United States General Accounting Office

GAO

Report to the Honorable Tom Daschle, U.S. Senate

March 2002

ECONOMIC MODELS OF CATTLE PRICES

How USDA Can Act to Improve Models to Explain Cattle Prices

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Contents

Letter		1
Executive Summary		3
	Purpose	3
	Background	3
	Results in Brief	5
	Principal Findings	7
	Agency Comments	12
Chapter 1 Introduction		13
	The Cattle and Beef Industry Consists of Several Interlocking Pieces	14
	Structural and Technological Changes in the Cattle and Beef Industry	20
	Beef's Competition from Other Meats	24
	International Trade in Beef and Cattle Is Growing	26
	The Cattle Cycle Is an Important Feature of Supply	30
	Modeling the Cattle and Beef Industry Can Take Different Forms	34
	Objectives, Scope, and Methodology	35
Chapter 2 The USDA and ITC Models Were Not Designed to Answer Questions about Structural Change		40
	USDA's Models Project Cattle Prices under Baseline Conditions	40
	Short-Term Projections Rely on Analysts' Judgments	41
	Long-Term Projections Are Based on USDA's Livestock Model	42
	The Livestock Model Has Not Been Reestimated, Documented, or Validated	44
	ITC's Models Lack Industry Specifics Needed to Predict Prices	45
	Research Is Inconclusive on How Structural Change Affects Domestic Cattle Prices	49
	Conclusions	52
	Recommendations for Executive Action	53
	Agency Comments and Our Evaluation	53
Chapter 3 Many Factors Determine Cattle Prices and Producers' Incomes		54
	Cattle Demand and Supply, International Trade, and Structural Change	54
	Consumer Demand for Beef Influences Demand for Cattle	55
	Several Considerations Shape Producers' Decisions to Supply Cattle	58
	International Trade Affects Domestic Prices and Producers'	

Incomes 59
Structural Change Is Relevant 62
Conclusions 64
Recommendations for Executive Action 65
Agency Comments and Our Evaluation 65

Chapter 4 Building a Comprehensive Model Depends on Resolving Modeling and Data Issues 66
Analyzing How Demand and Supply Link Producers to Consumers Is Important 66
Obtaining Better Data to Analyze Consumer Demand Is Important 68
Aspects of Cattle Supply and Prices Are Relevant 69
International Trade Issues 71
Overarching Issues Related to Modeling Scope 72
The Panel's Priority Items for Government Action 72
Conclusions 76
Recommendations for Executive Action 76
Agency Comments and Our Evaluation 77

Appendixes
Appendix I: Objectives, Scope, and Methodology 78
Appendix II: USDA's Livestock Model 82
The Cattle and Beef Sector 83
The Hog and Pork Sector 90
The Chicken Sector 92
The Turkey Sector 94
The Consumption Section of the Model 94
The Demand Section of the Model 95
The Price Section of the Model 99
Cost and Returns Section of the Model 103
Appendix III: Our Survey Phases and Methodology 106
Appendix IV: The Panel's Ratings of Problems and Issues in Developing an Adequate Model 113
Appendix V: Summary of Phase III of Our Survey 123
Panelists' Responses on Structural Change 123
Panelists' Responses on International Trade 129
Issues Facing Comprehensive Analysis 133
Specific Actions the Federal Government Should Take 136

Appendix VI: Our Panel of Experts 143

Appendix VII: Comments from the U.S. Department of Agriculture 146
GAO Comments 154

Appendix VIII: GAO Contacts and Staff Acknowledgments 158
GAO Contacts 158
Staff Acknowledgments 158

Glossary 159

Tables

Table 1: What Detailed Analysis Requires for Adequate Cattle Price Modeling 67
Table 2: Inadequate Retail Data and Quantification Factors Influencing Consumer Demand Pose Challenges to Modeling 68
Table 3: Cattle Cycle, Expectations of Profits, and Long-Term Variables Pose Challenges to Modeling 70
Table 4: Vertical Coordination Poses Challenges to Modeling 70
Table 5: Quantifying International Trade Factors Is an Issue for Modeling 71
Table 6: The Relevance of a Model's Purpose and Scope 72
Table 7: The Five Problems Most Important for Government Action in Developing a Comprehensive Analysis 73
Table 8: The Panel's Comments on Data Needs That the Government Can Address 74
Table 9: The Panel's Comments on the Government's Role in Data and Modeling Issues 75
Table 10: The Number of Panelists Participating in the Study's Three Phases 81
Table 11: Descriptive Statistics on Factors Rated in the Phase II Questionnaire 106
Table 12: Descriptive Statistics on Issues and Problems Rated in the Phase II Questionnaire 114
Table 13: Issues the Panel Recommended the Federal Government Act On 134

Figures

Figure 1: Cattle Being Fed in a Feedlot Prior to Slaughter 4
Figure 2: Cattle Demand and Supply Relationships Linking Producers and Consumers 15
Figure 3: Cattle Eating at a Feedlot Trough 16

Figure 4: The Beef and Cattle Industry from Animal Breeding to Consumption 18
Figure 5: Prices Signal Changes Along the Demand and Supply Chain between Producers and Consumers 19
Figure 6: Retail Beef, Boxed Beef, and Slaughter Steer Price Movements, 1974–99 20
Figure 7: The Rise in Steer and Heifer Slaughter, Accounted for by the Four Largest U.S. Meatpackers, Selected Years 1980–99 23
Figure 8: U.S. Per Capita Retail Beef Consumption Fell in the 1970s and 1980s and Leveled Off in the 1990s 25
Figure 9: U.S. Retail Beef Prices Were Higher Than Chicken and Pork Prices, 1970–99 26
Figure 10: U.S. Beef Exports Have Generally Risen Since 1980 27
Figure 11: U.S. Beef Exports Rose as a Percentage of U.S. Consumption, 1970–99 27
Figure 12: U.S. Beef Imports Varied as a Percentage of Commercial Production, 1970–99 28
Figure 13: U.S. Cattle Imports Exceeded Exports, 1970–2000 29
Figure 14: U.S. Cattle Imports Rose as a Percentage of Slaughter, 1970–2000 30
Figure 15: The Cattle Cycle: Rising and Falling Cattle Inventories, 1930–2000 31
Figure 16: How Cattle Inventories Peaked Before Beef Production, 1970–99 32
Figure 17: The Cyclical Movement of Cattle Prices, 1970–99 33
Figure 18: The Opposite Movement of Cattle Prices and Commercial Slaughter, 1974–2000 34
Figure 19: Domestic Cattle Demand and Supply Are More Important Than Other Factors 55
Figure 20: The Panelists' Assessment of Structural Change and International Trade Varied 55
Figure 21: Consumer Preferences, Prices of Beef Substitutes, and Health Concerns Are More Important Than Other Factors Influencing Consumer Demand 56
Figure 22: Capacity Use at Meatpacking Plants and Retailing Beef Costs Are More Important Than Other Factors Influencing Meatpackers' and Retailers' Demand for Cattle and Beef 57
Figure 23: Supply Factors Vary in Importance 58

Figure 24: Beef Is More Important in International Trade Than Cattle 60
Figure 25: International Trade Will Be More Important 5 Years from Now 61
Figure 26: Various Aspects of Structural Change Influence Cattle Prices and Producers' Incomes 62
Figure 27: Structural Change Will Be More Important 5 Years from Now 64

Abbreviations

AMS	Agricultural Marketing Service
BLS	Bureau of Labor Statistics
CGE	computable general equilibrium
COMPAS	Commercial Policy Analysis System
CPI	consumer price index
ERS	Economic Research Service
FAPSIM	Food and Agricultural Policy Simulator
FI	federal inspection, federally inspected
GIPSA	Grain Inspection Packers and Stockyards Administration
ICEC	Interagency Commodity Estimates Committee
ITC	U.S. International Trade Commission
LMR	livestock mandatory reporting
NAFTA	North American Free Trade Agreement
NASS	National Agricultural Statistics Service
USDA	U.S. Department of Agriculture

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United States General Accounting Office
Washington, D.C. 20548

March 15, 2002

The Honorable Tom Daschle
United States Senate

Dear Senator Daschle:

We are pleased to respond to your request that we review economic models of the U.S. Department of Agriculture and U.S. International Trade Commission, especially their treatment of competition, marketing practices, and international trade effects on U.S. cattle prices and producers' incomes. In this report, we address three research questions.

- To what extent do these models incorporate structural changes—specifically, market concentration in the meatpacking sector and the use of marketing agreements, forward contracts, and imports?

- What are the most important factors that affect cattle prices and producers' incomes?

- What are the most significant data and modeling issues to be considered in developing a more comprehensive model, or logical framework, to explain cattle prices and producers' incomes?

We make several recommendations to the secretary of agriculture about how to resolve issues and problems regarding cattle price modeling.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after its issue date. We will then send copies to the appropriate congressional committees; the secretary of agriculture; the chairman, U.S. International Trade Commission, and the director, Office of Management and Budget. We will also make copies available to others upon request.

If you have any questions about this report or would like to discuss it further, I can be reached at (202) 512-2700. Key contributors to the report are listed in appendix VIII.

Sincerely yours,

Nancy Kingsbury
Managing Director, Applied Research
and Methods

Executive Summary

Purpose

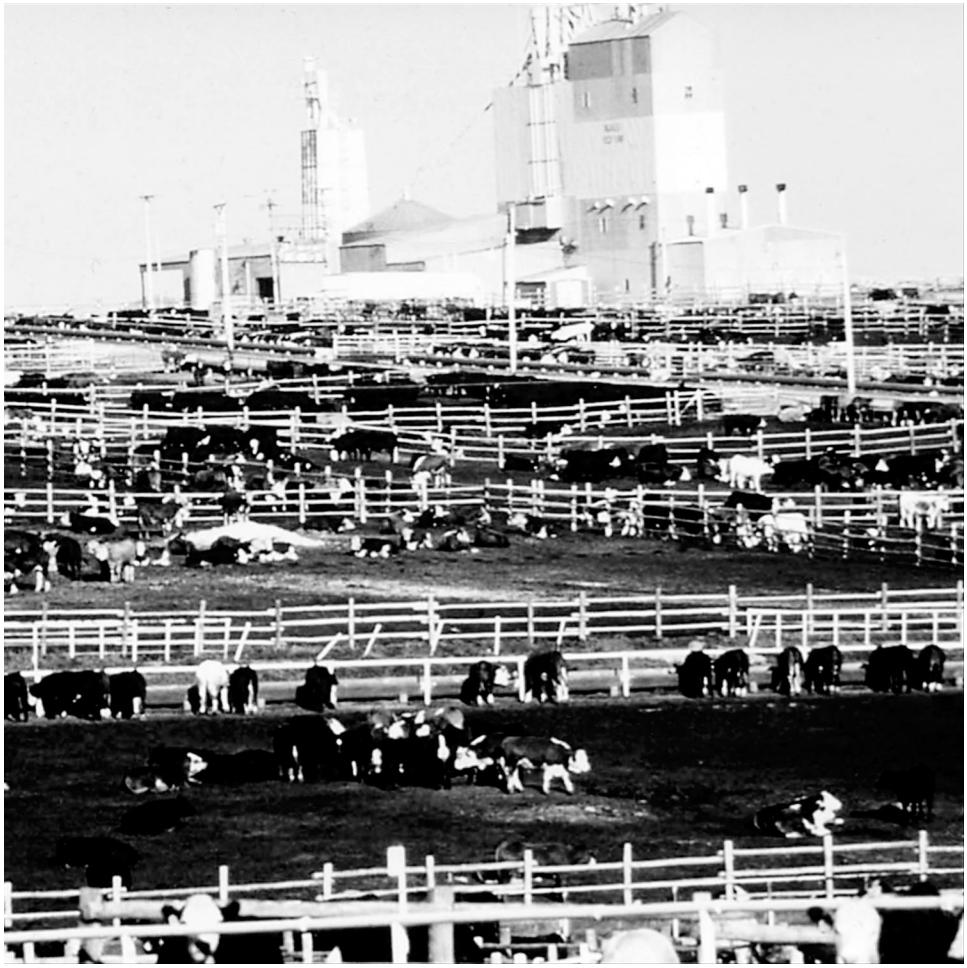
Cattle prices and the livelihood of those who raise cattle in the United States are influenced by many factors, ranging from weather to consumer taste. In addition, a number of structural changes are occurring in the cattle and beef industry. All these elements, and more, could be considered in developing a logical framework to explain cattle prices and producers' incomes.

There is some concern that economic models that the U.S. Department of Agriculture (USDA) and the U.S. International Trade Commission (ITC) use do not account for all the factors that affect cattle prices and producers' incomes. At the request of Senator Tom Daschle, GAO addressed the following questions: (1) To what extent do these models incorporate structural changes—specifically, market concentration in the meatpacking sector, the use of marketing agreements and forward contracts, and imports? (2) What are the most important factors that affect cattle prices and producers' incomes? (3) What are the most significant data and modeling issues that need to be considered in developing a more comprehensive model, or logical framework, to explain cattle prices and producers' incomes?

Background

Market concentration is a measure of total sales or purchases of the largest firms in a specific market or industry. Today, the four largest meatpacking firms handle more than 80 percent of all steer and heifer slaughter (fig. 1). Twenty years ago, market concentration was less than half as great. Meatpacking firms purchase cattle for slaughter and produce meat items for sale to wholesalers and retailers. Some cattle producers are worried that greater market concentration has meant that fewer meatpackers bid for their cattle and that they do so at lower prices. Other industry observers hold that technological change and cost economies are the most important factors driving the meatpacking sector and that market concentration has played a relatively minor role in determining cattle prices.

Figure 1: Cattle Being Fed in a Feedlot Prior to Slaughter



Cattle were traditionally bought and sold in spot or cash markets, where prices are determined in an auction setting.[1] Today, cattle are also being bought and sold by means of direct marketing agreements between meatpackers and producers, sometimes in the form of contracts. An agreement may stipulate the number of cattle to be delivered to the

[1]"Spot market" and other technical terms here and throughout the report are defined in the report's glossary.

meatpacker, their quality, and a pricing formula to determine the price to be paid for the cattle. Some industry analysts believe that such marketing arrangements can result in a less competitive market for cattle and lower prices, while others believe that producers benefit from such arrangements.

Although the United States is the largest beef producer in the world, it is a net beef importer, buying more beef from other nations than it sells to them. Most U.S. beef exports are choice cuts, while most imports are used for ground beef. The United States also imports a greater volume of cattle than it exports. Some U.S. cattle producers believe that imports of live cattle have resulted in lower U.S. cattle prices, but some industry analysts believe that international trade has benefited producers and consumers.

To determine the extent to which USDA and ITC models incorporate market concentration in the meatpacking sector, marketing agreements and forward contracts, and imports, GAO obtained the models' documentation and discussed the models with agency officials. To identify the most important factors affecting cattle prices and producers' incomes, GAO undertook a Web-based survey of a panel of 40 experts (named in app. VI). This panel, which reflected a broad range of expertise in agricultural economics, also identified the most significant data and modeling issues that need to be addressed if a more comprehensive modeling framework is to be developed. Appendix I contains a detailed description of this methodology.

Results in Brief

USDA and ITC models include imports but do not incorporate market concentration, marketing agreements, and forward contracts because they were not designed to answer questions about these factors. USDA uses various methods to predict cattle prices. Its long-term livestock model projects annual cattle prices over a 10-year period and consists of many mathematical relationships describing the U.S. livestock sector. In addition, a committee of USDA officials meets monthly to analyze market data and to forecast monthly cattle prices up to 18 months into the future. ITC's model, called the Commercial Policy Analysis System (COMPAS), has been used to calculate the effects of dumping imports of live cattle on U.S. cattle prices. ITC has other models that were designed mainly to assess the broader effects of international trade on sectors of the economy. ITC's models lack specific details on the cattle and beef industry and cannot be readily modified to include market concentration, marketing agreements, and forward contracts.

In GAO's review of USDA's livestock model to determine whether it incorporates imports, market concentration, marketing agreements, and forward contracts, several issues arose involving best modeling practices. The entire model has not been reestimated in more than a decade, even though much of the data used to estimate it predate the rapid rise of meatpacking concentration during the 1980s, the growing popularity of marketing agreements and forward contracts, technological change, and shifting consumer preferences. Thus, it is not clear to what extent the estimated values of model parameters would change and lead to different projections of cattle prices if newer data were used. Moreover, data sets used to estimate the model have been lost, along with standard measures of statistical goodness of fit and other diagnostics of model performance.[2] This information is critical to model evaluation. USDA offered several reasons for this lack of documentation. Foremost was that budgetary cuts have led to a lack of resources needed to provide better documentation and to replace lost data.

GAO's expert panel identified many important factors influencing cattle prices and producers' incomes. Some, but not all, of these factors are included in USDA's livestock model. The panel believed that domestic cattle demand and supply are the fundamental forces driving cattle prices and producers' incomes. It agreed less about the importance of international trade and structural changes that include market concentration, marketing agreements, and forward contracts.

The panel identified a number of important data and modeling issues to be addressed in developing a comprehensive modeling system to predict cattle prices and producers' incomes. It cited collecting better data to quantify a number of important factors not included in the model. It also would like to see a more complete characterization of the supply and demand relationships connecting the cattle producer to the final consumer. The panel's emphasis on a more complete characterization of the cattle and beef industry underscores the idea that the demand for cattle is ultimately driven by consumer demand for beef and other demand and supply forces linking cattle producers to feedlots, meatpackers, and retailers.

[2]Statistical goodness of fit is a measure of how well the predicted values of the model's variables match its observed values (see the glossary).

Principal Findings

Models Account for International Trade but Were Not Designed to Answer Questions about Market Concentration, Marketing Agreements, and Forward Contracts

USDA uses various methods to project cattle prices. Its long-term livestock model projects annual cattle prices over a 10-year period and consists of many mathematical relationships describing the U.S. livestock sector. In addition, a committee of USDA officials meets each month to analyze market data and forecast monthly cattle prices up to 18 months into the future.

USDA's livestock model focuses on a number of fundamental factors that influence cattle prices, including animal numbers, commercial beef production, and meat demand. Besides generating USDA's livestock long-term forecast, it is used by USDA's Economic Research Service (ERS) to project the effect of legislative policy and other events, such as changing feed costs, on the livestock sector.

The livestock model was estimated initially with 1960–88 data, and it does not incorporate market concentration, marketing agreements, and forward contracts. The model was not designed to address these kinds of questions. USDA's research on these structural changes is inconclusive on their effect on cattle prices paid to cattle producers. Similarly, USDA's short-term forecasting committee does not explicitly account for concentration, marketing agreements, and forward contracts.

Both the livestock model and the short-term forecasting committee explicitly account for imports and exports of beef and cattle in their projections of cattle prices. The model uses values of beef imports and exports that are based on the projections of another set of USDA models that focus on international trade. Likewise, USDA's short-term forecasting committee considers the latest information on beef imports and exports. Values of imports and exports of live cattle are determined outside the livestock model. Cattle imports and exports are considered in short-term, monthly forecasting.

ITC has a sweeping mandate to assess possible injury to any U.S. industry from imports, and it uses COMPAS to measure the effects of unfair or underpriced imports on U.S. industry. For example, COMPAS has been used to calculate the effects of such imports of live cattle on U.S. cattle prices.

ITC also maintains other models, including a multisector model to estimate the impact of broad trade initiatives such as the North American Free Trade Agreement (NAFTA). While this model is designed to estimate effects of these initiatives on all sectors, it is not detailed enough to estimate the effects of cattle imports on U.S. cattle prices. None of these models explicitly accounts for concentration, marketing agreements, and forward contracts.

USDA's livestock model has not been reestimated in more than a decade, even though much of the data used to estimate it predate the rapid rise of meatpacking concentration during the 1980s, the growing popularity of vertical alliances, technological changes, and shifting consumer preferences. Thus, it is unclear to what extent the estimated values of model parameters would change and lead to different projections of cattle prices if newer data were used. In addition, the data sets used to estimate the model have been lost, along with standard measures of statistical goodness of fit and other diagnostics of model performance. This information is critical to model evaluation, and its maintenance simply constitutes good housekeeping.

According to USDA, budgetary cuts have led to a lack of resources needed to provide better documentation and replace lost data. An assistant administrator of ERS acknowledged that reestimating the model with current data makes sense and should include back casting, a standard validation practice comparing model projections with actual results.

To help ensure that models USDA uses to project cattle prices are properly maintained and reflect the most current information on the cattle and beef industry, GAO recommends that the secretary of agriculture direct ERS to periodically reestimate and validate the livestock model. To ensure that models USDA uses to project cattle prices are properly documented, GAO recommends that the secretary of agriculture direct ERS to provide basic documentation on these models. This would include documenting (1) the data set used to estimate the model, (2) standard measures of statistical goodness of fit and other diagnostics of model performance, and (3) any changes made to improve or otherwise update the model.

GAO's Panel Identified the Most Important Factors Affecting Cattle Prices and Producers' Incomes and Some Are Included in USDA's Livestock Model

The first step GAO's expert panel took was to identify the most important factors affecting cattle prices and producers' incomes; the range they enumerated was wide. GAO then asked each panel member to vote on the importance of all the factors and tallied the votes. The panel judged domestic supply and demand for cattle more important than international trade and structural change as explanations for cattle price and income movements.

The panel identified many demand factors. For instance, the panelists pointed to an array of factors linking cattle prices to consumer and retailer demand for beef and to meatpacker demand for cattle. Chief among the factors affecting consumer demand for beef were consumer preferences, especially for quality and convenience, and prices of substitutes for beef, notably poultry and pork. The panelists also highlighted consumers' health concerns about food safety and diet.

The panel also identified numerous supply factors, including the cattle cycle and input costs, especially the costs of feed and forage. Weather is an important factor influencing both feed and forage costs. The cattle cycle, referring to increases and decreases in herd size over time, is determined by expected cattle prices and the time needed to breed, birth, and raise cattle to market weight, among other things. Expected prices are important because the relatively long biological cycle for cattle makes it necessary for producers to make decisions about herd size months and even years before animals are sold and prices are known. Cattle quality was another factor that scored relatively high in importance. Grade and yield were cited as important quality characteristics. Cattle quality is also a factor affecting the demand for cattle and is linked to consumer demand for quality beef products.

Structural change and international trade were generally viewed as somewhat less important, although there was less agreement among the panel. Structural change and international trade, depending on the element, can be a demand or supply factor affecting cattle prices and producers' incomes. The panel identified the most important elements associated with structural change in the cattle and beef industry as economies of scale and technological change. Economies of scale refers to cost savings from operating larger plants, which have become more prevalent with consolidation in the meatpacking sector. Economies of scale and technological change were judged more important in meatpacking than in retailing and feedlots. Some examples of technological change are developments in packaging and processing.

Vertical coordination also scored relatively high in importance among structural change factors. Within vertical coordination, value-based marketing and pricing scored the highest in importance. Efficiency of the supply chain—the distribution system used to move products beyond the farm gate to the final point of consumption—is another aspect of structural change that received more votes from the panel. In international trade, exports of beef were identified as the most important factor, with trade barriers having the most influence on net beef exports, the difference between beef exports and imports.

A number of factors the panel judged important are included in USDA's livestock model, such as feed costs and cattle inventory features of the cattle cycle. The model does not explicitly cover other important factors, such as product quality and convenience aspects of consumer preferences and grade and yield characteristics of cattle quality. The panel also believed that international trade and structural change will become more important in coming years, with implications for future modeling.

It is not clear to what extent the livestock model indirectly captures the effects of factors that it does not include but that influence cattle prices. For example, in the model, the retail price of beef and, therefore, cattle prices are influenced by beef, pork, and poultry consumption, which depend on consumer preferences. Similarly, the effects of economies of scale and market concentration may be hidden in the relationship between boxed beef prices, which represent prices meatpackers receive for their products, and cattle prices. However, because the model does not explicitly account for these factors, it is not equipped to shed light on their relative importance in explaining and projecting cattle prices. There is no ready way to know how important these excluded factors are in the model's cattle price projections.

To improve USDA's ability to answer questions about the current and future state of the cattle and beef industry, GAO recommends that the secretary of agriculture direct ERS to (1) review the findings of GAO's expert panel regarding important factors affecting cattle prices and producers' incomes and (2) prepare a plan for addressing these factors in future modeling analyses of the cattle and beef industry.

The Panel Identified the Most Important Data and Modeling Issues

The panel identified a number of important data and modeling issues to be addressed in developing a comprehensive modeling system to predict cattle prices and producers' incomes. It cited the need to collect better data to quantify important factors, particularly on the consumer demand side, such as tastes and health concerns, which are not included in USDA's livestock model. The panel also favored a more complete characterization of the supply and demand relationships connecting the cattle producer to final consumer. The model is more detailed "upstream" in its representation of cattle production than it is "downstream" in its representation of the packer, retailer, and consumer. The panel's emphasis on a more complete representation of the cattle and beef industry reflects that the demand for cattle is ultimately driven by consumer demand for beef and other demand and supply forces linking cattle producers to feedlots, meatpackers, and retailers.

The panel also emphasized that a model's purpose is critical in determining the factors to include in a model; it noted that what is appropriate to include in a short-term forecasting model differs from what is appropriate in a model designed for longer-term projections and policy simulation. Moreover, the panelists questioned the feasibility of constructing one all-encompassing model to address the wide variety of questions that may arise.

The panel recommended that the government take a number of actions to facilitate the development of a more comprehensive modeling framework for explaining and projecting cattle prices and producers' incomes. These actions focus primarily on the need for better data.

To improve USDA's ability—and that of the research community as a whole—to answer questions about the current and future state of the cattle and beef industry, GAO recommends that the secretary of agriculture direct ERS to (1) review the findings of GAO's expert panel regarding important data and modeling issues and, (2) in consultation with other government departments or agencies responsible for collecting relevant data, prepare a plan for addressing the most important data issues that the panel recommended for government action, considering the costs and benefits of such data improvements, including tradeoffs in departmental priorities and reporting burdens.

Agency Comments

We provided a draft of this report to the U.S. International Trade Commission and the U.S. Department of Agriculture for their review and comment. ITC generally agreed with the report and offered serveral points of clarification. USDA identified some changes and points of clarification. See appendix VII for USDA's comments and our evaluation.

Chapter 1

Introduction

The livelihood of cattle producers depends fundamentally on the price they receive for their product and their cost to produce it. But behind this simple arithmetic are a host of demand and supply factors that influence cattle prices and the costs of raising cattle. For instance, the outcome for producers depends on how consumer tastes affect the demand and price for beef. Producers' fortunes also hinge on how weather affects the supply and cost of forage and feed grains. The long biological cycle for cattle means that producers have to make supply decisions about herd size long before animals are sold and prices are known. International trade in cattle and beef, competition from poultry, pork, and other protein sources for a place in the consumer's shopping cart, and household income are also among the many demand factors that influence cattle prices and producers' incomes.

In addition, structural changes that have been reshaping segments of the industry are affecting cattle demand and supply. The four largest meatpacking firms now slaughter more than 80 percent of all steers and heifers, compared with 36 percent 20 years ago. Agreements between producers and meatpackers stipulating prices, number of cattle, and quality considerations are becoming more commonplace. Technological changes now enable packers to deliver shelf-ready products to grocers. Information technology is being used to conduct live-cattle auctions on the Internet. All these developments and more potentially influence the demand and supply of cattle, directly or indirectly affecting cattle prices and producers' incomes.

Many demand and supply factors can be considered in developing a model, or logical framework, to explain cattle prices and producers' incomes. Which of these factors to include depends on the model's purpose or the specific questions it is intended to answer. Data availability and the results of testing how well various factors explain prices and incomes also determine which factors to include in a model. Modeling frameworks can range from highly complex mathematical formulations to less formal meetings of the mind among a panel of experts.

The Cattle and Beef Industry Consists of Several Interlocking Pieces

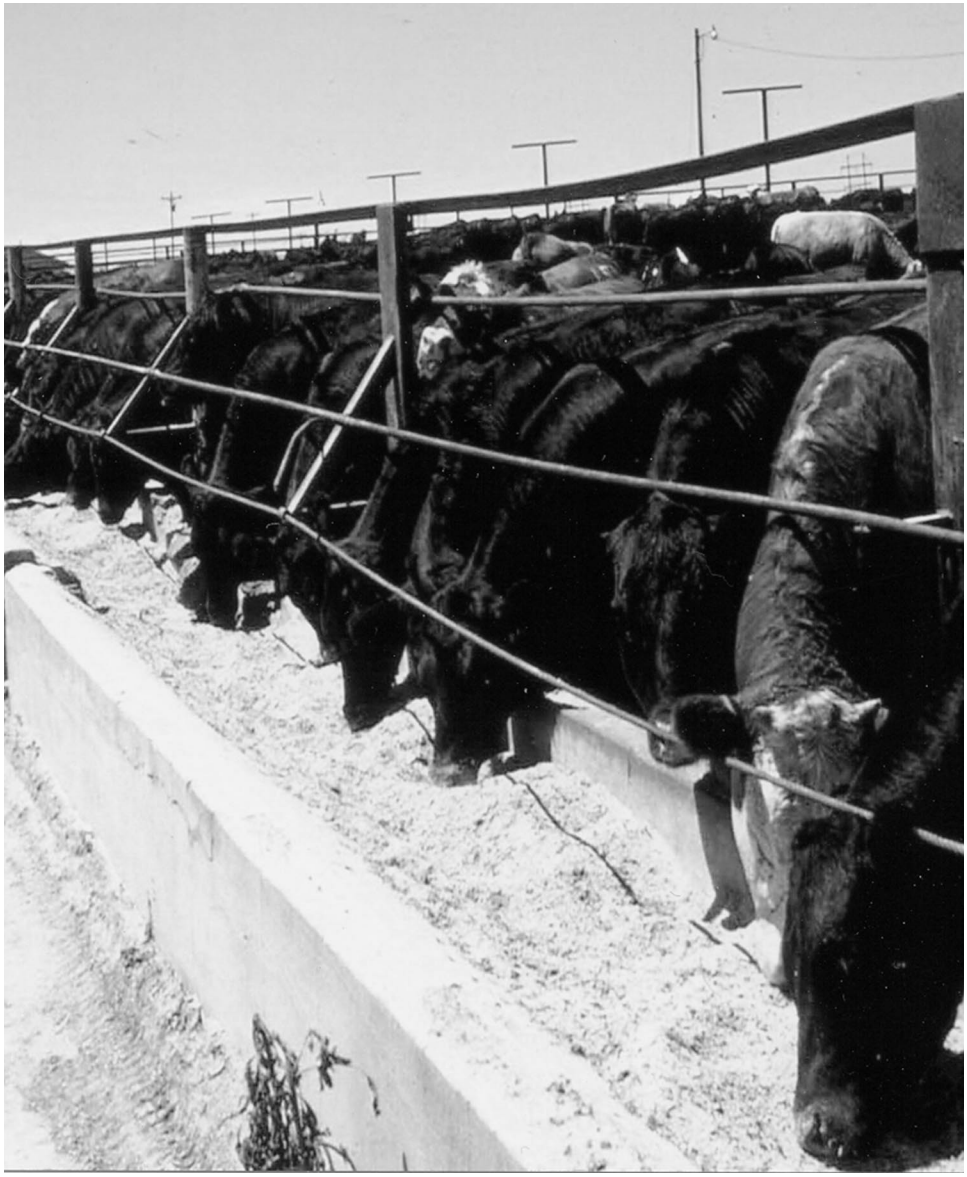
A series of demand and supply relationships links consumer preferences for beef to producers' decisions to raise cattle.[3] Circumstances at any link in the chain, such as a change in consumer preferences for beef, can affect other links and can result in changes in cattle prices and producers' incomes. Figure 2 shows how this chain of supply and demand works. For instance, consider a situation in which consumers signal an increased preference for beef through their meat counter selections and menu choices and their willingness to pay higher prices for beef. In turn, higher retail beef prices provide an incentive for retailers to supply more beef to consumers. To supply consumers with these extra products, grocers and food service providers respond by placing more orders for ready-to-consume beef products, which processors and wholesale distributors supply. To meet the greater demand, the processors place more orders for boxes of larger meat cuts to be supplied by meatpackers, which they convert into smaller cuts ready for consumption at the retail level. Increasingly, packers supply these smaller cuts, having integrated meat processing into their plants. Greater orders for beef at the wholesale level lead to upward pressure on wholesale beef prices and boxed-beef prices. To provide more beef, packers place orders for more cattle supplied by feedlots, which puts upward pressure on cattle slaughter prices.

[3]Beef by-products include hides used to make leather and also are used in a number of industrial applications in food manufacturing and pharmaceuticals.

Figure 2: Cattle Demand and Supply Relationships Linking Producers and Consumers

Feedlots specialize in feeding steers and heifers a concentrated diet of corn and other grains before the animals are slaughtered at the meatpacking plant. Typically, animals remain in feedlots until they weigh 950 to 1,250 pounds. Greater demand for these fed cattle, resulting from increased demand for beef, has a ripple effect throughout other cattle production stages. To supply more cattle to meatpackers, feedlots need more cattle from stocker or growing operations, which in many cases are integrated with cow-calf producers. Most of the calves that cow-calf producers supply for beef production are placed in these growing operations, where they take on weight while they pasture on grass and other forages. These feeder cattle are sent to feedlots when they weigh between 500 and 750 pounds (fig. 3 shows such cattle feeding at a feedlot trough). Increased demand for these feeder cattle by feedlots puts upward pressure on feeder cattle prices.

Figure 3: Cattle Eating at a Feedlot Trough



In the face of increased demand, cow-calf producers raise more calves, sometimes relying on seedstock operators, who supply more breeding stock, such as bulls. Calves are usually weaned from cows when they weigh

about 500 pounds. Figure 4 traces the movement of animals from breeding to processing and consumption. Thus, as the effects of an increase in consumer demand for beef unfold, prices, signaling this change in demand, eventually rise along the chain, depending on the strength of demand and the availability of supply, as depicted in figure 5. Figure 6 outlines the changes in retail beef, boxed beef, and slaughter prices from 1974 through 1999.

Figure 4: The Beef and Cattle Industry from Animal Breeding to Consumption

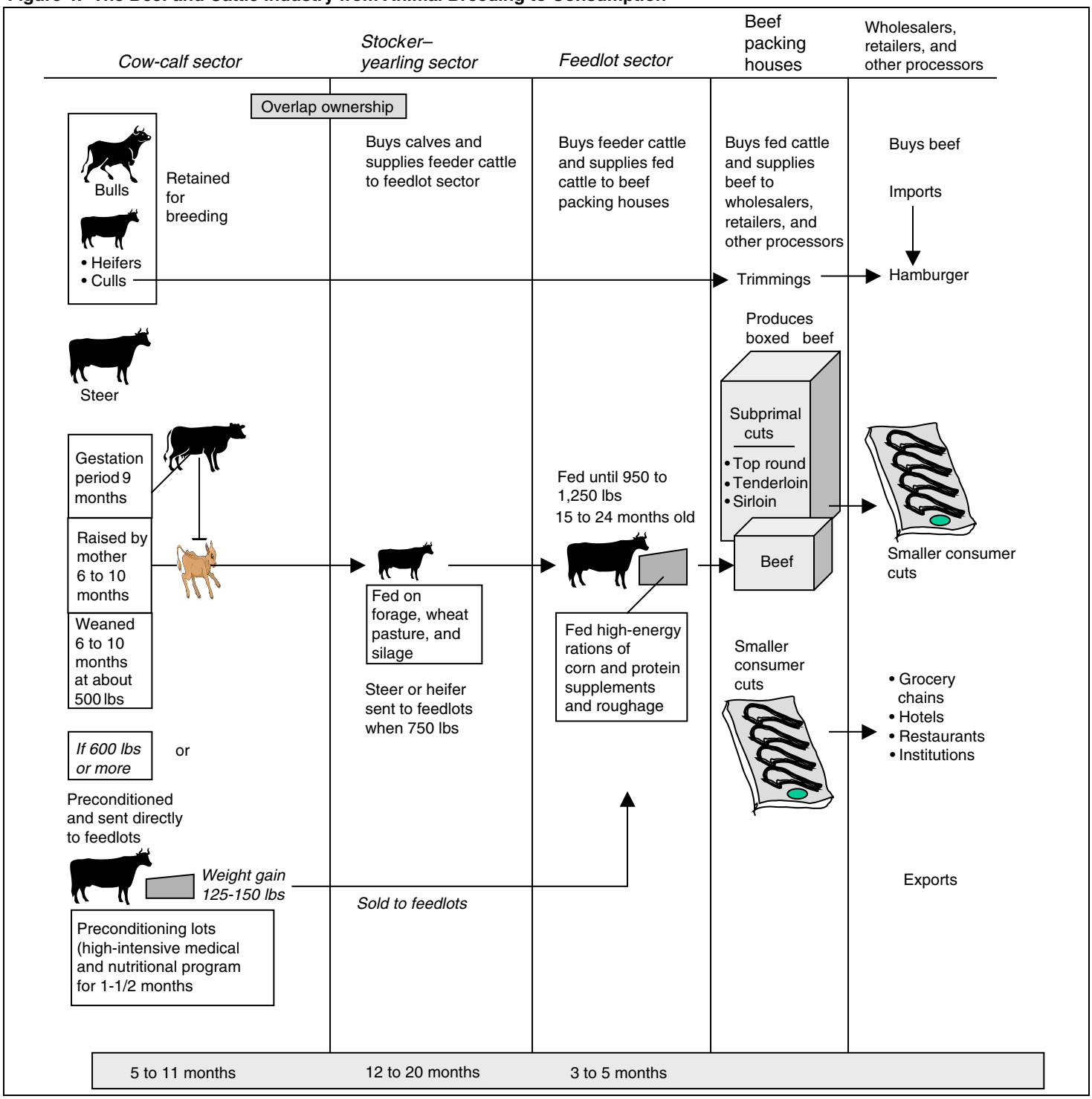
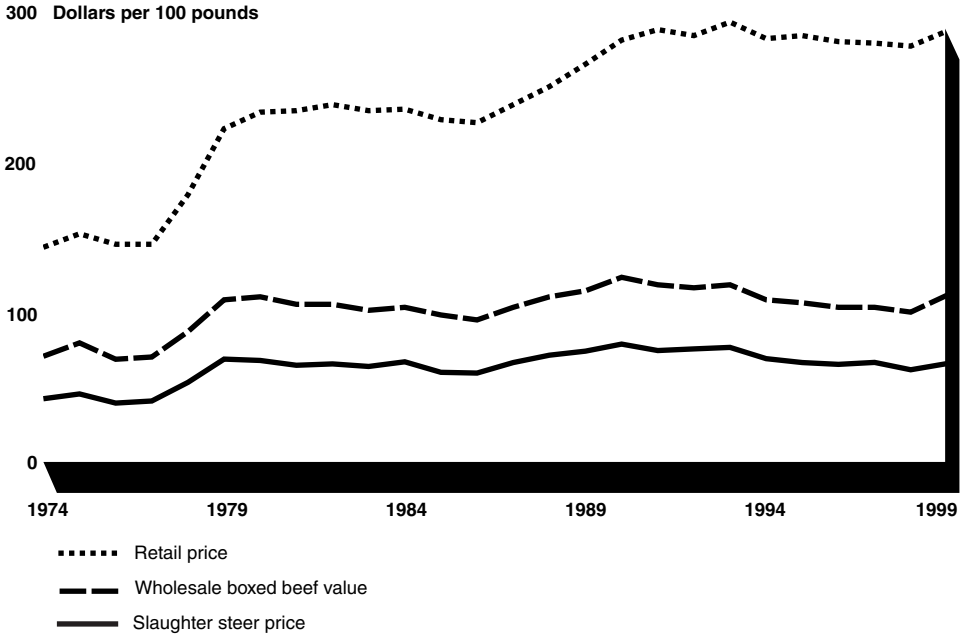


Figure 5: Prices Signal Changes Along the Demand and Supply Chain between Producers and Consumers

Figure 6: Retail Beef, Boxed Beef, and Slaughter Steer Price Movements, 1974–99



Source: USDA, Agricultural Marketing Service, ERS.

Important connections exist also between the cattle and beef industry and other sectors of the economy. Some of the closest connections are with products that compete with beef, such as poultry and pork. Other close connections are with critical inputs to the cattle and beef industry, such as feed grains. Because the cattle and beef industry is a major user of feed grains, beef production is also affected by grain supplies and prices. Feed is a major cost component in cow-calf production. In addition, foreign demand and supply of beef and cattle interact with domestic demand and supply in determining cattle prices and producers' incomes.

Structural and Technological Changes in the Cattle and Beef Industry

The demand and supply relationships connecting various segments of the cattle and beef industry are changing in a number of ways. Some of the structural changes relate to how meatpackers procure cattle. Historically, cattle were bought and sold in a spot market. Most sales occurred at terminal markets and auctions with cattle ready for delivery on sale. More recently, this activity has shifted to feedlots, where packers purchase cattle

directly from cattle owners or feedlot managers. Cattle procurement no longer relies solely on the spot market and now involves closer ties between packers and feedlots. Three procurement methods involving such closer ties are marketing agreements, forward contracts, and packer fed cattle.

In a marketing agreement, a feedlot may sell cattle to a packer according to a prearranged schedule and price. Such agreements generally involve ongoing relationships between feedlots and packers for the sale of cattle rather than a single transaction. Prices paid for cattle are often determined by a formula, which may be based on prices paid for other cattle slaughtered at the meatpacker's plant or publicly reported prices. In addition, price premiums and discounts may be paid that are based on cattle quality.

In a forward contract, the packer and seller agree on future delivery of cattle, typically using a formula based on futures prices or publicly reported prices to set the contract's base price. When the price is based on futures prices, the parties agree on a differential from futures prices, called the price basis. Premiums and discounts are applied for differences in cattle quality. Typically, feedlots and packers agree on delivery month, specific cattle to be delivered, cattle quality standards, and the price basis.

Packers also slaughter cattle that they own themselves and feed in feedlots. Packers may also share ownership of cattle with individuals or feedlots where the cattle are fed. This arrangement, called vertical integration, goes a step further, supplanting the coordinated exchange relationship between feedlots and packers that characterizes marketing agreements and forward contracts with the meatpacker's outright ownership of the cattle. Vertical integration also occurs when a single entity has ownership control of animal production, processing, and marketing beef products.

Tying cattle prices to quality is called value-based pricing. It derives from the belief that traditional cattle pricing, relying on animal weight, does not adequately relay consumer preferences for quality and attendant price signals to producers. Grade and yield pricing is frequently used, which applies price premiums and discounts to a predetermined base price according to carcass attributes. Another slight variation is grid pricing, in which a base price is determined after the transaction between buyer and seller has been negotiated. In addition, some beef packers use the wholesale value of beef to determine the price they are willing to pay for cattle.

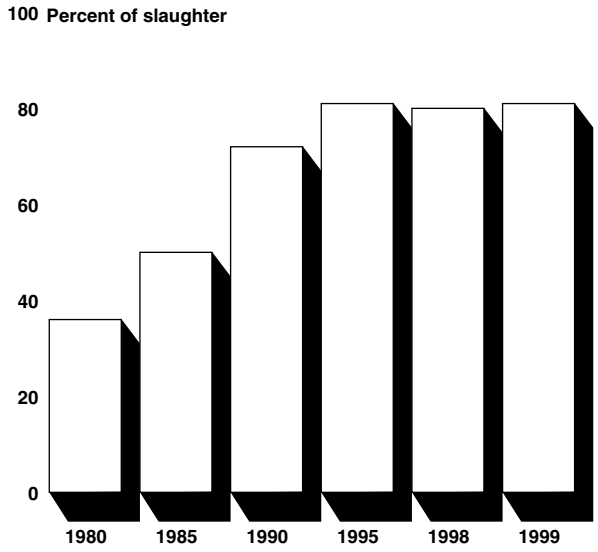
What effect vertical coordination—through marketing agreements and forward contracts, vertical integration, and value-based pricing—is having on cattle prices and producers' incomes has been debated by various industry analysts. For instance, some believe that marketing agreements and forward contracts have adversely affected prices paid for cattle bought in the spot market, while others hold that producers benefit from these arrangements. Some research suggests that rising levels of vertical coordination and integration can be traced to consolidation in the meatpacking and feedlot sectors.

Another feature of structural change in the cattle and beef industry has been the consolidation of the meatpacking sector into fewer firms operating large production facilities able to slaughter half a million or more steers and heifers per year. Large plants accounted for less than 25 percent of steer and heifer slaughter in 1980 but more than 75 percent in 1995. A recent USDA study found that economies of scale help explain this increase in consolidation and market concentration in the meatpacking sector.[4] USDA also found that large facilities are fabricating more meat products because they can do so at lower cost than meat wholesalers and retailers, the traditional carcass buyers.

Market concentration measures total sales of the largest firms in a specific market or industry. The four largest meatpacking firms accounted for 36 percent of total commercial slaughter in 1980, 72 percent in 1990, and 81 percent in 1999, as seen in figure 7, which therefore can be seen as illustrating a rise in market concentration in the meatpacking sector over that period of time. Some analysts are concerned that greater concentration has led to fewer meatpackers bidding for cattle and offering lower prices. Others hold that technological change and cost economies are the most important factors driving the meatpacking sector and that market power associated with concentration has played a relatively minor role in determining cattle prices.

[4]James M. MacDonald and others, *Consolidation in U.S. Meatpacking*, Agricultural Economic Report 785 (Washington, D.C.: USDA, ERS, 2000).

Figure 7: The Rise in Steer and Heifer Slaughter, Accounted for by the Four Largest U.S. Meatpackers, Selected Years 1980–99



Source: USDA, Grain Inspection, Packers and Stockyard Administration.

Technological changes in the cattle and beef industry, according to USDA, are becoming an underlying cause of economies of scale in meatpacking. In a development directly affecting packers, retailers, and consumers, packaging and processing technology has enabled meatpackers to move from supplying boxed beef to firms that specialize in further processing to directly supplying case-ready meats, convenience products, often seasoned and marinated, and precooked products for immediate retail sale. In contrast, in the early 1970s, meatpacking plants were typically engaged only in slaughter, sending carcasses to wholesalers and retailers for processing into retail products. Packers have also begun marketing their products electronically.

Another technological development that affects packers and producers directly is the electronic measurement of animal carcass quality, making it easier for packers to determine the grade and other characteristics of carcasses. In another development affecting producers and packers, cattle marketing has begun on the Internet. Cattle feeding through feed additives and computerized onsite feedmills and feeding operations represents yet more technological innovation.

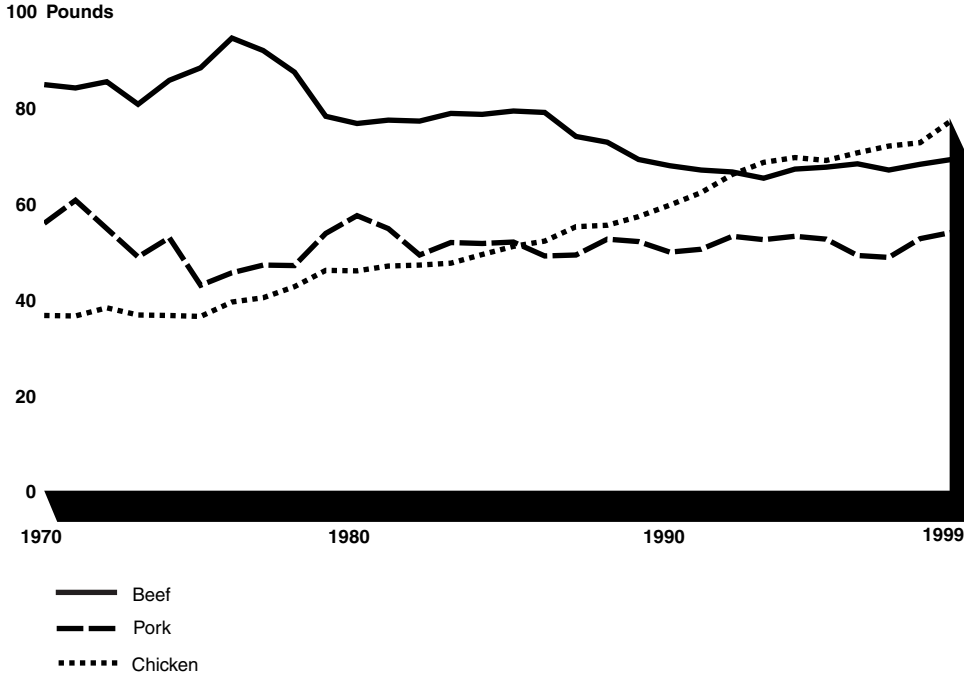
Beef's Competition from Other Meats

The consumption of beef and other meats has changed over time. A USDA study concluded that decreased demand for beef was a major reason for the larger increase in market concentration in the beef industry than in the pork industry.[5] According to USDA, decreased demand for beef was an important incentive for meatpacking firms to seek cost savings through larger plants. As shown in figure 8, per capita beef consumption began falling in the mid-1970s but leveled off in the 1990s.[6] During these two decades, per capita poultry consumption rose steadily while per capita pork consumption remained relatively stable. Meanwhile, retail beef prices were higher and remained higher than chicken and pork prices, as shown in figure 9.

[5]MacDonald, *Consolidation*.

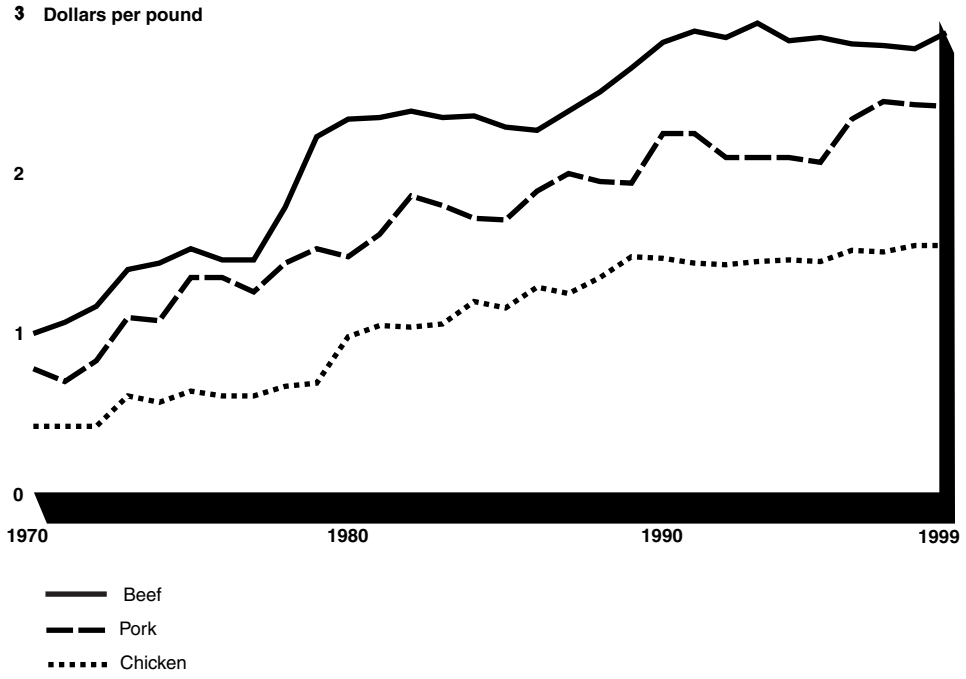
[6]Notwithstanding the decline in per capita beef consumption, total U.S. beef consumption was 15 percent higher in 1999 than in 1970, as the population increased 33 percent.

Figure 8: U.S. Per Capita Retail Beef Consumption Fell in the 1970s and 1980s and Leveled Off in the 1990s



Source: USDA, ERS.

Figure 9: U.S. Retail Beef Prices Were Higher Than Chicken and Pork Prices, 1970–99

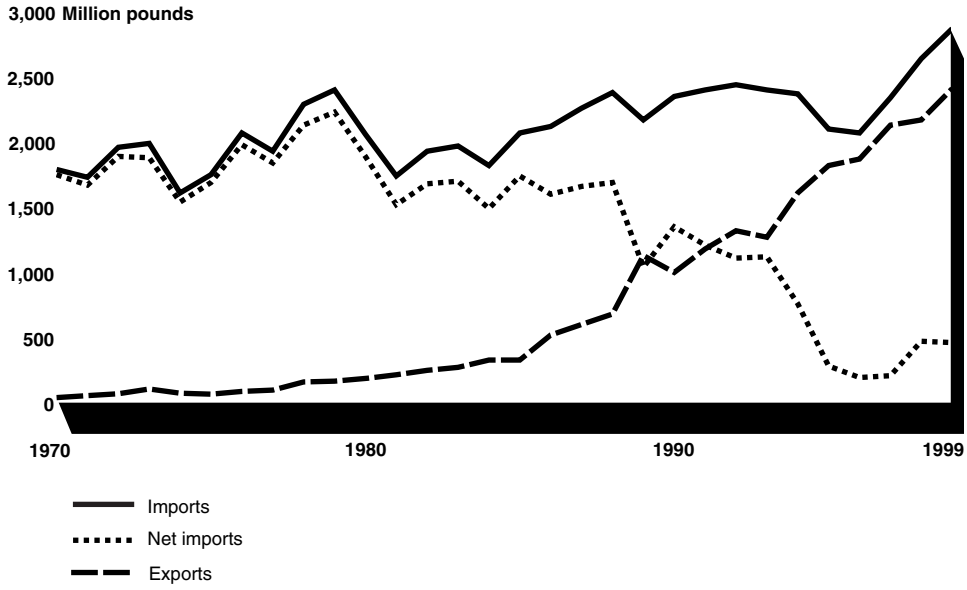


Source: USDA, ERS.

International Trade in Beef and Cattle Is Growing

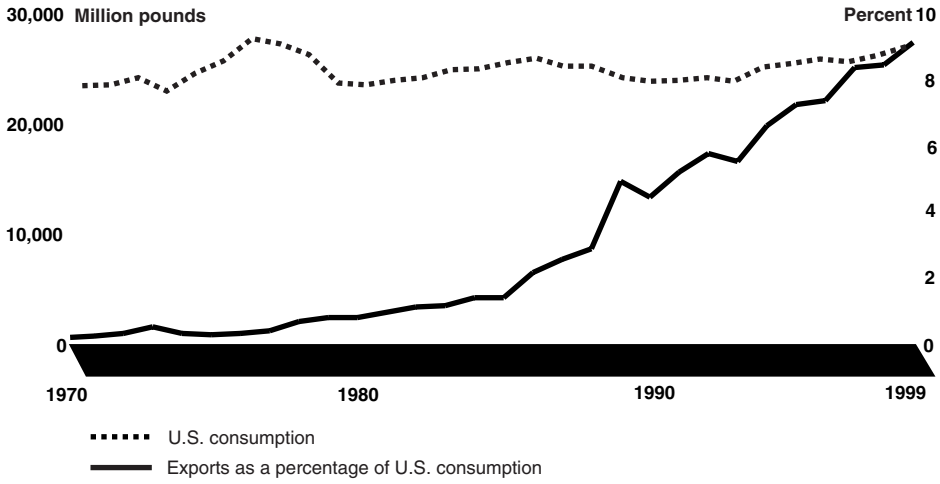
Although the United States is the largest beef producer in the world, and although its exports of beef to other nations have grown more rapidly than its imports, it is a net beef importer, as depicted in figure 10. Most beef exports from the United States are choice cuts, while most imports into the United States are used for ground beef. Beef exports rose from less than 1 percent of U.S. beef consumption in 1970 to 9 percent in 1999, seen in figure 11. Beef imports, in contrast, have ranged between 7 percent and 11 percent of U.S. commercial production since 1970, seen in figure 12.

Figure 10: U.S. Beef Exports Have Generally Risen Since 1980



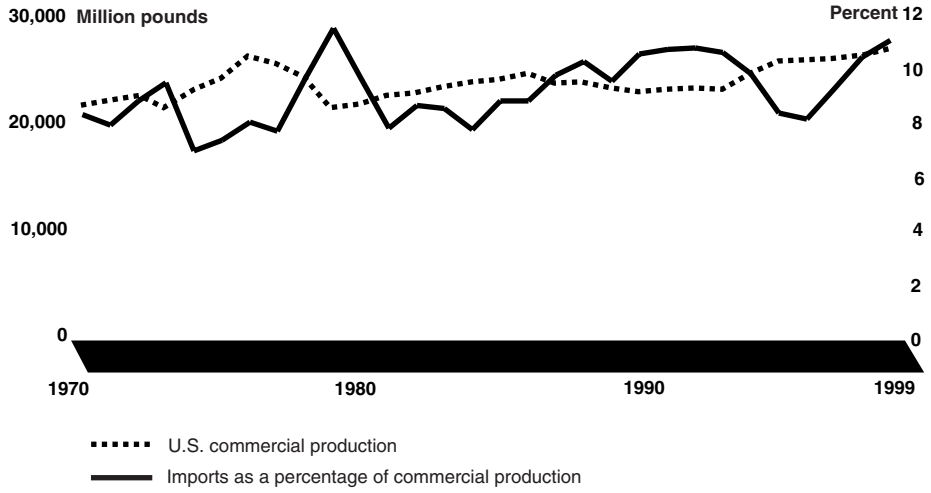
Source: USDA, ERS.

Figure 11: U.S. Beef Exports Rose as a Percentage of U.S. Consumption, 1970–99



Source: USDA, ERS.

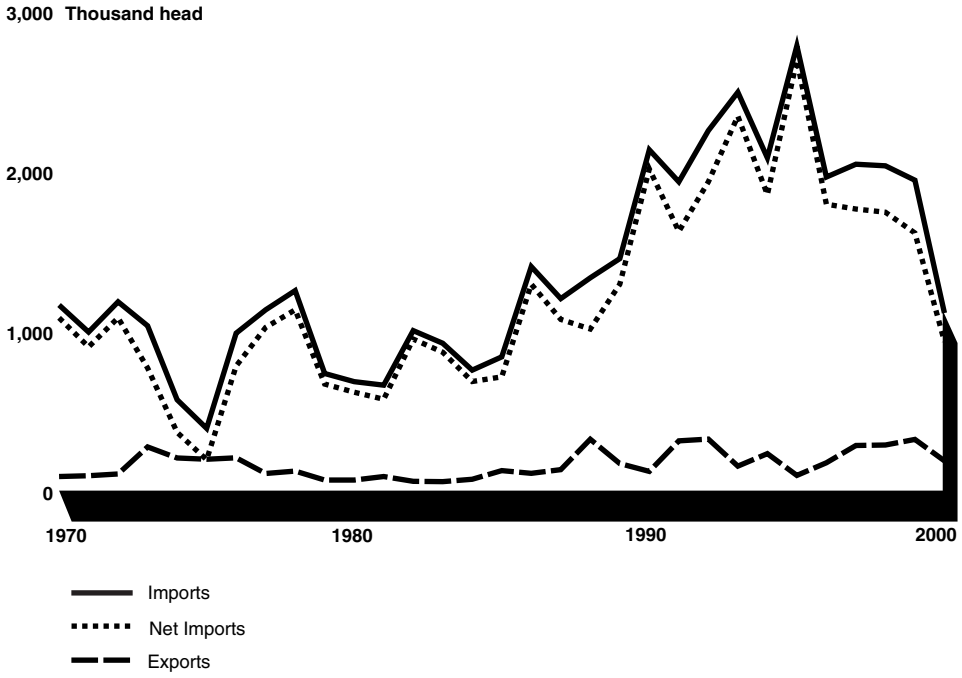
Figure 12: U.S. Beef Imports Varied as a Percentage of Commercial Production, 1970–99



Source: USDA, ERS.

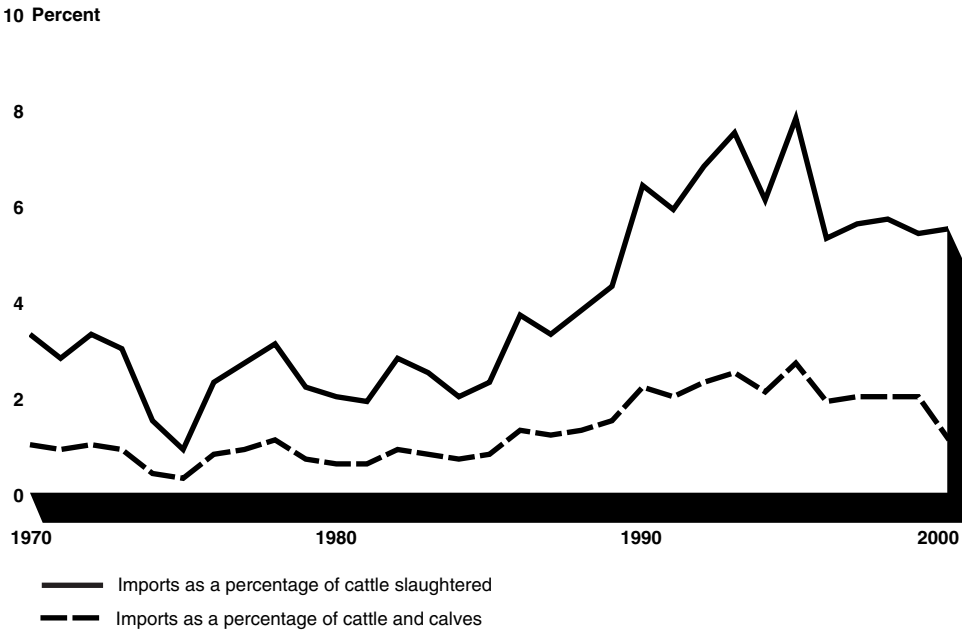
The United States imports more cattle than it exports, as seen in figure 13. The nations from which it imports cattle—Canada and Mexico—are, for all practical purposes, the same nations to which it exports cattle. Imports of cattle also made up a greater percentage of cattle slaughtered in the United States during the 1990s, as seen in figure 14.

Figure 13: U.S. Cattle Imports Exceeded Exports, 1970–2000



Source: USDA, National Agricultural Statistics Service, ERS.

Figure 14: U.S. Cattle Imports Rose as a Percentage of Slaughter, 1970–2000

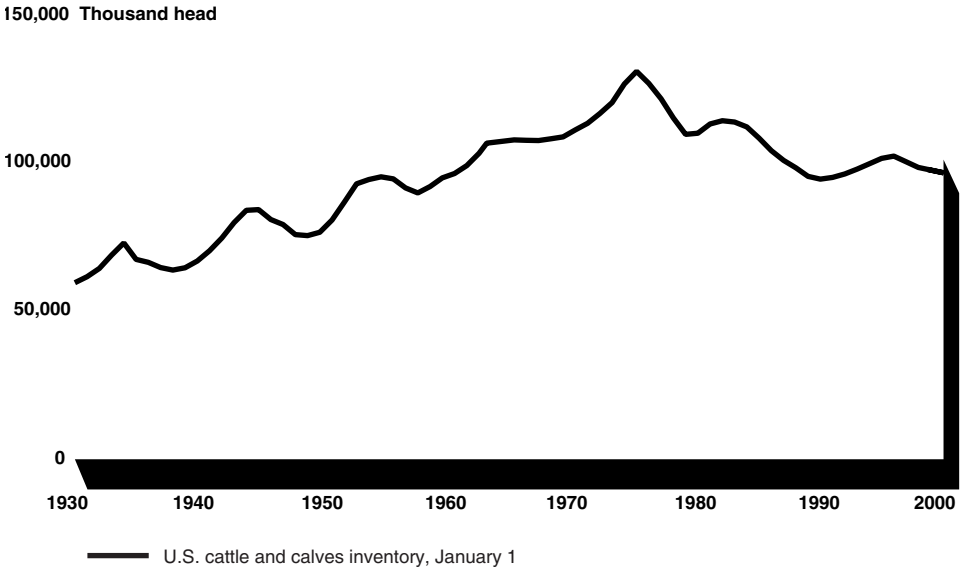


Source: USDA, National Agricultural Statistics Service, ERS.

The Cattle Cycle Is an Important Feature of Supply

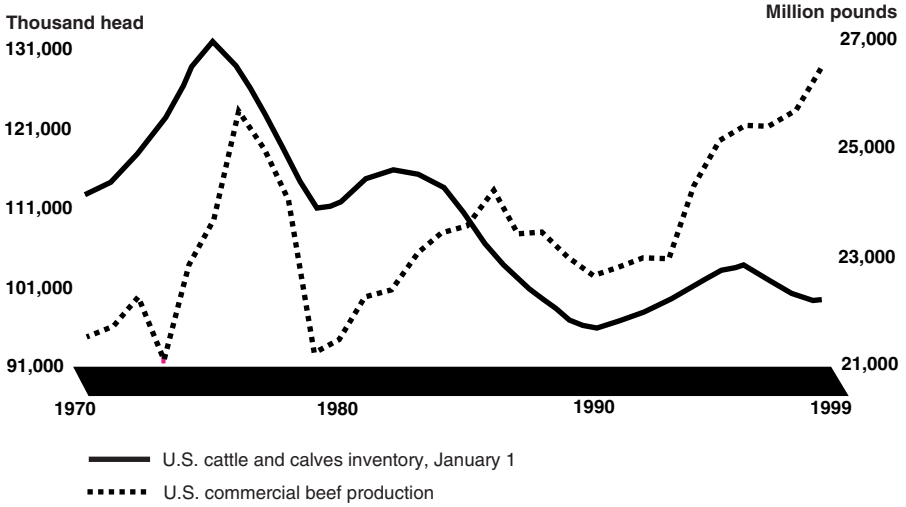
Cattle have the longest biological cycle of all meat animals. The cattle cycle (illustrated for 1930–2000 in fig. 15) refers to increases and decreases in herd size over time and is determined by expected cattle prices and the time needed to breed, birth, and raise cattle to market weight, among other things. The actions of individual producers to "time the market" by building up their herds in advance of expected cyclical peaks in cattle prices can also shape the cattle cycle. As figure 16 shows, cattle inventories have at times reached peak numbers before associated peaks in beef production, and while the number of cattle has fallen, beef production has risen. Figure 17 illustrates the cyclical movement that cattle prices have exhibited over time. They tend to move in a direction opposite to that of commercial cattle slaughter, as shown in figure 18.

Figure 15: The Cattle Cycle: Rising and Falling Cattle Inventories, 1930–2000



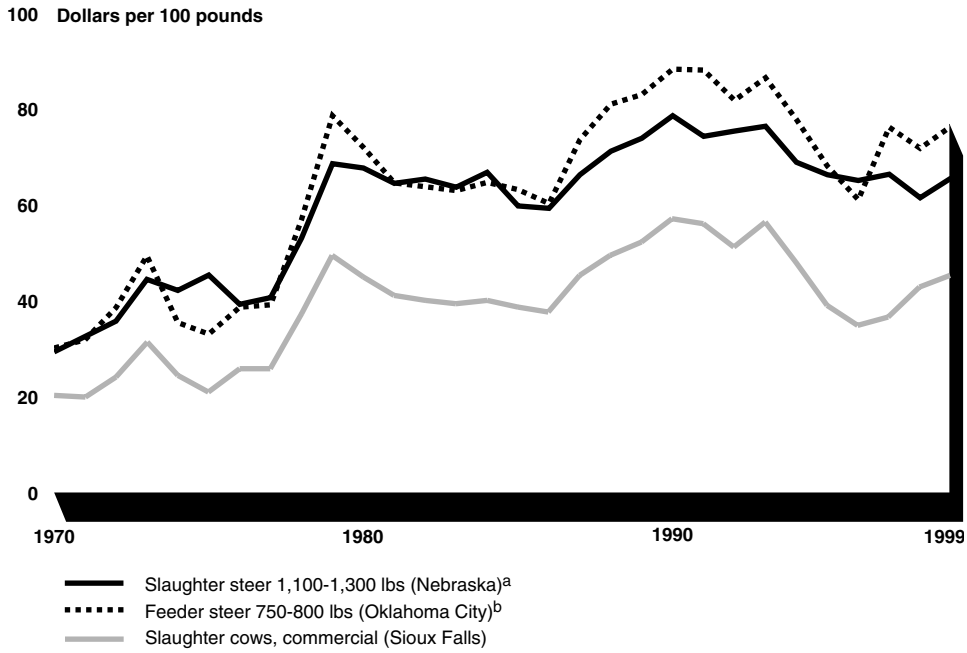
Source: USDA.

Figure 16: How Cattle Inventories Peaked Before Beef Production, 1970–99



Source: USDA, ERS.

Figure 17: The Cyclical Movement of Cattle Prices, 1970–99

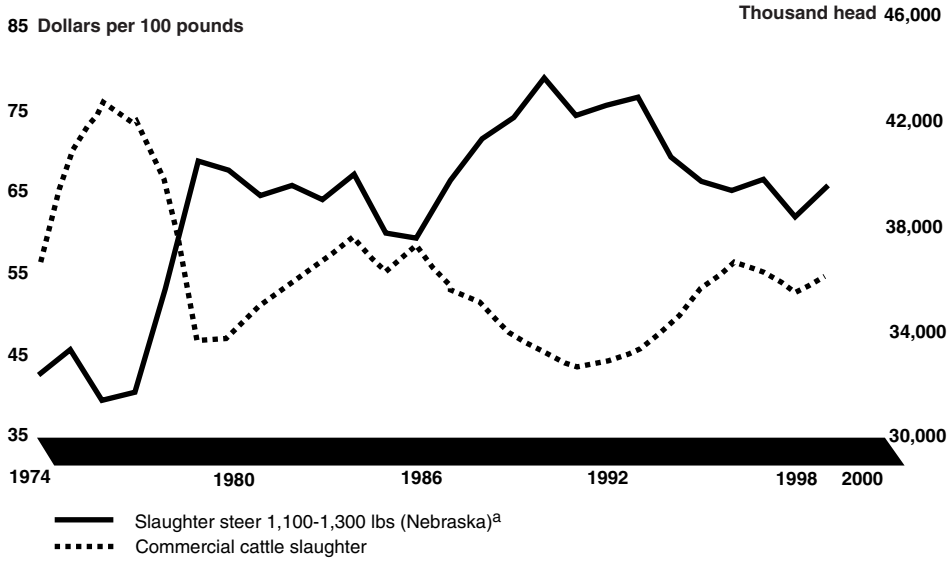


[a]The slaughter steer price indicated is for quality grades choice 2–4. Choice is one of eight quality grade designations for steers and heifers: prime, choice, select, standard, commercial, utility, cutter, and canner. Quality grades are based on an evaluation of factors related to the palatability of the lean meat. Yield grades 2–4 are three of five (1–5), of which yield grade 1 represents the highest degree of cutability, or the yield of closely trimmed retail cuts.

[b]The feeder steer price indicated is for medium number 1. For feeder steers, medium number 1 means medium frame, number 1 thickness. According to USDA: "Variations in frame size among feeder cattle primarily affect the composition of their gain in weight. The gain in weight of a larger framed feeder animal of a given degree of thickness normally will consist of more muscle and bone but less fat than a smaller framed animal. There are three frame classifications: large, medium, and small. Variations in thickness are reflected in differences in ribeye area and, therefore, relate primarily to the ultimate yield grade of the carcass that a feeder animal will produce."

Source: USDA, *U.S. Standards for Grades of Slaughter Cattle* (Washington, D.C.: USDA, AMS, Livestock and Seed Division, July 1, 1996), p. 3, and *U.S. Standards for Grades of Feeder Cattle* (Washington, D.C.: USDA, AMS, Livestock and Seed Program, October 1, 2000), pp. 1–2. See also http://www.ers.usda.gov/data/sdp/view/asp?f=livestock/94006/ (Jan. 16, 2002).

Figure 18: The Opposite Movement of Cattle Prices and Commercial Slaughter, 1974–2000



[a]The slaughter steer price indicated is for quality grade choice 2–4. Choice is one of eight quality grade designations for steers and heifers: prime, choice, select, standard, commercial, utility, cutter, and canner. The quality grades are based on an evaluation of factors related to the palatability of the lean meat. Yield grades 2–4 are three of five (1–5), of which yield grade 1 represents the highest degree of cutability or the yield of closely trimmed retail cuts.

Source: USDA, *U.S. Standards for Grades of Slaughter Cattle* (Washington, D.C.: USDA, AMS, Livestock and Seed Division, July 1, 1996), p. 3. See also http://www.ers.usda.gov/data/sdp/view/asp?f=livestock/94006/ (Jan. 16, 2002).

Modeling the Cattle and Beef Industry Can Take Different Forms

Economic modeling of the beef and cattle industry can take a variety of forms, depending on the questions asked. These questions define the purpose of a model.

The purpose of modeling the cattle and beef industry can range from wanting accurate short-term forecasts of cattle prices to seeking information on how farm policy affects cattle producers. Models can also be designed to answer questions about the effects of structural change and international trade, to name two.

Another critical issue determining the type of modeling has to do with judgments about how successful a model will be in answering relevant questions. Success depends on the availability and cost of acquiring

reliable data to estimate key supply and demand relationships in the cattle and beef industry. In some cases, it also depends on the ability to isolate cause and effect in the model—for instance, being able to pinpoint what caused the decline in per capita beef consumption. Being able to accurately define and estimate cause and effect in a model is complicated by the possibility of multiple causes and the challenge of isolating each one's effect. Limited knowledge about the processes being studied and changes in demand and supply relationships over time are important hurdles, as well. Success is also contingent on the quality of previous research.

Models can consist of a single equation representing the link between current and past values of a variable for short-term forecasting purposes to frameworks consisting of many interrelated equations. The parameters of these equations—measuring, for example, how sensitive herd expansion is to rising feed costs—may be estimated by the statistical analysis of historical data in the course of building the model. Alternatively, parameter values may be based on the results of previous research or may be calibrated to replicate the data of a chosen benchmark year. The results of previous empirical research or calibration are often relied on when data are unavailable.

Regardless of how simple or complex the modeling is, projections of key variables, such as cattle prices, typically reflect more than just running the model. An analyst's judgment concerning the plausibility and consistency of a model's results also plays an important role in deciding what projections to report. A pronounced example of this is the instance in which the modeling framework consists solely of an expert panel meeting periodically to reach consensus forecasts on variables of interest, after considering a variety of relevant information sources.

Objectives, Scope, and Methodology

Concerned that current models the government uses do not fully account for how some marketing practices and trade affect prices U.S. cattle producers receive for their livestock, Senator Daschle asked us to determine

- the extent to which economic models that USDA and ITC incorporate imports, concentration in the U.S. meatpacking industry, and marketing agreements and forward contracts in predicting domestic cattle prices;

- the most important factors affecting cattle prices and producers' incomes; and

- the most important data and modeling issues in developing a comprehensive analysis to project cattle prices and producers' incomes.

To determine the extent to which USDA's and ITC's economic models incorporate imports, market concentration, and marketing agreements and forward contracts, we obtained documentation on their relevant models. We also met with USDA and ITC officials to discuss these models. We examined the structure and specification of the models, including estimated equations, methods of estimation, estimation results, and information on data used for estimation.

To address the second and third objectives, we convened a virtual panel on the Internet of 40 agricultural experts. We asked them (1) what the most important factors affecting cattle prices and producers' incomes are and (2) what the most important data and modeling issues would be for developing a comprehensive analysis to project cattle prices and producers' incomes.

In selecting the panel, we generated a prospective list of experts, based on a literature review, referrals from USDA and ITC officials, and congressional sources. Of 48 experts we contacted, 42 agreed to participate. Forty experts completed all phases of our panel survey.

To structure and gather opinions from the expert panel, we employed a modified version of the Delphi method.[7] The Delphi method can be used in a number of settings, although when first developed at the RAND Corporation in the 1950s, it was applied in a group-discussion forum. One of the strengths of the Delphi method is its flexibility. Rather than employing face-to-face discussion, we used a version that incorporated an iterative and controlled feedback process, administering a series of three questionnaires over the Internet. We used this approach to eliminate the potential bias associated with live group discussions. The biasing effects of live discussions can include the dominance of individuals and group pressure for conformity. Moreover, by creating a virtual panel, we were

[7]Harold A. Linstone and Murray Turoff, eds., *The Delphi Method: Techniques and Applications* (Reading, Mass.: Addison-Wesley, 1975).

able to include many more experts than we could have with an actual panel. This allowed us to obtain the broadest possible range of opinion.

In the first questionnaire, in phase I, we asked the experts three open-ended questions:

- During the past few years, what were the most important factors or variables affecting (a) the prices received by domestic cattle producers and (b) producers' incomes?

- If you were to conduct a comprehensive analysis of domestic cattle prices and producers' incomes, are there other factors or variables not listed in question 1 that you would include?

- What problems or issues would you face in developing a comprehensive and reliable analysis to estimate domestic cattle prices and producers' incomes?

After they completed the first questionnaire, we analyzed their responses in order to compile a list of the most important factors affecting cattle prices and producers' incomes, as well as key problems or issues facing analysis of prices and incomes. We combined the responses to the first two questions, organizing them into four categories—(1) domestic demand for cattle, (2) domestic supply of cattle, (3) international trade, and (4) structural change. While the last two categories overlapped the first two to some degree, we broke them out to directly link our first objective regarding USDA and ITC models to the experts' responses. For the list of key problems or issues, we organized each item under either a data or a modeling issue.

In the questionnaire in the second phase, experts rated the importance of each of the factors identified during the first phase. Our analysis of the data produced a ranking of most important factors and level of agreement about each factor's importance (see app. III).

During the second phase, we also asked the experts to evaluate issues facing the development of a comprehensive analysis identified during the first phase. They identified 41 data and modeling related issues (see app. IV). We asked the experts to rate each of these data and modeling issues by answering the following questions:

- How important is it to address this problem or issue for purposes of modeling cattle prices and/or producers' incomes?

- How feasible is it to overcome or implement the solution for this problem or issue for purposes of modeling cattle prices and/or producers' incomes?

During the third phase, we presented the panel with the results of the questionnaires from phases I and II, including a summary of findings and descriptive statistics on the importance of the factors and the importance and feasibility ratings of the 41 data and modeling issues. We asked the experts to consider these results and give their opinions of why there was a greater divergence of opinion on the importance of structural change and international trade (see app. V for excerpts from their statements of opinion).

After the panel members examined the results and considered the reasons for the variance of opinion on international trade and structural change, we offered the experts the opportunity to change their original assessments. Two panelists changed their opinions on structural change, and five changed their ratings on international trade.

Regarding data and modeling issues, we asked each expert whether the federal government should take action to help overcome these issues. We asked those who believed that government action was warranted to select up to 5 issues from the 41 issues that had been identified. (The list of rank-ordered issues recommended for federal action is in app. V.)

To ensure that the wording of the initial questions was unambiguous, three panel members pretested a paper version of the first questionnaire, and we made relevant changes before we deployed the first questionnaire on the Internet. We did not pretest subsequent questionnaires because they were based on the panel's answers to preceding questionnaires. We did, however, review them before we deployed them.

Some of the panelists may have cooperative agreements or other ongoing relationships with the federal government, trade groups, individual companies, or other organizations within the agricultural industry. In addition, some panel members may want to develop such relationships in the future. Therefore, to mitigate potential conflict of interest, the panel we convened was large enough to have a wide range of experience and

views in the subject area. None of the panel members were compensated for their work on this project.

The USDA and ITC Models Were Not Designed to Answer Questions about Structural Change

USDA and ITC have several models for analyzing the cattle and beef industry. These models account for imports but do not incorporate market concentration, marketing agreements, and forward contracts because they were not designed to answer questions about these aspects of structural change. USDA's models include a variety of domestic and international supply and demand variables to project U.S. cattle prices. One is a short-term model projecting up to 18 months into the future, and the other is a long-term model projecting up to 10 years. ITC's models are used to investigate injury claims resulting from imports that sell in the United States at less than fair value or are subsidized and to conduct broad economic studies. USDA separately monitors and conducts research on how structural changes involving market concentration, marketing agreements, and forward contracts affect the cattle and beef industry.

USDA's Models Project Cattle Prices under Baseline Conditions

Each year, USDA publishes an agricultural baseline report with projections for the livestock sector, including cattle and beef.[8] Changes in market concentration, marketing agreements, and forward contracts are not explicitly considered in making these projections. The baseline projections reflect a composite of results from various economic models and judgmental analysis. The projections of the livestock industry in the baseline are estimated by using USDA's short-term and long-term livestock models. They are based on specific assumptions about the economy, agricultural policy, and international developments. They assume normal weather patterns.[9] Current baseline projections also assume the continuation of the Federal Agricultural Improvement and Reform Act of 1996.

As a result, these projections are a description of what to expect, given assumptions defining a baseline scenario. Commodity projections in the baseline are used to estimate the cost of farm programs needed to prepare the president's budget. Baseline projections are also used to determine the incremental effects of proposed changes in agricultural policy.

[8]U.S. Department of Agriculture. *USDA Agricultural Baseline Porjections to 2010*, WAOB-2001-1 (Washington, D.C. 2001).

[9]For example, the livestock model is designed to project average outcomes, so it does not project anomalous conditions such as an increase in the number of cattle brought to market because of drought conditions.

Short-Term Projections Rely on Analysts' Judgments

USDA's Interagency Commodity Estimates Committee (ICEC) for meat animals makes short-term cattle price projections. The committee uses a data set that includes beef and cattle imports and exports but does not contain information on changes in market concentration, marketing agreements, and forward contracts. The committee consists of an official from the World Agricultural Outlook Board, who serves as the chair, and other members.[10] Analysts from ERS make initial projections that the committee reviews. Consensus is reached, and final projections are included as the World Agricultural Supply and Demand Estimates forecast in USDA's agricultural baseline report.

In making initial projections, ERS starts by updating a historical database, compiling the most current information on production, prices, and trade statistics for the livestock industry. Monthly data are collected on the production of beef, veal, pork, lamb, and poultry and slaughter of steers, heifers, beef and dairy cows, broilers, hogs, and turkeys. Most data are obtained from USDA's Agricultural Marketing Service (AMS) and National Agricultural Statistics Service (NASS). ERS supplements these monthly data with the latest information from daily and weekly releases, using numerous public and private sources. This data set, combined with the latest release on cattle inventories, class breakouts, and live and wholesale and retail prices, is used to make projections.

The next step involves entering the updated data into a spreadsheet to simulate possible short-term scenarios for the livestock industry. Analysts' judgments of current trends in the industry are used to select one scenario and corresponding projections to present at the monthly ICEC meeting.

Committee members meet monthly to review ERS' initial projections; they discuss whether recent information or developments related to weather, the national and industry economic outlook, and international trade suggest a need to revise these projections. The May meeting produces quarterly and annual projections through the following year. Meetings in subsequent months review projections approved the previous month that are then revised as needed. The committee's chairperson sees his role as

[10]The four USDA agencies on the meat animals committee are the Agricultural Marketing Service, Economic Research Service, Farm Service Agency, and Foreign Agricultural Service.

helping committee members reach consensus; however, the chair has overall responsibility for approving projections and will impose a decision if consensus cannot be reached. Projections from the October meeting are used in the 10-year baseline report.

The most current available data on beef and cattle imports and exports are used in arriving at the short-term projections. However, these trade statistics are not as current as other data, being 6 weeks out of date when the Department of Commerce releases them. An ERS analyst said that to lessen the effect of this lag, it adjusts its trade forecasts by using the most recent releases and information on important trading partners and competitors, including currency rates, and changing supply conditions in other countries. Information on market concentration, marketing agreements, and forward contracts, while not part of the data set analyzed, we believe can be implicitly included in committee discussions.

Long-Term Projections Are Based on USDA's Livestock Model

ERS uses its livestock model to make annual projections of the cattle and beef industry as well as the hog and poultry industries. It includes international trade in beef and cattle in the model but not market concentration, marketing agreements, and forward contracts. These projections are included in USDA's baseline report. This model consists of equations specifying supply and demand relationships that affect the livestock sector. It was estimated initially with 1960–88 data.

Production sectors supplying beef, pork, and poultry are modeled, along with demand for them. The demand sector consists of a consumer demand component, which determines retail prices, and another component derived from consumer demand, which determines wholesale and producer prices. Feedback from demand to production takes place through the effect of producer prices on returns to cow-calf producers. Production, supply, and demand variables are determined within the system of equations making up the model, while macroeconomic, trade, and feed variables are determined outside the model. An official from USDA who helped build the model said that emphasis was placed more on modeling production than on demand. Appendix II describes the model in detail. The largest component of the livestock model deals with the cattle and beef industry, including the size and composition of the cattle herd, commercial slaughter, beef production and consumption, and retail, wholesale, and cattle prices.

For herd size and composition, the model contains equations explaining inventories of beef cows, calves, steers, heifers, and bulls. The inventory of beef cows is the main driver of the cattle and beef sector, helping determine the number of calves, steers, heifers, and slaughter. The number of animals slaughtered plus cattle imports and exports determine beef production.

Domestic beef consumption is computed by first adding beef imports and beef inventories at the beginning of the year to beef production during the year and then subtracting from this beef exports and beef inventories at the end of the year. Beef, pork, and poultry consumption help determine retail beef prices.[11] Retail beef prices are critical in explaining prices that meatpackers and cattle producers receive, which, in turn, are an important component of returns to cow-calf producers in the model. Returns to cow-calf producers help explain the number of beef cows and calves, beef cows slaughtered, and heifers added to the beef cow herd or slaughtered.

The cost of feed comes into play at several places in the model. For example, hay and corn prices help explain the number of heifers added to the beef cow herd and the number of beef cows slaughtered. Feedlot costs also explain the number of steers slaughtered and feeder steer prices. In addition, feed and other input costs are used in determining returns to cow-calf producers. Feed cost projections come from USDA's Food and Agricultural Policy Simulator (FAPSIM).[12]

[11]A number of variables measuring consumer expenditures for various goods and services are also included in the equations explaining retail prices for beef, pork, and poultry. Values for these variables are determined outside the livestock model.

[12]FAPSIM is calibrated to USDA's national baseline and includes 22 crops and livestock commodities.

Changes in market concentration, marketing agreements, and forward contracts are not explicitly included in any of these modeled relationships. International trade in beef and cattle is included, although values for these trade variables are determined outside the livestock model. Beef export and import projections are based on USDA's link system model.[13]

The Livestock Model Has Not Been Reestimated, Documented, or Validated

USDA has not reestimated the livestock model in its entirety since 1990, when it was first developed. Much of the data used in the original estimation are from the 1960s and 1970s, before rapid consolidation in the meatpacking sector and increased use of marketing agreements and forward contracts. Reestimating the model using the most current data available would better reflect structural and other changes and would reveal whether estimated values of key model parameters change and result in different projections of cattle prices.

Originally published in 1990, documentation for the livestock model contained estimation results, including standard errors for parameter estimates, T ratios, and R squares, described as "vital statistics of the model".[14] Including these statistics in model documentation is standard practice. Since the model was first estimated, some components of the model in the production and demand sectors have been modified. According to USDA officials familiar with the model, it was last modified about 1994. However, there is no documentation on how such vital statistics may have changed as a result of these modifications.

The 1990 documentation also described the validation of the livestock model, noting that individual parameter estimates were obtained for 1960–86 to test its forecasting ability during 1987–89. Validation measures such as mean percentage error and Theil's relative change U1 statistics were reported, and the authors concluded that on the basis of these results, the model forecasted reasonably well. Since then, the model has not been further validated. An assistant administrator for ERS said that validating, or back casting, the current version of the model makes sense.

[13]The link system models the world market. It consists of 46 country or sector models. FAPSIM is the U.S. model used in the link system. The link system is sometimes referred to as the country sector models.

[14]Mark R. Weimar and Richard P. Stillman, *A Long Term Forecasting Model of the Livestock and Poultry Sectors* (presented at NCR Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management, Chicago, Illinois, April 23–24, 1990), 219.

Current documentation of the livestock model includes a listing of the equations and values for estimated parameters, seen in appendix II. USDA officials said that other documentation of the livestock model, including the data set used to estimate it, along with standard measures of statistical goodness of fit and other diagnostics of the model's performance described above, were lost during a move to a new location. They also said that budgetary cuts led to a lack of resources needed to provide better documentation of the model, as well as to replace lost data. USDA officials said that lack of resources has also negatively affected the quality of documentation for FAPSIM and the link system model.

ITC's Models Lack Industry Specifics Needed to Predict Prices

ITC uses two types of models to analyze the cattle and beef industry. One type is a model to support its mandate to investigate domestic injury claims resulting from imports being subsidized or selling in the United States at less than fair value. The second type is a sector-specific model used to carry out broad economic studies, including those related to trade liberalization efforts.[15] Neither type of model is detailed enough to project cattle prices or address the effects of structural changes associated with market concentration, marketing agreements, and forward contracts in the cattle and beef industry.

When investigating domestic injury claims, ITC economists use COMPAS, a partial equilibrium model.[16] COMPAS was designed to estimate how importers' selling of a specific product below its fair price would affect price, sales, and revenue of that product in the competing domestic sector. Selling imports at less than fair value is sometimes referred to as dumping.[17] COMPAS is also used to estimate the effects of governments' subsidizing exports. To do so, COMPAS uses a standardized methodology, beginning with a supply and demand framework and assuming less than perfect substitutability between domestic and imported products.[18] Values

[15]ITC is authorized under section 332 of the Tariff Act of 1930 to conduct broad economic studies.

[16]A partial equilibrium model typically solves for prices and quantities for one sector while treating economic variables of other sectors as predetermined and unchanged.

[17]Dumping occurs when a foreign producer sells a product in the United States at a price that is lower than that producer's sales price in the country of origin ("home market") or lower than the average cost of production.

[18]This assumption is relatively standard in applied trade models.

of demand and supply parameters needed to assess the effects of dumping are often obtained from other researchers' estimates. ITC typically uses a range of estimated values for these parameters to reflect uncertainty. ITC commissioners may consider the results of this analysis in their deliberations. However, according to ITC officials, commissioners rely on the specifics of legal statutes and the record of facts collected during ITC's investigation in reaching their decisions rather than on model results in assessing injury.

ITC injury investigations involving dumping and subsidies must adhere to specific statutory criteria, procedures and time periods.[19] The process starts with an interested party filing a petition with ITC and the Department of Commerce. For both dumping and subsidies investigations, ITC must make a preliminary determination of whether there is a "reasonable indication" that an industry is materially injured or threatened with material injury by the imports in question. If ITC's determination is negative, the investigation ends. If it is affirmative, the investigation continues and Commerce makes a preliminary determination of whether there has been dumping or subsidies and, if so, a preliminary calculation of what the dumping or subsidy margin would be. Commerce continues the investigation, regardless of its preliminary findings, and makes a final determination of dumping or subsidies and a final calculation of margins. If Commerce's final determination is affirmative, ITC continues its investigation and makes a final determination of material injury or threat of material injury.

[19]In connection with proceedings to determine whether additional customs duties must be imposed on imported merchandise, ITC is required under the Tariff Act of 1930 to investigate claims of material injury due to subsidized imports or imports selling at less than fair value, which the Department of Commerce accepts for investigations. Commerce investigates the allegations of subsidization or less than fair value sales.

Recently, COMPAS was used, in response to a 1998 petition by the Ranchers–Cattlemen Action Legal Foundation and others, to investigate Canadian and Mexican cattle alleged to have been sold in the United States at less than fair value. ITC staff used a range of estimates representing supply, demand, and product substitution relationships in the U.S. cattle market. These estimates, along with data on market share, Commerce's dumping margins, transportation costs, and tariffs, were incorporated in COMPAS to analyze the likely effects of unfair pricing of cattle imports on the U.S. cattle industry. In the absence of dumping, ITC estimated U.S prices would have been between 0.2 percent and 1.8 percent higher, U.S. cattle producers' revenue would have been from 0.3 percent to 1.8 percent higher, and U.S. cattle producers' output would have been between 0 and 0.4 percent higher. The commissioners determined that the industry was not materially injured or threatened with material injury by these imports.[20]

[20]ITC issued a preliminary and final report on this investigation. International Trade Commission, *Live Cattle From Canada and Mexico*, Pub. 3155, (Washington, D.C., 1990) and *Live Cattle From Canada*, Pub. 3255, (Washington, D.C., 1999). Some of the reasons the ITC commissioners offered for this determination are related to a small (less than 4 percent) share of total U.S. cattle supplied by imports from Canada. The dumping margin determined by Commerce averaged about 6 percent.

This 1998 investigation reveals some limitations in the COMPAS model for analyzing problems in the cattle and beef industry. ITC's estimates of the effects of these imports relied on the value of the dumping margin Commerce determined and on supply and demand price elasticities (parties to the investigation are requested to provide feedback on these values and other expert sources are consulted).[21] In the absence of a dumping investigation and data on a dumping margin, COMPAS cannot be readily applied to assess the effect of an import quantity surge. Furthermore, while COMPAS can be used to estimate the effect of price changes in the cattle or beef sector, the model does not explicitly link downstream beef-sector effects to the upstream cattle sector.[22] COMPAS also does not explicitly account for changes in concentration in the meatpacking industry, marketing agreements, and forward contracts.[23]

The ITC 1998 investigation reveals other analytical issues. To account for uncertainty about the values of key parameters used in COMPAS, such as price elasticity or sensitivity of U.S. demand and supply of cattle and the extent to which imported cattle can be substituted for U.S. cattle, ITC used a fairly wide range of estimates for the parameters. In addition, while ITC was informed that imports affected some U.S. producers and regions more than others, published data at this level of detail are often unavailable, and most studies that have estimated price sensitivities used national data.

[21]The dumping margin is the percentage difference between price (or cost) in the foreign market and price sold in the U.S. market. The elasticities measure the sensitivity of quantities demanded (or supplied) to price changes.

[22]ITC staff said that this linkage could be implicitly considered by adjusting elasticities.

[23]The influence of these factors could be reflected indirectly in the estimated values of elasticities used in COMPAS, depending, among other things, on when these elasticity estimates were made.

ITC uses various models to carry out other economic studies examining the effects of broad trade policy changes, such as NAFTA. For example, ITC issued a study in 1997 on the effect of NAFTA and the Uruguay Round on U.S. trade of cattle and beef with Canada and Mexico, using an econometric model that estimated effects on trade volume, but did not estimate or predict effects on U.S. cattle prices.[24] ITC has also used computable general equilibrium (CGE) models to assess the likely effects on various sectors of the U.S. economy from major trade liberalization.[25] CGE models are generally not specific enough to predict cattle prices or to address structural changes associated with market concentration, marketing agreements, and forward contracts.

Research Is Inconclusive on How Structural Change Affects Domestic Cattle Prices

The models that USDA and ITC use do not explicitly account for the structural changes occurring in the industry from greater concentration in the meatpacking industry and greater use of marketing agreements and forward contracts. According to USDA, its current research on these structural changes is inconclusive about how they affect cattle prices paid to cattle producers.

[24]International Trade Commission, *Cattle and Beef: Impact of the NAFTA and Uruguay Round Agreements on U.S. Trade*, Pub. 3048, investigation 332-371, (Washington, D.C., 1997).

[25]An econometric analysis tests relationships among economic variables, using statistical methods. A CGE model is a simplified representation of the economy that simultaneously determines prices and quantities in all sectors without employing econometric analysis. Using a CGE model involves selecting a base year for analysis and assigning values for parameters representing demand elasticities and production technologies, among other things. Economic effects of policy changes are estimated by comparing simulated conditions before and after policy changes. ITC uses two CGE models. One, representing the U.S. economy, has 487 production sectors and combines all meat animals into one sector and all meatpacking plants into another sector. Another, representing the global economy, has 50 commodities and combines bovine cattle, sheep and goats, and horses into one sector.

USDA and others have conducted research on the effects of these structural changes on domestic cattle prices. Overall, research conducted by or for the Grain Inspection Packers and Stockyards Administration (GIPSA), a USDA agency, has not found conclusive evidence linking these changes to domestic cattle price changes.[26] For example, GIPSA reported in 1996 that the findings of an extensive literature review were inconclusive concerning the effects of concentration, primarily because of limitations in methods or data in the research reviewed.[27] This report also stated that while the body of evidence from the literature was insufficient to support a finding of noncompetitive behavior, GIPSA also could not conclude that the industry is competitive. The study recommended that future research focus more directly on data disaggregation at the firm and plant levels to provide a better understanding of the dynamics of individual firm behavior and rivalry between firms.

[26]Under the Packers and Stockyards Act, GIPSA is responsible for helping to guard against unfair and anticompetitive practices, among other things. GIPSA addresses these concerns by investigating complaints about anticompetitive activities and by analyzing data on the structure and operations of the livestock, poultry, and meatpacking industries.

[27]Grain Inspection Packers and Stockyards Administration, Packers and Stockyards Programs, *Concentration in the Red Meat Packing Industry* (Washington, D.C.: USDA, 1996).

Assessing competitiveness from available data was also difficult in an ERS study on the causes and effects of consolidation and concentration.[28] While this analysis did not support conclusions about the exercise of market power by beef packers, even though no other manufacturing industry showed as large an increase in concentration since the U.S. Bureau of the Census began regularly publishing concentration data in 1947, it also concluded that models need to be improved to more fully incorporate relevant determinants of company behavior. Difficulty in assessing the competitiveness from available data held true for another study entitled *Effects of Concentration on Prices Paid for Cattle*, contracted for by GIPSA. The study's summary states: "The analysis did not support any conclusions about the exercise of market power by beef packers. It appears that improved models are needed to more fully incorporate relevant determinants of firms' behavior".[29]

The ERS study, using data from the Census of Manufacturers for 1963–92, found that meatpackers had shifted toward larger plants that annually slaughtered at least half a million steers and heifers. The study found that scale economies were modest but extensive. The largest meatpacking plants maintained only small cost advantages (1 to 3 percent) over smaller plants, but these modest scale economies appeared to extend throughout all sizes of 1992 plants. According to ERS, if larger meatpackers realize lower costs, then concentration, by reducing industry costs, can lead to improved prices for consumers and livestock producers.[30] However, because meatpackers face fewer competitors, they could reduce prices paid to livestock producers, and they might be able to raise meat prices charged to wholesalers and retailers.

Another study, sponsored by GIPSA, examined the underlying cost relationship believed to motivate packer behavior.[31] This study used

[28]MacDonald, *Consolidation*.

[29]Grain Inspection Packers and Stockyards Administration, Packers and Stockyards Programs, *Effects of Concentration on Prices Paid for Cattle* (Washington, D.C.: USDA, 1996), 36.

[30]Economic Research Service, "Consolidation in Meatpacking: Causes & Concerns," *Agricultural Outlook*, June–July 2000.

[31]Catherine J. Morrison Paul, *Cost Economies and Market Power in U.S. Beef Packing*, Giannini Foundation Monograph 44 (Davis, Calif.: University of California–Davis, 2000).

monthly cost and revenue data for 1992–93 from a GIPSA survey of the 43 largest U.S. beef packing plants. Estimates from this study indicated significant cost economies and little if any depression of cattle prices or excess profitability in the meatpacking industry.

GIPSA has also studied the effects on cattle prices of the greater use of marketing agreements and forward contracts. Some of these studies have found an inverse or negative relationship between captive supplies, which encompass marketing agreements and forward contracts, and spot market prices, but none has yet shown that captive supplies cause low spot or cash market prices. For example, GIPSA entered into a cooperative agreement in March 1998 with economists from two universities.[32] The agreement was to conduct an econometric analysis of Texas cattle data to determine whether marketing agreements and other contracting methods for procuring cattle (captive supplies) had an adverse effect on the prices paid for cattle on the spot market.[33] The researchers said that their statistical analysis did not support the notion that reducing captive supply purchases or increasing spot market purchases would result in an increase in the spot price.

Conclusions

Cattle production is an important part of American agriculture. Industry participants rely on USDA data and modeling results when they base their future decisions on how best to plan and operate their businesses. However, the primary model USDA uses for projecting critical information that the industry needs has not been well maintained. The model has not been reestimated in its entirety and has not been validated by comparing its projections with actual results since its construction in 1989, despite significant changes in the structure of the industry. Data sets used to estimate the livestock model along with standard measures of statistical goodness of fit and other diagnostics of model performance have been lost, and USDA has no plans to replace them. Statistical goodness of fit and other diagnostics are also unavailable for USDA's link system and FAPSIM

[32]John R. Schroeter and Azzeddine Azzam, "Econometric Analysis of Fed Cattle Procurement in the Texas Panhandle," Iowa State University, Ames, Iowa, and University of Nebraska–Lincoln, Lincoln, Nebraska, 1999.

[33]GIPSA compiled extensive data on cattle procurements at four plants in the Texas panhandle from February 1995 through May 1996. Grains Inspection Packers and Stockyards Administration, *Investigation of Fed Cattle Procurement in the Texas Panhandle* (Washington, D.C.: USDA, 1999).

models, which provide key information for the livestock model. This information is critical to model evaluation, and its maintenance simply constitutes good housekeeping. This lack of transparency carries with it the risk that projections will be perceived as emanating from a black box.

Recommendations for Executive Action

To help ensure that models USDA uses to project cattle prices are properly maintained and reflect the most current information on the cattle and beef industry, we recommend that the secretary of agriculture direct ERS to periodically reestimate and validate the livestock model. To ensure that models USDA uses to project cattle prices are properly documented, we recommend that the secretary of agriculture direct ERS to provide basic documentation on these models. This would include documenting (1) the data set used to estimate the model, (2) standard measures of statistical goodness of fit and other diagnostics of model performance, and (3) any changes made to improve or otherwise update the model.

Agency Comments and Our Evaluation

See appendix VII.

Many Factors Determine Cattle Prices and Producers' Incomes

The expert panel we convened to identify the most important factors affecting cattle prices and producers' incomes listed numerous demand and supply factors, including market concentration, marketing agreements, forward contracts, and international trade. Many of the most important factors cause consumer demand for beef to move up or down, in turn pulling cattle prices and producers' revenues up or down. On the supply side, the most important factors motivate producers to contract or expand herd size, in turn pushing cattle prices up or down. The panel enumerated key input costs, which, together with producers' revenues, determine incomes. Other important demand and supply factors underscore the effects that feedlots, meatpackers, and retailers may have on cattle prices and producers' incomes. The panel also identified key international trade factors that affect cattle demand and supply. Appendix III contains a complete list of how the 40 panelists scored all factors in importance.

Cattle Demand and Supply, International Trade, and Structural Change

The factors the panel identified can be summarized under four broad, overlapping headings: domestic cattle demand, domestic cattle supply, international trade, and structural change. Structural change includes changes in market concentration and growing use of marketing agreements and forward contracts, all of which have been associated with industrialization in the agricultural sector. A characteristic of industrialization is a trend toward standardized methods of production and economies of scale, as when production costs decline as plant size increases.

The panel believed that domestic cattle demand and supply are the fundamental forces driving cattle prices and producers' incomes. Ninety-five percent or more considered that these demand and supply factors were important or most important (see fig. 19). (We had asked the panelists to rate each factor as least important, somewhat important, moderately important, important, or most important.) The panelists agreed less about the importance of international trade and structural change (fig. 20). While 31 percent of the panel designated structural change important or most important, 30 percent believed it somewhat or least important. Forty percent rated structural change moderately important. A similar result held for international trade, with 28 percent rating it important or most important and 41 percent judging it somewhat or least important.

Figure 19: Domestic Cattle Demand and Supply Are More Important Than Other Factors

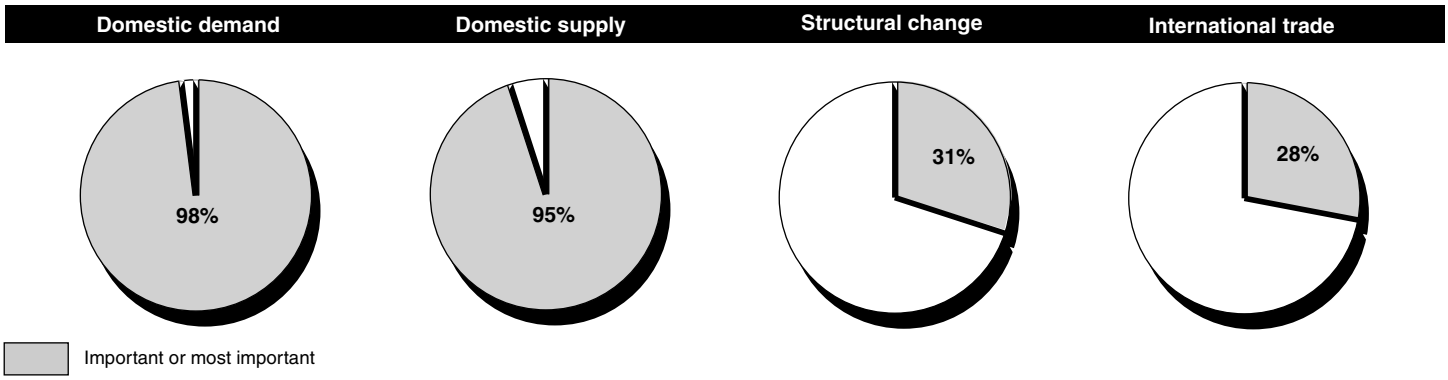
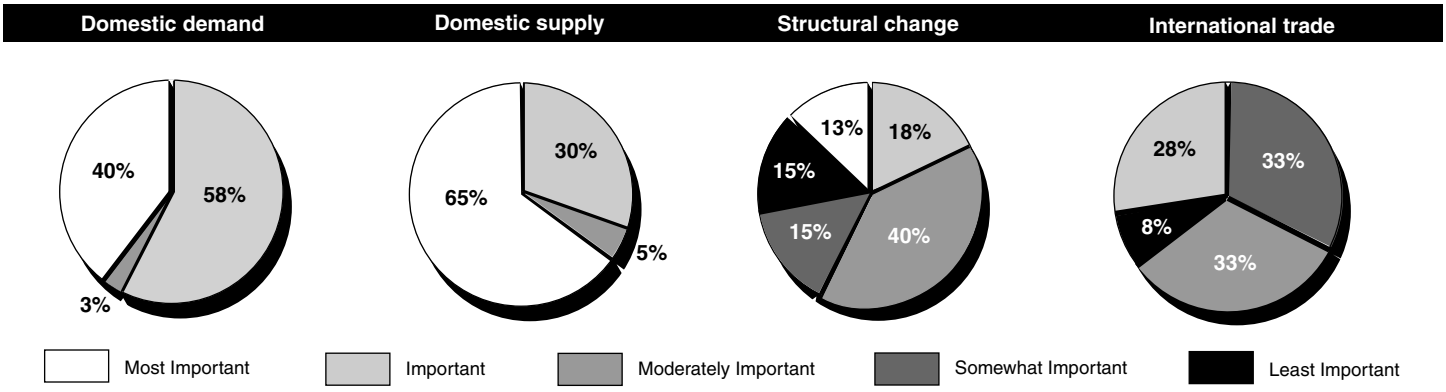


Figure 20: The Panelists' Assessment of Structural Change and International Trade Varied

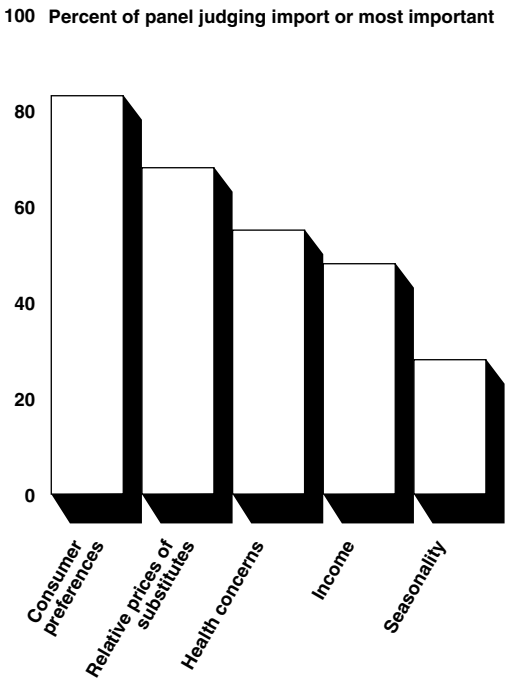


Consumer Demand for Beef Influences Demand for Cattle

The panel pointed out a number of important factors that influence consumer demand for beef, which has a cascading effect on the demand for cattle. As consumer demand for beef rises or falls, so does the demand for cattle. Changes in the demand for cattle directly affect cattle prices and cattle sales revenues, an important source of producers' income. Figure 21 shows that more than half the panel believed that consumer preferences, the prices of substitutes for beef, and health concerns tied to food safety

and diet were important or the most important determinants of cattle prices and producers' incomes as they affected consumer demand. Ninety-five percent of the panel viewed product quality and 79 percent saw product convenience as important or most important in driving consumer preferences. Poultry and pork were the most significant substitutes for beef, with nearly 80 percent of the panel rating poultry and pork prices important or most important.

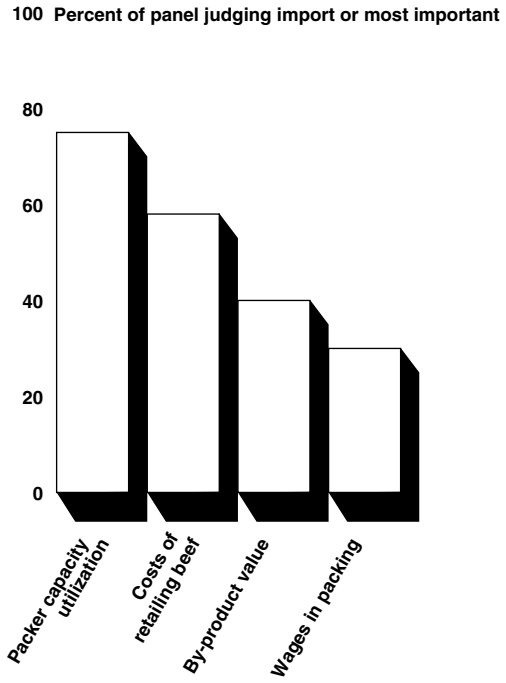
Figure 21: Consumer Preferences, Prices of Beef Substitutes, and Health Concerns Are More Important Than Other Factors Influencing Consumer Demand



The panelists also identified a number of other factors in the retail and meatpacking sectors that influence cattle prices and producers' incomes through their effect on the demand for cattle and beef. The majority of the panel believed that the degree to which meatpacking plants were being used—packer capacity utilization—and the costs of retailing beef products were important or most important through their influence on meatpackers' demand for cattle and retailers' demand for beef (see fig. 22). Forty

percent of the panel believed that by-product values, such as hides, were important or most important, while 29 percent judged that the wages meatpackers paid were important or most important.[34] We asked the panelists to judge the importance of these factors separately from any effects that related structural change, such as economies of scale, might have.

Figure 22: Capacity Use at Meatpacking Plants and Retailing Beef Costs Are More Important Than Other Factors Influencing Meatpackers' and Retailers' Demand for Cattle and Beef

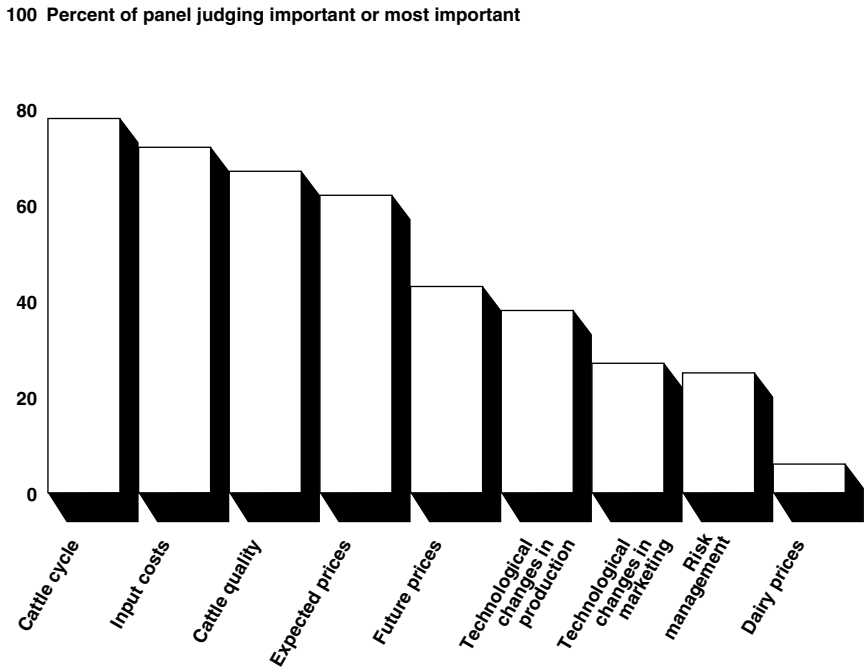


[34]Other by-products are fat and bone, blood, and meat meal. Beef by-products are used in the pharmaceutical industry and in formulating high-energy and high-protein animal feed. Fat can be classified as industrial and edible tallow, lard, yellow grease, and feed grade fat. A relatively high percentage of beef tallow is exported.

Several Considerations Shape Producers' Decisions to Supply Cattle

The panel pointed out a number of important factors that influence producers' decisions about how many cattle to supply to the market. Changes in the supply of cattle directly affect cattle prices. Figure 23 suggests that producers' decisions are set by how much it costs to produce cattle with certain quality characteristics and by the prices they expect to receive for those cattle. Producers' incomes are determined after subtracting input costs from sales revenues. Expected prices are important because the relatively long biological cycle of cattle makes it necessary for producers to make decisions about herd size months and even years before they sell animals or know their prices.

Figure 23: Supply Factors Vary in Importance



The cattle cycle, referring to increases and decreases in herd size over time, is determined by expected cattle prices and the time it takes to breed, birth, and raise cattle to market weight, among other things. The underlying risk in producers' decisions leads producers to use risk management techniques and participate in futures markets, where producers can lock in futures

prices as a hedge against the possibility of receiving prices lower than they expect.

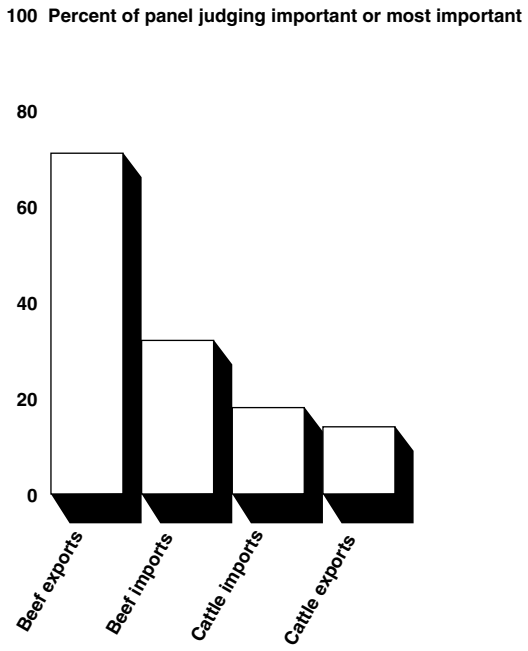
Technological changes have also been a factor. Growth hormones and new methods of measuring carcass quality are examples of production technology. Advances in computer technology have meant enhanced marketing capabilities.

The panel believed that feeding cattle was the most significant input cost, with 100 percent rating feed costs and 53 percent rating forage costs important or most important. Eighty-three percent of the panel viewed weather and 73 percent saw grain and oilseed policies as important or most important in their influence on feed costs. Eighty-one percent of the panel judged weather to be important or most important in affecting forage costs. Ninety percent of the panel judged grade and 81 percent saw yield as important or most important factors affecting cattle quality.

International Trade Affects Domestic Prices and Producers' Incomes

The panel believed that exports and imports of beef and live cattle affect domestic prices and producers' incomes. Seventy-one percent regarded beef exports as important or most important (fig. 24). These exports, representing foreign demand for U.S. beef, affect cattle demand and prices through their effect on beef prices. An increase in beef exports raises beef prices, which in turn increase the demand for cattle and raise cattle prices. Beef imports, representing the foreign supply of beef, also affect domestic demand for cattle through their effect on beef prices. For example, an increase in beef imports causes beef prices to fall, which in turn reduces the domestic demand for cattle and causes cattle prices to fall. Exports of live cattle, representing foreign demand for U.S. cattle, and imports of live cattle, representing the foreign supply of cattle to the United States, directly affect cattle prices.

Figure 24: Beef Is More Important in International Trade Than Cattle

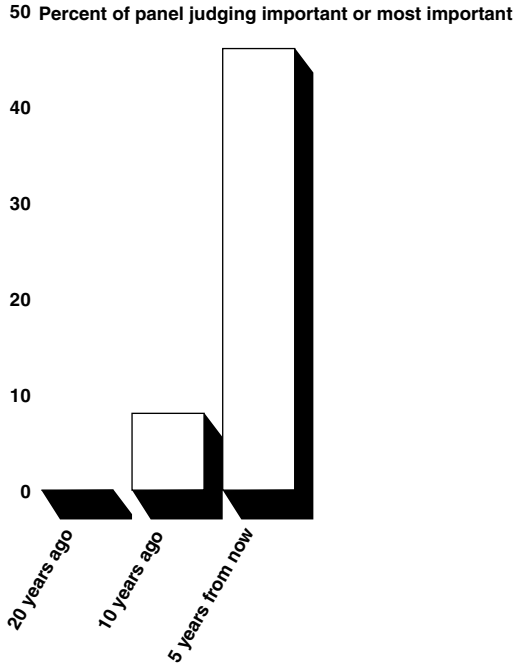


As for the components of international trade, the panelists agreed more about the importance of beef exports than about the importance of beef imports and cattle exports and imports. Seventy-one percent rated beef exports important or most important, with 8 percent voting somewhat important and none checking least important. In contrast, 32 percent believed beef imports were important or most important, while 32 percent believed they were somewhat or least important. Seventy-eight percent of the panel believed exports of live cattle were somewhat or least important, while 8 percent rated cattle exports important or most important. Forty-seven percent believed cattle imports were somewhat or least important, while 16 percent believed they were important or most important.

We also asked the panel to assess the importance of international trade 20 and 10 years ago and 5 years from now in determining cattle prices and producers' incomes. Most panelists believed that international trade was less important 20 years ago than 10 years ago and believed that it will be more important 5 years from now (fig. 25). For instance, nearly half the panel thought that international trade will be important or most important

5 years from now. In contrast, 95 percent believed that international trade was somewhat or least important 20 years ago.

Figure 25: International Trade Will Be More Important 5 Years from Now

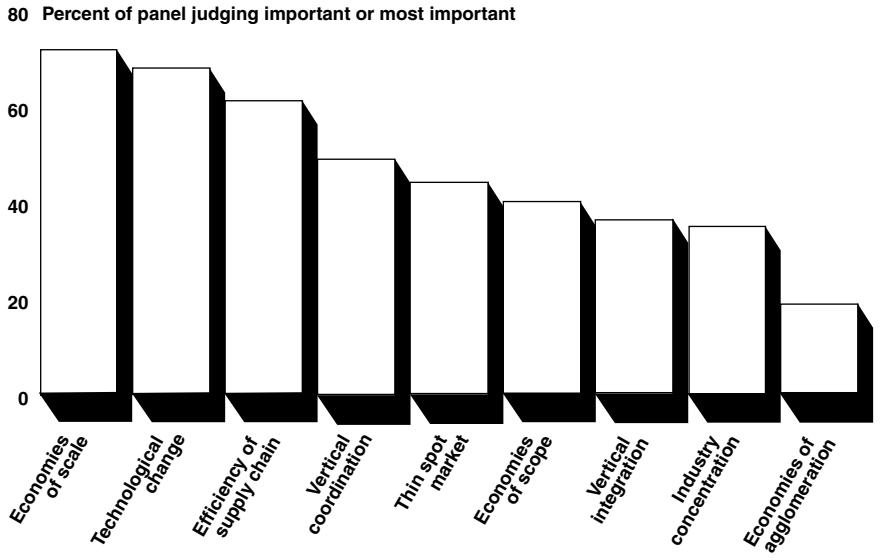


In addition, the panel pointed out several factors that influence how much U.S. beef other nations buy compared with how much foreign beef the United States buys. They thought trade barriers were the most significant factor determining the difference between beef exports and imports, with 81 percent of the panel regarding these barriers as important or most important. The majority of the panel viewed currency exchange rates, foreign income, disease, and the use of hormones as important or most important in affecting net imports of beef. The panel also thought trade barriers were the most significant determinant of trade in live cattle between the United States and other nations, with 65 percent rating it important or most important. Fifty-five percent assessed disease as important or most important in determining trade in live cattle.

Structural Change Is Relevant

The panelists identified numerous factors that may have altered the structure of the demand and supply relationships that link the prices and incomes that cattle producers receive to the actions that meatpackers, retailers, and consumers take. We have already discussed some of these factors, such as growing consumer awareness of health and food safety issues and greater emphasis on product convenience. The panelists also cited the consolidation of the meatpacking sector into fewer firms operating larger plants and vertical coordination among meatpackers, producers, and retailers. Figure 26 lists a number of factors that researchers have (1) scrutinized in recent years for their potential effect on cattle prices and producers' incomes and (2) associated with structural change; the figure shows how important the panel believed these factors are.

Figure 26: Various Aspects of Structural Change Influence Cattle Prices and Producers' Incomes



Economies of scale is the most significant factor associated with structural change in the cattle and beef industry—72 percent of the panel viewed it as important or most important. It was viewed as especially important in meatpacking, where 85 percent of the panel judged it to be important or

most important. Some researchers believe that economies of scale and other types of cost economies have been important factors driving the meatpacking sector and that market power associated with concentration has played a relatively minor role in determining cattle prices. Technological change, sometimes associated with economies of scale, is also important, especially in meatpacker production, where 76 percent of the panel viewed it as important or most important. The panel judged concentration to be more important in the meatpacking sector, where the majority thought it important or most important. The panel judged it less important in the retail and feedlot sectors.

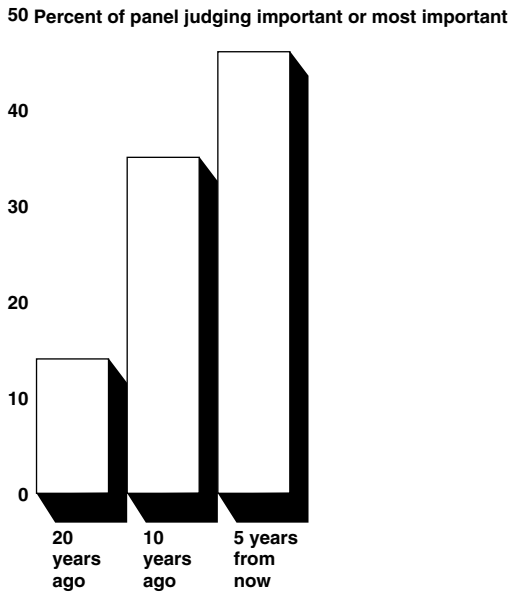
Efficiency of the supply chain—another factor sometimes associated with structural change and referring to the distribution system that moves products beyond the farm gate to the final point of consumption—is also important. Sixty percent of the panel rated it important or most important. Some believe that greater efficiency in the distribution system has an upward effect on cattle prices. Almost half the panel thought that vertical coordination, involving the use of marketing agreements and forward contracts as well as value-based marketing and pricing, was important or most important. Value-based marketing and pricing scored highest in importance among this type of coordination, with 70 percent of the panel rating it important or most important.

Debate has been considerable about what effect vertical coordination has on cattle prices. Some believe that thin spot markets for cattle result from increased vertical coordination between meatpackers and cattle producers, leading to lower spot prices for cattle and, through pricing formulas, to lower prices in marketing agreements and forward contracts. Other analysts disagree. Forty-three percent of the panel viewed thin spot markets as important or most important. Thinness in markets generally refers to a relatively small volume of market transactions and relatively high price volatility.

In assessing structural change, the panelists agreed less about the importance of industry concentration and thin spot markets than about the importance of economies of scale. While 35 percent believed that concentration was important or most important, 43 percent believed it somewhat or least important. Similarly, 43 percent believed thin spot markets were important or most important, while 38 percent labeled them somewhat or least important. In contrast, 72 percent of the panel assessed economies of scale as important or most important, 8 percent somewhat important, and none least important.

We asked the panel to assess the importance of structural change 20 years ago, 10 years ago, and 5 years from now in determining cattle prices and producers' incomes. Most panelists believed that structural change was less important 20 years ago than 10 years ago and believed that it will be more important 5 years from now (fig. 27). For instance, nearly half the panel thought that structural change will be important or most important 5 years from now. In contrast, nearly half the panel believed that structural change was somewhat or least important 20 years ago.

Figure 27: Structural Change Will Be More Important 5 Years from Now



Conclusions

The expert panel we convened identified numerous demand and supply factors that it believed to be important determinants of cattle prices and producers' incomes. The panel's findings underscore the importance of demand and supply relationships throughout the cattle and beef industry, from cow-calf producer to retail consumer. Some factors that the panel scored relatively high in importance are included in USDA's livestock model—such as feed costs and cattle inventory features of the cattle cycle—while others—such as product quality and the convenience aspects

of consumer demand and grade and yield characteristics of cattle quality—are not explicitly covered. Economies of scale, capacity utilization in meatpacking, costs of retailing beef products, and value-based marketing are some of the other factors that the panel scored relatively high in importance but that the livestock model does not specifically address. The panel also believed that international trade and structural change will become more important in the future, with implications for future modeling.

For factors not included in the livestock model, it is unclear to what extent their influence is captured indirectly. For example, in the livestock model, the retail price of beef and, therefore, cattle prices are influenced by the consumption of beef, pork, and poultry, which depends on consumer preferences. Similarly, the effects of economies of scale and market concentration may be hidden in the relationship between boxed beef prices, which represent prices meatpackers receive for their products, and cattle prices. However, because the livestock model does not explicitly account for these factors, it is not equipped to shed light on their relative importance when it attempts to explain and project cattle prices. There is no ready way to know how important these excluded factors are in the cattle price projections of the livestock model.

Recommendations for Executive Action

To improve USDA's ability to answer questions about the current and future state of the cattle and beef industry, we recommend that the secretary of agriculture direct ERS to (1) review the findings of our expert panel regarding important factors affecting cattle prices and producers' incomes and (2) prepare a plan for how to address these factors in future modeling analyses of the cattle and beef industry.

Agency Comments and Our Evaluation

See appendix VII.

Building a Comprehensive Model Depends on Resolving Modeling and Data Issues

When we asked the expert panel to identify problems in developing a comprehensive and reliable analysis for projecting the most important factors that affect cattle prices and producers' incomes, the panel mentioned many modeling and data issues. Some pointed to a web of demand and supply connections that tie producers to packers, retailers, and consumers and to gaps in how much we know about how these connections affect cattle producers. Much of what the panel pointed to deals directly or indirectly with structural change. Other panel members pointed to the need for better data for analyzing consumer demand. They cited a number of problems regarding cattle supply and prices and international trade.

An overarching issue was whether one all-encompassing model can adequately address the variety of questions that policymakers and stakeholders raise. Altogether, the panel identified 41 modeling and data issues. Appendix IV lists them all and their scores by importance and feasibility of resolution. From this list, the panel identified a number of actions it believed the government should take to advance our knowledge in this area; the actions focus primarily on the need for better data. Good data are basic to any comprehensive analysis of cattle prices and producers' incomes. In the absence of good data, the most sophisticated method of analysis is likely to produce questionable results.

Analyzing How Demand and Supply Link Producers to Consumers Is Important

The panel indicated that analyzing cattle prices and producers' incomes extends beyond the confines of cow-calf producers, stockers, and feedlots. Table 1 lists modeling and data issues emphasizing the interrelated nature of the cattle and beef industry and, with it, the role of structural change. The panel's comments suggested that policymakers, stakeholders, and others concerned about the industry now have a limited ability to analyze structural change and assess how it affects cattle prices and producers' incomes. A majority of the panel believe that the unavailability of or inaccessibility to detailed data linking information on producers, processors, and retailers is an important problem in conducting a comprehensive analysis of changes to the cattle and beef industry.

Table 1: What Detailed Analysis Requires for Adequate Cattle Price Modeling

What adequate analysis requires	What modeling now lacks[a]	What data now lack[a]
Detailed knowledge of food chain relationships	Because relationships between the levels of the food chain are changing, it is difficult to establish the driving factors and their results • Rank: 5 • Important or most important: 56% • Somewhat or least important: 18%	Disaggregated cost and revenue data linking ranchers, feeders, packers, and retailers are not available • Rank: 2 • Important or most important: 64% • Somewhat or least important: 20%
Complete understanding of the cattle cycle	Prices and producers' incomes vary significantly at different stages of the cycle, but industry restructuring has meant greater reliance on contracts and proprietary data; it has become more difficult to assess how economic incentives and incomes vary over time and space. It is not clear who benefits the most from the evolving structure and how benefits are distributed (if at all) among producers, processors, retailers, and consumers • Rank: 7 • Important or most important: 45% • Somewhat or least important: 21%	Confidential data on farmers, processors, and retailers are not accessible • Rank: 6 • Important or most important: 54% • Somewhat or least important: 26%
Detailed cost and demand data; data at the transaction and micro levels	Most models focus on isolated detail or try to do more general equilibrium analysis with assumptions too simplistic to capture what is actually happening • Rank: 14 • Important or most important: 58% • Somewhat or least important: 32%	Publicly available government data do not contain information over a given period at the transaction or micro levels • Rank: 13 • Important or most important: 51% • Somewhat or least important: 36%

[a]Rank is based on the average ratings that the panelists assigned to the importance of addressing the modeling and data issues they identified. For example, according to the panel's assessment, it is more important to address an issue with a rank of 1 than an issue with a rank of 41. Appendix IV lists the ranking of all 41 data and modeling issues the panel identified.

The U.S. Census Bureau collects data on establishments and firms for parts of the cattle and beef industry, including animal slaughtering and processing, grocery and related product wholesalers, retail food stores, and restaurants. Every 5 years, the bureau conducts a census that it supplements monthly and annually by sample surveys. For instance, the census of manufacturing, which includes animal slaughtering and processing, collects data on the value of shipments, payroll and employment by location, products shipped, the cost of materials, inventories, capital expenditures and depreciable assets, fuel and energy costs, hours worked, payroll supplements, and rental payments. Fewer data are collected from the censuses on wholesale and retail trade and food

services. In addition, the monthly and annual surveys contain less information than the 5-year census. Individual panelists' remarks suggest that these censuses do not contain sufficiently detailed information on the cattle and beef industry.

Obtaining Better Data to Analyze Consumer Demand Is Important

The panel believed that poor retail data and the difficulty of quantifying factors that influence consumer demand hinder making accurate model projections (see table 2). Given the importance that the panel gave to consumer demand for beef, including the role of consumer preferences, product convenience, and health concerns, making progress in this area could improve model projections of cattle prices and producers' incomes.

Table 2: Inadequate Retail Data and Quantification Factors Influencing Consumer Demand Pose Challenges to Modeling

Issue	Problem	Importance[a]
Lack of data	Retail and consumption data are very poor	• Rank: 3 • Important or most important: 62% • Somewhat or least important: 13%
	While consumers set retail value, quantity-weighted retail prices are lacking	• Rank: 16 • Important or most important: 36% • Somewhat or least important: 28%
	Data to quantify the impact of convenience on beef demand are lacking	• Rank: 19 • Important or most important: 50% • Somewhat or least important: 35%
Quantification	Key long-term variables such as trends in health concerns are hard to quantify conceptually, much less to get good data for	• Rank: 10 • Important or most important: 52% • Somewhat or least important: 23%
	Many factors such as consumer tastes and preferences needed for incorporating in a model are difficult to quantify	• Rank: 22 • Important or most important: 45% • Somewhat or least important: 31%

[a]Rank is based on the average ratings that the panelists assigned to the importance of addressing the modeling and data issues they identified. For example, according to the panel's assessment, it is more important to address an issue with a rank of 1 than an issue with a rank of 41. Appendix IV lists the ranking of all 41 data and modeling issues the panel identified.

Individual panelists' remarks indicate that retail data may lack consistent retail-level micro detail on prices and sales of fresh meats. Some private sources of retail data, such as Information Resources, Inc., offer data on sales and pricing, collected weekly from supermarkets across the United

States. These data, from grocery store scanners, reflect actual consumer purchases at both regular and sale prices.[35]

In addition, USDA reports retail prices for beef, but these prices reflect not actual purchases by consumers but, rather, an average of selected beef cuts offered for sale, without regard to the amount purchased. USDA first obtains average retail prices from the Bureau of Labor Statistics, which collects them to calculate the consumer price index (CPI). The bureau collects regular and sales prices from grocery stores and averages these prices, regardless of the amount purchased at each price. Then, USDA weights these prices by each cut's proportion of a cattle carcass. As a result, USDA does not report retail prices on the basis of actual consumer purchases of beef products. The lack of current-period quantity-weighted retail prices, which the panel cited, has been a problem in the pork industry, too.[36]

Aspects of Cattle Supply and Prices Are Relevant

The panel identified several issues important in modeling cattle supply related to the cattle cycle, expectations, and long-term variables dealing with technological change and policy changes in feed crops (see table 3). In addition, it cited problems with cattle prices, suggesting that vertical coordination in the form of contracts and value-based marketing is reducing how representative reported prices are (see table 4). The panel also pointed to problems with cattle price data not being adjusted for volume and grade—a cattle quality consideration we noted in chapter 3. We have discussed similar problems with hog prices.[37]

[35]U.S. General Accounting Office, *Pork Industry: USDA's Reported Prices Have Not Reflected Actual Sales*, GAO/RCED-00-26 (Washington, D.C.: Dec. 14, 1999).

[36]GAO/RCED-00-26.

[37]GAO/RCED-00-26.

Table 3: Cattle Cycle, Expectations of Profits, and Long-Term Variables Pose Challenges to Modeling

Issue	Problem	Importance[a]
Cattle cycle	Appropriate modeling of dynamics in prices	• Rank: 4 • Important or most important: 52% • Somewhat or least important: 21%
Expectations of profits	Since current supply is a function of profits producers expected to receive when they started production, analysts must use a proxy for expectations, which measures the underlying concept with error	• Rank: 9 • Important or most important: 57% • Somewhat or least important: 23%
Long-term variables	Key long-term variables, such as technical change and policy changes (e.g., in feed crops) are hard to quantify conceptually, much less to get good data for	• Rank: 10 • Important or most important: 52% • Somewhat or least important: 23%

[a]Rank is based on the average ratings that the panelists assigned to the importance of addressing the modeling and data issues they identified. For example, according to the panel's assessment, it is more important to address an issue with a rank of 1 than an issue with a rank of 15. Appendix IV lists the ranking of all 41 data and modeling issues the panel identified.

Table 4: Vertical Coordination Poses Challenges to Modeling

Issue	Problem	Importance[a]
Reported cattle prices	If the cattle prices the NASS reports no longer represent prices actually paid to producers, it is difficult to use them for meaningful analysis	• Rank: 11 • Important or most important: 51% • Somewhat or least important: 33%
Available cattle price data	Cattle price data are questionable because they are not weighted for volume, grade, and so on	• Rank: 21 • Important or most important: 41% • Somewhat or least important: 26%
Reported market prices	Reported market prices may not indicate true prices received because of extensive contracting and pricing quality grid differences	• Rank: 12 • Important or most important: 53% • Somewhat or least important: 38%

[a]Rank is based on the average ratings that the panelists assigned to the importance of addressing the modeling and data issues they identified. For example, according to the panel's assessment, it is more important to address an issue with a rank of 1 than an issue with a rank of 15. Appendix IV lists the ranking of all 41 data and modeling issues the panel identified.

In April 2001, USDA's AMS began collecting and reporting cattle and other livestock market data, including prices, under the livestock mandatory reporting (LMR) program, as required by the Livestock Mandatory Price Reporting Act of 1999. Unlike AMS's previous voluntary market news program, which relied on industry cooperation to obtain information on negotiated or cash sales, LMR is collecting data from meatpackers on purchase prices in forward contracts and other transactions using price formulas, such as those found in marketing agreements. Under the LMR program, AMS is also collecting data on the quantity of cattle purchased on a live weight and carcass basis, cattle weight, the quality grade of cattle, and price premiums or discounts.[38] These data may help in future modeling efforts.

International Trade Issues

The panel identified international trade issues, such as the difficulty of quantifying the effects of trade barriers, as a factor in modeling (see table 5). Difficulty quantifying the effects of trade barriers could be significant in light of the panel's assessment of their importance in determining beef net exports and trade in live cattle.

Table 5: Quantifying International Trade Factors Is an Issue for Modeling

Issue	Problem	Importance[a]
Trade barriers	Data to quantify liberalization are lacking	• Rank: 15 • Important or most important: 44% • Somewhat or least important: 21%
Importing countries	Data to quantify purchasing power are lacking	• Rank: 36 • Important or most important: 24% • Somewhat or least important: 59%
International effects	International effects such as from Australia, Canada, Mexico, New Zealand, and the Pacific Rim countries have not been integrated	• Rank: 23 • Important or most important: 34% • Somewhat or least important: 34%

[a]Rank is based on the average ratings that the panelists assigned to the importance of addressing the modeling and data issues they identified. For example, according to the panel's assessment, it is more

[38]Information is also being collected on boxed beef, including the price per hundredweight, the quantity in each lot of boxed beef cuts sold, information on the characteristics of each lot, such as domestic and export sales, USDA quality grade, the type of beef cut, and trim specification.

important to address an issue with a rank of 1 than an issue with a rank of 15. Appendix IV lists the ranking of all 41 data and modeling issues the panel identified.

Overarching Issues Related to Modeling Scope

Table 6 presents important questions the panelists raised about the purpose of modeling cattle prices and producers' incomes and the feasibility of developing a "one size fits all" model. This is relevant in evaluating USDA's and ITC's models because they were not designed to answer questions about the effects of market concentration, marketing agreements, and forward contracts. In addition, these models are national in scope and were not designed to analyze regional effects.

Table 6: The Relevance of a Model's Purpose and Scope

Issue	Problem	Importance[a]
The purpose of modeling	To keep misspecification as small as reasonable and to make the cattle price model most useful, its purpose should be defined before it is developed. A model whose purpose is short-term forecasting should differ markedly from a model designed to answer policy questions	• Rank: 1 • Important or most important: 84% • Somewhat or least important: 8%
One all-purpose model versus several types of models	Attempting to come up with one all-encompassing model may be problematic, because issues may differ from state to state or region to region. Separate models and perhaps more than one type of modeling and analysis may be needed	• Rank: 8 • Important or most important: 53% • Somewhat or least important: 24%

[a]Rank is based on the average ratings that the panelists assigned to the importance of addressing the modeling and data issues they identified. For example, according to the panel's assessment, it is more important to address an issue with a rank of 1 than an issue with a rank of 15. Appendix IV lists the ranking of all 41 data and modeling issues the panel identified.

The Panel's Priority Items for Government Action

Eighty-five percent of the panelists believed that government action is needed to resolve the data and modeling issues they identified as problems in developing a comprehensive and reliable analysis of cattle prices and producers' incomes. All who recommended government action pointed to the need for better data for conducting analysis. The panelists expressed concern about the availability of and access to data at all levels of the demand and supply chain that links producers to consumers. They also stressed that the quality of the data that are now being collected on the cattle and beef industry could be improved, citing the need for more representative, reliable, and consistent data. These data issues are

important because, as one panelist succinctly said: "The results of the models are only as good as the data used to estimate them." Table 7 lists the top five issues that the panelists believed warrant government action. Ninety-four percent of those who cited the need for government action selected one or more of the data issues in table 7. Appendix V presents the panelists' own descriptions of their beliefs about these issues.

Table 7: The Five Problems Most Important for Government Action in Developing a Comprehensive Analysis

		Panelists recommending government action	
Rank	**Issue**	**Number[a]**	**Percent[b]**
1	Access to data on farmers, processors, and retailers is lacking because the data are confidential	19	56%
2	Reported market prices are likely not to indicate true prices received because of extensive contracting and pricing quality grid differences	16	47
3	Disaggregated cost and revenue data linking ranchers, feeders, packers, and retailers are not available	14	41
4	Retail and consumption data are very poor	13	38
5	If the cattle prices the NASS reports no longer represent prices actually paid to producers, it is difficult to use them for meaningful analysis	10	29

[a]The total number of panelists who believed the federal government should take action was 34 of 40.

[b]Percentages are calculated based on the 34 panelists who believed that the federal government should take action.

Proprietary or confidential data, the first issue in table 7 and the one receiving the most votes for government action, is relevant to the second and fifth issues in table 7, dealing with cattle prices, because of contracting for cattle. It is an issue that the Livestock Mandatory Price Reporting Act addresses, under which USDA is required to publish data on cattle prices in a manner that protects the identity of those who report them and preserves the confidentiality of proprietary transactions.

USDA has tried to preserve confidentiality by reporting data only if at least three reporting entities supply the information and no single entity is responsible for reporting 60 percent or more of the data. According to USDA, this resulted in the withholding of nearly 30 percent of the daily swine and cattle reports from publication, because of confidentiality, between April 2 and June 14, 2001. To reduce the amount of data being withheld, USDA recently announced a new confidentiality guideline; it believes that had this guideline been in place earlier, less than 2 percent of the daily swine and cattle reports would have been withheld from publication during that period.[39]

The panelists also offered general and specific comments about how the government can help address the issues it identified in table 7. Table 8 enumerates some of these comments. Appendix V presents excerpts of all the panelists' comments.

Table 8: The Panel's Comments on Data Needs That the Government Can Address

Issue	Comment
Data access	Only the federal government can provide access to data, since most are proprietary
	To take advantage of existing but unavailable data, allow researchers to use data in-house under a confidentiality agreement, as the Census Bureau does
	The federal government can make processor data available to researchers with a protective order agreement that prohibits them from making data on firms public
	GIPSA has very good data on packers but is not readily available to outside researchers; data at other levels of the market channel are much poorer[a]
Retail price data	Volume-weighted, representative price data are needed
	It is not clear whether ERS will provide detailed prices on meat cuts for better demand analysis
	Retail prices should reflect "featuring" and "club-card" discounts, using scanning data
Cattle price data	Data representing all quality levels of cattle should be collected
	Better ways to summarize quality-adjusted fed cattle prices are needed
	Price reporting should be revised to include contracting, requiring access to private market data
	Price data and detail on the grade and quality of export shipments are not available

[39]The new confidentiality guideline requires three conditions for publication. First, at least three reporting entities need to provide data at least 50 percent of the time over the most recent 60-day time period. Second, no single reporting entity may provide more than 70 percent of the data for a report over the most recent 60-day period. Third, no single reporting entity may be the sole reporting entity for an individual report more than 20 percent of the time over the most recent 60-day period.

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Issue	Comment
Overall data	The quality and quantity of data, from farm to retail level, need to be improved; cooperative research using experts should be conducted, dividing the work according to their expertise
	The primary issue is availability of reliable, consistent data on firms and markets
	Competitive grants should be established for primary data collection
	Additional surveys should be undertaken
	Data are often too aggregate and nonspatial; better data is the key to better analysis
	The primary issue, after defining the questions, is data availability and quality. The importance of supply factors calls for detailed cost analyses to assess cost economies, with data on plants over time. The importance of consumer demand calls for tracking quality variations. Data availability should be enhanced, and studies should be encouraged or commissioned

[a]GIPSA publishes an annual statistical report on the meat packing industry based on data from meatpackers and others, dealing with packer procurement practices, changing plant size, concentration ratios, financial performance, and other matters. GIPSA also collects detailed data for investigation work, but its acccess to this data is limited to pursuing the investigation. According to one panelist, GIPSA has accumulated very good data on feedlot-packer transactions, including prices paid, types of contractual arrangements, and characteristics of the lot transacted, but this data is not accumulated routinely.

The panelists expressed a range of views about the federal government's primary role in addressing the question of what the government should do about data and modeling issues. Some panelists commented that the government should emphasize data collection, while others saw the need for more government analysis as well. Table 9 presents some of their specific comments.

Table 9: The Panel's Comments on the Government's Role in Data and Modeling Issues

Issue	Comment
Data collection versus modeling	Collecting and disseminating data would have a greater effect than modeling
	Resources should be devoted more to data collection than to data analysis
	The government's role should be collecting data
Data improvement	Improving data is the primary role the government can and should play
	Government's direct role should be limited to improving the way it generates data and the types of data it makes available to researchers
Quantification	Quantify the effect of government actions such as recalls, nutritional guidelines, the effects of the cattle cycle and supply and demand on prices, and the effect of feed grain policy on calf prices
	Provide more public data on market structure, such as Lerner indexes and local market Herfindahls[a]
Funding	The government needs to provide long-term funding for research on all issues that motivated this survey, supporting the research infrastructure at land grant universities

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Issue	Comment
Leadership in research and modeling	The government should support a team of leading academic and government experts to come together to design the modeling and implementation process
	The government should support a research focus on such issues as structural change and cattle cycle that include researchers from government and academia
	The government should stimulate research on key priorities identified in this survey, using a minigrant competition and bilateral agreements between USDA and other institutions, as well as within USDA
	Issues other than data involve setting an agenda to have a set of policy models that account for market structure across the various levels of the marketing system

[a]The Herfindahl-Hirshman index is equal to the sum of each firm's squared percentage share of the total market and is a measure of market concentration. Lerner indexes refer to the spreads between prices and the marginal costs of production in product markets and to the percentage markup of price over marginal cost. In a perfectly competitive market, price is equal to marginal cost. Applied to input markets, this concept translates to differences between the values of marginal product and the prices paid for a factor of production. In a perfectly competitive market, the value of marginal product equals the price paid for the factor of production. Lerner indexes measure market power.

Conclusions

The expert panel we convened identified numerous data and modeling issues that need to be addressed if a more comprehensive analysis of the cattle and beef industry is to be conducted. However, the panel emphasized the importance of carefully defining the questions for which answers are to be sought before an ambitious data collection and modeling effort is embarked on. The majority of the panel believed that the federal government should take steps to improve the quantity and quality of data that are available to researchers so that their understanding of the factors that explain cattle prices and producers' incomes will be better.

Recommendations for Executive Action

To improve USDA's ability—and that of the research community as a whole—to answer questions about the current and future state of the cattle and beef industry, we recommend that the secretary of agriculture direct AMS, ERS, GIPSA, and NASS to (1) review the findings of our expert panel regarding important data and modeling issues and, (2) in consultation with other government departments or agencies responsible for collecting relevant data, prepare a plan for addressing the most important data issues that the panel recommended for government action, considering the costs and benefits of such data improvements, including tradeoffs in departmental priorities and reporting burdens.

Agency Comments and Our Evaluation

See appendix VII.

Objectives, Scope, and Methodology

We were asked the following questions:

1. To what extent do the economic models that USDA and ITC use incorporate imports, market concentration in the U.S. meatpacking industry, and marketing agreements and forward contracts in predicting domestic cattle prices?

2. What are the most important factors affecting cattle prices and producers' incomes?

3. What are the most important data and modeling issues that need to be addressed in developing a comprehensive analysis to project cattle prices and producers' incomes?

To answer the first question, we obtained documentation on several models that USDA and ITC use, and we met with USDA and ITC officials to discuss these models. We examined the models' structure and specification, including estimated equations, methods of estimation, estimation results, and information on data used for estimation. We were not able to fully evaluate USDA's models because information on statistical goodness of fit and other statistical diagnostics were not available.

To address the second and third questions, we convened a virtual panel on the Internet of 40 experts selected for their knowledge of the cattle and beef industry. To help identify these experts, we reviewed the extensive literature on cattle markets and the economics of the cattle and beef industry, including studies USDA commissioned. To structure and gather expert opinion from the panel, we employed a modified version of the Delphi method.[40] The Delphi method can be employed in a number of settings, although when first developed at the RAND Corporation in the 1950s, it was applied in a group discussion forum. One of the strengths of the Delphi method is its flexibility. We used a version that incorporated an iterative and controlled feedback process rather than a committee or face-to-face discussion method of obtaining expert opinion.

[40]Linstone and Turnoff, *The Delphi Method*.

We administered a series of three questionnaires to the virtual panel over the Internet. This approach helped minimize potential biasing effects often associated with live group discussions. Biasing effects of live expert discussion sessions may include the dominance of individuals and group pressure for conformity.[41] The former bias would tend to limit the input of less dominant individuals, and the latter bias would tend to suppress true opinion, particularly on more controversial issues. Moreover, by creating a virtual panel we were able to include many more experts than we could have if we had convened a live panel. This allowed us to obtain the broadest possible range of opinion on these matters.

On the first questionnaire (phase I), we asked the experts the following two open-ended questions.

"During the past few years, what were the most important factors or variables affecting (a) the prices received by domestic cattle producers and (b) producers' incomes?

"What problems or issues would you face in developing a comprehensive and reliable analysis to estimate domestic cattle prices and producers' incomes?"

After the first questionnaire was completed, we performed a content analysis on the open-ended responses to compile a list of the most important factors, as well as the various points of view the panel held on the data and modeling issues facing analysis of prices and incomes. Applying basic principles of economics and relying on published articles, we were able to categorize the numerous factors the panelists identified as domestic cattle demand and supply, international trade, and structural change. The challenge at this stage was to organize the very large number of factors the panelists enumerated into a smaller list that was more tractable for the panelists' further analysis yet remained as consistent as possible with the basic economics of the cattle and beef industry.

During the second phase of the study, the panel evaluated and rated the importance of each of the factors it had generated during the first phase. This step was the first component of the feedback process. In the second questionnaire, also administered on the Internet, we presented the panel with the list of factors identified in the first phase, explaining that the list was produced by the experts' peers during phase I. We gave the expert panelists the opportunity to assess the importance of those factors, even if

[41]James P. Wright, "Delphi—Systematic Opinion-Gathering," *The GAO Review* (spring 1972): 20–27.

an individual expert did not mention the factor in the first round. We organized the factors into four main categories, each with subcategories. Factors were rated on importance at each category level. Analysis of the data, based on descriptive statistics, produced a relative rank-ordering of the most important factors and also indicated the level of agreement, based on the standard deviation, within the panel about the level of importance for each factor (see app. III).

During the second phase, we also asked experts to evaluate data and modeling issues in developing a comprehensive analysis the panel identified during the first phase. We presented to the expert panel a total of 41 unique data and modeling-related issues, derived from the phase I questionnaire responses (see app. IV). We asked the experts to rate each issue on two dimensions—importance and feasibility—by answering the following questions for each issue listed.

"How important is it to address this problem or issue for purposes of modeling cattle prices and/or producers' incomes?

"How feasible is it to overcome or implement the solution for this problem or issue for purposes of modeling cattle prices and/or producers' incomes?"

During the final phase of the study, we presented the panelists with the results of the two questionnaires in the form of two HTML tables embedded within a third Internet questionnaire. The results included a summary interpretation of the findings and descriptive statistics on the importance of the factors affecting cattle prices and producers' incomes, as well as the importance and feasibility ratings of the 41 data and modeling issues in developing a comprehensive analysis (the tables we presented to the panel were essentially tables 11 and 12 in apps. III and IV). The importance ratings for the factors associated with international trade and structural change were more diverse than they were for the categories of domestic demand for cattle and domestic supply of cattle. We asked the panel to consider these results and explain why there might be a relatively greater divergence of opinion on the importance of structural change and international trade. These responses are reproduced in appendix V.

After the panel members examined the results and considered the reasons for the variance of opinion on international trade and structural change factors, we offered them the opportunity to change their original assessments of the importance of these factors. Two of the 40 respondents changed their opinions slightly on structural change, and 5 changed their ratings on international trade.

The second part of the phase III questionnaire pertained to data and modeling issues in developing a comprehensive analysis. We were interested in knowing whether the panel believed the government should take any action to address any of these issues to advance our state of knowledge. We asked each panelist who believed government action was warranted to select up to 5 issues from the 41 identified that he or she would recommend the federal government take action on (the list was presented in order of the average importance rating from the responses to the phase II questionnaire). Of the 40 panelists, only 3 selected more than 5 issues (one selected 6, another selected 9, and the last of the 3 selected 19). Another 6 panelists opted not to select any issues for recommendation. We rank ordered the list of issues by the number of votes the panel offered. For the rank ordering of issues that the panel recommended for federal action, see appendix V.

Initially, 42 experts agreed to participate in the panel. Forty panelists actually completed the first questionnaire, making the response rate 95 percent for the phase I questionnaire. There was no attrition on the two subsequent phases, as all 40 experts who completed phase I also completed questionnaires for phases II and III (see table 10).

Table 10: The Number of Panelists Participating in the Study's Three Phases

Experts selected who agreed to participate	Experts responding to questionnaire		
	Phase I	Phase II	Phase III
42	40	40	40
	95%	95%	95%

We pretested a paper version of the first questionnaire with three of the panel members and made changes based on the pretests before we deployed the first questionnaire. We did not pretest the second and third questionnaires because their content was derived from respondent answers to preceding questionnaires. They were reviewed before deployment. We did conduct usability tests of all three versions of the questionnaires for the Internet to ensure operability.

USDA's Livestock Model

USDA's livestock model is a series of mathematical equations describing the cattle and beef industry as well as the pork, poultry, and turkey sectors. Annual data were used in the model's statistical estimation.

The model's largest component describes the cattle and beef industry. Within this component, several major parts deal with herd size and composition, commercial slaughter and beef production, beef consumption and demand, and prices.

The livestock model contains equations explaining inventories of beef cows, calves, steers, heifers, and bulls. The inventory of beef cows is a major factor influencing the cattle and beef industry in the model. Several key relationships illustrate how. First, the number of beef cows helps determine the number of calves. In turn, the number of calves helps determine the number of steers and heifers and how many are slaughtered. The number of beef cows is also a factor explaining how many beef cows and bulls are slaughtered. Animals slaughtered, plus cattle imports and exports, determine beef production.

Beef production is added to inventories of beef at the beginning of each year, along with beef imports, and from this sum are subtracted beef exports and inventories at the end of the year to derive beef consumption for each year. Beef consumption, along with pork, poultry, and turkey consumption and several other factors, is used to explain retail beef prices in an analytical framework called inverse demand, indicating the price at which consumers buy given quantities of beef.

Retail beef prices help determine the prices that meatpackers, feedlots, stockers, and producers receive, including boxed beef prices and prices for cow carcasses, steers, heifers, feeder steers, and cows.

Feeder steer prices and cow prices play a role in determining returns to cow-calf producers. These returns help explain the number of beef cows and calves, beef cows slaughtered, and heifers added to the beef cow herd or slaughtered.

The cost of animal feed comes into play at several places in the model. For example, hay and corn prices help explain the number of heifers added to the beef cow herd, as well as the number of beef cows slaughtered. Similarly, feedlot costs are a factor explaining the number of steers slaughtered. Feed costs for a fed steer, dependent on corn, soybean meal,

and hay prices, help explain feeder steer prices. Finally, feed costs as well as other input costs are used in determining returns to cow-calf producers.

This appendix lists the equations making up the livestock model, along with the estimated values for their parameters. No measures of statistical goodness of fit are available for this model.

The Cattle and Beef Sector

Beef Cow Inventory on Hand January 1

Changes in the number of beef cows reflect both the present and future production capacity of the cattle and beef sector. Beef cow inventory (cbcijus) is a function of previous numbers of beef cows, net returns to cow-calf producers adjusted for inflation (rrct), previous heifers kept for herd replacement (hfcbjus), and previous beef cows slaughtered (cwkgnbe). The estimated equation is

cbcijus = ca10 + ca11*lag(cbcijus) + ca12*lag2(rrct) + ca14*lag(hfcbjus) + ca15*lag(cwkgnbe)

The values for estimated coefficients are

ca10 = 457.591670

ca11 = 0.790458

ca12 = 17.758247

ca14 = 1.301077

ca15 = –0.351960

Calf Crop

Calves can be slaughtered about 1.5 to 2 years after birth, or they can be used for herd replacement. Calf crop (ccrop) is a function of beef cow inventory (cbcijus) and dairy cow inventory (cmcijus) and previous real returns to cow-calf producers (rrct). The average calving rate is around 90

percent, and previous returns measure changes at the margin in breeding decisions. The estimated equation is

ccrop = ca20 + ca21*(cbcijus + cmcijus) + ca23*lag1(rrct)

The values for estimated coefficients are

ca20 = –459.150520

ca21 = 0.909530

ca23 = 15.559700

Steers Larger Than 500 Pounds

The number of steers weighing more than 500 pounds is used to project total cattle inventory but not beef production. Steers larger than 500 pounds (stcijus) are a function of previous numbers of calves (ccrop), adjusted for how many were slaughtered as calves (cvkcnus), cattle imported (cimport), and exported (cexports). The estimated equation is

stcijus = ca30 + ca31*lag(ccrop – cvkcnus + cimport – cexports)

The values for estimated coefficients are

ca30 = 4944.79

ca31 = 0.231615

Heifers Larger Than 500 Pounds

The number of heifers weighing more than 500 pounds is also used to project total cattle inventory. Heifers larger than 500 pounds (hfcijus) are a function of previous numbers of calves (ccrop), adjusted for how many were slaughtered as calves (cvkcnus), cattle imported (cimport) and exported (cexports), a ratio of hay prices (rhayp) to corn prices (rcornp), and a time trend. The ratio of hay prices to corn prices measures pasture conditions. If forage prices rise relative to corn prices, there is pressure on the pasture.

The estimated equation is

hfcijus = ca40 + ca41*lag(ccrop – cvkcnus + cimport – cexports) +

ca42* lag(rhayp/rcornp) + ca43*t

The values for estimated coefficients are

ca40 = 11444.70

ca41 = 0.127433

ca42 = –52.518250

ca43 = 80.385386

Other Heifers Larger Than 500 Pounds

A number of heifers weighing more than 500 pounds are destined for the feedlot or slaughter, not cow replacement. They are also used in projecting total cattle inventory. Other heifers larger than 500 pounds (hfcojus) are a function of previous numbers of calves (ccrop), adjusted for how many were slaughtered as calves (cvkcnus), cattle imported (cimport) and exported (cexports), a ratio of hay prices (rhayp) to corn prices (rcornp), and real returns to cow-calf producers (rrct). The estimated equation is

hfcojus = ca50 + ca51*lag(ccrop – cvkcnus + cimport – cexports) + ca52*lag(rhayp/rcornp) + ca53*lag(rrct)

The values for estimated coefficients are

ca50 = 3700.42

ca51 = 0.027243

ca52 = 94.656956

ca53 = –7.532166

Heifers Larger Than 500 Pounds Kept for Beef Cow Replacements

The number of heifers weighing more than 500 pounds kept for beef cow replacement represent new additions to the breeding herd for beef cattle. Heifers larger than 500 pounds kept for beef cow replacements (hfcbjus) are a function of beef cow inventory (cbcijus), the ratio of previous hay prices to corn prices (rhayp/rcornp), and previous real returns to the cow-calf producer (rrct). The estimated equation is

hfcbjus = ca60 + ca61*cbcijus + ca62* lag(rhayp/rcornp) + ca63*lag(rrct)

The values for estimated coefficients are

ca60 = –787.962926

ca61 = 0.205469

ca62 = –25.668633

ca63 = 2.652821

Bulls Larger Than 500 Pounds

The number of bulls weighing more than 500 pounds is also used to project total cattle inventory. Bulls larger than 500 pounds (blcijus) are a function of the number of beef and dairy cows (cbcijus + cmcijus) and a time trend. The estimated equation is

blcijus = ca70 + ca71*(cbcijus + cmcijus) + ca72*t

The values for estimated coefficients are

ca70 = –1122.50

ca71 = 0.064177

ca72 = 14.276446

Calves Smaller Than 500 Pounds

The number of calves weighing less than 500 pounds is used to project total cattle inventory. Calves smaller than 500 pounds (cvcijus) are a function of previous numbers of calves (ccrop), adjusted for how many were slaughtered as calves (cvkcnus), cattle imported (cimport) and exported (cexports), and hay prices (rhayp). The estimated equation is

cvcijus = ca80 + ca81*lag(ccrop – cvkcnus + cimport – cexports) + ca82*lag(rhayp)

The values for estimated coefficients are

ca80 = –6199.43

ca81 = 0.562424

ca82 = 148.097736

Federally Inspected Steer Slaughter

The number of steers slaughtered under federal inspection (FI) is used in projecting beef production. When slaughter is federally inspected (FI), the resulting meat products can move between states. If not, meat products must be sold in the state where slaughter took place. The proportion of FI slaughter has been increasing and is now about 98 percent of all slaughter. FI steer slaughter (stkgnus) is a function of previous numbers of calves (ccrop), adjusted for how many were slaughtered as calves (cvkcnus), cattle imported (cimport) and exported (cexports), feedlot costs (rfedcost), and the FI slaughter ratio (firatio). The estimated equation is

stkgnus = ca90 + ca91*lag(ccrop – cvkcnus + cimport – cexports) + ca93*rfedcost + ca94*lag(ccrop – cvkcnus + cimport – cexports)* (1 – firatio)

The values for estimated coefficients are

ca90 = 4846.86

ca91 = 0.368034

ca93 = –14053.28

ca94 = –0.172560

Federally Inspected Heifer Slaughter

The number of heifers slaughtered under FI is also used in projecting beef production. FI heifer slaughter (hfkgnus) is a function of previous numbers of calves (ccrop), adjusted for how many were slaughtered as calves (cvkcnus), cattle imported (cimport) and exported (cexports), the change

in dairy cow inventory (cmcijus), real returns to cow-calf producers (rrct), and the FI slaughter ratio (firatio).

The estimated equation is

hfkgnus = ca100 + ca101*lag(ccrop – cvkcnus + cimport – cexports) + ca102*dif(cmcijus) + ca104*lag(rrct) + ca105*lag(ccrop – cvkcnus + cimport –cexports)*(1 – firatio)

The values for estimated coefficients are

ca100 = 6057.44

ca101 = 0.142822

ca102 = –1.148699

ca104 = –11.557551

ca105 = –0.795383 Federally Inspected Beef Cow Slaughter

The number of beef cows in the beef breeding herd that are slaughtered is used in projecting beef production. There are two main reasons for slaughtering beef cows—declines in productivity as the cow ages and adjustments for profitability and forage conditions. FI beef cow slaughter (cwkgnbe) is a function of the beef cow inventory (cbcijus), previous returns to the cow calf producers (rrct), the hay price to corn price ratio (rhayp/rcornp), and the FI slaughter ratio (firatio). The estimated equation is

cwkgnbe = ca130 + ca131*cbcijus + ca132*lag(rrct) + ca134*rhayp/rcornp + ca135*(cbcijus)*(1 – firatio)

The values for estimated coefficients are

ca130 = 2767.41

ca131 = 0.085020

ca132 = –9.450633

ca134 = –44.259710

ca135 = –0.359632

Federally Inspected Bull Slaughter

FI bull slaughter (blkgnus) measures the slaughter of the male component of the beef and dairy breeding herd. It is a function of beef and dairy cow herds and bulls larger than 500 pounds. The estimated equation is

blkgnus = ca140 + ca141*(cwkgnbe + cwkgnda) + ca142*blcijus

The values for estimated coefficients are

ca140 = –879.305602

ca141 = 0.044822

ca142 = 0.502197

Cattle Slaughter Weight

Cattle slaughter weight (cekcaus) is used in computing beef production and is based on the historical growth rate in slaughter weight.

For years after 2000, cekcaus = 743 + ((year2000)*2).

Before 2000, cekcaus = 707.

Commercial Beef Production

The model projects beef produced and sold commercially in the United States under federal and state inspection. Commercial beef production (bescpus) is the sum of FI steer slaughter (stkgnus), FI heifer slaughter (hfkgnus), FI beef cow slaughter (cwkgnbe), FI dairy cow slaughter (cwkgnda), and FI bull slaughter (blkgnus), multiplied by average dressed weights (cekcaus) and divided by the FI slaughter ratio (firatio). The identity is

bescpus = (cekcaus*(stkgnus + hfkgnus + cwkgnbe + cwkgnda + blkgnus)*1/firatio)/1,000

The Hog and Pork Sector

Sows Farrowing

Sows farrowing (swfalt) is a measure of the breeding herd in the hog production sector of the model. This equation is estimated as a change equation (this year minus last year)(dswfalt). The data for the dependent variable in this equation is on a July-to-June year. A July year was used to reflect the time lag in the production of pork. It takes about 6 months to finish a pig for slaughter. The variables in this equation are a dummy variable for 1975 and lagged hog net returns (rhogrec). The estimated equation is

dswfalt = hog10 + hog11*d75 + hog12*lag(rhogrec) + hog13*lag2(rhogrec)

swfalt = lag(swfalt) + dswfalt

The values for estimated coefficients are

hog10 = –700

hog11 = 656.392756

hog12 = 85.174465

hog13 = 39.336416

The Pig Crop

Pig crop (pigcalt) is an identity that is the product of sow farrowings (swfalt) and pigs per litter (pslalt). Pigs per litter is determined outside the model. The identity is

pigcalt = swfalt*pslalt

Federally Inspected Barrow and Gilt Slaughter

Barrow and gilt slaughter (bgkgnus) is the equivalent of steer and heifer slaughter in cattle and is the main source of pork production (about 95 percent). Barrow and gilt slaughter is a function of the pig crop (pigcalt), the FI slaughter ratio (firatio), and net returns to hog production (rhogrec).

Net returns to hog production reflects the ability of hog producers to retain gilts as profitability increases. The estimated equation is

bgkgnus = hog20 + hog21*pigcalt + hog24*pigcalt*(1 – (firatio)) + hog25*(rhogrec)

The values for estimated coefficients are

hog20 = 12015.42

hog21 = 0.775401

hog24 = –1.385406

hog25 = –122.936289

Federally Inspected Sow Slaughter

Sow slaughter (swkgnus) is the culling of the hog breeding herd. Sow slaughter is less than 5 percent of total hog slaughter. It is a function of sow farrowings (swfalt) and the FI slaughter ratio (firatio). The estimated equation is

swkgnus = hog30 + hog31*swfalt + hog34*swfalt*(1 – (firatio))

The values for estimated coefficients are

hog30 = –692.784442

hog31 = 0.369626

hog34 = 0.809428

Boar Slaughter

Boars (bskgnus) are the male component of the breeding herd and make up less than 1 percent of slaughtered animals. Bskgnus is a function of net returns to hog production (rhogrec). The estimated equation is

bskgnus = hog40 + hog41*rhogrec

The values for estimated coefficients are

hog40 = 808.838566

hog41 = –16.163353

Hog Slaughter Weights

Hog slaughter weights (hokcaus) are an identity:

hokcaus = 194 + 0.25*(year2000)

Commercial Pork Production

Commercial pork production (poscpus) is an identity. It is the sum of barrow and gilt (bgkgnus), sow (swkgnus), and boar slaughter (bskgnus), times slaughter weights (hokcaus), adjusted for the FI slaughter ratio (firatio). The identity is

poscpus = (hokcaus*(bgkgnus + swkgnus + bskgnus)*1/firatio)/1,000

The Chicken Sector

Broiler Hatchery Supply Flock

Broiler hatchery supply flock (chpbrhsf) is the breeding herd equivalent of beef cows and sows. It is a function of lagged hatchery supply flock (chpbrhsf) and lagged broiler net returns (rbroilnr). The estimated equation is

chpbrhsf = brf0 + brf1*lag(chpbrhsf) + brf2*lag(rbroilnr)

The values for estimated coefficients are

brf0 = 0

brf1 = 0.99

brf2 = 280.514419

Broiler Chicks Hatched

Broiler chicks hatched (chiscbr) is a measure of the number of chickens available for slaughter. It is a function of the hatchery supply flock (chpbrhsf) times the number of eggs per layer (eggaa), which is determined outside the model, net returns to broiler production (rbroilnr), and a time trend. The estimated equation is

chiscbr = brc0 + brc1*chpbrhsf* eggaa/100 + brc2*rbroilnr + brc3*t

The values for estimated coefficients are

brc0 = 190813.86

brc1 = 0.402329

brc2 = 76853.16

brc3 = 16532.47

The Average Dressed Weight of Broilers

The average dressed weight of broilers (cykdgaus) is a trend equation:

cykdgaus = brd0 + brd2*t + brd3*t*t

The values for estimated coefficients are

brd0 = 2.425356

brd2 = 0.011888

brd3 = 0.00045267

Broiler Slaughter

Broiler slaughter (chikiyo) is a function of chicks hatched (chiscbr) and a time trend. The estimated equation is

chikiyo = brs0 + brs1*chiscbr + brs2*(t)

The values for estimated coefficients are

brs0 = 20526.26

brs1 = 33181.54

brs2 = 0.756102

Broiler Production

Broiler production (chiaiyo) is an identity and is the product of broiler slaughter (chikiyo) and average dressed weight (cykdgaus). The identity is

chiaiyo = chikiyo*cykdgaus

The Turkey Sector

The turkey component of the model is a single equation. In the original model, there were equations for supply flocks and eggs hatched. However, much of these data were discontinued.

Turkey Production

Turkey production (turai) is estimated as a change equation. It is a function of lagged net returns (rturknr). The estimated equation is

dturai = tp0 + tp3*lag(rturknr)

The values for estimated coefficients are

tp0 = 0.023609

tp3 = 0.0047

The Consumption Section of the Model

Consumption is a residual, and the markets are cleared through a price-dependent demand equation. Consumption for each of the meats is production plus beginning stocks plus imports minus exports and ending stocks.

Beef Consumption

For beef consumption (bcn), the identity is

bcn = (bescpus + becitus + besmtus – beuxtus – becotus)/(popa)*0.700

where bescpus is beef production, becitus is beginning beef stocks, besmtus is beef imports, beuxtus is beef exports, becotus is ending beef stocks, and popa is population.

Pork Consumption

For pork consumption (pcn), the identity is

pcn = (poscpus + pocitus + posmtus – pouxtus – pocotus)/(popa)*0.776

where poscpus is pork production, pocitus is beginning pork stocks, posmtus is pork imports, pouxtus is pork exports, pocotus is ending pork stocks, and popa is population.

Broiler Consumption

For broiler consumption (brcn), the identity is

brcn = (chiaiyo + chiazyo + chihtyo – chimxyo – chihtyoe)/(popa*1,000)

where chiaiyo is broiler production, chiazyo is beginning broiler stocks, chihtyo is broiler imports, chimxyo is broiler exports, chihtyoe is ending broiler stocks, and popa is population.

Turkey Consumption

For turkey consumption (tucn), the identity is

tucn = (turai + turaz + turht – turmx – turhte)/(popa*1,000)

where turai is turkey production, turaz is beginning turkey stocks, turht is turkey imports, turmx is turkey exports, turhte is ending turkey stocks, and popa is population.

The Demand Section of the Model

Demand equations for beef, pork, broilers, and turkey look alike. For each meat, the percentage change in the CPI is a function of the percentage changes in beef consumption (dbcn), pork consumption (dpcn), broiler consumption (dbrcn), and turkey consumption (dtucn). It is also a function of consumer expenditures less durables (drceldpc) and consumer expenditures on nondurables less meats and energy (dqlfd), services (dqcesp), and energy (dqcengp).

Beef Demand

For beef, the estimated equation is

drcpibv = f10 + f11*dbcn + f12*dpcn + f13*dbrcn + f14*dtucn + f15*dqlfd + f16*drceldpc + f17*dqcesp + f18*dqcengp + f19*dqcedp

dbcn = (dif(bcn)/lag(bcn))

dpcn = (dif(pcn)/lag(pcn))

dbrcn = (dif(brcn)/lag(brcn))

dtucn = (dif(tucn)/lag(tucn))

The values for estimated coefficients are

f10 = –0.012032

f11 = –1.195495

f12 = (0.0056/0.01)*f21 – 0.0132750*(f16 – f26)

f13 = (0.0055/0.01)*f31 – 0.0047744*(f16 – f36)

f14 = (0.001/0.01)*f41 – 0.0015217*(f16 – f46)

f15 = (0.16501/0.0281963)*f51 – 0.16501*(f16 – f56), where f51 = –0.038531 and f56 = 1

f16 = 1

f17 = (0.462395/0.0281963)*f71 – 0.462395*(f16 – f76), where f71 = 0.00971957 and f76 = 1

f18 = (0.0353225/0.0281963)*f81 – 0.0353225*(f16 – f86), where f81 = 0.361559 and f86 = 1

f19 = (0.1379945/0.0281963)*f91 – 0.1379945*(f16 – f96), where f96 = 1

Pork Demand

For pork, the estimated equation is

drcpipo = f20 + f21*dbcn + f22*dpcn + f23*dbrcn + f24*dtucn + f25*dqlfd + f26*drceldpc + f27*dqcesp + f28*dqcengp + f29*dqcedp

dbcn = (dif(bcn)/lag(bcn))

dpcn = (dif(pcn)/lag(pcn))

dbrcn = (dif(brcn)/lag(brcn))

dtucn = (dif(tucn)/lag(tucn))

The values for estimated coefficients are

f20 = –0.019802

f21 = –0.409412

f22 = –1.088128

f23 = –0.129141

f24 = –0.025320

f25 = –0.205671

f26 = 1

f27 = (0.462395/0.0132750)*f72 – 0.462395*(f26 – f76), where f72 = 0.00645992 and f76 = 1

f28 = (0.0353225/0.0132750)*f82 – 0.0353225*(f26 – f86), where f82 = 0.230693 and f86 = 1

f29 = (0.1379945/0.0132750)*f92 – 0.1379945*(f26 – f96), where f96 = 1

Broiler Demand

For broilers, the estimated equation is

drcpibr = f30 + f31*dbcn + f32*dpcn + f33*dbrcn + f34*dtucn + f35*dqlfd + f36*drceldpc + f37*dqcesp + f38*dqcengp + f39*dqcedp

dbcn = (dif(bcn)/lag(bcn))

dpcn = (dif(pcn)/lag(pcn))

dbrcn = (dif(brcn)/lag(brcn))

dtucn = (dif(tucn)/lag(tucn))

The values for estimated coefficients are

f30 = –0.00354035

f31 = –0.947073

f32 = (0.0056/0.0055)*f23 – 0.0132750*(f36 – f26)

f33 = –1.55

f34 = (0.001/0.0056)*f43 – 0.0015217*(f36 – f46)

f35 = (0.16501/0.0047744)*f53 – 0.16501*(f36 – f56), where f53 = 0.029685 and f56 = 1

f36 = 1

f37 = (0.462395/0.0047744)*f73 – 0.462395*(f36 – f76), where f73 = –0.00027045 and f76 = 1

f38 = (0.0353225/0.0047744)*f83 – 0.0353225*(f36 – f86), where f83 = 0.043442 and f86 = 1

f39 = (0.1379945/0.0047744)*f93 – 0.1379945*(f36 – f96), where f96 = 1

Turkey Demand

For turkey, the estimated equation is

drcpitu = f40 + f41*dbcn + f42*dpcn + f43*dbrcn + f44*dtucn + f45*dqlfd + f46*drceldpc + f47*dqcesp + f48*dqcengp + f49*dqcedp

dbcn = (dif(bcn)/lag(bcn))

dpcn = (dif(pcn)/lag(pcn))

dbrcn = (dif(brcn)/lag(brcn))

dtucn = (dif(tucn)/lag(tucn))

The values for estimated coefficients are

f40 = –0.011060

f41 = –0.956750

f42 = (0.0056/0.001)*f24 – 0.0132750*(f46 – f26)

f43 = –0.443534

f44 = –0.667360

f45 = 1.604581

f46 = 1

f47 = (0.462395/0.0015217)*f74 – 0.462395*(f46 – f76), where f74 = –0.00523878 and f76 = 1

f48 = (0.0353225/0.0015217)*f84 – 0.0353225*(f46 – f86), where f84 = 0.027265 and f86 = 1

f49 = (0.1379945/0.0015217)*f94 – 0.1379945*(f46 – f96), where f96 = 1

The Price Section of the Model

Boxed Beef Price

The boxed beef price (drbxbwp) is an average of the wholesale cuts of beef and is a change equation. It is a function of the change in the CPI for beef and the percentage of steer and heifer beef production and exports of beef to total beef production.

The estimated equation is

drbxbwp = be10 + be11*(drcpibv) + be14*(dif((stkgnus*stkgaus + hfkgnus*hfkgaus + beuxtus)/bescpus)/lag((stkgnus*stkgaus + hfkgnus*hfkgaus + beuxtus)/bescpus))

The values for estimated coefficients are

be10 = 0.00388167

be11 = 1.252152

be14 = –1.177702

Cow Carcass Price

The cow carcass price (drcwp) is the wholesale price for cull breeding animals. It is also a change equation. Cow carcass price is a function of the change in the CPI for beef and the percentage change in the amount of beef production that is made up of cow beef production and imports. The estimated equation is

drcwp = be20 + be21*(drcpibv) + be24*dif(((cwkgnbe + cwkgnda)* cwkgaus + besmtus)/bescpus)/lag(((cwkgnbe + cwkgnda)* cwkgaus + besmtus)/bescpus)

The values for estimated coefficients are

be20 = 0.00615177

be21 = 1.447117

be24 = –0.396987

Steer Price

The steer price (drstpom) is a function of the change in the boxed beef price and is also a change equation. The estimated equation is

drstpom = be30 + be31*drbxbwp

The values for estimated coefficients are

be30 = –0.00167894

be31 = 0.868567

Heifer Price

The heifer price (drhfpom) is a function of the change in the boxed beef price and is also a change equation. The estimated equation is

drhfpom = be40 + be41*drbxbwp

The values for estimated coefficients are

be40 = –0.00086034

be41 = 0.826819

Cow Price

The cow price (drcwpom) is a function of the change in the cow carcass price and is a change equation. The estimated equation is

drcwpom = be50 + be51*drcwp

The values for estimated coefficients are

be50 = –0.00169167

be51 = 0.891149

Feeder Steer Price

The feeder steer price (rfstp) is a function of the steer price, feed costs for a fed steer (corn price (rcornp), soybean meal price (rsbmp), and hay price (rhayp)), and the change in the lagged calf crop. The estimated equation is

rfstp = fst10 + fst11*(rstpom/0.649) + fst12*(rcornp*(248/56) + rsbmp*(20/2000) + rhayp*(38/2000)) + fst13*(dif(lag(ccrop)))

The values for estimated coefficients are

fst10 = –11.109730

fst11 = 1.036045

fst12 = –1.599263

fst13 = –0.00212560

Barrow and Gilt Price

Barrow and gilt price (drbg7mp) is a change equation and is a function of the CPI for pork and the year-over-year change in pork production. The estimated equation is

drbg7mp = sph10 + sph11*(drcpipo) + sph12*dif(poscpus)/lag(poscpus)

The values for estimated coefficients are

sph10 = 0.010541

sph11 = 1.174368

sph12 = –1.099576

Broiler Price

The broiler price (drchip) is a change equation and is a function of the change in the broiler CPI and the change in broiler production. The estimated equation is

drchip = rbrs0 + rbrs1*(drcpibr)+ rbrs2*dif(brcn)/lag(brcn)

The values for estimated coefficients are

rbrs0 = 0.017798

rbrs1 = 1.223751

rbrs2 = –0.570622

Turkey Price

The turkey price (drerturp) is a function of the change in the retail CPI for turkey. The estimated equation is

drerturp = rertys0 + rertys1*(drcpitu)

The values for estimated coefficients are

rertys0 = 0.00277665

rertys1 = 1.155973

In the equations above for beef, pork, broiler, and turkey prices,

rcpibv = lag(rcpibv)*(1 + drcpibv)

rcpipo = lag(rcpipo)*(1 + drcpipo)

rcpibr = lag(rcpibr)*(1 + drcpibr)

rcpitu = lag(rcpitu)*(1 + drcpitu)

rbxbwp = lag(rbxbwp)*(1 + drbxbwp)

rcwp = lag(rcwp)*(1 + drcwp)

rbg7mp = lag(rbg7mp)*(1 + drbg7mp)

rerturpr = lag(rerturpr)*(1 + drerturpr)

Cost and Returns Section of the Model

Fed Cattle Returns

Fed cattle returns (fedret) are the ratio of the output price (rstpom or real steer price) to feeding costs (real corn price (rcornp), real soybean meal price (rsbmp), real hay price (rhayp), and real feeder steer price (rfstp)). The identity is

fedret = rstpom/(rcornp*(248/56) + rsbmp*(20/2000) + rhayp*(38/2000) + 0.649*rfstp)

Cattle Returns

Cattle returns (rrct) are generated by using the cost and returns survey data that ERS collects. Gross returns to the cow-calf operator are indexed by the real feeder steer price (rfstp) and the real cow price (rcwp). Costs (cattcc) are determined outside the model from cost and returns data that ERS collects. The identity is

rrct = (((77.71 + 46.27 + 61.52 + 40.30)*(rfstp*cpi/100)/64.56*
(1 + (0.01*(year1996))) + ((28.64*rcwp*cpi/100)/38.29)*
(1 + ((year1995)*0.01))) – (cattcc – (55)))/cpi*100

Hog Returns

Hog returns (rhogrec) are generated using the cost and returns survey data at ERS. Gross returns to the hog operator are indexed by the real hog (rbg7mp) price. Costs—total costs (httcc) minus economic costs (hcostf))—are determined outside the model, using ERS cost-and-returns data. The identity is

rhogrec = ((44.20*(rbg7mp*cpi/100)/44.76) – (httcc – hcostf – ((0 + (year2000)*0.5)*cpi/136)))/cpi*100

Broiler Net Returns

Broiler net returns (rbroilnr) are wholesale broiler price minus broiler costs (brtc). The identity is

rbroilnr = rchip – (brtc/cpi*100) – 1

Broiler Feed Costs

Broiler feed costs (brfeedc) are calculated by using a formula ERS developed by using survey data. The exogenous data are corn price (cornp), soybean meal price (sbmp), and a broiler feed conversion factor (brfcv). The identity is

brfeedc = ((((((cornp + 0.4*(cpi/124.0))/56*2,000)*0.70) + ((sbmp + 19.5*(cpi/124.0))*0.30)))*1.09 + (10.5*cpi/124.0))/2,000*brfcv*100)

Broiler Total Cost

Broiler total cost (brtc) is a formula based on ERS survey data. The identity is

brtc = (brfeedc/0.75 + ((8*(cpi/124.0)*0.9))/0.75 + (11.4*(cpi/124.0)*0.9))

Turkey Net Returns

Turkey net returns (rturknr) are turkey price (rerturpr) minus turkey costs (tutc). The identity is

rturknr = rerturpr – (tutc/cpi*100) + 5

Turkey Feed Costs

Turkey feed costs (brfeedc) are calculated by using a formula ERS developed by using survey data. The exogenous data are corn price (cornp), soybean meal price (sbmp), and a turkey feed conversion factor (tufcv). The identity is

tufeedc = (((cornp)/56*2000)*0.70 + ((sbmp)*0.30))/2,000*tufcv*100

Turkey Total Cost

Turkey total cost (tutc) is a formula based on ERS survey data. The identity is

tutc = (tufeedc + 8.50*cpi/118.3)/(0.80) + 43

Our Survey Phases and Methodology

In the questionnaire in phase I of our Web-based survey, we asked the panel of experts to identify the most important factors, or variables, that affected the prices that domestic cattle producers received and producers' incomes over the past few years. We compiled a list of the factors that the experts identified and we categorized them by groups. We then presented the categories to the panelists in the questionnaire in phase II of the survey. In phase II, we asked the experts to rate each factor on a five-point scale, ranging from "least important" to "most important" (we also gave the experts the option of responding "don't know/no opinion").

In preparing for the phase III questionnaire, we calculated basic descriptive statistics on the factors that the experts had rated in the phase II questionnaire. These statistics consisted of the mean (average), median, standard deviation, and frequency distribution and are presented in table 11.

Table 11: Descriptive Statistics on Factors Rated in the Phase II Questionnaire

					Rating					
(1) Factor[a]		(2) Mean	(3) Median	(4) Standard deviation	(5) Least important (%)	(6) Somewhat important (%)	(7) Moderately important (%)	(8) Important (%)	(9) Most important (%)	(10) Number of respondents
Main category										
1	Domestic demand for cattle	4.38	4	0.54	0%	0%	3%	58%	40%	40
2	Domestic supply of cattle	4.60	5	0.59	0	0	5	30	65	40
3	International trade	2.80	3	0.94	8	33	33	28	0	40
4	Structural change	2.98	3	1.21	15	15	40	18	13	40
Subcategory										
1	**Domestic demand for cattle**									
Consumer demand items										
1.1	Income	3.38	3	0.93	0	20	33	38	10	40
1.2	Relative prices of substitutes	3.90	4	0.98	0	10	23	35	33	40
	a. Poultry	4.10	4	0.97	0	10	10	38	41	39
	b. Pork	4.05	4	0.83	0	5	15	49	31	39
	c. Seafood	2.00	2	0.89	31	46	15	8	0	39
	d. Lamb	1.64	1	0.81	54	31	13	3	0	39
	e. Plant protein source	1.45	1	0.69	66	24	11	0	0	38

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(1) Factor[a]		(2) Mean	(3) Median	(4) Standard deviation	(5) Least important (%)	(6) Somewhat important (%)	(7) Moderately important (%)	(8) Important (%)	(9) Most important (%)	(10) Number of respondents
		Rating								
1.3	Consumer preferences	4.18	4	0.84	0	5	13	43	40	40
	a. Product quality	4.30	4	0.72	0	5	0	55	40	40
	b. Product variety	3.47	4	0.76	0	11	37	47	5	38
	c. Product convenience	3.97	4	0.93	3	5	13	51	28	39
	d. Product promotion	2.55	2	0.99	13	43	23	23	0	40
1.4	Health concerns	3.55	4	0.89	0	13	32	42	13	38
	a. Dietary	3.65	4	1.14	3	19	14	41	24	37
	b. Food safety	3.88	4	0.99	0	10	25	33	33	40
1.5	Seasonality	2.68	3	1.10	20	20	33	28	0	40
Retailer demand and packer demand items separate from any structural change effects										
1.6	Cost of retailing beef products	3.41	4	1.04	5	15	23	46	10	39
1.7	By-product value	3.11	3	1.10	8	22	30	32	8	37
1.8	Packer capacity utilization	3.90	4	0.85	0	8	18	51	23	39
1.9	Wages in packing	2.95	3	0.84	3	29	39	29	0	38
2	**Domestic supply of cattle**									
2.1	Cattle cycle	4.08	4	0.80	0	3	20	45	33	40
2.2	Cattle quality	3.64	4	0.84	0	13	21	56	10	39
	a. Weight	3.79	4	0.87	0	8	26	45	21	38
	b. Yield	4.00	4	0.82	3	0	16	57	24	37
	c. Grade	4.38	4	0.68	0	0	11	41	49	37
2.3	Input costs	3.67	4	0.96	3	13	13	59	13	39
	a. Interest rates	3.03	3	0.96	0	36	33	23	8	39
	b. Land	2.74	3	0.88	8	31	41	21	0	39
	c. Taxes	2.34	2	0.85	13	50	26	11	0	38
	d. Regulations	2.92	3	1.02	5	32	37	18	8	38
	e. Transportation	2.79	3	0.98	8	36	26	31	0	39
	f. Labor	2.73	3	0.87	5	35	43	14	3	37
	g. Feed	4.79	5	0.41	0	0	0	21	79	39
	(i) Grain and oilseed	3.76	4	1.12	5	11	11	49	24	37
	policies	3.92	4	0.87	3	5	10	62	21	39
	(ii) Weather	3.50	4	0.98	0	18	29	37	16	38
	h. Forage	4.11	4	0.95	3	3	14	42	39	36
	(i) Weather									
2.4	Risk management	2.86	3	0.92	5	30	41	22	3	37
2.5	Expected prices	3.62	4	1.16	5	14	19	38	24	37
2.6	Futures prices	3.14	3	1.00	3	29	26	37	6	35

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(1) Factor[a]	(2) Mean	(3) Median	(4) Standard deviation	(5) Least important (%)	(6) Somewhat important (%)	(7) Moderately important (%)	(8) Important (%)	(9) Most important (%)	(10) Number of respondents
	Rating								
2.7 Technological changes in production	3.19	3	1.05	0	32	30	24	14	37
2.8 Technological changes in marketing	2.97	3	1.08	11	17	44	19	8	36
2.9 Dairy prices	1.72	2	0.85	47	39	8	6	0	36
3 International trade									
3.1 Exports of beef	3.95	4	0.93	0	8	21	39	32	38
3.2 Imports of beef	3.00	3	1.14	11	21	37	21	11	38
3.3 Exports of cattle	1.80	1.5	0.98	50	28	14	8	0	36
3.4 Imports of cattle	2.47	3	1.01	21	26	37	16	0	38
3.5 Net imports of cattle									
a. Currency exchange	3.45	3.5	1.01	0	21	29	34	16	38
rates	3.66	4	1.17	3	21	11	39	26	38
b. Trade barriers	2.61	3	1.13	22	19	36	19	3	36
c. Foreign income	2.94	3	1.04	8	28	28	33	3	36
d. Foreign competition	3.50	4	1.29	11	11	24	29	26	38
e. Disease	2.59	2	1.34	24	35	5	27	8	37
f. Use of Hormones	1.89	2	0.98	44	31	17	8	0	36
g. Trade promotion									
3.6 Net imports of beef									
a. Currency exchange rates	3.63	4	0.97	0	16	24	42	18	38
b. Trade barriers	4.16	4	0.72	0	0	18	47	34	38
c. Foreign income	3.72	4	0.88	0	8	31	42	19	36
d. Foreign competition	3.43	3	0.90	0	16	35	38	11	37
e. Disease	3.39	4	1.26	8	21	16	34	21	38
f. Use of Hormones	3.44	4	0.99	0	23	23	41	13	39
g. Trade promotion	2.53	3	1.00	17	31	39	11	3	36

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(1) Factor[a]		(2) Mean	(3) Median	(4) Standard deviation	(5) Least important (%)	(6) Somewhat important (%)	(7) Moderately important (%)	(8) Important (%)	(9) Most important (%)	(10) Number of respondents
		Rating								
4	**Structural change**									
4.1	Industry concentration	2.90	3	1.34	18	25	23	20	15	40
	a. National packer level	3.30	4	1.33	11	24	8	38	19	37
	b. Regional packer level	3.57	4	1.07	3	16	22	41	19	37
	c. Local packer level	3.33	4	1.31	14	14	14	42	17	36
	d. National retailer level	2.91	3	1.21	12	30	21	27	9	33
	e. Regional retailer level	2.62	2.5	1.26	24	26	21	24	6	34
	f. Local retailer level	2.58	2	1.60	42	9	15	15	18	33
	g. National feedlot level	2.47	2	1.19	26	26	24	21	3	34
	h. Regional feedlot level	2.54	2	1.22	23	31	20	20	6	35
	i. Local feedlot level	2.53	2	1.56	35	26	9	9	21	34
4.2	Vertical integration	2.79	3	1.24	21	21	23	31	5	39
4.3	Vertical coordination	3.41	3	1.09	8	8	36	33	15	39
	a. Marketing agreements	3.59	4	0.98	0	16	27	38	19	37
	b. Forward contracts	3.39	3.5	1.03	3	18	29	37	13	38
	c. Value-based marketing and pricing	3.86	4	1.08	3	11	16	38	32	37
4.4	Horizontal integration	2.68	3	1.14	16	32	26	21	5	38
4.5	Economies of scale	3.95	4	0.92	0	8	21	41	31	39
	a. Packer	4.31	5	0.95	3	3	10	31	54	39
	b. Retailer	3.18	3	1.19	10	21	21	38	10	39
	c. Feedlot	3.72	4	0.86	0	5	38	36	21	39
4.6	Economies of scope	3.09	3	1.09	11	14	34	34	6	35
	a. Packer	3.27	4	1.23	15	9	18	48	9	33
	b. Retailer	3.59	4	0.99	6	6	24	53	12	34
4.7	Economies of agglomeration	2.30	2	1.14	33	22	26	19	0	27
4.8	Efficiency of supply chain	3.47	4	1.08	5	16	18	47	13	38
4.9	Technological change	3.59	4	1.01	3	16	14	54	14	37
	a. Packer production	3.95	4	0.87	0	8	16	50	26	38
	b. Packer marketing	3.03	3	1.01	8	19	41	27	5	37
	c. Retailer production	2.84	3	1.14	19	14	35	30	3	37
	d. Retailer marketing	3.19	3.5	1.35	17	14	19	33	17	36

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	Rating								
(1) Factor[a]	(2) Mean	(3) Median	(4) Standard deviation	(5) Least important (%)	(6) Somewhat important (%)	(7) Moderately important (%)	(8) Important (%)	(9) Most important (%)	(10) Number of respondents
4.10 Thin spot market	3.03	3	1.45	22	16	19	24	19	37
a. Price discovery	4.00	4	1.06	3	10	10	40	38	40
b. Information	3.62	4	1.11	8	10	10	56	15	39
transparency	3.08	3	1.27	17	14	25	33	11	36
c. Bidding procedures									

[a]Experts mentioned these items in response to the following question in phase I: "During the past few years, what were the most important factors/variables affecting (a) the prices received by domestic cattle producers and (b) producers' incomes?" Percentages may not add to 100 because of rounding.

The basic question on the importance of each factor or variable varied slightly, depending on the category or subcategory being rated. The question for the four main categories—items 1 through 4—was

"During the first phase of this study we asked you to identify 'the most important factors or variables affecting (a) the prices received by domestic cattle producers and (b) producers' incomes.' The panel identified many unique factors. We have organized those factors under four main categories:

1. Domestic Demand for Cattle
2. Domestic Supply of Cattle
3. International Trade
4. Structural Change

"In this section, we ask that you rate the importance of each of the main categories relative to the other main categories. In subsequent sections, we will ask you to rank the relative importance of the factors listed within each of the main categories.

"How important are each of the following main categories of factors in affecting (a) the prices received by domestic cattle producers and (b) producers' incomes?"

Following this question, we listed each main category factor, and experts rated each factor on a five-point scale, ranging from "least important" to "most important," as shown in column heads 5–9. We gave the experts the option of responding "don't know/no opinion"; the default response on the Web-based questionnaire was "no response." When rating a factor, the experts had to actively de-select the "no response" option.

The question for the subcategory factors (for example, 1.1, 1.2, . . . 1.9 and 2.1, 2.2, . . . 2.9), was

"In this section we ask that you rate the importance of the factors related to [main category factor—for example, 'Domestic supply of cattle'] that affect (a) the prices received by domestic cattle producers and (b) producers' incomes.

"How important is each of the following factors?"

We listed each of the subcategory factors following this question, and the experts rated them on the same five-point scale, ranging from "least important" to "most important."

Finally, we probed further within some of the subcategories; they are listed under subcategories and are preceded by lower-case letters (for example, items 1.2a through 1.2e). To obtain a rating of importance from experts on these factors, we asked

"Within the subcategory [subcategory factor—for example, 'relative prices of substitutes'], how important are each of the following factors?"

The experts also rated each subcategory factor on the same five-point scale described above.

During phase III, we offered experts the opportunity to change their original assessments of the importance of structural change and international trade factors. Two of the 40 respondents changed their opinions on some of the structural change factors, and 5 changed their ratings on some of the international trade factors. The numbers in table 11 reflect the changes the panelists made. The factors in table 11 affected by these changes are 3, 3.2, 3.3, 3.4, 4.8, and 4.10.

The Panel's Ratings of Problems and Issues in Developing an Adequate Model

In the phase I Web-based questionnaire, we asked the panel of experts to identify any problems or issues that would be faced in developing a comprehensive and reliable analysis to estimate domestic cattle prices and producers' incomes. We compiled a list of the issues and problems they identified and then presented that list back to the panelists as part of the phase II questionnaire. In the phase II questionnaire, we asked the experts to rate each issue and problem identified in phase I on two dimensions. First, we asked them to assess how important it would be to address the issue or problem and, second, we asked how feasible it would be to overcome it.

For our analysis (and in preparation for the phase III questionnaire), we calculated basic descriptive statistics on these issues and problems the experts rated in the phase II questionnaire. These statistics consisted of the mean (average), median, standard deviation, and frequency distribution. These statistics are presented in table 12.

Table 12: Descriptive Statistics on Issues and Problems Rated in the Phase II Questionnaire

Rank	(1) Issue or problem[a]		(2) Mean	(3) Median
1	One very important question to answer to develop a model, keep misspecification as small as reasonable, and provide some usefulness is "What is the purpose of the cattle price model?" If the purpose is short-term forecasting, the answer will differ markedly from policy modeling or something else.	Importance	4.05	4
		Feasibility	3.47	3.5
2	Disaggregated cost and revenue data linking ranchers, feeders, packers, and retailers are unavailable.	Importance	3.75	4
		Feasibility	2.46	2
3	Retail and consumption data are very poor.	Importance	3.57	4
		Feasibility	3.16	3
4	A challenge is the appropriate modeling of dynamics in prices due to the cattle cycle.	Importance	3.47	4
		Feasibility	3.32	3
5	The relationships between the different levels of the food chain are changing, and it is difficult to establish both driving factors and results.	Importance	3.47	4
		Feasibility	3.00	3
6	Confidential data on farmers, processors, and retailers are inaccessible.	Importance	3.41	4
		Feasibility	2.25	2
7	A better understanding of the cattle cycle is needed, because prices and producers' incomes vary significantly at its different stages. This is especially important if the cattle cycle is changing significantly with restructuring of the industry. With increased reliance on contracts, it has become more difficult to assess how economic incentives and incomes vary over time and space. It is not clear who benefits most from the newly evolving structure and how benefits are distributed (if at all) among producers, processors, retailers, and consumers.	Importance	3.37	3
		Feasibility	2.94	3
8	Any attempt to come up with one all-encompassing model may be problematic because problems may differ in the states and regions. Separate and perhaps more than one type of modeling and analysis may be needed.	Importance	3.37	4
		Feasibility	3.31	3
9	Current supply is a function of profits that producers expected to receive when they started production. Analysts must use a proxy for expectations that measures the underlying concept with error.	Importance	3.36	4
		Feasibility	3.08	3

	Rating					
(4) Standard deviation	(5) Least important or feasible (%)	(6) Somewhat important or feasible (%)	(7) Moderately important or feasible (%)	(8) Important or feasible (%)	(9) Most important or feasible (%)	(10) Number of experts
0.85	0%	8%	8%	54%	30%	37
1.06	6	8	36	33	17	36
1.25	6	14	17	28	36	36
1.15	23	37	11	29	0	35
1.09	8	5	24	46	16	37
1.04	5	22	32	32	8	37
1.08	3	18	26	34	18	38
0.97	3	19	30	41	8	37
0.99	3	15	26	44	12	34
0.89	3	26	41	26	3	34
1.16	5	21	21	36	18	39
1.11	28	39	17	14	3	36
1.05	3	18	34	29	16	38
1.12	11	25	28	31	6	36
1.17	8	16	24	37	16	38
1.08	6	17	29	37	11	35
1.18	10	13	21	44	13	39
1.12	11	21	24	39	5	38

Rank	(1) Issue or problem[a]		(2) Mean	(3) Median
10	Many key long-term variables—technical change, policy changes (e.g., in feed crops), and trends in health concerns—are hard to quantify conceptually, much less to get good data for.	Importance	3.26	4
		Feasibility	2.50	2.5
11	If cattle prices NASS reports no longer represent prices actually paid to producers for cattle, it is difficult to use these series for meaningful analysis.	Importance	3.24	4
		Feasibility	2.95	3
12	Reported market prices are likely not to indicate true prices received because of extensive contracting and pricing quality grid differences.	Importance	3.21	4
		Feasibility	3.08	3
13	Publicly available government data do not contain information over a given period at the transaction or micro level.	Importance	3.19	4
		Feasibility	2.44	3
14	Most models focus on one piece of the puzzle in isolation or try to do a more general equilibrium type of analysis with assumptions far too simplistic to capture what is actually happening. Detailed models of the cost and demand structure at each level, as well as their connections, are important for understanding these patterns.	Importance	3.18	4
		Feasibility	2.83	3
15	Data to quantify liberalization of trade barriers are lacking.	Importance	3.18	3
		Feasibility	3.08	3
16	With consumers setting value at the retail level, a lack of quantity-weighted retail prices poses problems.	Importance	3.17	3
		Feasibility	3.25	3
17	The theory to model structural change is not very strong and is especially difficult to model since it is not typically measured.	Importance	3.13	3
		Feasibility	2.77	3
18	Specifying cost functions is notoriously difficult because of the lack of data and knowledge about response functions by type of operations.	Importance	3.11	3
		Feasibility	2.56	2
19	Data to quantify the impact of convenience on beef demand are lacking.	Importance	3.11	3.5
		Feasibility	2.78	3
20	Prices are made up of a very large number of determinants whose importance changes over time, suggesting that model misspecification is always present.	Importance	3.11	3
		Feasibility	2.63	3
21	Cattle price data are questionable because they are not weighted for volume, grade, etc.	Importance	3.10	3
		Feasibility	3.42	3

	Rating					
(4) Standard deviation	(5) Least important or feasible (%)	(6) Somewhat important or feasible (%)	(7) Moderately important or feasible (%)	(8) Important or feasible (%)	(9) Most important or feasible (%)	(10) Number of experts
1.12	10	13	26	44	8	39
1.16	24	26	32	12	6	34
1.28	11	22	16	35	16	37
1.08	8	30	27	30	5	37
1.30	10	28	8	38	15	39
1.12	11	18	32	32	8	38
1.33	14	22	14	35	16	37
1.30	36	11	31	17	6	36
1.27	16	16	11	50	8	38
1.08	11	28	33	22	6	36
0.97	8	13	36	41	3	39
1.10	5	29	29	26	11	38
1.03	3	25	36	25	11	36
1.08	8	11	39	31	11	36
1.20	5	31	28	18	18	39
1.31	20	29	14	29	9	35
1.07	5	24	35	24	11	37
1.11	18	35	24	21	3	34
1.16	11	24	16	45	5	38
1.06	8	41	19	30	3	37
1.20	13	18	21	39	8	38
1.24	26	13	39	13	8	38
0.99	8	18	33	38	3	39
0.98	3	13	37	34	13	38

Rank	(1) Issue or problem[a]		(2) Mean	(3) Median
22	Many factors such as consumer tastes and preferences needed to incorporate in a model are difficult to quantify.	Importance	3.03	3
		Feasibility	2.68	3
23	One needs to integrate international effects such as those from Australia, Canada, Mexico, New Zealand, and the Pacific Rim countries.	Importance	3.00	3
		Feasibility	3.38	3
24	Although the demand for beef and other meats has been analyzed extensively, there is little consensus as to the fundamental own-price and cross-price elasticities of demand.	Importance	3.00	3
		Feasibility	3.45	4
25	Properly accounting for changes in market structure makes it more difficult to estimate prices.	Importance	2.95	3
		Feasibility	2.89	3
26	There are data constraints regarding what types of nonprice market power may be exercised, such as controlling the flow of supplies to particular plants or the effects of requirements retailers place on the industry.	Importance	2.94	3
		Feasibility	2.32	2
27	A system analysis should examine the marketing channel from cow-calf producer to retail.	Importance	2.94	3
		Feasibility	3.28	3.5
28	The data to calculate Lerner ratios and quantify the impact of packer concentration on live cattle prices exist, but GIPSA has not made them available.	Importance	2.92	3
		Feasibility	3.39	3
29	Complicated dynamic feedback relationships in the cattle sector suggest that one "true" structural model may not exist.	Importance	2.89	3
		Feasibility	2.60	2
30	The literature on demand shifts has emphasized that functional form may matter to income and price elasticities.	Importance	2.86	3
		Feasibility	3.42	4
31	Data reliability has become an issue for the less tangible issues that affect market sentiment, such as food scares and promotional activity.	Importance	2.81	3
		Feasibility	2.48	2
32	A challenge is identifying and modeling weather and drought as they affect the beef industry.	Importance	2.76	3
		Feasibility	3.24	4
33	Good, standardized cost series are lacking at the cow-calf level.	Importance	2.74	3
		Feasibility	2.97	3

	Rating					
(4) Standard deviation	(5) Least important or feasible (%)	(6) Somewhat important or feasible (%)	(7) Moderately important or feasible (%)	(8) Important or feasible (%)	(9) Most important or feasible (%)	(10) Number of experts
1.13	13	18	24	42	3	38
1.28	24	21	26	21	8	38
1.01	5	29	32	29	5	38
1.09	5	16	27	38	14	37
1.03	5	32	22	38	3	37
0.86	3	11	32	50	5	38
1.16	13	24	24	34	5	38
0.95	6	31	36	25	3	36
1.18	12	29	18	35	6	34
1.01	26	29	32	13	0	31
1.32	15	32	9	32	12	34
1.11	3	28	19	38	13	32
1.38	25	8	31	22	14	36
1.27	9	15	27	24	24	33
1.22	16	22	27	27	8	37
1.26	23	29	23	17	9	35
1.12	14	23	29	31	3	35
1.02	8	6	31	47	8	36
1.15	14	30	24	27	5	37
1.18	26	29	16	29	0	31
0.97	11	29	34	26	0	38
1.16	11	16	19	46	8	37
1.16	15	32	24	24	6	34
1.10	9	27	27	30	6	33

Rank	(1) Issue or problem[a]		(2) Mean	(3) Median
34	Data to quantify the impact of nutrition on beef demand are lacking.	Importance	2.73	3
		Feasibility	2.89	3
35	USDA's estimates of cattle inventories by class are subject to error.	Importance	2.67	3
		Feasibility	3.00	3
36	Data to quantify purchasing power in importing countries are lacking.	Importance	2.51	2
		Feasibility	3.22	3
37	Concentration among processors, although likely to be relevant at levels in the cattle industry, has become more or less a constant and has not changed substantially in the past few years. It is unlikely to be statistically significant unless studied over a longer period than has been done in the recent few years.	Importance	2.49	2
		Feasibility	2.94	3
38	Cash price and marketing in any particular time period do not necessarily determine actual producer incomes, because some producers participate in the futures market.	Importance	2.46	2
		Feasibility	2.78	3
39	Data to quantify exchange rate influences on export prices and quantities are lacking.	Importance	2.44	2
		Feasibility	3.73	4
40	An inability to separate beef imports from total U.S. beef production may result in overestimating or underestimating how imports affect meat and cattle prices.	Importance	2.36	2
		Feasibility	3.13	3
41	It is a challenge to create an aggregate income index that accounts for not only aggregate income but also the risk level to achieve that level of income.	Importance	1.81	2
		Feasibility	1.94	2

	Rating					
(4) Standard deviation	(5) Least important or feasible (%)	(6) Somewhat important or feasible (%)	(7) Moderately important or feasible (%)	(8) Important or feasible (%)	(9) Most important or feasible (%)	(10) Number of experts
1.19	19	27	19	32	3	37
1.12	8	33	28	22	8	36
1.12	20	23	27	30	0	30
0.85	3	24	41	31	0	29
1.07	15	44	18	21	3	39
1.13	5	19	43	14	19	37
1.22	27	27	19	24	3	37
1.26	14	25	28	19	14	36
1.14	23	33	21	21	3	39
1.17	17	28	19	33	3	36
1.10	23	33	21	23	0	39
1.04	3	11	22	41	24	37
1.13	25	36	19	17	3	36
1.13	3	34	22	28	13	32
0.97	47	34	9	9	0	32
0.96	39	39	13	10	0	31

[a]Experts mentioned these items in response to the following question in phase I: "What problems or issues would you face in developing a comprehensive and reliable analysis to estimate domestic cattle prices and producers' incomes?" Percentages may not add to 100 because of rounding

These ratings in the table were obtained from the experts' responses to the following question on the phase II questionnaire:

"In the first phase of this study, we asked you to identify, 'problems or issues you would face in developing a comprehensive and reliable analysis to estimate domestic cattle prices and producers' incomes.'

"The responses have been organized under two broad categories:

1. Data Issues
2. Modeling Issues

"In this section, we present those responses and ask you to rate both the importance and feasibility of each response on a scale of 1 to 5, where 1 is least important or least feasible and 5 is most important or most feasible. In your ratings, consider the following concepts of importance and feasibility.

1. How important is it to address this problem or issue for purposes of modeling cattle prices and/or producers' incomes?

2. How feasible is it to overcome or implement the solution for this problem or issue for purposes of modeling cattle prices and/or producers' incomes?"

The experts then rated each item on a five-point scale from "least important" or "least feasible" to "most important" or "most feasible," as shown in columns 5–9. We gave the experts the option of responding "don't know/no opinion"; the default response on the Web-based questionnaire was "no response." When rating a factor, experts had to actively de-select the "no response" option.

Summary of Phase III of Our Survey

On the questionnaire in phase III of our Web-based survey, we asked the experts to review the summary and results from the preceding questionnaire. The summary explained that there was relatively more variation of responses for the categories of factors relating to international trade and structural change, while opinions of the importance of domestic demand for cattle and domestic supply of cattle factors were more cohesive. We asked the panel,

> "(1) in your opinion, why is there greater variation among panel members over the importance of structural change as a factor affecting cattle prices and producers' incomes, and (2) in your opinion, why is there greater variation among panel members over the importance of international trade as a factor affecting cattle prices and producers' incomes?"

This appendix consists of excerpts from the respondents' answers (set as full text within quotation marks) .

Panelists' Responses on Structural Change

"I think the difference depends on the source of the change, whether in supply or demand."

"Again, it's a less-studied issue, as well as being more amorphous in its definition. Structural change is not well defined. One aspect of structural change is differences in markets, which for most industries have experienced increasing concentration and consolidation. This is certainly true in the beef industry but appears to have strong supply and demand drivers, due to cost effects (scale and scope economies) and demand changes (quality, diversification/processing). These might be considered structural changes, but I would say they are more basic supply and demand changes. I think the importance of costs and prices has increased, as has the potential for scale economies in our 'new economy,' even though this is not exactly a 'new economy' industry, which might be called structural change. These types of structural/market changes are also likely to expand further in the near future, I expect."

"There is disagreement over how important structural change has really been and will be on the level of prices. Also, some may be thinking of year-to-year changes in prices (where structure is

not important) while others, like me, are thinking of where average prices are likely to go. I think structural change will result in continuing downward pressure on prices, and this will be a big problem for traditional small-scale cattle feeders."

"Many economists believe that regardless of structural changes (e.g., rising concentration among meat packers), it is the supply of cattle/beef that determines cattle prices and consequently farmers' income. In that case, farmers need to control their output through quality control or to learn to respond to consumer demand better or explore market expansion, etc. On the other hand, if rising concentration or vertical integration shuts down or forecloses the output market for farmers, both cattle prices and farmers' income will be adversely affected."

"The term is not well defined."

"Some think that structure, in particular large processors, have a large adverse impact on cattle price. The research says otherwise. It probably is not a completely resolved issue."

"I recall some frustration with not being able to identify the direction of the impacts. Moving to concentrated processing markets was accompanied by moves to very large packing operations with hourly kills of up to 400 head of cattle per hour and large feedlots to service those large-scale processing needs. The packers like IBP, Excel, and Conagra were first low-cost commodity operators that only recently have turned to branded products and merchandising. Part of the benefit of those low packing and fabricating costs were passed back to the fed cattle owner in the form of higher prices than would have been the case with smaller plants in the preconcentrated industry. If you adjust the packer margin as reported by USDA for inflation, it trends down from the mid-1980s to today, documenting the presence of economies of size and the passing of at least part of the benefits of low costs to the producers. I suspect the question was asked under a presumption of market power imposing lower prices on producers, but the facts simply do not support that. The market power research that has sometimes reported a relationship between large firms in concentrated markets is not valid, in my opinion. An *American Journal of Agricultural Economics* article shows the assumptions of the widely used market power

tests to be invalid. It may be that the structure of the industry that has become very concentrated has prompted a less progressive sector than there would be if 20 firms, not 3, controlled the roughly 20 large plants, but I have no research to support that notion."

"Packer concentration in beef took place between 1986 (after the Supreme Court ruling on Monfort vs. Cargill) and 1990. Price movements in cattle since 1990 have not been due to structural change because concentration levels changed less than 3 percentage points during that time. In addition, new entrants have come or are coming into beef packing during 2000–01."

"I think there's more true ambiguity of how important this is. That is, international trade clearly affects levels of prices and quantities. The implications of structural change are less clear from an increase/decrease/unchanged perspective of its impacts on prices and incomes. For example, in considering the swine industry, those that participated heavily in structural change by rapidly adopting technology, forming integrated production systems, and branding products saw their incomes increase dramatically. Those on the other end saw their incomes decline. So while international trade is more likely a phenomenon of a 'rising tide raises all ships,' structural change has greater implications for micro-level impacts that depend on particular circumstances. I'm sure this accounts for more ambiguity: Maybe net structural change simply leads to the 'zero profit' condition of technical change in markets in the long run?"

"Structural change is difficult to measure, and there has been little research on the impact of structural change in the beef industry. Some research on structural change has been done in demand for meat, but the basic conclusions have been somewhat mixed or have favored no structural change. That is, relative prices are the important drivers. I think there are those who believe that structural change has been substantial and important. There are those who believe little real structural change has occurred. There are those who believe that substantial structural change has occurred but it didn't impact prices."

"In my view, the greater variation may be due to differing opinions about the cause and consequences of structural change. For example in my opinion, on the topic of value-based marketing and pricing, I could make the following argument. Livestock producers want to be paid for the quality of livestock they produce. They want to be paid premium for producing the kind of the cattle that produces the kind of beef the consumer demands. Value-based agreements between producers and packers allow the price signal to be transmitted from the consumer all the way back to the cow-calf producer, who can make the management decisions necessary to earn the premiums and avoid the discounts, thus improving the bottom line and income. Others may argue the following. Large packing companies have put in place contracts that force discounts on the producers so that the packer can buy the product cheaper and sell the product for higher prices to retailers. You can sell product to the packers only if you agree to their terms and sell them the kind of cattle they want to buy. Producers who don't comply lose a market for their cattle and subsequently don't have a place to sell their livestock. Change is occurring in the beef industry, no doubt. The key is to understand what is driving the change and to fully understand cause and effect. There is plenty of research describing the changes taking place. One of the most interesting studies done at Virginia Tech, I believe, showed that producers have benefited to a great degree because the efficiencies created in the packing industry have kept inflation-driven costs, such as wage increases, from being paid by the producers in terms of lower cattle prices."

"There may be some confusion about the meaning of the term—I took it to mean changes in supply/demand balance."

"From a modeling standpoint, it is hard to incorporate the effects of structural change. That makes it difficult to decide how important a factor it has been."

"Structural change is taking place, but it is difficult to measure and evaluate."

"Until recently, the conventional wisdom has been that higher concentration leads to higher beef prices and lower cattle prices. The thought in modern industrial organization does not put so

much weight on concentration as on other items such as elasticities of demand and supply, conduct, quantity, or price as decision variables, dynamics, etc."

"'Structural change,' like 'international trade,' is an imprecise term. Each person will interpret in his/her own way. Some see structural change as increasing the competitiveness of industry, therefore a good thing. Others see it as limiting competitiveness, therefore a bad thing."

"I think the research literature is pretty clear on this issue. Structural change has been important—i.e., significant—but the impact is relatively small."

"The impact of structural change is much harder to assess than the old standbys of supply and demand. The trade suggests that concentration is having an impact—but if you believe the research, it suggests differently. The captured cattle question and its effect on price discovery is truly an important factor. It is important enough that the government has new discovery rules. But if the industry is moving more toward 'alliances' and away from the 'auction' market, the importance of price discovery becomes paramount to the producer side. I don't think that structure is a short-term price/income question; it is a longer-term question. The industry is likely to work on this question over time."

"Concentration in the industry has changed little in the past few years; thus, much of the impact is long term. Some may be thinking on a shorter-term or longer-term basis. In addition, structure changed prior to changes in industry practice. These practices (marketing agreements) have greater impact on packer market behavior because they are concentrated and gain market knowledge they would not have with only one plant using these practices. So as structure impacts practice, practice impacts prices. Some may see that as structure, others not."

"Important issues are involved in what one means by 'structural change.' Some might think this applied only to demand (the old health concerns argument) while others (myself included) think that changing structure applies to all structure— such as market

consolidation, changing technologies (economies of scale), feeding practices, and demand."

"Some judge that there is more opportunity for market power with the increased concentration of the packer industry than others."

"Structural change is a less well defined term and can relate to different levels of the industry with differing degrees of impact. There is also a time element to structural change that means that importance from one year to the next is small, but over a long period of change, the impact shows up as being more significant."

"Reflects the vigorous debate about the impact of increased packer concentration on cattle prices."

"Structural change remains controversial in spite of the large volume of research completed in this area. In my opinion, we have discovered in all our research that the effect of structural change, at least on prices, is significant but not large. Hence, the argument is that there is no need to regulate the industry. At the same time, large concentration levels are difficult to rationalize from the point of view of economics, since they appear to have the potential of having market power. We need two things: (1) We need more information on the actual costs of operating packing plants if definitive studies are to be done and (2) we need to concentrate more on transaction costs to determine why relationships in these markets are so rigid."

"It is difficult to define what is meant by structural change. It includes changes in consumers' tastes and preferences and technological change in production and processing, as well as changes in packer concentration. People may be using different definitions. I think packer concentration is least important. But the other two do matter. Further, structural changes are gradual. Therefore, structural change has little effect on price changes in the short run. Structural change would need to be considered when estimating an econometric model."

"Two reasons. First, economists have differing definitions and views of the meaning of structural change. One extreme is that no such thing as structural change exists, if one has taken proper account of all the factors affecting prices. Second, and related, some economists would likely have relatively broad categories of factors, one of which would be structural change. In other words, after considering prices and incomes, everything else would be a change in structure."

Panelists' Responses on International Trade

"International trade has not played as significant a role in the determination of cattle prices and producer incomes as have the other factors. International trade in beef is a relatively new function, and its dollar size compared to the domestic market makes it less important."

"The empirical evidence is unclear, especially given the complexity of the cattle market."

"We are a huge market, and except in niche products, domestic supply and demand drive market prices."

"International trade, while important, is still a relatively small part of the total demand/supply of beef/cattle. International trade has been controversial as to its effects. International trade is always less predictable than domestic trade. Bottom line: More uncertainty exists about the effects and importance of international trade in cattle/beef markets."

"Substantially less research has been conducted on the impact of trade on prices and income to validate the impact. What work has been conducted has mixed results. On the other hand, there is substantial research validating the importance of demand and supply effects on prices."

"I believe the discrepancy is due to something like the difference between interpreting a t statistic and an elasticity. International trade is significant in impacting domestic livestock and meat prices, but its elasticity is going to be smaller that those associated with domestic supply or total domestic demand."

"It is harder to model and analyze, since there are both import and export flows to deal with. The difficulty is compounded by a lack of detailed price data on imports or exports, and there is no detail on what is in a shipment regarding quality, consistency, etc. The imports add to the domestic supply of largely processing beef and, taken alone, would tend to lower beef prices in the United States. But they are not taken alone, since there are exports of high-quality (nonprocessing) beef that add to the demand for U.S. beef. The net impact is likely to be positive by a substantial amount, but this is hard to estimate empirically, and it still is not as important as domestic supply variations and then domestic demand variations as a factor in prices and incomes."

"It is a small part of total tonnage and value, but it is also the marginal market and generally the only area for growth."

"'International trade' and 'structural change' are specific factors that may have demand-side and/or supply-side effects of undetermined magnitude. I think there is much greater scope for differing opinions about the importance of these factors."

"Export demand is more volatile than domestic demand. I, however, did not rate international trade as highly important because trade in cattle and beef is a small portion of total demand."

"Because the share of imports and exports is so small, international trade's relative importance can change dramatically from one year to the next."

"Some people focus on the relatively small volume of U.S. production that moves through trade channels, but others focus on the volatility, policy sensitivity, and future possible importance of that volume."

"International trade is not as 'free' when it comes to importing cattle or beef for various reasons—e.g., importing countries may restrict U.S. livestock or beef import if our cattle/beef is bioengineered or has quality problems (perceived or real). For this and similar reasons, many of us believe that international trade is not as big a factor as, say, domestic demand."

"How trade impacts the cattle market in particular, it may affect beef more than cattle."

"The direct effect of international trade in meat is probably small. However, the indirect effect of international trade on cattle prices and producers' income may be more important. In particular, the effect of trade on feed prices can be quite considerable, and feed prices can have an important effect on cattle prices and ranchers' income."

"It is a small percentage of total production. Some might contend that it is small enough to ignore, and it may be. It is not the major determinant, but it is important and relevant."

"If one interpreted the question in a historical sense, then trade is not important, since it is not a large component of total production. If the question were interpreted as whether the trade is important in a general sense, then the answer is important. Indeed, should trade expand, then it will be important."

"There is always likely to be more variation in opinions for an issue that has received less attention and therefore has less information and consensus. Trade in this industry may have a marginal effect, but simply the quantity of trade compared to other industries for which there has been more study suggests that this aspect of the industry is not going to have an important effect. This is still a more domestic industry than most."

"International trade has historically not been extremely important. However, it has been growing in importance and will likely continue to become more important."

"Perhaps because some may be responding to this question from a theoretical perspective, others may be responding from an empirical perspective. If one thinks about international trade from a theoretical perspective, it should be an important variable. I don't think the empirical evidence is quite so strong. We found that trade was not a particularly strong mover of prices—not unimportant but not a strong mover. Of course, all our work (mine included) is tentative and subject to reinterpretation, given new evidence."

"First, most producers never see their international customers. Second, trade deals take a long time to establish, negotiate, and implement, and often the final deal may not seem significant in the eyes of the producers. During trade negotiations, there is a give and take. Third, it is easy to discount the importance of trade in order to make statements about something else—for example, some beef producers knock NAFTA because of low cattle prices. However, the only thing NAFTA did for the beef industry was allow the United States to sell boxed beef to Mexico, and it is now one of our biggest customers. In this case, low cattle prices brought about anti-NAFTA sentiment. Interestingly enough, cattle prices would have been low, with or without NAFTA, due to the cattle cycle, supply, and corn at $5 a bushel. In this case, NAFTA was actually a benefit to the beef industry or prices would have been lower, but NAFTA became, in the eyes of many, the cause. Lastly, trade is often hard to quantify because each opportunity may seem miniscule when compared to the entire beef market. For example, some may wonder, how can such a small percentage of product play such a factor in overall income. The answer is that trade benefits are additive and building, and growing markets take time. Benefits to trade usually accrue in the future, so producers don't see the impact on their bottom line immediately."

"A broad range of factors could result in trade's affecting cattle prices—i.e., exchange rates as well as imports."

"On the one hand, trade matters. On the other hand, both transportation costs and trade barriers contribute to reducing the importance of trade in the beef sector."

"Trade does impact the market, but it is around 10 to 12 percent of the total, and consequently the magnitude of change in percentage terms required to have the same impact as domestic demand will obviously be much greater. Also, imports and exports are pretty well balanced, although the type of product differs between the two. There is an argument that the availability of lean imported product actually helps the price of fatter U.S. trimmings as it increases their use in ground beef etc. Consequently, I do not consider trade to be nearly as important as domestic demand, but I do believe it to have a reasonably

significant impact on the market, probably more on the export than on the import side."

"Trade may be overemphasized as a determinant of total market demand for cattle. Exports represent only a small share of U.S. cattle production. Imports also may be overemphasized as a determinant of total market supply—only a small share of total cattle use is represented by imports, and for live cattle, the impacts of imports is fairly localized or regionalized, not a major determinant of prices nationally."

Issues Facing Comprehensive Analysis

In the phase III questionnaire, we presented the panel with the list of issues facing comprehensive analysis to predict or explain domestic cattle prices and producers' incomes. The list of issues derived from the panel's responses to the phase I questionnaire were presented in the order of the importance of each issue. The importance of each issue was determined by calculating the average importance rating from the phase II responses.

We first asked the experts whether or not they believed that the federal government should take action to help overcome these issues. Eighty-five percent (34) responded "yes," 2.5 percent (1) responded "no," and 12.5 percent (5) responded "don't know."

We asked those who responded affirmatively to select up to five issues that they would recommend for federal action. We tabulated the selections and ordered the list of issues according to the number of selections on each issue. This produced a prioritized list of issues recommended for federal action (at least by the 34 panelists who shared the opinion that federal action is warranted). The responses and ranking of these issues are presented in table 13.

Table 13: Issues the Panel Recommended the Federal Government Act On

Rank	Issue	Number
1	Data on farmers, processors, and retailers are confidential and not accessible.	19
2	Reported market prices are not likely to indicate true prices received due to extensive contracting and pricing quality grid differences.	16
3	Disaggregated cost and revenue data linking ranchers, feeders, packers, and retailers are unavailable.	14
4	Retail and consumption data are very poor.	13
5	If cattle prices NASS reports no longer represent prices actually paid to producers for cattle, it is difficult to use these series for meaningful analysis.	10
6	Many key long-term variables—technical change, policy changes (e.g., in feed crops), trends in health concerns—are hard to quantify conceptually, much less get good data for.	7
7	The relationships between the different levels of the food chain are changing and it is difficult to establish driving factors and results.	6
8	Publicly available government data do not contain information over a given period at the transaction or micro level.	6
9	Cattle price data are questionable because they are not weighted for volume, grade, etc.	6
10	GIPSA has not made available existing data to calculate Lerner ratios to quantify the impact of packer concentration on live cattle prices.	6
11	A challenge is appropriate modeling of dynamics in prices due to the cattle cycle.	5
12	A better understanding of the cattle cycle is needed because prices and producers' incomes vary significantly at different stages of the cycle. This is especially important if the cattle cycle is changing significantly with restructuring of the industry. With increased reliance on contracts, it has become more difficult to assess how economic incentives and incomes vary over time and space. It is not clear who benefits the most from the newly evolving structure and how the benefits are distributed (if at all) among producers, processors, retailers, and consumers.	5
13	An inability to separate imports of beef from total U.S. beef production may result in overestimating or underestimating how imports affect meat and cattle prices.	5
14	Current supply is a function of profits that producers expected to receive when they started production. Analysts must use a proxy for expectations, which measures the underlying concept with error.	4
15	Data to quantify the impact of convenience on beef demand are lacking.	4

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Rank	Issue	Number
16	There are data constraints on the types of nonprice market power that may be exercised, such as controlling the flow of supplies to particular plants or the effects of requirements retailers place on the industry.	4
17	One very important question to answer to develop a model, keep misspecification as small as reasonable, and provide some usefulness is the purpose of the cattle price model. If the purpose of the model is short-term forecasting, the answer will differ markedly from the answer for policy modeling or some other reason for designing a model.	3
18	Data to quantify the liberalization of trade barriers are lacking.	3
19	With consumers setting value at the retail level, there are some problems with lack of quantity-weighted retail prices.	3
20	Many factors, such as consumer tastes and preferences, needed to incorporate in a model are difficult to quantify.	3
21	A challenge is identifying and modeling weather and drought as they impact the beef industry.	3
22	USDA's estimates of cattle inventories by class are subject to error.	3
23	Any attempt to come up with one all-encompassing model may be problematic because problems may differ in different states and regions. Separate and perhaps more than one type of modeling and analysis may be needed.	2
24	Most models focus on one piece of the puzzle in isolation or try to do a more general equilibrium type of analysis with assumptions far too simplistic to capture what is actually happening. Detailed models of the cost and demand structure at each level as well as their connections are important for understanding these patterns.	2
25	One needs to integrate international effects such as from Australia, Canada, Mexico, New Zealand, and the Pacific Rim countries.	2
26	Properly accounting for changes in market structure makes it more difficult to estimate prices.	2
27	A system analysis should be included that examines the marketing channel from cow-calf producer to retail.	2
28	Reliability of data becomes more an issue for the less tangible issues that impact market sentiment, such as food scares and promotional activity.	2
29	Good, standardized cost series at the cow-calf level are lacking.	2
30	Data to quantify the impact of nutrition on beef demand are lacking.	2
31	Data to quantify purchasing power in importing countries are lacking.	2
32	Concentration among processors, though likely to be relevant at levels in the cattle industry, has become more or less a constant and has not changed substantially in the past few years. It is unlikely to be statistically significant unless a study is done over a longer period than the recent few years.	2

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Rank	Issue	Number
33	The theory to model structural change is not very strong and is especially difficult to model since it is not something typically measured.	1
34	Prices are made up of a very large number of determinants whose importance changes over time, suggesting that model misspecification is always present.	1
35	Complicated dynamic feedback relationships in the cattle sector suggest that one "true" structural model may not exist.	1
36	Cash prices and marketings in any particular time period do not necessarily determine actual producer incomes because some producers participate in the futures market.	1
37	Data to quantify exchange rate influences on export prices and quantities are lacking.	1
38	Specifying cost functions is notoriously difficult because data and knowledge about response functions by types of operations are lacking.	0
39	Although the demand for beef and meats has been analyzed extensively, there is little consensus as to the fundamental own-price and cross-price elasticities of demand.	0
40	The literature on demand shifts has emphasized that functional form may matter to income and price elasticities.	0
41	It is a challenge to create an aggregate income index that accounts for not only aggregate income but also the risk level to achieve that level of income.	0

Specific Actions the Federal Government Should Take

After the panel had selected up to five items for recommendation, we asked it, "What specific actions should the federal government take to address the issues you recommended for action in question 12? (Answer only if you made selections from the list in question 12)." The members' excerpts from this question follow.

> "Establish competitive grants for primary data collection."

> "The government has an important role in making high-quality data available so that market participants can better evaluate market conditions. The provision of reliable data provides a public good by allowing market participants to make informed (economically efficient) decisions."

"Improve data transparency while acting to protect the confidentiality of producers, processors, wholesalers, and retailers."

"The primary underlying issue in addressing the overall research question is the availability of reliable and consistent data at the level of firms and markets. The federal government's impact from collecting and disseminating these data would be greater than specific modeling efforts, because if you build the databases, researchers will follow, and you will gain multiplier effects for research."

"The manner in which the Bureau of Labor Statistics (BLS) samples retail beef prices does not lend itself to an accurate picture of the price that beef is actually selling at. I would modify this practice to make it more than a statistical sampling, and retail prices collected should reflect 'featuring' and 'club-card' discounts. This could be accomplished by using commercially available retail scanning data. BLS and Department of Commerce data can tremendously overstate the retail price of beef and exaggerate the often maligned retail-to-farm-gate spread."

"Significantly improve the quality and quantity of data for the entire supply chain, starting at the farm/farmer level and ending at the retail level. Conduct cooperative well-funded research, using a panel of experts and dividing the work among them according to their expertise."

"Fund more data collection efforts and research to answer the questions noted."

"The government's key role should be providing timely and accurate data. The government currently does a good job. But I do think that the government's resources should be devoted more to data collection than to data analysis."

"There should be a continued focus on collecting retail price and quantity, better than is done today. Perhaps USDA should have the lead in collecting retail price data instead of BLS. There needs to be a research focus that addresses the many issues like

structural change, the cattle cycle, etc., that would include researchers from both the government and academic circles."

"Undertake additional surveys."

"Most of these issues regard not barriers to modeling but simply aspects that must be included or taken into account. A perfect model is impossible, but an adequate job seems within reach according to feasibility and importance ratings. As actions for government, they provide guidance about the information that should be collected. For the future, price reporting must certainly not be diminished (reporting only when transactions reach a certain number of firms or sales is bad for the industry and for analysis)."

"Improve data collection on prices/quantities in the beef sector."

"The primary issue, in my view, after carefully defining the questions for which answers are sought (this is an important issue, since no model can answer a wide variety of questions), is data availability and quality. The importance of supply factors implies that detailed cost analyses are necessary to determine the impact of cost economies on observed technological and market structure. This requires plant-level data, and data over time, which are currently limited. The importance of consumer demand also suggests that quality variations, as they become increasingly important price drivers, will be important to track. If answers are sought for these questions, data availability will be important to enhance, and studies should be encouraged, or even commissioned, for particular questions."

"Quantify impacts from government actions (impacts on demand from recalls specific to only one species, or changing nutritional guidelines, for example), education about cattle cycle and supply/demand impacts on prices, information about impacts of government feed grain policy, changes on prices for calves. Improved data regarding changes in consumer tastes and preferences, convenience, nutrition, and safety, for example."

"The government sponsors research and collects basic data. Those roles continue to be important."

"Only the federal government can provide access to the needed data, since most are proprietary."

"I am sympathetic to the 'data are public goods' argument. Or, stated a bit more properly, 'data have elements of nonexclusivity,' which is a necessary but not a sufficient condition for the government to be involved in data collection and dissemination. I suppose I selected those data sets where I thought collection and dissemination could be accomplished at reasonable cost. But understand that I have no real idea of how costly it would be to collect such data. Perhaps if we rely on the private market to provide these data, we may increase welfare, relative to forcing governmental collection and dissemination. My only problem here is that initial wealth or income levels of parties may be unequal, giving especially large benefits to those with larger wealth endowments. When dealing with private contracts between parties, we have required reporting such prices in other areas (I'm thinking about rail rates). The cost of such programs may be in parties' giving up the right to trade in private (a nonpecuniary cost). This gets us into very difficult issues of rights of individuals versus rights of the group. As we evolve to more concentrated or controlled markets (fewer open outcry sales and more contract sales), these issues of individual rights versus group rights become central. Why should company X be forced to divulge the price it paid feeder Y for cattle? But again, I'm not well versed in the area. My casual observation of the rail rate reporting case of the 1980s suggests that reporting did have an effect on industry performance."

"Improved and broadened data collection."

"Collect the best data and try to collect data that represent all quality levels of cattle."

"Better retail price and volume data would be helpful. The work on getting and using scanner data is a good start."

"More involvement in obtaining needed data and processing it for able/quantitative/qualitative purposes."

"The federal government's role should be in data collection—getting better (i.e., realistic) data that reflect the true actions of the market. This may require reporting information and monitoring the reports. The government needs also to review its existing reports and determine if they need to change."

"Put together a team of leading academic and government economic experts to design the modeling and implementation process and have a team of government economists do it with review by the team members."

"Collect and provide more data to researchers."

"Develop an index system to score pasture availability."

"Put in place more stringent and required reporting of price data at all levels of the marketing system for cattle and meats. It will be important to have data on substitute meats, as well."

"Improve data. Mandatory price reporting legislation is prompting new efforts, but it is not clear that ERS will provide detail on the prices of cuts of meats to allow better demand analysis or that it will release retail meat prices more often than monthly and then with a 6-week to 7-week time lag. The detail on live prices has been improved by this legislation, but there are no price data or detail on the grade and quality of the export shipments. The price-based system will totally disappear unless data are better, and that is the primary role the government can and should play in this industry. We do not need, in my assessment, to impose strict regulations on how buyers and sellers do business in the meats industry."

"To take advantage of existing but not-available data, grant researchers access to data in-house, to use it without taking it home, under a confidentiality agreement, pretty much the way the Census Bureau operates. Stimulate research on key priorities identified in this survey by engaging in a mini-grant competition and bilateral agreements between USDA and other institutions, as well as within USDA."

"Revise price reporting to include contracting. Go after true transactions: prices, quantities, qualities, other factors. This requires access to private market transactions data. If politically infeasible, then report only percentage sold under contract and don't report any 'market' price information at all. This will force the issue and prevent further thinning of the market information by those who formula price off the reported prices. Provide more public data on market structure. Lerner indexes would be great, but just local market Herfindahls would be a start. Provide data on imports and exports in the same format as domestic data are provided."

"Presumably the government's direct role at this point should be limited to considering improvements in the way it generates data and the types of data that it makes available to researchers. GIPSA has very good data on packers in many cases, but they are not readily available to outside researchers. Data at other levels of the market channel are much poorer, however."

"Two key weaknesses of industrial organization analysis of the effects of packer concentration have been that (1) models have been inherently static and do not do a good job of analyzing structural change in a dynamic setting. So better modeling of the dynamics of structural change is critical. (2) The results of the models are only as good as the data used to estimate them. Often the data are too aggregate in terms of industry and products and are nonspatial. In addition, it is a lot easier to measure Lerner indexes directly than via econometric methods if the data are available. So better data is a key to better analysis."

"Many of the issues I checked were related to data issues. The federal government can make processor data available to researchers with a protective order agreement that prohibits the researchers from making data on firms public. The other issues relate to setting an agenda to have a set of policy models related to cattle that account for market structure across the various levels of the marketing system."

"The federal government needs to provide long-term funding for research on all the issues that motivated this survey. None of these issues are new. However, many of them will not be researched in an ongoing fashion if new research dollars involve

a competitive grants process. For example, there was little research on structural change and competition during the late 1980s because it was not politically popular. It is interesting to note what a huge issue this topic became in the mid-1990s. The federal government needs to support the research infrastructure at land grant universities. Further, the federal government needs to learn a lesson from the institution of mandatory price-reporting legislation. This legislation had good intentions and has absolutely harmed the quality of data available on livestock and meat product prices. The federal government needs to go back to the old system and needs to be extremely careful before attempting to do anything in the future. It needs to know what the final product will be before it acts. If it does not, then it should not act."

"Retail price reporting needs to be changed. Volume-weighted, representative price data are needed. Better ways of summarizing quality-adjusted fed cattle prices are needed. This could be done; it has not been done adequately in mandatory price reporting."

Our Panel of Experts

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Comments from the U.S. Department of Agriculture

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

USDA

United States Department of Agriculture

March 4, 2002

INFORMATIONAL MEMORANDUM

TO: Lawrence J. Dyckman
Director, Food and Agriculture Issues
General Accounting Office

FROM: Susan E. Offutt
Administrator
Economic Research Service

SUBJECT: GAO Report 02-246, "Economic Models of Cattle Prices"

We have reviewed for the draft report to "Economic Models of Cattle Prices: How USDA Can Act To Improve Models to Explain Cattle Prices." Our subject matter experts have identified some changes and points of clarification that we feel need to be included in the final report. We would like to have the corrections we have identified included in the final published report. Our comments are attached.

Attachment

Economic Research Service
1800 M Street, NW, Washington, DC 20036-5831
www.ers.usda.gov

Comments on Draft Report GAO-02-246
"Economic Models of Cattle Prices:
How USDA Can Act to Improve Models to Explain Cattle Prices"
March 4, 2002

The draft report by the General Accounting Office (GAO) addresses modeling and data issues needed to improve economic models of cattle prices. ERS commented on both the modeling and data issues, and the characterization of the industry structure. The other agencies (AMS, GIPSA, and NASS) focused on recommendations by GAO and GAO's expert panel to improve the quantity and quality of data available to researchers.

Summary.

See comment 1.

ERS believes that the GAO report mischaracterizes the process used to develop and document its livestock model. It agrees with GAO that the model, as developed, was not designed to examine issues of market structure. Whether or not structural detail could or should be added to a model designed primarily to forecast supply, demand and trade remains an open question, as the report itself indicates. However, ERS agrees that re-estimating the model using more current data could be valuable, that any new model developed should be appropriately documented and that applications should provide appropriate measures to evaluate model performance.

See comment 2.

When the model was initially developed, it was appropriately documented in Weimer, Mark R. and Richard P. Stillman, "A Long Term Forecasting Model of the Livestock and Poultry Sectors." Proceedings for the NCR Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management., June 1990. That documentation, in line with standard professional practice, included the specification of the model, as well as evaluation of its goodness of fit and ex post model performance statistics. Measures provided included t statistics, R-squared and Thiel's U, mean absolute error and mean square error statistics.

See comment 3.

The original data set used to initially estimate the model is not available. However, as ERS analysts attempted to explain, even if these data were still available, they would not be a useful basis for additional work with the model. Data series are regularly updated, and updates are incorporated into improved historical series. Any attempt to use the model today would begin from an historical series that included the best available data. In addition, developments in database technology are making it increasingly possible to provide the public with direct access to databases, allowing them to select the data they need for specialized applications. ERS has made substantial progress in developing such databases, some of which are currently available on its website. In this environment documenting the selection procedures for assembling data will be more relevant than producing a static"snapshot" of data selected at a particular moment in time.

See comment 4.

ERS recognizes the importance of emerging issues, such as structural change, retail price monitoring, animal diseases and biosecurity. Four additional staff have recently been added to the animal products branch in the Market and Trade Economics Division to increase our capacity in this important area. ERS does not, however, believe that the best approach to addressing these issues is to mandate specific tasks, such as updating the existing model (page 6) but instead to

encourage a broader effort to develop a strong program to address new issues. The latter approach is consistent with the final recommendation on page 9.

Detailed comments.

See comment 5.

1. Comments on pages 4, 6, 39, 45 the report seem to suggest that data needed to validate the initial estimation of the model are "lost." This is not the case. While the data drawn from databases that existed in 1990 are not available, accurate historical data for the period in question exist in the public domain and are readily available from USDA's website. These data are the most accurate series available, incorporating updates from NASS and other data generating agencies. The operational definition of the data--the SAS code used to compile it--also exists. Therefore any researcher with a basic knowledge of SAS could reconstruct the dataset. The code used for estimation of the models is the same as code used in simulation model and that code is thoroughly documented by SAS. PROC MODEL is an estimation procedure as well as a simulation package and provides the requisite statistical reliability measures. To re-estimate the model, the research would have to collect the data from the public sources and make a few minor changes in the SAS command statements of the programs.

See comment 6.

2. Page 4. The report indicates that standard measures of statistical goodness of fit and other diagnostics of model performance are critical to model evaluation. SAS, the statistical program used to produce the estimates for the ERS cattle model, typically provides these measures of goodness of fit in the course of producing model results. And, FAPSIM, the simulation model, provides several statistical evaluation measures in its output.

See comment 7.

3. Page 5, paragraph 3 under the Principal Findings heading. "The model was not designed to address these kinds of questions," refers to concentration and market structure. Several studies have found that market structure and rising concentration may have led to more market power and cost-efficiency, but does not have a significant effect on meat prices. Thus, incorporating these variables might not increase the explanatory power of the model. See for example: Lopez, R., A. Azzam, and C. Liron-Spana, Market Power and/or Efficiency: A Structural Approach," **Review of Industrial Organization** 20(2):115-126, 2002. Other ERS-based work also shows despite growth of packer concentration, no negative effects of packer concentration on cattle prices have been demonstrated. See the report: **U.S. Beef Industry: Cattle Cycles, Price Spreads, and Packer Concentration,** Kenneth H. Mathews, Jr., William F. Hahn, Kenneth E. Nelson, Lawrence A. Duewer, and Ronald A. Gustafson. Technical Bulletin No. 1874, April 1999. Access from the ERS website at: http://www.ers.usda.gov/publications/tb1874/. A GIPSA report indicates that studies have not shown that increase in the use of captive supply cause spot market prices to fall, or that packers' use of captive supply causes spot market prices to change. See: **Captive Supply of Cattle and GIPSA's Reporting of Captive Supply**. USDA, Grain Inspection, Packers and Stockyards Administration, January 11, 2000. Web access from GIPSA site at: http://www.usda.gov/gipsa/pubs/captive_supply/captive.htm. Another GIPSA report indicates that the analysis did not supply any conclusion about the exercise of market power by beef packers. See: **Concentration in the Red Meats Packing Industry**, Packers and

Stockyards Programs, USDA-GIPSA, February 1996. Web access at: http://www.usda.gov/gipsa/pubs/packers/conc-rpt.htm.

See comment 8.

4. Page 8, and the chapter detailing the focus group results, referring to the discussion of relevant variables to include in a model of cattle prices. We recognize that improved models are needed to more fully incorporate relevant determinants of variation in cattle and meat prices. The description fails to capture the modeling problem which is… there are more possible variables to be explained (endogenous variables), than there is reliable time-matching data available to explain them (exogenous variables). Any inclusion of explanatory variables in a model meant for forecasting requires that those explanatory variables must also be forecasted. The econometric modeler must create a model that addresses the relevant question and can actually be estimated. Even if variables describing market structure are determined to be relevant, it is difficult to ascertain how future market structure could be determined for modeling purposes without proposing a series of assumptions for scenario-driven explorations. Less formal expert opinion may be better able to incorporate current information on rapidly changing situations and an understanding that historic statistical relationships may not currently hold because of structural and technological changes.

See comment 9.

5. Page 6, text indicates the cattle pricing models need "better documentation." Admittedly, documentation of the modeling efforts is sparse, but it is adequate for researchers with a basic knowledge of SAS. The model has been documented in ERS publications, and the SAS code provided to GAO contained programming comments to describe statistical process used in the models. In addition, SAS manuals document modeling procedures that are routinely used to make the necessary estimates.

See comment 10.

6. Page 12 Par. 2. Implies that corn is the only concentrate feed. While corn comprises the majority of US feedlot concentrate rations other grains e.g. sorghum, barley, and even wheat at times are economically significant.

See comment 11.

7. Page 12 Footnote 3. Incorrect (or at least awkward) to say "by-products are important in **producing** hides". Hides **are** the most valuable of the many by-products of animal slaughter. Leather is the product made from hides and skins.

See comment 12.

8. Page 13 Paragraph 1. It would be more common to say "..graze on grass and other forages." While the usage is not universal, many use roughage to mean any high cellulose feed including hay bales brought to the animal, while forage is used to mean roughage that animals graze for themselves.

See comment 13.

9. Page 13, Paragraph 2. The phrase "…relying on seedstock producers.." may suggest more reliance on specialized breeding operations than is probably the case. According to the NAHMS survey-- most replacement heifers (88%) are retained from their own herd and only about 1/4 of all operations purchased, borrowed, or leased a bull in their last breeding season and about 1/2 over the past 12 months (1992-93)

See comment 14.

10. Page 14, Figure 4. First Column. The gestation period for a beef cow is 9 months (not 9 to 11 months); 2/3 of cows birth their calves between 278 and 288 days. (Ensminger)

See comment 15.

11. Page 14, Figure 4. First Column. Average weaning weight is now much higher than 400 lbs. Average per operation was over 480 lbs. in 1992 and the weighted average (total pounds/number of calves) was over 500 lbs. (NAHMS). And since 1992 mature size of beef cattle has increased. According to NASS's January 25 Livestock Slaughter report, average live weight of slaughter cattle was 1255 pounds and dressed weight was about 738 pounds.

See comment 16.

12. Page 14, Figure 4. Second Column. The phrase "Becomes steer or heifer when weighed, at 750 lbs." is technically inaccurate. Heifer is another name for female, so a heifer is a heifer calf when born. A bull calf becomes a steer when castrated, usually well before entering the feedlot.

See comment 17.

13. Page 14, Figure 4. Third column. Need to add "…**supplies fed cattle** to beef packing plant"

See comment 18.

14. Page 14, Figure 4. Third column. Again suggests corn as only concentrate. Not so serious in the chart where brevity is important.

See comment 19.

15. Page 14, Figure 4. Fourth column. "buys feed cattle" (presumably) should be "buys **fed steers and heifers and culled cows and bulls"**

See comment 20.

16. Page 14, Figure 4, Fifth column. Add **Institutions** to the list beginning with Grocery chains. (e.g. schools, prisons, hospitals)

See comment 21.

17. Page 15, Figure 5. Change "stockers" to "stocker operations".

See comment 22.

18. Page 16, 1st paragraph under Figure 6: The statement, "Feed is the largest direct cots component in cow-calf production," is misleading. Cow-calf operations depend mainly on forage and pasture to sustain their cattle and use little feed grains. Thus, land ownership (or leasing costs) is the largest direct cost for cow-calf operations. Even in the fed cattle sector, the top direct cost is the price of the cattle, with feed grains coming in as the second largest direct cost component.

See comment 23.

19. Paragraph beginning on Page 16 and continuing to Page 17 and detailing the cattle procurement process. Producers have never relied "solely" on the spot market to sell their cattle. While the cattle sector is moving to include more alliances and arrangements that include contracting and vertical integration, the sector still relies on the spot market to move animals. The procurement processes of marketing agreements, forward contracts, and packer fed beef are not "new" processes as they have been in existence in one form or another since the middle of last century.

See comment 24.

20. Page 17 Paragraph 4. Reorganization of this paragraph with its precedents may make it easier to follow; though, the material is basically correct. Try beginning the discussion on procurement with definitions or discussions of cash market, to vertical coordination, to vertical integration. Then, the reader could follow the progression from pure open cash live-weight auctions with no direct communication between buyer and seller until the point of sale, to coordinated market exchange where some transaction attributes are prespecified, to

full ownership of all assets for all stages of production by one entity. After introducing the concepts and describing coordinated exchange, Paragraph 4 could be rewritten: Vertically integrated entities formalize the coordination of production through ownership of some or all of ranches, feedlots, cattle, feed mills, meat packing and processing, distribution and retail operations that contribute to the finished product. The most common ownership arrangements combine meat packing and cattle feeding in varying ways, but vertical integration is far less prominent in cattle than in broilers or hogs. About 2 million of the more than 27 million fed cattle marketed were owned or fed in packer owned lots in 1999. (GIPSA, NASS)

See comment 25.

21. Page 17, Paragraph 5. The terms value-based pricing and grid pricing are more interchangeable than suggested in this paragraph, but not a big issue.

See comment 26.

22. Page 19, Paragraph 4. Again, what is "new"? Most of these techniques and products have been around for decades, but rates of adoption may be accelerating.

See comment 27.

23. Page 20, Figure 8 shows and text discusses per capita consumption. These statements about meat consumption need clarification on the basis that consumption is reported--carcass, retail, or boneless. Chicken consumption passed pork in the mid 1980s, if it is measured on a retail-weight basis. This is what the graph seems to show, so we assume that the data as for retail-weight per capita consumption. Chicken consumption passed beef consumption in 1993 when measured on a retail-weight basis. See: http://www.ers.usda.gov/Data/FoodConsumption/Spreadsheets/mtpcc.xls

See comment 28.

24. USDA recommends that wording be changed on the bottom of page 36 and top of page 37 to read:

    "The committee's chairperson sees his role as helping committee members reach consesus; however the chair has overall responsibility for approving projections and will impose a decision if consensus can't be reached."

See comment 29.

25. Page 69, GAO recommends that GIPSA, AMS, ERS, and NASS work together, "in consultation with other government departments or agencies" to prepare a plan for improving the amount and quality of data that are available for research and analysis of prices and related issues. This issue is summarized on page 8 and again on page 9 of the Executive Summary where it is recommended that the Secretary of Agriculture direct ERS to periodically re-estimate and document the models. While frequent re-estimation is desirable, it requires a commitment of funding, staff, administrative resources, and computer resources. ERS is a user of secondary data and has no resources to conduct data collection necessary to more fully implement model development.

See comment 30.

GAO's expert panel identified several areas for improvement in cattle price data. The primary role of the Agricultural Marketing Service (AMS) with regard to these issues is the collection and dissemination of market information by AMS Market News. Current Market News reports released under the livestock mandatory reporting (LMR) program already address a number of issues identified by the expert panel. For example, Market News reports on slaughter cattle purchases include information on volume and weighted average prices

categorized by quality grades, problems identified by the panel. Market News reports for slaughter cattle include information on negotiated purchases, formulated purchases, forward contract purchases, and packer-owned cattle. In terms of spatial and temporal dimensions identified by the panel, daily and weekly regional reports are available. Information on premiums and discounts for slaughter cattle are also reported on a weekly basis, further addressing the need for information on cattle quality as noted by the panel. Information on imported slaughter cattle currently is reported, and information on export sales of beef will be included in a new report to be released in the near future. This new LMR data is available since April 2001 and will provide a wealth of information about the pricing of slaughter cattle.

See comment 31.

The expert panel provided several recommendations for providing greater access to data, including proprietary information such as data submitted to AMS under LMR. There are two sources of proprietary data reported to AMS. The first source is proprietary data reported voluntarily to AMS for price reporting. For example, sales of pork by packers are not subject to LMR and are reported voluntarily to AMS. Under voluntary reporting, the information reported to AMS is aggregated for publication and proprietary data are not maintained following release of the aggregated information by Market News. The proprietary data are not maintained because voluntary reporting depends on the assurance of confidentiality of the information reported to AMS. Without such assurance, some firms that now report information voluntarily would cease to participate, which would reduce the quality and comprehensiveness of reported information substantially. Thus, providing access to voluntarily reported information is not feasible.

The second source of proprietary data reported to AMS is the information reported by packers on purchases of cattle, hogs, and sheep and on sales of beef and lamb. GAO's expert panel suggested granting researchers access to such data in a manner similar to the operation of the Census Bureau, which provides researchers access to certain confidential census data in-house. There are differences between the operation of the Census Bureau and AMS Market News. The time sensitive nature of current market information reported under LMR is more restrictive in terms of access and potential impacts on businesses and the marketplace compared to information available from Census Bureau data. In addition, the Livestock Mandatory Reporting Act of 1999 requires that confidentiality be preserved of information submitted to or obtained by AMS regarding "the identity of persons, including parties to a contract" and "proprietary business information." There are limited exceptions to this confidentiality provision, but there is no explicit mechanism or exception for making these confidential data available to researchers.

See comment 32.

Even if LMR data could be made available to researchers, substantial resources would have to be committed and the infrastructure developed. For example, the Census Bureau makes data available to researchers under its American Statistical Association/National Science Foundation/Census Bureau Research Fellowship Program. This is a substantive program involving commitment of funding, staff, administrative resources, computing resources, and physical space. AMS currently has no such program in place and does not have the funding or resources to commit to such a program.

See comment 33.

GAO also reports that GIPSA has some of the best data available on livestock procurement transactions. GIPSA collects these data as a result of its statutory authority for enforcing the Packers and Stockyards Act of 1921, as amended. Data are often collected as part of an investigation, and most of the data are proprietary. While GIPSA enters into cooperative agreements and makes data available for research, it requires that recipients sign a strict non-disclosure agreement that forbids public release of proprietary information. GIPSA is willing to work with other agencies to address important data issues, consistent with the Agency's restrictions on release of confidential data.

The following are GAO's comments on the U.S. Department of Agriculture's (USDA) letter dated March 4, 2002.

GAO Comments

1. We are pleased that ERS agrees with our recommendation that re-estimating the livestock model with more current data could be valuable. In addition, we agree that any new model should be appropriately documented. We disagree that the GAO report mischaracterizes the process used to develop and document the livestock model. Our characterization of this process was based on interviews of ERS officials and documents that they provided.

2. We agree that when originally developed the livestock model was appropriately documented. The problems with documentation arose as this model was subsequently revised. The same kind of documentation was not continued. In addition, even for the original model, data sets were lost, thereby making replication or verification very difficult.

3. The principal reason for wanting to have the original data set is for replication or verification purposes. In addition, some of the original data would presumably be used along with newer data in subsequent reestimates.

4. The livestock sector is important and steps taken by ERS to increase staff devoted to this area recognizes that fact. ERS agrees that re-estimating the livestock model using more current data could be valuable. Updating this model would include reestimation but could also involve respecifying its structure, which could come about as a result of a broader effort to develop a stronger program to address new issues. Our recommendation to periodically reestimate and validate the livestock model is intended to ensure credible and accurate results regardless of what form any future modeling might take. Because data are readily available, this should not pose an undue burden.

5. Our point is that USDA needs to have better documentation of their models and there seems to be agreement on that point. Specifically, in reviewing USDA's livestock model, we noticed that parts of the model are different from what was originally estimated. As a result, we asked for complete documentation of the model. In response to our request for this data, we were told repeatedly that the data was lost during an office move. Knowing what data was actually used in estimating the model would allow an outside reviewer to replicate the estimation

results, which would include validation statistics. While historical data may be available in the public domain, it is not possible to determine which of these data was actually used in estimating the model without further documentation. After examining SAS code for the livestock model, we asked USDA officials for the data sets actually used to estimate the model and were told that these data were lost.

6. We agree that SAS provides measures of goodness of fit. We were told that these measures of goodness of fit as they applied to the latest version of the model were also lost during the move or not documented.

7. We agree that the effect of these structural changes remains unclear. On pages 5 and 43 of the draft (pages 7, 49, and 50 of the final report), we point out that according to current USDA research the effect of these structural changes on cattle prices is inconclusive. Our panel told us that these factors will be more important in the future. In addition, re-estimating the model with more current data would be an indirect way of incorporating any affects that these structural changes may have had on cattle prices. This is one reason why we believe reestimating the model with more current data makes sense.

8. We agree that the econometric modeler must create a model that not only addresses the relevant questions but also can be estimated. Our expert panel identified the need for better data to do such modeling. We agree that expert opinion is valuable in trying to sort out what makes sense, and we have recommended that USDA review the findings of our expert panel in this regard.

9. See our response in comment #5.

10. We agree and clarified text.

11. We agree and clarified footnote.

12. We agree and clarified text.

13. We agree and clarified text.

14. We agree and clarified text.

15. We agree and clarified text.

16. We agree and clarified text.

17. We agree and clarified text.

18. We agree and made change in text.

19. We agree and clarified text.

20. We agree and clarified text.

21. Stockers and stocker operations are synonymous.

22. We agree and clarified text.

23. We agree and clarified text.

24. We do not believe any changes are needed.

25. We agree and clarified text.

26. We agree and clarified text.

27. We agree and clarified text.

28. We agree and clarified text.

29. GAO is recommending that AMS, ERS, GIPSA, and NASS review the findings of our expert panel regarding important data and modeling issues in preparing a plan for improving data, considering the costs and benefits of such data improvements, including tradeoffs in departmental priorities and reporting burdens. As such, this recommendation is not directly linked to periodic reestimation of the livestock model. Since ERS is a major user of such data, it makes sense for it to be included in this planning process.

30. On pages 63 and 64 of the draft, (pages 71 and 72 of the final report) we recognize AMS's role in collecting data on cattle prices, including data on cattle weight and quality as well as data on cattle purchased under marketing agreements and forward contracts. As a result, AMS is in a good position to offer valuable insight in developing a plan for further data enhancements.

31. In preparing a plan for addressing the most important data issues that the expert panel recommended for government action, USDA should explore creative ways to deal with the issue of confidentiality while satisfying the needs of researchers.

32. As noted above, we recommend that the costs and benefits of procuring better data be considered.

33. We are pleased that GIPSA is willing to work with other agencies to address important data issues, and our recommendation is designed to harness this cooperative spirit among all relevant agencies and departments, including those outside USDA. We can appreciate restrictions on the use of certain data. However, our panel of experts told us that better data is needed. Perhaps further communication with the user community can alleviate some of the concerns that the expert panel had about data. Other data concerns may entail more creative thinking.

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Glossary

Beef Cow	A sexually mature female bovine used in the production of beef.
Bull	A bovine male of breeding age.
Bullock	A young bull younger than 20 months old—that is, not of breeding age.
Cow	A sexually mature female bovine that has usually produced a calf.
Cow-Calf Operation	A management unit that maintains a breeding herd and produces weaned calves.
Economies of Agglomeration	Average cost reductions resulting from the clustering of activities.
Economies of Scale	A decrease in the average cost of a product or service as the output of the commodity rises.
Economies of Scope	Factors that make it cheaper to produce a range of related products than to produce any of the individual products on their own.
Fed Cattle	Steers and heifers that have been fed concentrates, usually for 90 to 120 days in a feed lot.
Feeder Cattle	Cattle that have been fed on forage but need further feeding on high-energy rations before slaughter.

Feedlot	An enterprise in which cattle are fed grain and other concentrates, usually for 90 to 120 days.
Finished Cattle	Fed cattle whose time in the feed lot has been completed so that they are now ready for slaughter.
Forage	Herbaceous plants, such as grass, used to feed cattle.
Forward Contract	A transaction that involves a contract to buy or sell a commodity at a fixed future date and at a price agreed on in the contract.
General Equilibrium Model	A study of the behavior of economic variables that takes full account of the interaction between those variables and the rest of the economy—for example, the effect of a single change such as a change in the price of milk on the entire economy.
Goodness of Fit	Refers in statistics to how well the predicted values of a variable match its observed values.
Heifer	A young female bovine cow before she produces her first calf.
Partial Equilibrium Model	A study of the behavior of variables that ignores the indirect effects that the variable has on the rest of the economy.
Spot Market	A market for buying and selling commodities for immediate, rather than future, delivery or for cash payment. The price for such commodities is called the spot or cash price.
Spot Price	The price of commodities sold in the spot market.

Steer	A bovine male castrated before puberty.
Stocker	Weaned cattle that are fed high roughage diets (including grazing) before going into feedlots.
Thin Market	A market in which trading is light and price fluctuations relative to volume tend to be much greater than in a market where trading is very active.
Vertical Integration	The extent to which successive stages in production and distribution are placed under the control of a single enterprise

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Contents

Table 1: What Detailed Analysis Requires for Adequate Cattle Price Modeling 67
Table 2: Inadequate Retail Data and Quantification Factors Influencing Consumer Demand Pose Challenges to Modeling 68
Table 3: Cattle Cycle, Expectations of Profits, and Long-Term Variables Pose Challenges to Modeling 70
Table 4: Vertical Coordination Poses Challenges to Modeling 70
Table 5: Quantifying International Trade Factors Is an Issue for Modeling 71
Table 6: The Relevance of a Model's Purpose and Scope 72
Table 7: The Five Problems Most Important for Government Action in Developing a Comprehensive Analysis 73
Table 8: The Panel's Comments on Data Needs That the Government Can Address 74
Table 9: The Panel's Comments on the Government's Role in Data and Modeling Issues 75
Table 10: The Number of Panelists Participating in the Study's Three Phases 81
Table 11: Descriptive Statistics on Factors Rated in the Phase II Questionnaire 106
Table 12: Descriptive Statistics on Issues and Problems Rated in the Phase II Questionnaire 114
Table 13: Issues the Panel Recommended the Federal Government Act On 134

Contents

Figure 1: Cattle Being Fed in a Feedlot Prior to Slaughter 4
Figure 2: Cattle Demand and Supply Relationships Linking Producers and Consumers 15
Figure 3: Cattle Eating at a Feedlot Trough 16
Figure 4: The Beef and Cattle Industry from Animal Breeding to Consumption 18
Figure 5: Prices Signal Changes Along the Demand and Supply Chain between Producers and Consumers 19
Figure 6: Retail Beef, Boxed Beef, and Slaughter Steer Price Movements, 1974–99 20
Figure 7: The Rise in Steer and Heifer Slaughter, Accounted for by the Four Largest U.S. Meatpackers, Selected Years 1980–99 23
Figure 8: U.S. Per Capita Retail Beef Consumption Fell in the 1970s and 1980s and Leveled Off in the 1990s 25
Figure 9: U.S. Retail Beef Prices Were Higher Than Chicken and Pork Prices, 1970–99 26
Figure 10: U.S. Beef Exports Have Generally Risen Since 1980 27
Figure 11: U.S. Beef Exports Rose as a Percentage of U.S. Consumption, 1970–99 27
Figure 12: U.S. Beef Imports Varied as a Percentage of Commercial Production, 1970–99 28
Figure 13: U.S. Cattle Imports Exceeded Exports, 1970–2000 29
Figure 14: U.S. Cattle Imports Rose as a Percentage of Slaughter, 1970–2000 30
Figure 15: The Cattle Cycle: Rising and Falling Cattle Inventories, 1930–2000 31
Figure 16: How Cattle Inventories Peaked Before Beef Production, 1970–99 32
Figure 17: The Cyclical Movement of Cattle Prices, 1970–99 33
Figure 18: The Opposite Movement of Cattle Prices and Commercial Slaughter, 1974–2000 34
Figure 19: Domestic Cattle Demand and Supply Are More Important Than Other Factors 55
Figure 20: The Panelists' Assessment of Structural Change and International Trade Varied 55
Figure 21: Consumer Preferences, Prices of Beef Substitutes, and Health Concerns Are More Important Than Other Factors Influencing Consumer Demand 56

Figure 22: Capacity Use at Meatpacking Plants and Retailing Beef Costs Are More Important Than Other Factors Influencing Meatpackers' and Retailers' Demand for Cattle and Beef 57
Figure 23: Supply Factors Vary in Importance 58
Figure 24: Beef Is More Important in International Trade Than Cattle 60
Figure 25: International Trade Will Be More Important 5 Years from Now 61
Figure 26: Various Aspects of Structural Change Influence Cattle Prices and Producers' Incomes 62
Figure 27: Structural Change Will Be More Important 5 Years from Now 64