CARD Briefing Paper 95-BP 9

Meat Exports or Soybean Exports?
An Iowa Perspective

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August 1995

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This is the ninth in a series of *CARD Briefing Papers* that analyzes a variety of issues of interest to agriculture.

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This study was commissioned by the Iowa Soybean Promotion Board.

Desktop production by Janet K. Krengel.

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Executive Summary

- Currently, the single largest outlet for Iowa soybean meal is via whole soybean exports to destinations outside the United States. Next in order of importance comes the hogs produced in Iowa for the U.S. domestic market. Only a small fraction of Iowa's annual soybean meal production is used to feed animals destined for meat exports.

- The current reliance of the U.S. and Iowa soybean industries on bulk exports works to the detriment of soybean producers located away from export ports. This is true because the producer ultimately pays the cost of transporting soybeans to export customers.

- U.S. meat exports have been growing very rapidly. This growth is based on some very sound economic reasons and can be expected to accelerate into the future.

- New export-oriented livestock facilities (all else being equal) will tend to locate where feed prices are lowest and animal prices are highest. Iowa and southern Minnesota have the country's lowest feed costs and highest hog prices, and therefore are a likely location for new hog facilities. Iowa's low feed costs will also help attract new export-oriented beef and poultry operations.

- The principal beneficiaries of new livestock feeding operations are the owners of crop land surrounding these facilities. This is true because livestock facilities reduce or remove the discount associated with transporting the soybeans to export customers. This means that Iowa's corn and soybean producers have an enormous stake in the current debate about large-scale livestock feeding operations.

- Assuming that Iowa receives its share of new livestock feeding operations, large parts of the state will cease to export soybeans over the next ten years.

- In parts of the state where soybeans are no longer exported, prices will rise and the harvest-time basis will disappear.

- *All* U.S. soybean producers benefit from new export orders for soybeans or soybean meal. *All* U.S. soybean producers benefit from *new* export markets for U.S. meats. This second effect is particularly important for soybean producers located at a distance from export ports. However, when U.S. meat exports displace U.S. grain and soybean exports, producers located at a distance from export ports gain and producers located near export ports lose.

- It is in the best interests of Iowa soybean producers to promote meat exports instead of soybean exports because meat exports increase national soybean prices *and* local soybean prices, whereas soybean exports increase only national prices.

- However promotional dollars could be more usefully allocated to solve the environmental and social problems associated with locating new large-scale animal feeding operations in Iowa. This use of market promotion funds is a zero-sum game on a national basis and will only be an effective use of funds for Iowa as long as other states do not respond.

- U.S. soybean exports have been flat for the past twenty years and, unless China intervenes, will remain flat into the foreseeable future. It is very difficult to justify market promotions for stagnant commodity markets of this type.

- Soybean producers located near export ports will continue to find soybean promotion campaigns attractive. This is true in part because one of the greatest competitors to U.S. soybean exports in the next decade will be U.S. meat exports originating in the Upper Midwest.

MEAT EXPORTS OR SOYBEAN EXPORTS?
AN IOWA PERSPECTIVE

Introduction

Soybean meal can be exported from Iowa in three forms: as soybeans, as soybean meal, or in combination with corn as meat. Promotional dollars from Iowa soybean farmers (typically in combination with funds from other states) can be used to increase exports of all three forms of soybeans. Because export promotions are almost always funded on a national basis, the nature of the promotions must appeal to a representative U.S. soybean producer. The question addressed here: How would a representative *Iowa* soybean producer optimally allocate promotional dollars?

First, we must identify what is different about the economic environment faced by the representative Iowa soybean producer (which relates directly to the way transportation costs are absorbed for meat, soybeans, and soybean meal) from that faced by other U.S. soybean producers. This economic environment is described in the first and second sections of this report (pp.1-6). The third section (pp. 6-10) shows current soybean use and export patterns and breaks out Iowa and national soybean exports separately by end use (i.e., soybeans, soybean meal, beef, pork, and poultry). The fourth section (pp. 10-13) which discusses the potential for growth in each end-use market, is important because promotions are more profitably spent on markets with growth potential. The fifth section (pp. 13-14) combines results from the first three sections and answers the strategic question about the optimal allocation of Iowa promotional dollars.

As with most policy questions of this type, it is important to lay out the underlying assumptions. The following assumptions were used for this study.

- It is assumed that the representative soybean producer places a priority on getting the highest price possible for harvested soybeans. The results would be completely different, however, if we were to assume that producers want to maximize or maintain market share in the world soybean meal market.

- It is assumed that promotional campaigns and promotional organizations work equally well. This assumption allows us to narrow the question to manageable proportions.

- It is assumed that Iowa will allow new livestock feeding operations to locate here. Were Iowa to restrict the construction of new hog lots, the results outlined in this report would change.

- It is assumed that there is a representative Iowa soybean producer and that this producer receives an *average* Iowa price. The disaggregation from the national level to the state level performed here could also be done from the state level to the county level, and one would expect the results for northwest Iowa to differ from those for southeast Iowa.

Why Might Optimal Promotional Spending Be Different for Iowa Producers Than for National Producers?

Optimal promotional spending is different for Iowa soybean producers compared with that for national soybean producers because soybeans and soybean meal are commodity items. A foreign buyer purchasing soybeans in Baton Rouge, Louisiana, will not differentiate between soybeans grown in Louisiana, Arkansas, Iowa, or Minnesota. For Iowa producers to compete for this export customer, the price of soybeans in Iowa must be lower than the price received in Louisiana by an amount equal to the transportation costs between Iowa and the export port. This means that so long as both the United States and Iowa export soybeans and soybean meal, Iowa producers will receive a discount on all their soybean production equal to the cost of transporting soybeans to export points. This will

generally be true *even for soybeans that are not exported*. This price difference, or transportation cost, is also called the *basis,* as it represents the discount that local elevators require to price new-crop beans using the Chicago Futures Market. Data on these price discounts are available for hundreds of points within Iowa and for locations outside of Iowa. For example, on a day when new-crop beans were quoted at $6.25 per bushel in Chicago, the contract price was $6.06 in Cedar Rapids, $6.10 in Dubuque, $5.90 in Sioux City, and $6.13 in Keokuk. Prices in Minnesota were lower, with Canby being lowest at $5.64 per bushel. On the same date, new-crop contract prices reached $6.30 per bushel in Decatur, $6.32 in Memphis, $6.35 in Norfolk, Virginia, $6.26 in St. Louis, and $6.55 in New Orleans.

Iowa offers the greatest locational advantage to export-oriented feeding facilities, but it suffers most (relative to other major producing states) from circumstances that cause soybeans and soybean meal to be exported in lieu of meat.

If these prices were plotted on a three-dimensional map, the surface of the map would be highest near southeastern Iowa and would fall away in Northwestern Iowa. Nationally, prices would be highest at export elevators near Baton Rouge and would fall as one moves up the river system toward Red Wing, Minnesota. This surface is not always smooth because local conditions such as intense livestock feeding and oil crushing facilities cause distortions.

Table 1 shows actual bids along the river system, and Table 2 shows some current basis prices for new-crop beans. The presence of large differences within Iowa means that the state average harvest-time prices compiled by the USDA hide much of the interesting state information. Nevertheless, this information does show the price received by a representative Iowa producer.

Table 3 presents average prices received in some of the important soybean producing states. The data show that Iowa and Minnesota have consistently lower prices than do the other major soybean states. Southern states such as Arkansas, Louisiana, Mississippi, and Alabama have average prices that exceed Iowa prices by $0.30 to $0.60 per bushel. A similar price pattern occurs for soybean meal, with processing plants located farthest from the export destination receiving price discounts.

Curiously, this price discount pattern seen for soybeans and soybean meal is not true for animal producers. Surplus hog states such as Iowa record the highest hog prices, and surplus cattle regions such as the Texas Panhandle typically post the highest cattle prices. This somewhat counterintuitive price pattern occurs because livestock processing facilities tend to locate where the animals are and, once established, these facilities compete with each other to ensure that they are running at full capacity.

The four top price locations for hogs are Iowa, Minnesota, South Dakota, and North Carolina, with each state earning about $1 per hundredweight more than the national priceIllinois, Missouri, and South Carolina all report hog prices of about $1 per hundredweight less than the national average. Consequently, what differentiates both Iowa and southern Minnesota is that these regions have the greatest difference between input prices and output prices. This difference means that the price incentive to locate additional feeding facilities is greatest in these two states. The same argument is true, though to a lesser extent, for cattle feeding.

Now consider what will happen as U.S. meat exports increase. New facilities for producing this meat (all else held constant) will tend to locate as far as possible from export points and as close as possible to regions where grain is in surplus. As U.S. meat exports increase, the regions that are *farthest* from export destinations will be the first to stop exporting. This trend will roll in a southeasterly direction

Table 1. Mississippi River Bids for Soybeans, July 20, 1995, 4:07 PM (dollars per bushel)

Location	Spot	Basis
Red Wing, MN	5.95	-0.23
La Crosse, WI	5.96	-0.22
Prairie du Chien, WI	5.98	-0.20
Dubuque, IA	N/A	C
Muscatine, IA	6.07	-0.11
Clinton, IA	6.08	-0.10
Davenport, IA	6.08	-0.10
Burlington, IA	6.09	-0.09
Keokuk, IA	6.13	-0.05
Hannibal, MO	6.13	-0.05
Louisiana, MO	6.13	-0.05
St. Louis, MO	6.15	-0.03
Savanna, IL	6.18	0.00
Quincy, IL	6.19	0.01
E. St. Louis, IL	6.23	0.05
Grand Tower, IL	6.25	0.07

Table 2. Soybeans, Current Bid and August Basis, July 20, 1995, 4:20 PM (dollars per bushel)

Location	Current Bid	August Basis
Marshall, MN	5.71	-0.47
Sisseton, SD	5.74	-0.48
Dodge City, KS	5.75	-0.43
Superior, NE	5.85	-0.33
Sioux City, IA	5.88	-0.31
Minneapolis, MN	5.97	-0.19
Des Moines, IA	5.99	-0.17
Omaha, NE	6.00	-0.19
North Platte, NE	C	N/A
Cedar Rapids, IA	6.01	-0.17
Saginaw, MI	6.02	-0.15
Columbus, OH	6.06	-0.11
Davenport, IA	6.08	-0.08
Central, IL[a]	6.10	-0.07
Kokomo, IN	6.13	-0.04
Keokuk, IA	6.13	-0.06
Chicago, IL	6.15	-0.01
St. Louis, MO	6.15	-0.02
Toledo, OH	6.16	-0.01
Louisville, KY	6.21	0.04

Kansas City, MO	6.24	0.07

Table 2. Continued

Cincinnati, OH	6.26	-0.08
Evansville, IN	6.26	0.08
Lafayette, IN	6.31	0.14
Decatur, IL	6.33	N/A
Memphis, TN	6.41	0.22
Norfolk, VA	6.43	0.26
Gulf (LA, TX)	6.56	0.37

[a]The Central, IL, bid is a composite bid from the Illinois Department of Agriculture.

Table 3. Average Harvest-Time Prices in Major Soybean Producing States, 1990-94 (dollars per bushel)

Location	1990	1991	1992	1993	1994
Arkansas	5.91	5.71	5.60	6.10	5.59
Illinois	5.85	5.70	5.45	5.86	5.37
Indiana	5.81	5.68	5.40	5.84	5.43
Iowa	5.63	5.51	5.35	5.85	5.21
Minnesota	5.55	5.41	5.35	5.77	5.18
Missouri	5.73	5.59	5.30	5.90	5.35
Ohio	5.81	5.69	5.45	5.90	5.40

across Iowa and then down the river system to the Gulf. For regions that rely on rail for export, the first regions to run out of grain will be insouthwestern Minnesota (the current extreme for western origin of rail shipments), followed by regions in a westerly direction to the Pacific Coast.

In summary, what differentiates Iowa (and southern Minnesota) is that Iowa offers the greatest locational advantage to export-oriented feeding facilities, but it suffers most (relative to other major producing states) from circumstances that cause soybeans and soybean meal to be exported in lieu of meat.

Impact of Soybean and Meat Exports on Soybean Prices: A Case Study

Until very recently, it was not possible to accurately measure the impact of meat exports on soybean prices. This situation existed because to isolate the impact of feed demand from all other ongoing market events, the change in livestock feeding must be large and sudden. The recent growth of Premium Standard Farms (PSF) in Princeton, Missouri, provides a unique opportunity to measure this impact. The company has kept very detailed records both of local purchases and of the impact of these purchases within PSF's 50-mile draw area. In addition, the Food and Agricultural Policy Research Institute (FAPRI) at Iowa State University maintains economic models of the national soybean sector and has completed studies on how national prices would respond to export increases. Consequently, we can compare the effects of (a) an export increase and (b) a feed demand increase, using both the PSF and ISU data.

In 1994, PSF used 17 million bushels of soybeans, all purchased within 50 miles of

Princeton, Missouri. This 17 million bushels represents about 0.66 percent of total national soybean production in 1994, or 3.8 percent of Iowa's 1994 production. Using the FAPRI modeling system, the first step in measuring the impact of this soybean use is to measure how a 17 million bushel demand increase would influence national prices. Then, we can use the PSF data to examine any additional local impacts.

A 17 million bushel export order would increase national prices by 15.81 cents per bushel, or by about 2.8 percent during the first year. Note that this price increase would occur in all regions and states. In terms of the three-dimensional map described in the previous section, a 17 million bushel export order would cause a parallel upward shift of 15.81 cents per bushel at all points.

Now consider the PSF case in Missouri alone. By withdrawing 17 million bushels of soybeans that would otherwise have been exported from the U.S. market, the impact of PSF on the national price was exactly the same as a similar export shock. However, PSF also influenced local prices, as measured by the local basis. By increasing local demand by about 20 percent, PSF increased local prices by 6.3 percent, or by 34.65 cents per bushel. This impact was greatest at Princeton and then fell away gradually as the distance from Princeton increased. The impact of PSF was to turn a surplus region into a deficit region and to eliminate the discount associated with transporting soybeans to export points.

In terms of the three-dimensional map, PSF represents a parallel upward shift of 15.81 cents *and* an elevation in the surface equal to 34.65 cents at the facility itself and zero change at points more than 50 miles from the facility.

With a sufficiently large number of facilities the size of PSF, this elevation would become a tilt in the map's surface, with the greatest increase located where the basis is presently the greatest and with less and less effect the closer to export ports.

Assuming that the average price increase for soybeans within PSF's 50-mile draw area was 50 percent (17.325 cents per bushel), the revenue received by the sellers of the 17 million bushels of soybeans consumed by PSF would be increased by more than $2.94 million. This result means that the PSF facility is worth about $2.94 million *per year* to soybean producers within 50 miles of the facility.

Under the somewhat simplistic scenario described above, Iowa producers should spend all their promotional dollars on meat exports. Such an expenditure would make sense because meat exports sourced in Iowa increase both national and local demand for soybeans, whereas increased soybean exports increase only national demand for soybeans. However, this outcome ignores two important points. First, a certain amount of substitution occurs between meat exports and soybean exports. For example, if PSF pork ultimately competes with pork produced abroad using U.S. soybean meal, demand for exported soybeans will fall. Second, there is no guarantee that new export-orientated livestock plants will locate in Iowa, despite the price advantage discussed earlier. These issues need further attention before a definitive answer can be provided.

Current Soybean Use and Export Patterns

Soybeans

In 1994, Iowa produced 447 million bushels of soybeans and national production reached 2.55 billion bushels. Dr. Daniel M. Otto at Iowa State University has estimated that 215 million bushels of Iowa's soybeans were crushed within the state, 15 million bushels were exported whole to other states, and 152 million bushels were exported whole outside of the United States.

Nationally, 1.36 billion bushels of soybeans were crushed and 790 million bushels were exported, with the remainder being accounted for by seed use and increased inventories. Of the 32.24 million tons of soybean meal produced, exports accounted for 5.83 million tons.

Livestock

To calculate the amount of soybean meal exported as meat, we must first determine how much soybean meal it takes to produce beef, pork, and poultry. This calculation typically involves a simple multiplication of ration contents by feed conversions.

Budgets from Iowa State University Extension show that hog rations typically contain about 17 percent soybean meal. These budgets represent a weighted average of high-protein starter rations and lower-protein finish and sow rations. These budgets are not available for poultry; however, Professor William J. Owings from Iowa State University Poultry Extension estimates that poultry rations contain an average of 20 percent protein meal. Again, this estimate represents a weighted average over the life span of the bird.

Taking these ration contents and the feed conversion rates discussed earlier, we can calculate how many pounds of soybean meal it takes to produce one metric ton of meat (carcass weight equivalent). The results of these calculations are shown in Table 4.

The most interesting result shown in Table 4 is that it takes more soybeans to produce one pound of pork than it takes to produce one pound of poultry meat. This difference occurs because hogs require more feed per pound of gain.

Table 5 shows U.S. meat production and implied soybean meal use for 1994. Total soybean meal use in 1994 amounted to 26.33 million tons. The soybean meal not used for beef, pork, or broilers is used in the dairy, egg, non-broiler poultry, and pet food industries. Note that in converting to national figures, soybean meal use was multiplied by 0.92 because other oilseed meals are used in livestock and poultry rations. Note also that soybean meal weights are expressed in tons and meat production is expressed in metric tons, based on a USDA convention for reporting these values. Prior to 1995, the USDA maintained a data series of soybean meal use by livestock class. This series showed that beef production uses 10 percent of all U.S. soybean meal, broiler production uses 22 percent, and pork production uses 29 percent. The numbers in Table 5 show beef production consuming 7 percent, broiler production consuming 23 percent, and pork production consuming 29 percent of the soybean meal. The American Soybean Association (ASA) has updated the USDA study to 1994 and shows pork using 29 percent of U.S. soybean meal and poultry (broilers, turkeys, and eggs) using 52 percent. The ASA study is the source of the soybean meal use number for beef.[1]

Much of the difference between the ASA data and the numbers calculated here for poultry is attributable to the fact that eggs, turkeys, and other poultry are excluded in the calculations. This factor does not account for all of the difference, however, and further work may be justified to address this discrepancy. The key result is that broilers (as opposed to poultry) consume slightly less soybean meal than do hogs. This result is of relevance here because export markets for non-broiler poultry products are limited, whereas all parts of a hog carcass can be exported.

International Demand for U.S. Soybean Meal

Table 6 presents some calculations of U.S. soybean meal exports by category. In 1994, the United States exported 790 million bushels of soybeans (equivalent to 18.66 million tons of

[1] As an alternative to using the ASA soybean meal use number for beef, Iowa State University Beef Extension specialists and beef budgets were consulted about soybean meal use in the beef sector. The results of this research showed that soybean meal use in the beef sector is at least twice as high as the number reported in Table 5. However, because relatively little is known about soybean meal use in other states, the ASA data are used here.

Table 4. Amount of Soybean Meal Used to Produce One Metric ton of Broiler Meat and One Metric Ton of Pork (carcass weight equivalent).

	Feed Used per Pound of Gain	Soybean Meal per Pound of Live Gain	Soybean Meal per Metric Ton of Carcass Weight Equivalent
		(pounds)	
Broiler Meat	2.0	0.40	1,173
Pork	3.9	0.66	1,894

[a]The factors used to convert from live weight to carcass weight are 0.77 percent for hogs and 0.75 percent for poultry.

Table 5. U.S. Meat Consumption and Implied U.S. Soybean Meal Use, 1994

	Meat Production	Soybean Meal Use
	(1,000 metric tons)	(1,000 tons)
Cattle	11,380	1,900
Broilers	10,735	6,296
Pork	8,157	7,724

Table 6. U.S. Soybean Meal Exports, (by category), 1994

Category	Million Tons
Whole Soybeans	18.66
Soybean Meal	5.82
Poultry	0.75
Beef	0.12
Pork	0.23

soybean meal) and 5.82 million metric tons of soybean meal, for a total soybean meal export equivalent of 24.48 million tons. The soybean meal content of U.S. beef exports in 1994 equalled 0.12 million tons (6.5 percent of production). The United States exported 12 percent of total broiler production, or the equivalent of 0.75 million tons of soybean meal.

Pork exports equaled 3 percent of production, or a soybean equivalent of 0.23 million tons. Exports of beef, pork, and broilers therefore accounted for only 1.1 million tons, or about 4.5 percent (including meat exports), of the 25.58 million tons of soybean meal exported in 1994.

It is interesting to note that total soybean meal exports of 25.58 million tons (including soybean meal exported as meat) almost exactly equaled total soybean meal consumed as meat in the United States, which was 25.23 million tons (excluding soybean meal used in meat exports).

Demand for Soybean Meal in Iowa

Meat and soybean processing plants typically purchase input from surrounding states and, because no attempt is made to monitor interstate trade patterns, it is difficult to find accurate figures for the volume of Iowa soybeans and Iowa meats that are processed within the state. We do, however, have accurate *production* data

for animals and soybeans. Iowa produced 447.3 million bushels of soybeans in 1994, equivalent to 10.5 million tons of soybean meal. Estimates for 1994 indicate that Iowa produced 2,000 metric tons of pork and the United States (including Iowa) produced 8,037 metric tons of pork. These production data provide the basis of the calculations presented next.

The beef and pork in Iowa is more likely to be exported than are beef and pork produced in other states.

Hog rations in Iowa typically include a slightly higher percentage of soybeans (about 20 percent) and have lower levels of non-soybean plant proteins than do rations elsewhere in the United States. Using a 20 percent ration with a 4:1 conversion, it takes about 0.8 pounds of.
soybeans to produce one pound of pork (live weight), or 1.039 pounds of soybean meal for each pound of carcass weight pork. This level implies that Iowa's hog industry consumed 2.08 million tons of soybean meal, or about 20 percent of the soybean meal produced from Iowa's soybean crop.

Beef finishing rations in Iowa also contain a higher percentage of soybean meal than do rations in other states. Iowa State University Extension budgets for a cow/calf operator who fattens out the calves include 50 pounds of soybean meal for the cow and 225 pounds of soybean meal to fatten the calf. Using a 92 percent weaning rate and a 20 percent replacement rate, this level of consumption amounts to 373 pounds of soybean meal per 1,050 pounds of animal, or about 0.35 pounds ofsoybean meal per pound of (live weight) beef produced, implying that Iowa's beef production requires about 546,000 tons of soybean meal, or about 5.2 percent of the soybean meal available.

Iowa has seen explosive growth in broiler production, with production increasing almost sixfold from 1988 to 1992. However, the broiler industry in Iowa remains small by U.S. standards (0.37 percent of U.S. production), using 23,000 tons (0.2 percent) of the state's soybean meal production. In total, Iowa's beef, pork, and broiler industries account for use of 25.4 percent of the soybean meal produced from Iowa's soybean crop. Allowing another 6.6 percent for dairy, turkeys, and eggs implies that about 68 percent of Iowa's soybean meal is exported from the state, as either meal or soybeans. Using Dr. Otto's data on soybean processing, we know that 48 percent of Iowa's soybeans are processed in the state. If livestock and poultry consume approximately 32 percent of Iowa's soybean meal production, then about 16 percent of the soybean meal produced in Iowa is exported out of state. Dr. Otto's numbers also show that 152 million bushels, or 34 percent of the state's crop, is exported as whole beans out of the United States.

In summary, if Iowa's soybean crop produced 100 tons of soybean meal, approximately 32 tons would be consumed by Iowa's farm animals, 16 tons would be exported as meal and 34 tons would be exported out of the United States as whole beans. The remaining 18 tons would be exported whole to other states or stored within the state

International Exports of Iowa's Meat

Packer surveys conducted by A. Severin Johnson at Iowa State University show that the beef and pork produced in Iowa are more likely to be exported than are beef and pork produced in other states. This is true because Iowa's beef is more suited to Japanese tastes and because pork exports tend to originate in surplus regions.

The surveys indicate that 20 percent of the U.S. beef shipped to Japan originate in Iowa and that 30 percent of U.S. pork exports originate in Iowa. Assuming that Iowa's share of non-Japanese beef and broiler markets is the same as its share of national production, Iowa exports about 72,000 metric tons of pork, 110,000 metric tons of beef, and 4,792 metric tons of broilers.

Using the Iowa values presented in the previous section, these exports equate to a total soybean meal export value of 69,000 tons from pork, 42,000 tons from beef, and approximately 3,000 tons from poultry. Total soybean meal exported from Iowa (out of the United States) amounted to 114,000 tons, or 1.1 percent of the state's total production. These results are summarized in Table 7. Exports of Iowa soybean meal as meat are relatively small because Iowa's most important meat industry, pork, is not yet a major exporter and because Iowa produces such enormous volumes of soybean meal.

Prospects for U.S. (and Iowa) Meat Exports

The foregoing analysis shows that meat exports from Iowa and from the United States are not yet important outlets for soybean meal.

This result does not, however, address the promotional funding question because promotions are best used to expand markets and so it is potential market size, not current market size, that influences optimal promotional allocations.

U.S. consumers have almost reached the saturation point for meat consumption, so future growth in consumption of any one meat will most likely come at the expense of another, thereby having little impact on total demand for Iowa soybean meal. If demand for Iowa-sourced soybean meal is to expand, new markets for either soybean meal or meat must come from abroad. The purpose of this section, therefore, is to lay out the growth prospects for U.S. soybean, soybean meal, and meat exports. A key to all these projections is the trade-off that occurs when food importing countries decide whether to import meat or to import the soybean meal and feed grains required to produce that meat.

The Meat/Feed-Grain Trade-off

Consider the economic trade-off that must be made by countries that need more meat but that do not have surplus animal feeds. These countries will import only feed grains if the cost of producing meat domestically with imported feed grains is less expensive than the cost of importing meat directly. For beef and pork, such a price differential is clearly does not exist.

It is less expensive for food importing countries to import boneless boxed beef and pork than to import the feed-grain equivalent, transport feed grains to producers, and then process and transport the meat back to the

Table 7. Destination of Iowa's Soybean Meal, 1994

	Sold Domestically	Sold Internationally
	(1,000 tons)	
Hogs	2,011	69
Poultry	20	3
Beef	504	42
Other Livestock	525	0
Exported Out of State as Meal	617	1,062
Exported Out of State as Whole Beans	1,890	3,570
Total	5,567	4,746

Note: The difference between total produced (10.5 million bushels) and total used (10.3 million bushels) is stored.

retailer. For example, hog production costs in Taiwan (based on production using imported grain) currently equal $67 per hundredweight, whereas U.S. production costs equal $40 per hundredweight. Each 100 pounds of pork produced in the United States results in 46 pounds of boneless pork, which can be transported to Asia for $0.30 per pound, or $13.86 per hundredweight (live weight equivalent). This transportation cost brings U.S. costs up to $53.86 per hundredweight, which is still far less than Taiwanese production costs. The incentive to import meat is even greater because meat importing countries can choose to import only those cuts of meat that are in greatest demand. It is this "cherry picking" advantage that has allowed U.S. poultry exports to grow, even though the meat/feed-grain trade-off works against poultry.

These economic incentives to export meat rather than grain are relatively new and are due in large part to technological developments in meat transportation. The U.S. meat industry has not yet been able to take full advantage of these developments because (a) food importing countries impose higher tariffs on meat imports than on feed-grain imports, and (b) the European Community has been quick to offer subsidized sales into any new meat markets. The GATT agreement has removed both of these obstacles, and all indications are that U.S. meat exports will continue their recent growth surge. Note that not all of these new meat exports will go to satisfy market growth; some growth will occur because U.S. meat exports will displace existing U.S. feed-grain and soybean meal exports. This phenomenon will cause U.S. soybean and soybean meal exports to be relatively flat or declining for the foreseeable future.

These substitution possibilities may work to the detriment of corn and soybean producers located near export ports. To see why this is true, consider what would happen if U.S. grain and soybean meal exports were displaced by meat exports without any expansion in world meat consumption. Grain and soybean prices in the Upper Midwest would rise and those in the South would fall until eventually the current basis structure disappeared. These relative price changes would increase production in the Upper Midwest and decrease production in the South.

Fortunately, world meat consumption is growing, and in reality most of the adjustment will be driven by price increases in the Upper Midwest without associated price decreases in the South. Nevertheless, the tendency for the center of production to move toward the Upper Midwest will still occur.

The following sections present export forecasts for beef, pork, and poultry. A separate section on China is also included.

Pork Export Projections

Between 1990 and 1995, U.S. pork production increased an average of 238,000 tons per year. If we assume that this growth continues and that domestic pork consumption increases by 1.5 percent per year (122,000 tons), pork exports should increase by 116,000 metric tons per year. This growth path is higher than that proposed by the 1992 U.S. Meat Export Federation (USMEF) study on long-term export opportunities that projected an increase of around 50,000 metric tons per year. The USMEF study has proven quite accurate; however, it was based on a conservative assumption about market share because it was completed before the GATT agreement and before the recent devaluation of the U.S. dollar. Studies at Iowa State University have suggested that the GATT agreement alone would result in 300,000 metric tons of pork exports simply because it removes subsidized competition from the European Union.

Beef Export Projections

In a 1994 study prepared for the beef long-range plan, the USMEF projected U.S. exports individually for each important export customer through the year 2004. These results suggest a continued 10 percent increase in U.S. exports. The projections are still valid and are used in the projections presented later in this paper.

Broiler Export Projections

The U.S. broiler industry has grown at between 6 percent and 7 percent per year for the past 15 years. Initially, the extra production was absorbed by the U.S. market as extra production forced down prices. Per capita broiler consumption in the United States increased by about 1.5 to 2.0 pounds per year through 1992. The rate of increase fell to 1.0 pound in 1992 and to 0.5 pound in 1993. Fortunately, U.S. poultry prices have fallen so far that export markets became available as the U.S. consumption increase trailed off. These export markets added value by offering poultry processors an outlet for brown meat. These new markets do not drive up breast meat prices and consequently allow U.S. consumers to increase white meat consumption. This development has been good for all concerned and thus can be expected to continue. Therefore, the results reported in the projections presented later assume a continued 6 percent growth in U.S. poultry production and 3 percent growth in U.S. poultry consumption, implying that U.S. poultry exports will increase by 3 percent of production per year. This assumption might seem very optimistic; however, U.S. poultry exports in 1994 and in the first half of 1995 have increased at a much more rapid rate.

China - The Wild Card

In a recent publication, "Long Term Prospects for U.S. Meat Exports to China," the author projected China's meat consumption (feed-grain needs) and feed grain supply, assuming a continuation of recent impressive yield increases. The analysis was very conservative, assuming, for example, only 5 percent growth rather than the 9 percent to 12 percent growth experienced recently. The results presented in Figure 1 show that China is about to become a major importer of either feed grains or meat. This conclusion is borne out by recent events as China (via Hong Kong) has become a major importer of pig's ears, pig's stomachs, pig's feet, poultry, poultry hot dogs, chicken paws, and soybean oil. Recently, the price of corn in Shanghai reached $130 per ton, making Chinese pork producers uncompetitive with imports at the margin.

Just how Chinese consumption and import patterns evolve is probably the single most important international event facing Iowa soybean producers. Compare, for example, the increase in Chinese pork consumption between 1990 and 1993 (8 million metric tons) with *total* U.S. pork consumption in 1994 (also 8 million metric tons). Consider also that pork consumption in China's rural areas, where one billion people live, is only half the level of consumption by consumers in Chinese cities.

The meat/feed-grain trade-off outlined in the previous section would suggest that China will source its meat needs from abroad. As the low-cost supplier of both poultry meat and pork, North America could see exports rise to match domestic consumption. However, the Chinese government will attempt to halt this process. Because China is not yet a member of the GATT, the Chinese government will be able to restrict both consumption (via rationing) and imports. China needs food oil as much as it needs protein, and so a second likely outcome is that China will import whole soybeans, a market dominated by the United States with a 66 percent market share in 1994.

China's need for soybeans or meat is so great that U.S. soybean prices will be affected. If China chooses to import whole soybeans, U.S. soybean prices will rise, particularly near export ports. If China chooses to import poultry and pork, U.S. soybean prices will rise, particularly in the Upper Midwest. Higher prices will result in higher production, and China's decision whether to import soybeans or meat will determine to a large extent where these soybeans are grown. Because so little is known about China, it is impossible to say whether the country will remain stable, whether meat consumption will be allowed to increase, and whether meat or soybeans will be imported. The outcome has such enormous significance that the country-specific meat import projections discussed earlier

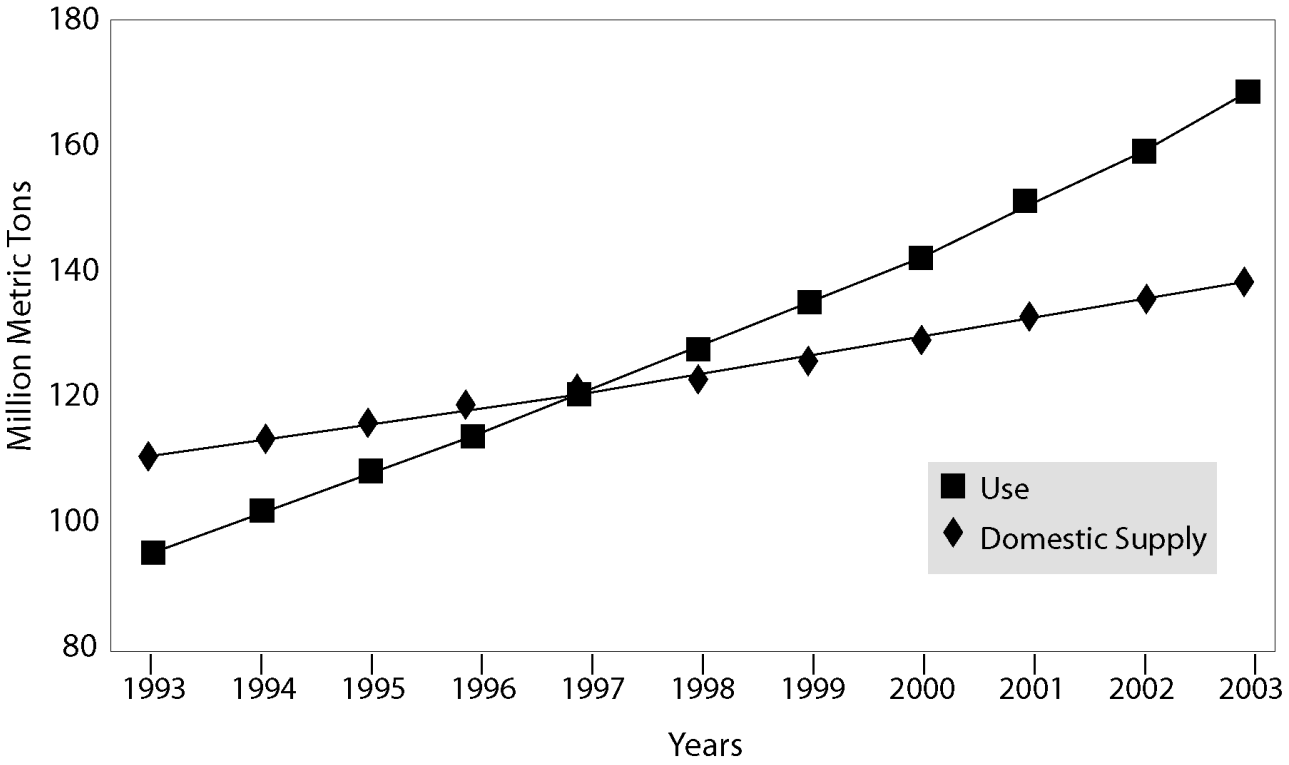

Figure 1. Feedgrain supply and use in China

in this paper will be meaningless if China does continue on its current path.

Projections

In the years from the mid-1970s to 1994, U.S. soybean production has increased by about 50 million bushels per year, from 1.5 billion bushels to 2.5 billion bushels, thereby increasing U.S. soybean meal availability by 1.2 million tons per year. The following projections next assume that this growth rate will continue. Figure 2 projects forward U.S. soybean availability and U.S. soybean demand.

The line labeled "available" in Figure 2 adds 50 million bushels to 1994 export values. The line labeled "needed" shows the amount of soybean meal needed for meat exports. Both lines ignore the domestic market, which is implicitly assumed to be flat.

Driven in large part by the optimistic assumption made regarding poultry exports, the "needed" and "available" lines in Figure 2 converge in about 2008. If these projections are valid, no soybean or soybean meal exports outside the United States will occur after that date. This date is so far into the future that it is not relevant for planning purposes. Of much greater relevance is that by 2002 the U.S. livestock industry will require as much additional soybean meal as Iowa produced in 1994. If a large proportion of new large-scale facilities locate in Iowa, the state will stop exporting whole soybeans well before the nation does. This crucial location decision is the subject of the next section.

Location of New Export-Orientated Meat Production

The previous analysis assumes, rather simplistically, that new meat production will locate where the wedge between input prices and output prices is greatest. Although this is probably the most important influencing factor, a host of factors can influence the decision. Other factors such as climate, labor rates, and the state's attitude toward the industry explain, for example, why the U.S. broiler industry is not located in Iowa and why the hog and cattle industries have

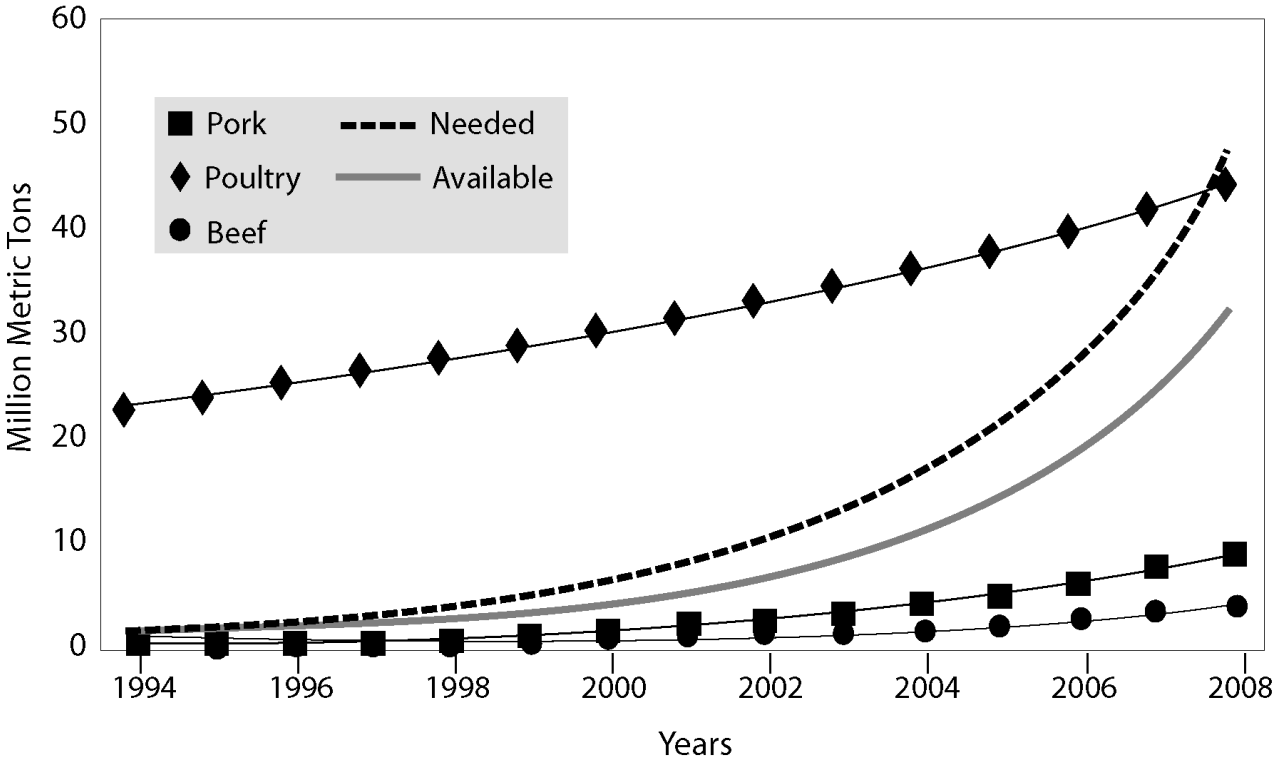

Figure 2. Projected soybean meal use and availability

grown so rapidly outside of Iowa, in North Carolina and Texas.

Efforts by Iowa producers to expand meat exports will not be well-spent unless some of these exports originate in Iowa, and there is no guarantee this will occur. The state's climate is not as conducive toward growing hogs and poultry as are states in the South, Iowa's high rainfall level makes manure disposal for hogs and cattle difficult. On the positive side, however, relative labor rates in Iowa (adjusted for productivity) are not as high as they once were. The recent growth in the state's poultry industry, coupled with the willingness of North Carolina integrators to contract-finish hogs in Iowa, demonstrate that Iowa's feed cost advantage is more important than its climatic disadvantage.

Funds spent by the Iowa Soybean Promotion Board to improve the state's attitudes toward expansion of the swine industry, and to influence location of new facilities within the state, have a higher payoff potential than funding promotion of meat or soybean.

Implications andConclusions

U.S. meat exports have grown very rapidly in recent years and will continue to do so for years to come. U.S. soybean exports have been flat for the past twenty years and, unless China intervenes, will continue at current levels. It is possible that U.S. meat exports will displace soybean meal exports and that soybean and meal exports will actually fall. This is a positive development for Iowa soybean producers because the state is currently being penalized for its distance from export ports. Soybean producers ultimately pay all costs associated with transporting grain to the customer, and the closer the customer, the lower these costs are.

When additional soybean meal is exported as meat out of Iowa, the Iowa soybean producer receives two benefits. First, overall demand for

soybeans increases, thereby drawing national prices up. Second, local demand increases, thereby drawing local prices up relative to national prices. Soybean producers located near export ports receive no additional benefit from meat exports and, to the extent that meat exports substitute for soybean exports, may actually lose from programs that promote meat exports.

The analysis presented here ignores China but is otherwise optimistic about meat exports. The results suggest that U.S. meat exports will eventually create demand for almost all of the U.S. soybean crop. First, surplus corn and soybean production located farthest from export ports will see increased livestock feeding that will use up the surplus. Then, points closer to export ports will see the same activity. By the year 2008, the trend will have worked all the way down to Gulf port and U.S. soybean prices will be approximately the same everywhere.

Faced with the choice of funding promotion of meat exports or soybean exports, our analysis shows more positive economic results for the funding of meat exports. This is true because (a) meat exports that originate in Iowa cause local and national prices to rise, and (b) promotional dollars spent to increase markets are best spent on markets with growth potential. Faced with a choice of promoting beef, pork, or poultry, Iowa soybean producers would see the most economic benefit from the promotion of pork for export. An obvious counter argument to the analysis just presented is that promotional dollars be spent on the most important *current* end users (i.e., exports of whole soybeans). Such promotion would be equivalent to a computer company such as IBM promoting mainframes in 1985 or to oil companies promoting leaded gas in 1982. There are, however, two valid criticisms that can be made. First, there is no guarantee that new export-oriented facilities will locate in Iowa, which means that ISPB funds might be wasted on promoting meats from other states, a development that cannot occur with soybeans or soybean meal. Second, it is quite possible that China will become a *major* importer of whole soybeans, and to the extend that this is true, funds spent to develop the Chinese market for whole soybeans might be more rewarding than those spent promoting meat exports.

Had IBM concentrated on mainframes, which in 1985 were its most important revenue source, instead of a microcomputers which at that time were a troublesome but very promising venture. The company, in all likelihood would not be profitable today. A similar outcome would have ocurred, in 1982, for oil companies who based their futures on leaded gas.

These last two points suggest that research dollars spent to facilitate the location of new livestock facilities in Iowa and in understanding how Chinese trade policies and impact patterns will evolve are two high-priority research topics.

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