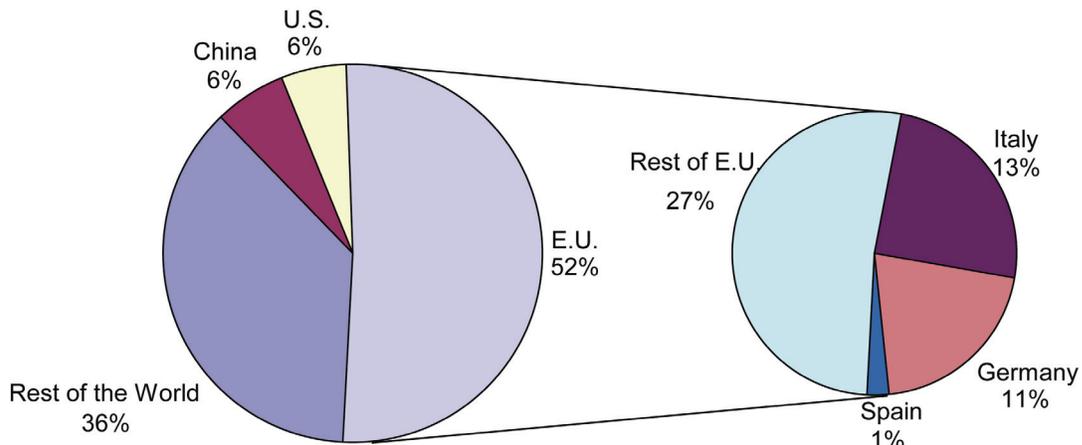
FIGURE 1A. World pig meat production, average 2000-2002



Source: FAOSTAT.

Note: Annual world pig meat exports averaged 8.0 million metric tons in 2000-2002.

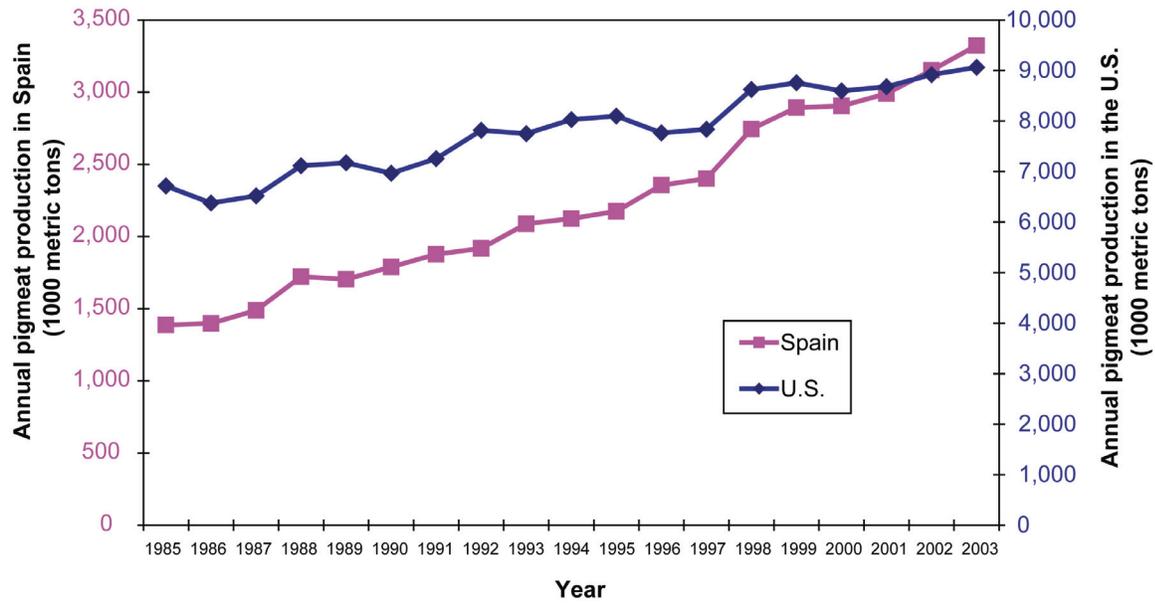
FIGURE 1B. World pig meat exports, average 2000-2002



Source: FAOSTAT.

Note: Annual world pig meat imports averaged 8.2 million metric tons in 2000-2002.

FIGURE 1C. World pig meat imports, average 2000-2002



Source: FAOSTAT.

FIGURE 2. Annual pig meat production in Spain and the United States

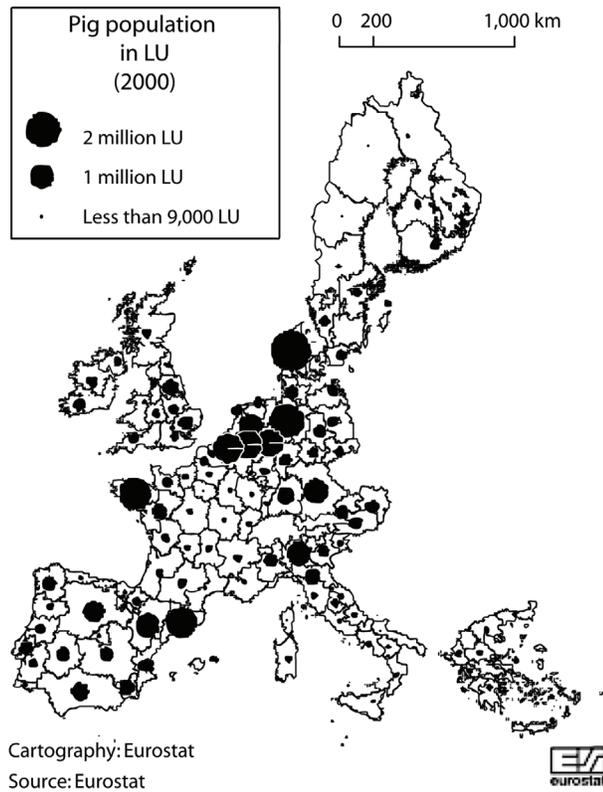
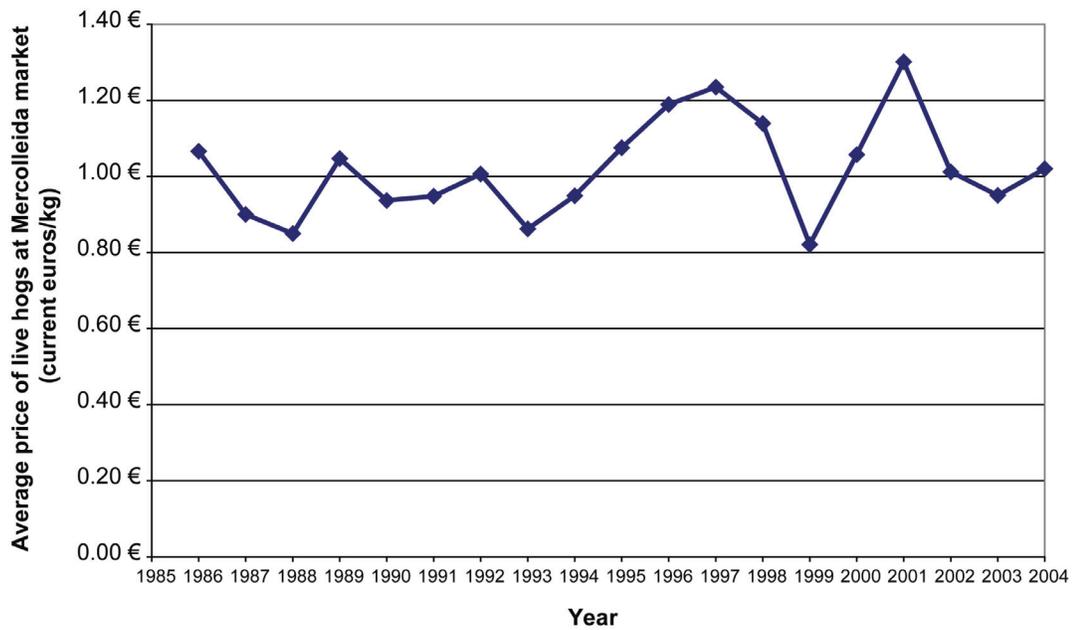
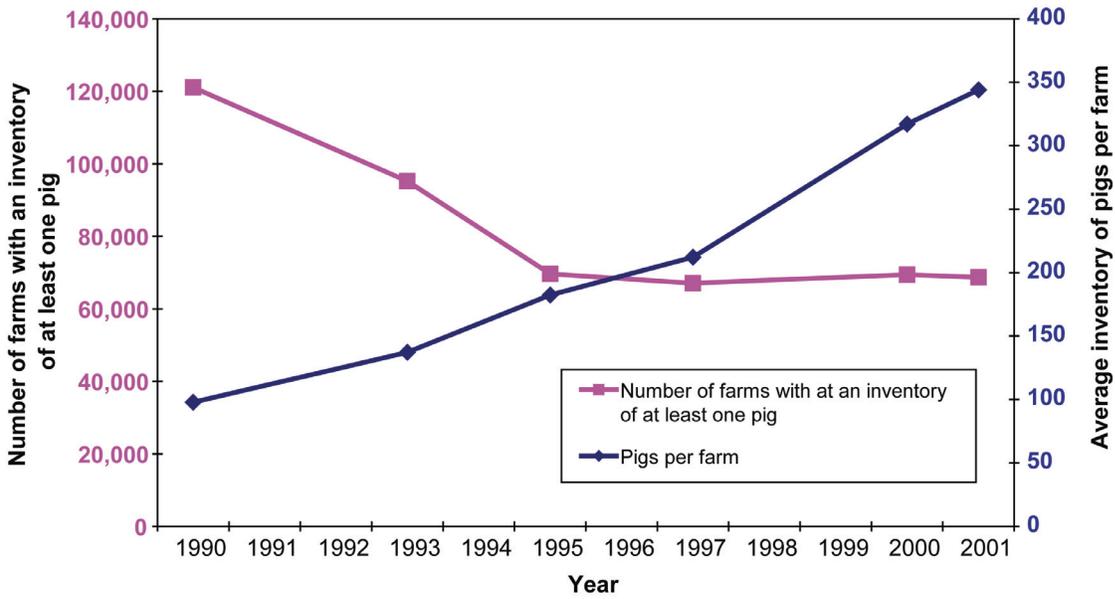


FIGURE 3. Pig inventories in the European Union, 2000



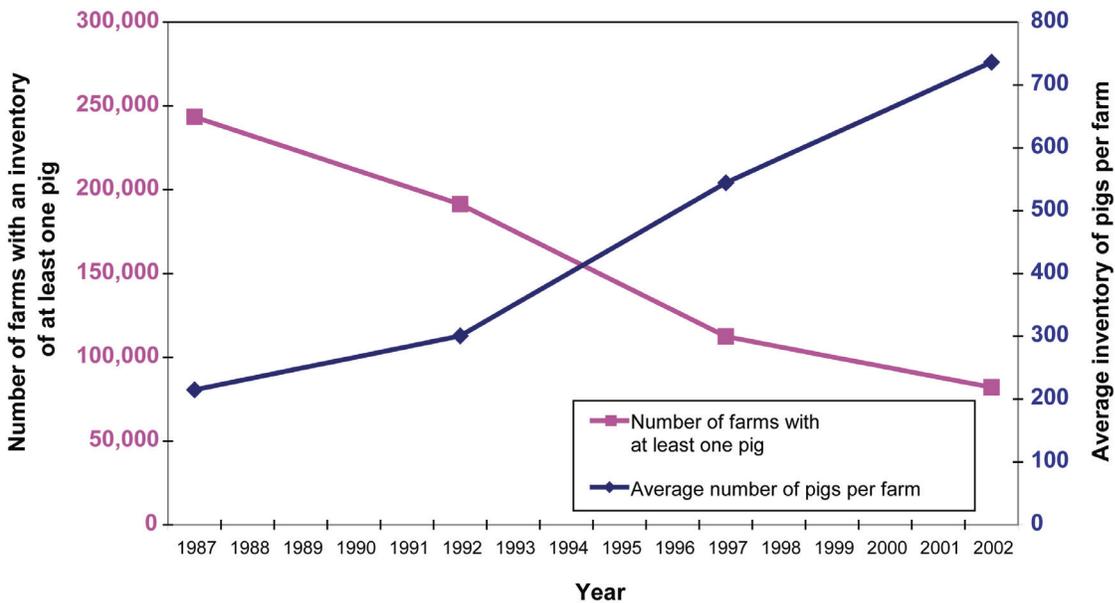
Source: Mercolleida.

FIGURE 4. Average price of live hogs at Mercolleida Market (Current euros/kg)



Source: Eurostat.

FIGURE 5. Number of hog farms and pigs per farm in Spain



Source: USDA-NASS.

FIGURE 6. Number of hog farms and pigs per farm in the United States

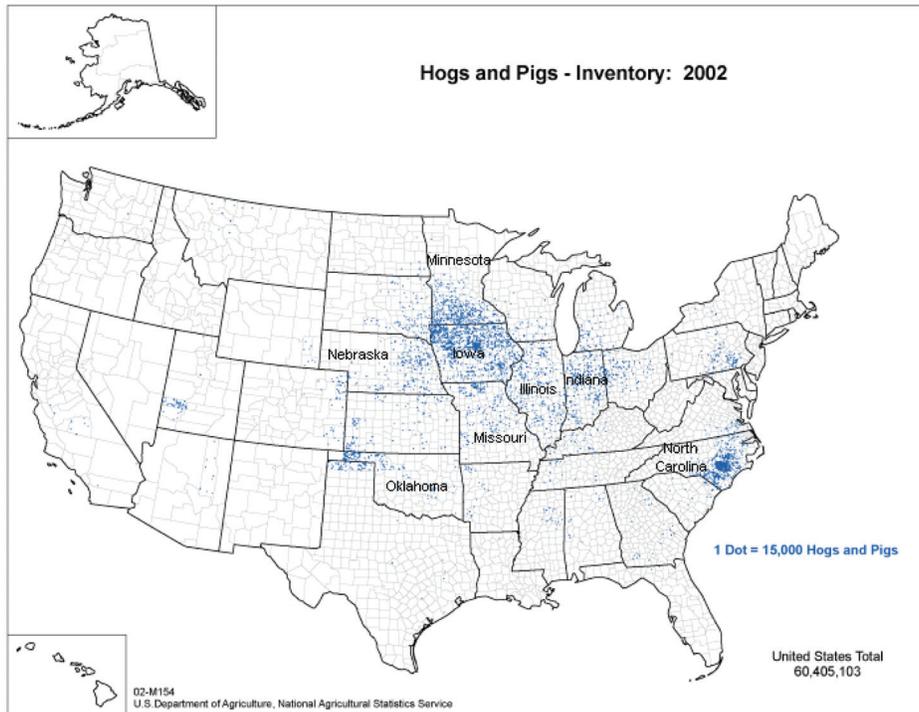


FIGURE 7. Pig inventories in the United States, 2002

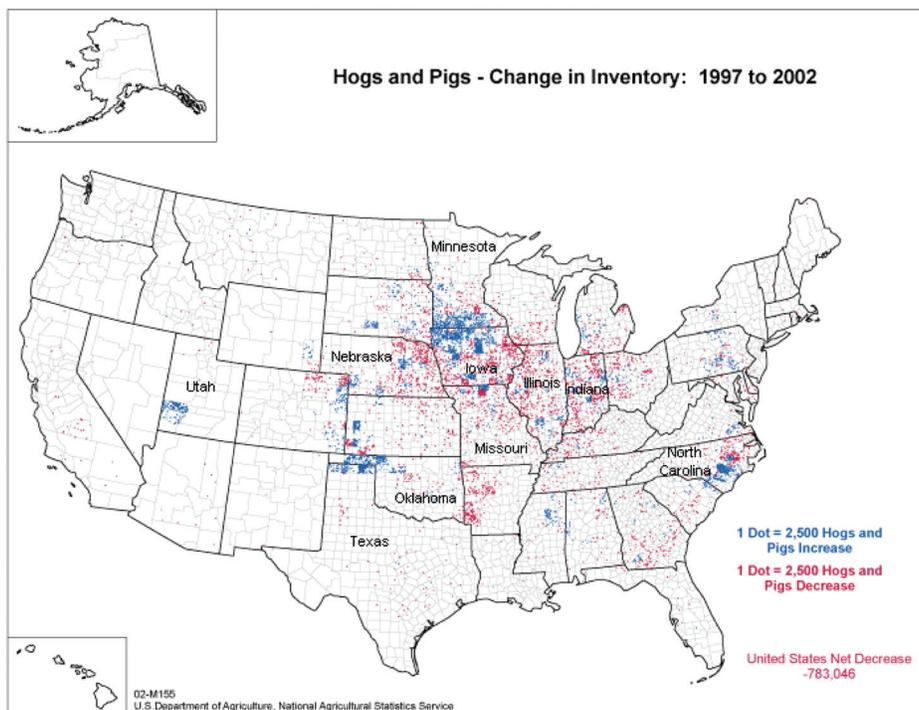
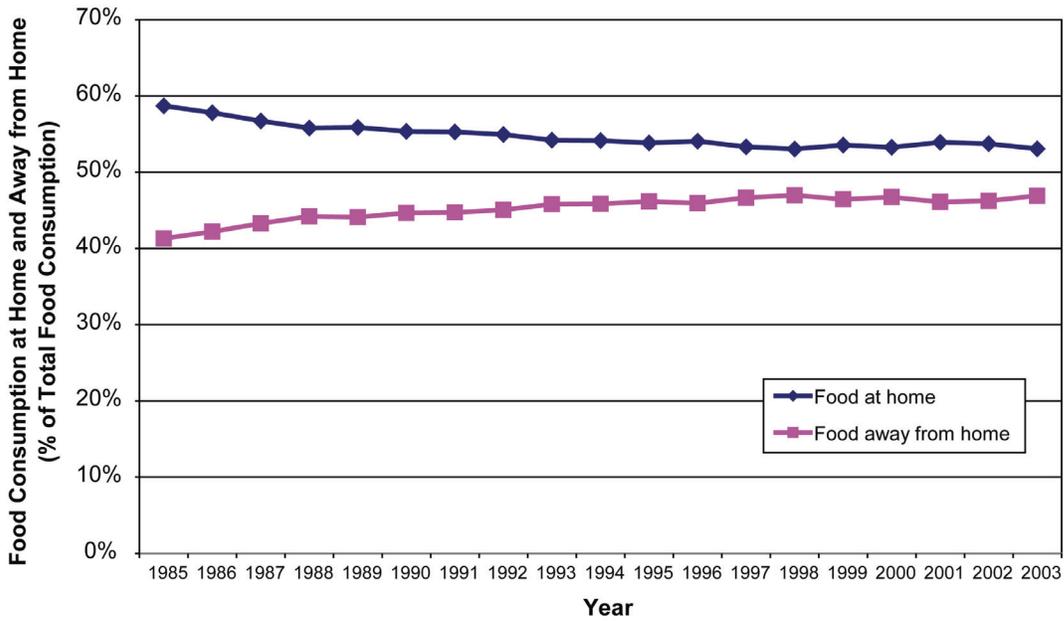
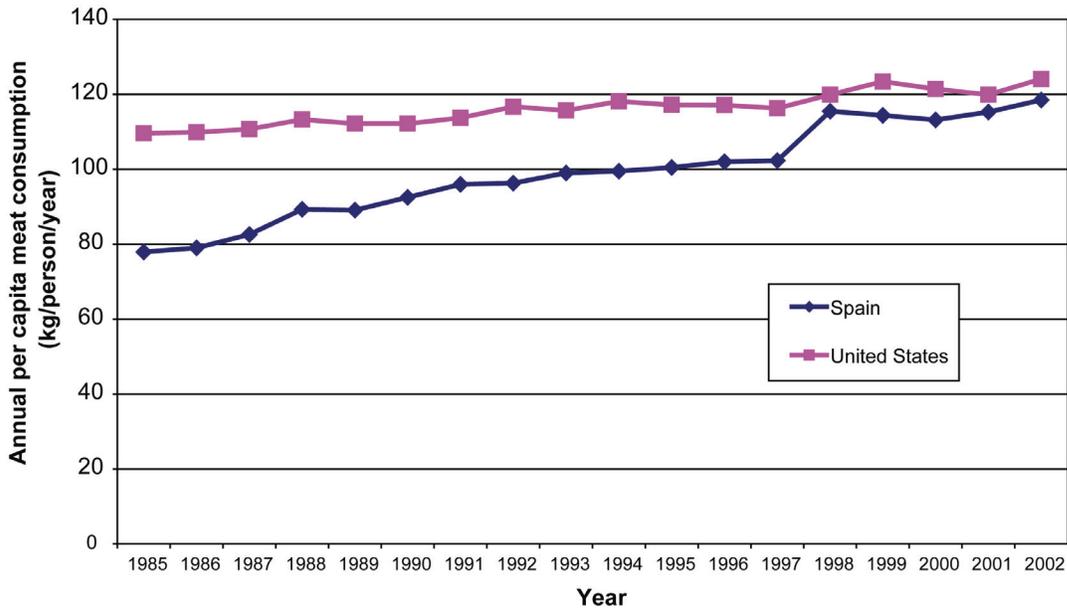


FIGURE 8. Changes in pig inventories in the United States, 1997-2002



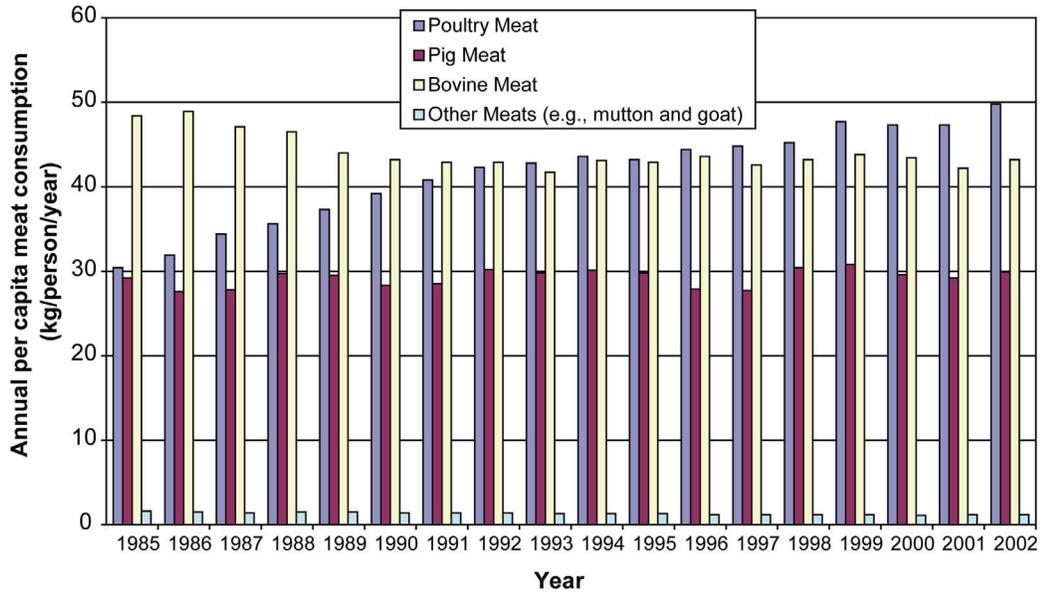
Source: Harris et al.

FIGURE 9. Composition of food expenditures in the United States



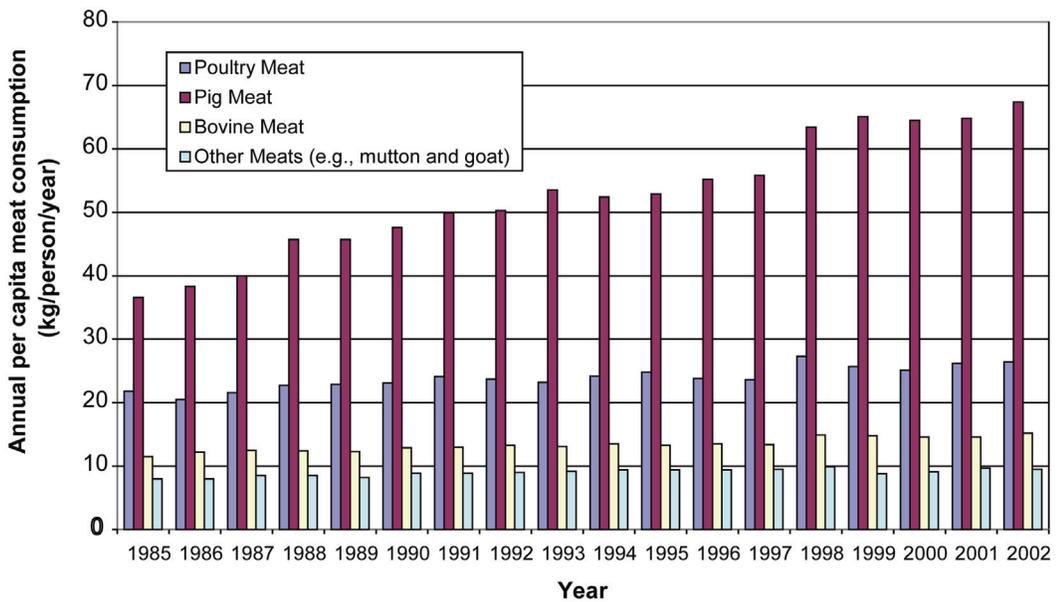
Source: FAOSTAT.

FIGURE 10. Annual per-capita consumption of meat in the United States and Spain



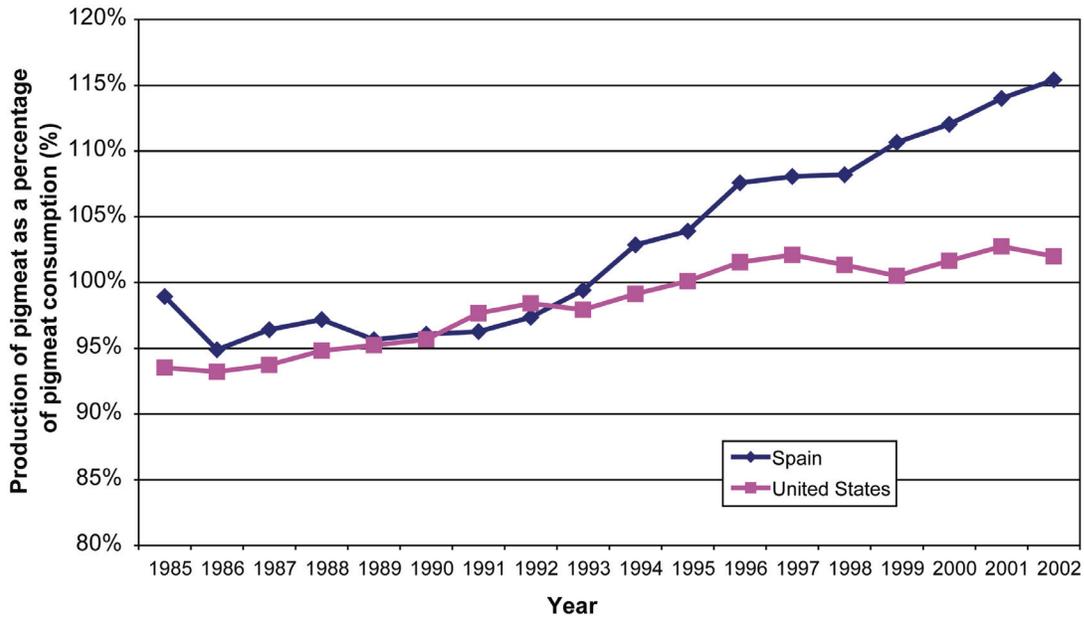
Source: FAOSTAT.

FIGURE 11. Annual per-capita consumption of different types of meat in the United States



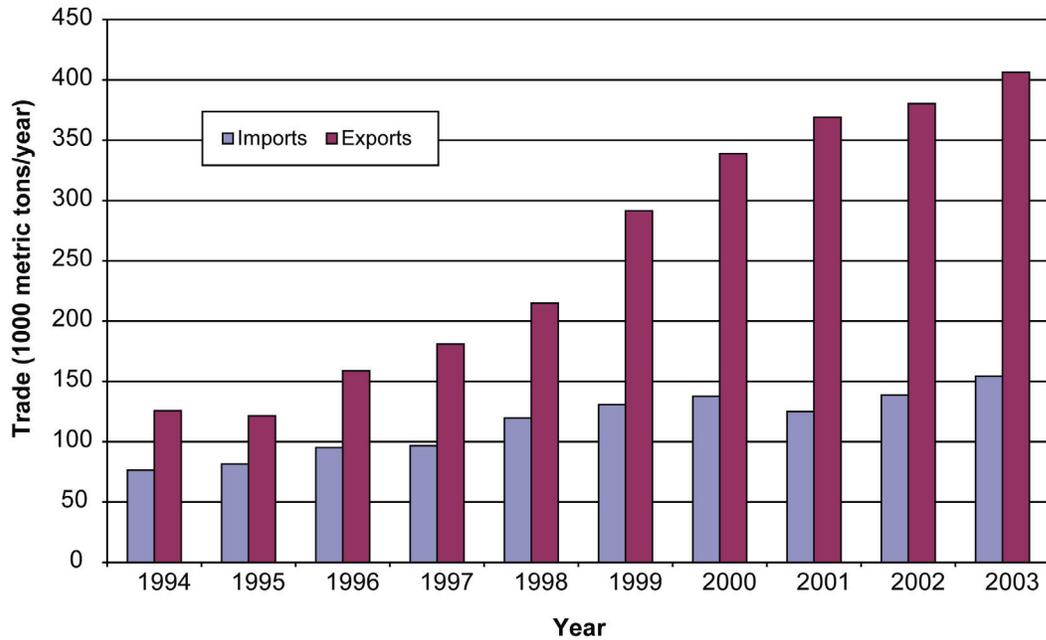
Source: FAOSTAT.

FIGURE 12. Annual per-capita consumption of different types of meat in Spain



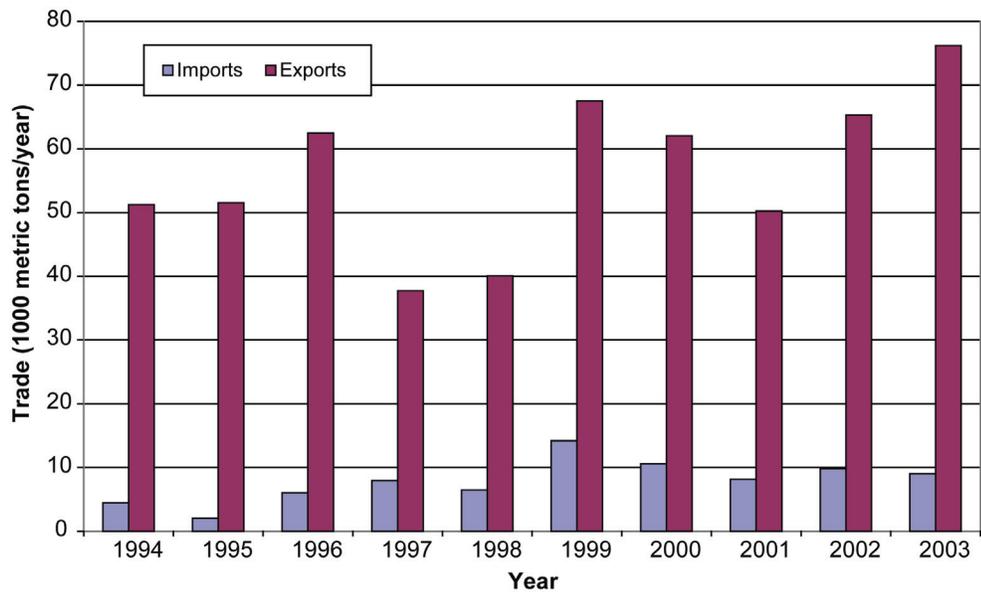
Source: FAOSTAT.

FIGURE 13. Self-sufficiency of pig meat in the United States and Spain



Source: DGA.

FIGURE 14. Pig meat trade of Spain with other E.U. countries



Source: DGA.

FIGURE 15. Pig meat trade of Spain with non-E.U. countries

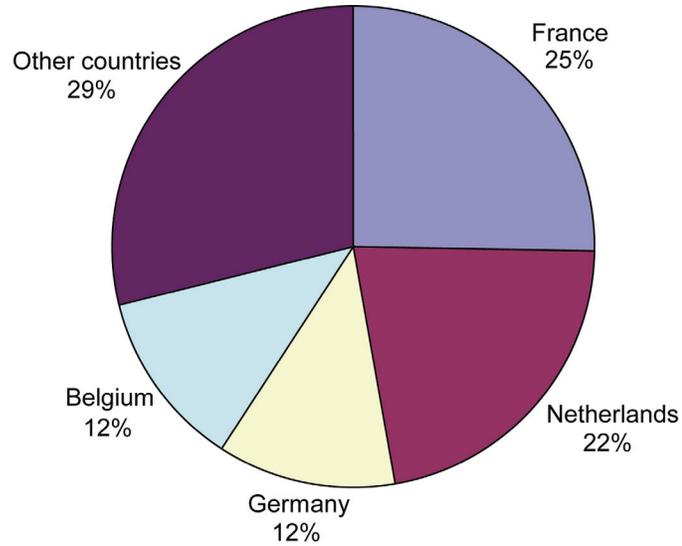
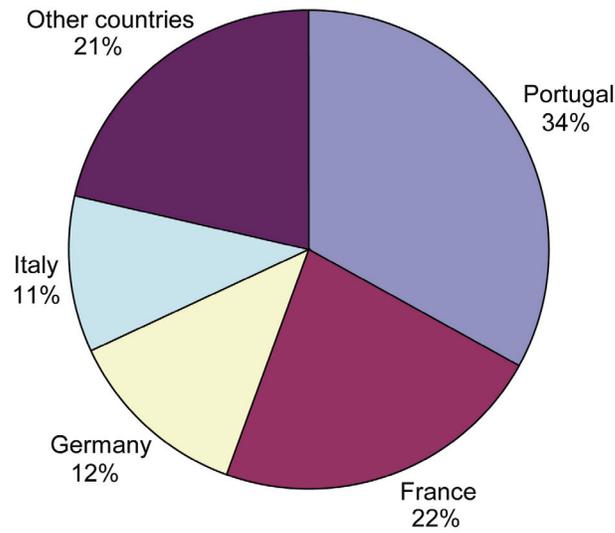


FIGURE 16. Origin of Spain's pig meat imports over 2001-2003

Source: DGA.

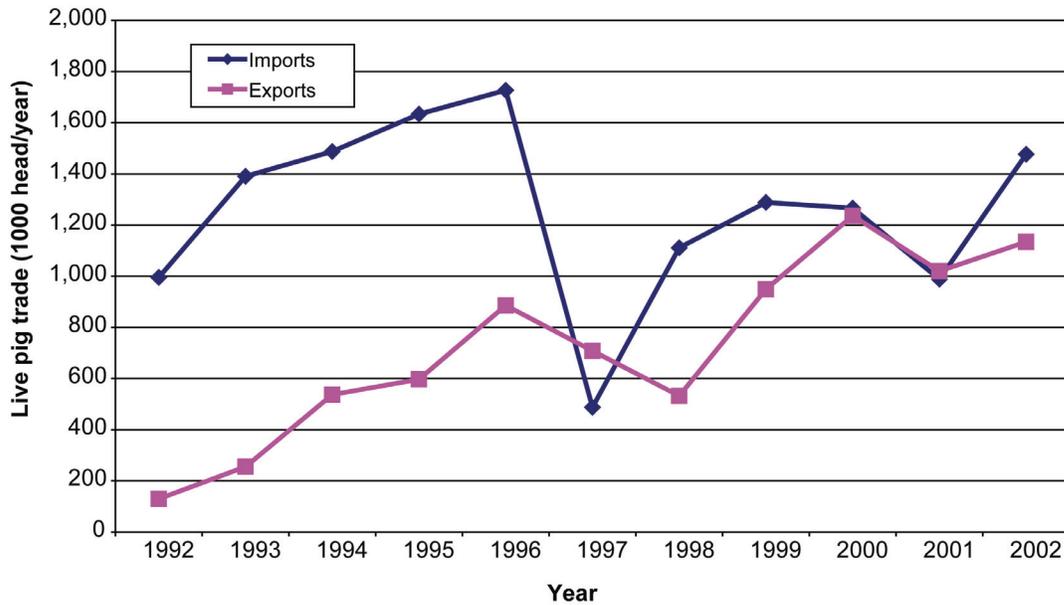
Note: Spain's total pig meat imports averaged 139,329 metric tons per year over 2001-2003.



Source: DGA.

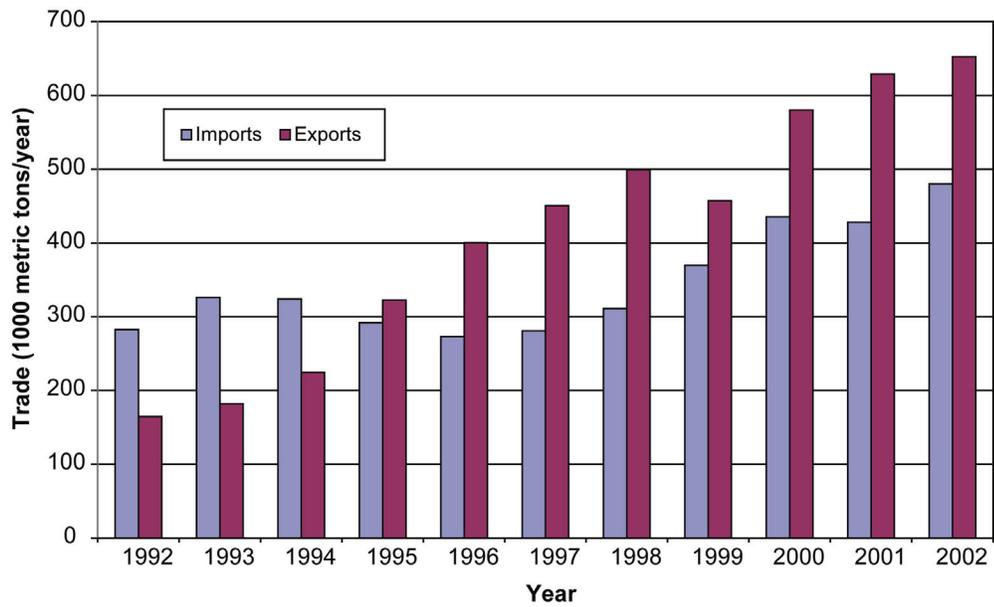
Note: Spain's total pig meat exports averaged 449,193 metric tons per year over 2001-2003.

FIGURE 17. Destination of Spain's pig meat exports over 2001-2003



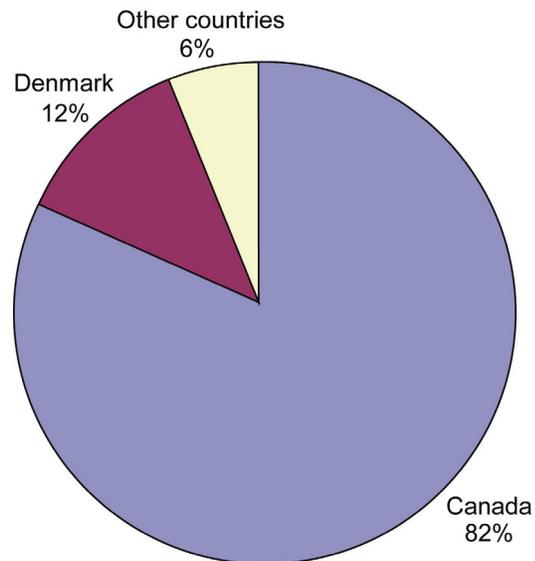
Source: FAOSTAT.

FIGURE 18. Live pig trade of Spain



Source: FAOSTAT.

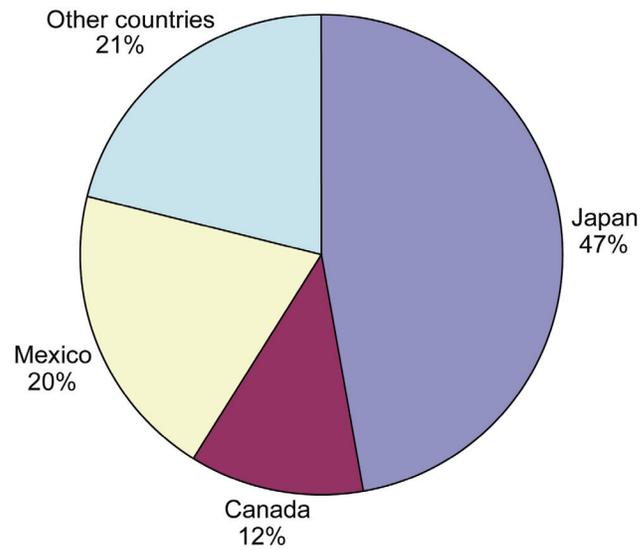
FIGURE 19. Pig meat trade of the United States



Source: USDA-ERS.

Note: U.S. total pig meat imports averaged 484,850 metric tons of carcass weight per year over 2001-2003.

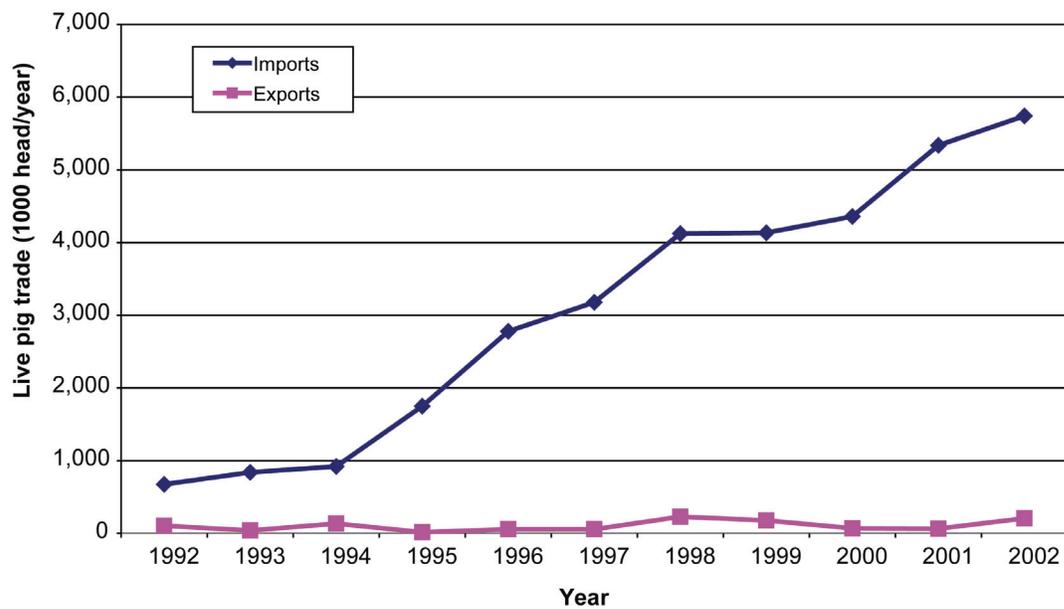
FIGURE 20. Origin of U.S. pig meat imports over 2001-2003



Source: USDA-ERS.

Note: U.S. total pig meat exports averaged 739,120 metric tons of carcass weight per year over 2001-2003.

FIGURE 21. Destination of U.S. pig meat exports over 2001-2003



Source: FAOSTAT.

FIGURE 22. Live pig trade of the United States

Endnotes

1. Unless stated otherwise, in this paper the term European Union (abbreviated E.U.) refers to the European Union consisting of the 15 member countries (EU-15): Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom. In May 2004, the E.U. enlarged to 25 member countries (EU-25), by incorporating Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia to the EU-15. Implications of the European Union enlargement for Spain's pork sector are discussed in a later section.
2. World consumption shares are very similar to the production shares shown in Figure 1a. Hence, they are omitted in the interest of space.
3. Please note that, because of a lack of data, some of the information in this section refers to the processing sector for meats generally rather than for pork specifically.
4. It is worth noting that about 5% of the pigs slaughtered in Spain are Iberian hogs that are raised under exacting conditions. Iberian swine are used to produce high-quality cured products. The main product is Iberian ham, which is mostly consumed in the domestic market in restaurants; other products include Iberian sausages and salami.
5. Despite the underutilization of installed capacity, many new processing plants have been built in recent years. These plants were constructed with the assistance of structural and/or adhesion funds from the European Union and local funds.
6. Please note that, because of a lack of data, some of the information in this section refers to the retailing sector for meats or food generally rather than for pork specifically.
7. See <http://www.mapya.es/app/SCP/legislacion/OCM1.aspx?lng=es>.
8. For shipments to non-E.U. countries.

References

- Agriculture and Agri-Food Canada. 2004. "Agriculture, Agri-Food and Seafood Country Report—Spain." January.
- Barkema, A., M. Drabenstott, and N. Novack. 2001. "The New Meat Industry." *Federal Reserve Bank of Kansas City Quarterly Review* (Second Quarter), pp. 33-56.
- Bureau of Labor Statistics, U.S. Department of Labor (BLS). n.d. "Consumer Expenditure Survey." <http://stats.bls.gov/cex/> (accessed October 2004).
- Colom Gorgues, A. 2003. "Estudio y Análisis de la Filière de Porcino: Especificaciones de la Cadena de Oferta de Carne de Porcino Fresca y Transformada." Unpublished manuscript, Escuela Técnica Superior de Ingeniería Agraria, Universidad de Lleida.
- Commission of the European Communities (CEC). 2001. "Commission Directive 2001/93/EC of 9 November 2001 Amending Directive 91/630/EEC Laying Down Minimum Standards for the Protection of Pigs." *Official Journal of the European Communities*, December 1.
- Confederación de Cooperativas Agrarias de España. 2004. "Promocion y Exportacion de Carne de Porcino en el Entorno Cooperativo."
- Council of the European Union (CEU). 2001. "Council Directive 2001/88/EC of 23 October 2001 on Amending Directive 91/630/EEC Laying Down Minimum Standards for the Protection of Pigs." *Official Journal of the European Communities*, December 1.
- . 2004. "Council Regulation No. 2081/92 of 14 July 1992 on the Protection of Geographical Indications and Designations of Origin for Agricultural Products and Foodstuffs." *Official Journal of the European Communities*, May 1.
- . 2005. "Council Regulation (EC) No. 1/2005 of 22 December 2004 on the Protection of Animals During Transport and Related Operations and Amending Directives 64/432/EEC and 93/119/EC and Regulation (EC) No. 1255/97." *Official Journal of the European Communities*, January 1.
- Dirección General de Alimentación (DGA), Ministerio de Agricultura, Pesca y Alimentación de España. 2001. "Sector Cárnico Español." April.
- . 2002. "Datos de las Denominaciones de Origen Protegidas (D.O.P.) e Indicaciones Geográficas Protegidas (I.G.P.) de Productos Alimentarios – Año 2002."
- . 2004. "El Sector de la Carne de Cerdo en Cifras – Principales Indicadores Economicos en 2003." June.
- Dirección General de Defensa de la Competencia (DGDC), Ministerio de Economía de España. 2004. "Proinserga/Carnicas Reville." Informe del Servicio de Defensa de la Competencia N-04007.
- European Commission, Directorate-General for Agriculture (ECDGA). 2004. "The Meat Sector in the European Union." Brussels, Belgium.

- Eurostat. n.d. Eurostat database. http://epp.eurostat.cec.eu.int/portal/page?_pageid=1090,1137397&_dad=portal&_schema=PORTAL# (accessed October 2004).
- Food and Agriculture Organization of the United Nations (FAO). n.d. FASTAT database. <http://apps.fao.org/default.jsp> (accessed October 2004).
- Harley, L. 2004. "Survey of the EU Pig Population in December 2003 and Production Forecasts for 2004." *Statistics in Focus: Agriculture and Fisheries Theme 5-15/2004*. Eurostat.
- Harris, M., P. Kaufman, S. Martinez, and C. Price. 2002. "The U.S. Food Marketing System, 2002." ERS Agricultural Economic Report No. AER811. U.S. Department of Agriculture, Economic Research Service. Washington, D.C. August.
- Kohls, R.L., and J.N. Uhl. 2001. *Marketing of Agricultural Products*, 9th ed. Upper Saddle River, NJ: Prentice Hall.
- Llotja Agropecuària Mercolleida S.A. n.d. <http://www.mercolleida.com/Index.html> (accessed November 2004).
- Martinez, S.W. 2002. "Vertical Coordination of Marketing Systems: Lessons from the Poultry, Egg and Pork Industries." ERS Agricultural Economic Report No. 807. U.S. Department of Agriculture, Resource Economics Division, Economics Research Service. May.
- McBride, W.D., and N. Key. 2003. "Economic and Structural Relationships in U.S. Hog Production." Agricultural Economic Report No. 818. U.S. Department of Agriculture, Resource Economics Division, Economics Research Service. February.
- MERCASA (Empresa Nacional Mercasa). 2004. *Alimentación en España 2004 – Producción, Industria, Distribución, y Consumo*. Madrid, España: Empresa Nacional MERCASA.
- Ministerio de Agricultura, Pesca y Alimentación de España (MAPAE). 2002. *The Spanish Agrifood Sector and Rural Environment: Facts and Figures*, 6th ed.
- National Pork Board. 2002. *Pork Facts 2002/2003*.
- Organization for Economic Cooperation and Development (OECD). 2004. "Analysis of the 2003 CAP Reform." Rome.
- Pan, C., and J. Kinsey. 2002. "The Supply Chain of Pork: The U.S. and China." Working Paper 02-01, Food Industry Center, University of Minnesota. March.
- Putnam, J., and J. Allshouse. 1998. "U.S. Per-Capita Food Supply Trends." U.S. Department of Agriculture. *Food Review*, September-December 1998, pp. 1-11.
- Scientific Panel on Animal Health and Welfare of the European Food Safety Authority (SPAHW). 2004. "Welfare Aspects of the Main Systems of Stunning and Killing the Main Commercial Species of Animals." *EFSA Journal* 45: 1-29.
- U.S. Department of Agriculture. 2002. *International Agricultural Trade Report: Dairy, Livestock, & Poultry Trade Update*. February 14.
- U.S. Department of Agriculture, Economic Research Service (USDA-ERS). Various. *Livestock, Dairy, and Poultry Outlook*.

- U.S. Department of Agriculture, Foreign Agricultural Service (USDA-FAS). 2000. "Spain Livestock and Products Annual 2000." *GAIN Report #SP0029*. August 1.
- . 2001. "Spain Livestock and Products Semi-Annual 2001." *GAIN Report #SP1003*. January 17.
- . 2005a. "EU-25 Livestock and Products Annual 2005." *GAIN Report #E35141*. July 15.
- . 2005b. "EU-25 Livestock and Products Semi-Annual 2005." *GAIN Report #EP35018*. January 31.
- U.S. Department of Agriculture, Grain Inspection, Packers and Stockyards Administration (USDA-GIPSA). 2002. *Assessment of the Cattle and Hog Industries, Calendar Year 2001*. June.
- U.S. Department of Agriculture, National Agricultural Statistical Service (USDA-NASS). 2004. "Census of Agriculture." <http://www.nass.usda.gov/census/> (accessed October 2004).
- Vidal, C. 2000. "A High-Performance Pig meat Industry with an Environmental Impact." *Statistics in Focus: Agriculture and Fisheries Theme 5-26*. Eurostat.