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Special study

The beef supply chain in the United States
Status, development and perspectives

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Diploma thesis

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Contents

List of abbreviations

AMA	Alternative Marketing Arrangements
AMS	Agricultural Marketing Service
AMS	Agriculture Marketing Service
APHIS	Animal and Plant Health Inspection Service
AU	Animal unit
avg.	average
BEO-FC	Bovine edible offal, fresh or chilled
BEO-FRZ	Bovine edible offal, frozen except livers and tongues
BG	Backgrounding
BL-FRZ	Bovine livers, frozen
BLS	Bureau of Labor Statistics
BM-FC	Meat of bovine animals, fresh or chilled
BM-FRZ	Meat of bovine animals, frozen
BM-SDM	Bovine meat salted, dried or smoked
BSE	Bovine Spongiform Enzephalopathy
BT-FRZ	Bovine tongues, frozen
CO	Colorado
COF	Cattle on feed
COOL	Country of origin labelling
CRB	Crop Reporting Board
CW	Carcass weight
CWE	Carcass weight equivalent
DL	Drylot
DWG	Daily weight gain
eKS	east Kansas
ERS	Economic Research Service
EU	European Union
EU-25	European Union – 25 member states
EUR	Euro
FAL	Federal Agriculture Research Centre
FAPRI	Food and Agricultural Policy Research Institute
FAS	Foreign Agricultural Service
FI	Federally Inspected
FMD	Food and Mouth Disease
FSIS	Food Safety and Inspection Service

FTC	Federal Trade Commission
FY	Fisical Year
GIPSA	Grain Inspection, Packers and Stockyards Administration
kg	kilogram
KS	Kansas
KSU	Kansas State University
LMPR	Livestock Mandatory Price Reporting
LW	Live weight
MGA	Melengesterol Acetate
NAICS	North American Industry Classification System
NASS	National Agriculture Statistic Service
NFI	Non-Federally Inspected
NK	Nebraska
OECD	Organisation for Economic Cooperation and Development
OSU	Oklahoma State University
SG	Summer grazing
TBA	Trenbalone Acetate
TX	Texas
U.S.	United States
USA	United States of America
USDA	United States Department of Agriculture
USDJ	United States Department of Justice
USEPA	United States Environmental Protection Agency
wKS	west Kansas
WWG	Winter-wheat-grazing

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1 Introduction

1.1 Situation

The increase of purchase power in the world economy results in a higher consumption of higher-value and quality foods. These changes in consumption, together with a projected population growth of about 1.1 percent annually in the next decade, lead to an increase in world demand for beef. While in 2004 beef consumption averaged nearly 15.9 kg per capita in OECD-countries and 4.9 kg in non-OECD countries, projections expect a moderate growth up to 16.2 kg and 5.6 kg per capita until 2014.

To cover the current world consumption, about 61 million tons of beef were produced in average of the years 2002 to 2004. South America, South Asia, and Africa keep about 60 percent of the cattle inventory. On the other hand, about 60 percent of the beef is produced in North America, Oceania, and the European Union. These figures illustrate the enormous differences in productivity. Furthermore, the United States of America (USA) is the world's largest producer with about 12 million tons of beef annually. On average for the years 2002 to 2004, the USA produced, with only about 6.4 percent of the world's inventory, nearly 20 percent of the world beef supply. These figures reveal a high productivity and raise questions about the size, structure, and organisation of the U.S. beef supply chain.

A further particularity of the United States (U.S.) is its position in the world beef market with regard to trade. With about 1.1 million tons exported and 919 thousand tons imported in 2003, the U.S. is both a major importer and exporter. However, beef exports in 2004 nearly disappeared due to the discovery of first U.S. Bovine Spongiform Encephalopathy (BSE) case. This raises further questions about the long-term impact of BSE on the U.S. beef supply chain.

This study addresses the importance of the U.S. beef industry for world beef production and trade. Furthermore the impact of recent events is considered in some detail. The investigation of the current supply chain structure and its historical development, as well as future perspectives and challenges, round out the study.

1.2 Objectives

While research has been done on specific parts of the U.S. beef industry, this study focuses on the entire U.S. beef supply chain, from the cow-calf operation to the final consumer. Furthermore international aspects are considered.

1. This study clarifies which role the U.S. beef industry plays in a worldwide context. Beside production volume, further indicators like import and export volumes and values of beef have to be taken in consideration while evaluating the industry.

2. Furthermore this study focuses on how the U.S. beef supply chain is structured and organized. Accordingly, it is investigated how the different production stages interact and how vertical integration is involved.

3. The competitiveness of beef production is investigated and costs and returns are compared on the international level.

4. Finally, this study has the objective to provide information about the perspectives and challenges of the U.S. beef supply chain within the next ten years.

1.3 Approach and implementation

In order to provide the reader with an overview about the methods used and how the results have been structured, this chapter is divided into three subsections: *"Working steps"* (describing the organisational approach) followed by the section *"Interviews"* (displaying the interview as a data collection tool) and *"Structure of the study"* (describing the external and internal structure of the research paper to be a form of metadiscourse).

Working steps

The working steps of the research project can be structured chronologically into three parts: prearrangements, research journey, and final analyses and aggregations. Each of those parts is explained in the following paragraphs.

In October 2005 prearrangements on organisational requirements were clarified and first literature was reviewed to obtain an overview about the U.S. beef industry.

These steps resulted in a better understanding of the U.S. beef supply chain and a more efficient study abroad.

The three month research journey abroad aimed at generating a maximum of knowledge, data, and information. Moreover, it was important to obtain practical impressions for accurate implication of the information collected. The period chosen – November 2005 to January 2006 – ensured a maximum availability of the persons interviewed. Persons met are farmers, lobbyists, and researchers. The prevailing regions visited were Washington D.C., Iowa, Kansas, Nebraska, Oklahoma, Texas and Colorado. Apart from the interviews, especially farmers provided further financial data and information. Furthermore, survey data were collected from the Iowa, Kansas, Oklahoma and Colorado State Universities.

In addition to the study abroad, another three months were required for final analyses and aggregations. Questions arising from the literature research and analysis of data were clarified by e-mail and telephone conversations in order to reduce misinterpretations.

Interviews

The interviews used for data collection can be classified as expert interviews which are defined by CASELLA-EVANS et al. (2002, p. 9) as “sessions where one or more people who are considered experts in a particular subject, program, policy, or process, etc. meet with others to share knowledge”. Experts chosen for this study were farmers, lobbyists, and researchers. The involved organisations and persons are displayed in the “list of interview partners”.

The type of interview applied can further be defined as a semi-structured interview. According to CASE (1990), semi-structured interviews are conducted with a fairly open framework which allow for focused, conversational, two-way communication. They can be used both to give and receive information. Unlike the questionnaire framework, where detailed questions are formulated ahead of time, semi-structured interviewing starts with more general questions or topics. Relevant topics are initially identified and the possible relationship between these topics and the issues such as availability, expense, effectiveness become the basis for more specific questions which do not need to be prepared in advance. The majority of questions are created during the interview, allowing both the interviewer and the person being interviewed the flexibility to probe for details or discuss issues.

As the group of interview partners was not homogeneous, the illustrated semi-structured interview has been applied.

Structure of the study

On the basis of the expert interviews, the data collection and the literature review described above the result contains seven main parts:

1. Overview about the whole industry
2. Production on farm-level
3. Marketing of live cattle
4. Slaughter and processing
5. Domestic distribution and consumption of beef
6. International trade of beef
7. Future perspectives

After an overview is given in Part One, the following part – **production on farm-level** – should be considered as the main part of this study. Subdivided into cow-calf, backgrounding and beef finishing, facts about the inventory, the regional distribution, the structure and finally the productivity and profitability are displayed. The **marketing of live cattle** is characterized by the different marketing arrangements used to trade specific types of live and slaughtered cattle. To describe the **slaughter and processing** of the beef industry the categories overview, regional distribution, structure, final products and profitability were chosen. After describing the domestic **marketing and distribution** *of beef*, the study expands – following an overall more national focus – to an international level, describing the **international trade** of beef. Domestic issues as well as international questions are discussed in the last chapter – **future perspectives** – and provide an overview about the current and future challenges the beef industry has to face.

2 Overview about the U.S. beef supply chain

In this chapter an overview is given by comparing the beef industry on an international level. Than the entire supply chain is structured from farm level to final consumer and the development of the cattle inventory is described. Finally the current composition of the U.S. cattle inventory is investigated.

2.1 The U.S. beef industry in a world-wide context

In order to give an overview about the world beef supply, central parameters and countries are chosen and displayed in the subsequent table.

Tab. 2.1: Global beef key-figures, average of the years 2002-2004 (own illustration based on UNCOMTRADE (2006); FAO (2006)).

					World Ranking				
	World	**US**	**EU-25**	**Germany**	***I***	***II***	***III***	***IV***	***V***
Cattle inventory									
'000 head	1,503,264	95,904	89,588	13,781	*283,999*	*191,426*	*131,409*	***95,904***	*49,912*
% of world	100	6.4	6.0	0.9	*18.9*	*12.7*	*8.7*	***6.4***	*3.3*
Country					*India*	*Brazil*	*China*	***US***	*Argentina*
Beef production									
'000 t	61,505	11,909	8,064	1,267	***11,909***	*7,381*	*6,323*	*2,939*	*2,725*
% of world	100	19.4	13.3	2.1	***19.4***	*12.0*	*10.3*	*4.8*	*4.4*
Country					***US***	*Brazil*	*China*	*India*	*Argentina*
Beef exports									
'000 t	6,735	821	308	448	*997*	***821***	*710*	*448*	*432*
% of world	100	12.2	4.6	6.6	*14.8*	***12.2***	*10.5*	*6.6*	*6.4*
Country					*Australia*	***US***	*Brazil*	*Germany*	*Canada*
'million EUR	13,677	1,887	349	1,002	*1,951*	***1,887***	*1,231*	*1,088*	*1,055*
% of world	100	13.8	2.6	7.3	*14.3*	***13.8***	*9.0*	*8.0*	*7.7*
Country					*Australia*	***US***	*Netherl.*	*Brazil*	*Canada*
Beef imports									
'000 t	6,291	1,023	249	163	***1,023***	*589*	*565*	*470*	*391*
% of world	100	16.3	4.0	2.6	***16.3***	*9.4*	*9.0*	*7.5*	*6.2*
Country					***US***	*Russia*	*Japan*	*Mexico*	*Italy*
'million EUR	13,309	2,360	839	500	***2,360***	*1,771*	*1,320*	*782*	*779*
% of world	100	17.3	6.2	3.7	***17.3***	*13.0*	*9.7*	*5.7*	*5.7*
Country					***US***	*Japan*	*Italy*	*Mexico*	*France*

Table 2.1 demonstrates the importance of the U.S. in relation to the World, Europe and Germany in different categories. Additionally a world ranking is shown and allows a comparison of the top five countries of each category. For simplification, cattle and buffalos are declared as cattle, and beef and buffalo meat as beef.

As can be seen, the top five countries keep about 50 percent of the world cattle inventory, which reaches approximately 1.5 billion head on average of the years 2002 to 2004. The top five countries in beef production produce about 50 percent of the world beef supply. After comparing these figures it is even more interesting to see that the countries with a large cattle inventory are not always the biggest beef

producers. The U.S., for example, as the world's biggest beef producer produces as much beef as China, Argentina and Australia together, but has only the fourth biggest cattle inventory with about 95 million head (depending on the cattle cycle explained in Chapter 2.3). These differences in cattle inventory and beef production depend on distinctions in overall productivity which includes the productivity of cow-calf, backgrounding and beef finishing farms (if existing). The U.S., for example, produces about 124 kg of beef per head inventory, whereas Brazil and Argentina reach only 39 to 55 kg.

Moreover the table presents information about the beef trade in two units: metric tonnes and EUR. These two numbers give an overview about the quantity and quality that have been traded. In terms of quantity and quality, 50 percent are exported and imported by the top five countries of each category. Unexpectedly the U.S. is not the top beef exporter. Because of its first BSE case confirmed in December 2003, the beef exports totally collapsed in 2004 and increased slowly in the following years. Therefore the 2002 to 2004 average beef export of 821 thousand tonnes should be interpreted carefully. On the import side the U.S. is the leading country in terms of quantity and value traded. They import about 17 percent of world value and quantity traded and around four times as much as the EU-25 does.

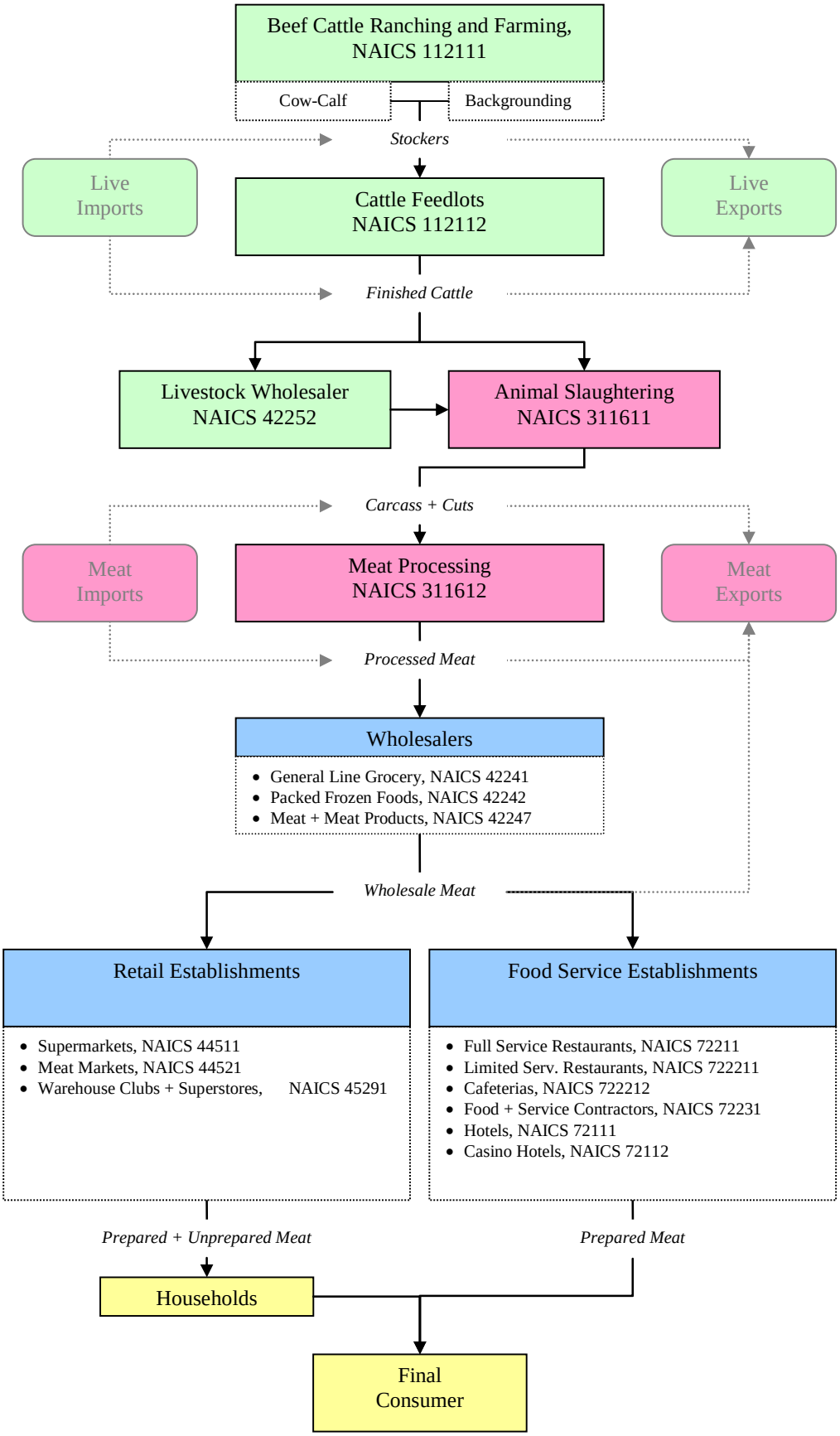
Despite the fact that the U.S. has lost its main export markets due to its first BSE case, it is still an important country for the world beef trade – especially as beef importer – and beef production with a very productive cattle inventory. More detailed analyses concerning the U.S. beef trade and relations between the quantity and the value of imports and exports are shown in Chapter 7.

2.2 Structure of the supply chain

According to GOODWIN and CROW (1973) the beef supply chain in the early 1900's – when cattle were mainly grazed in the West and then shipped East for slaughter and consumption – seemed to be fairly simple. Geographic changes in feed production, cattle inventory, slaughter capacity and beef consumption together with an increased specialisation resulted in a complex pattern of interregional flows of feed, cattle and beef (GOODWIN and CROW 1973). The entire chain from farm level to the final consumer can be structured into three main parts, visualized by the flow-chart with different colours in Figure 2.1. Part one is coloured green and highlights the business with live animals. The red colour in the second part is chosen for slaughtering and meat processing, where a transformation from an individual live animal to a standardized meat product emerges. The distribution of this meat – marked in blue – is done in by the wholesale followed by retail grocery or restaurants/food service establishments. The final consumption takes place directly in restaurants, and food service establishments or at home in the households.

The Industry classifications used in the flow-chart refer to the North American Industry Classification System (NAICS). "NAICS […] groups establishments into industries based on the activity in which they are primarily engaged. Establishments using similar raw material inputs, similar capital equipment, and similar labor are classified in the same industry." (USDOL BLS 2006). The overview does not represent the whole supply chain in detail. Because of the complexity of the whole industry only the main stages are displayed based on MUTH et al. (2005). Additionally added have been the "cow-calf" and "backgrounding" level and the "livestock exports". More detailed information about each stage of the industry is provided in the related chapters.

Fig. 2.1: Overview of the beef supply chain from farm to final consumer (MUTH et al. (2005) modified).

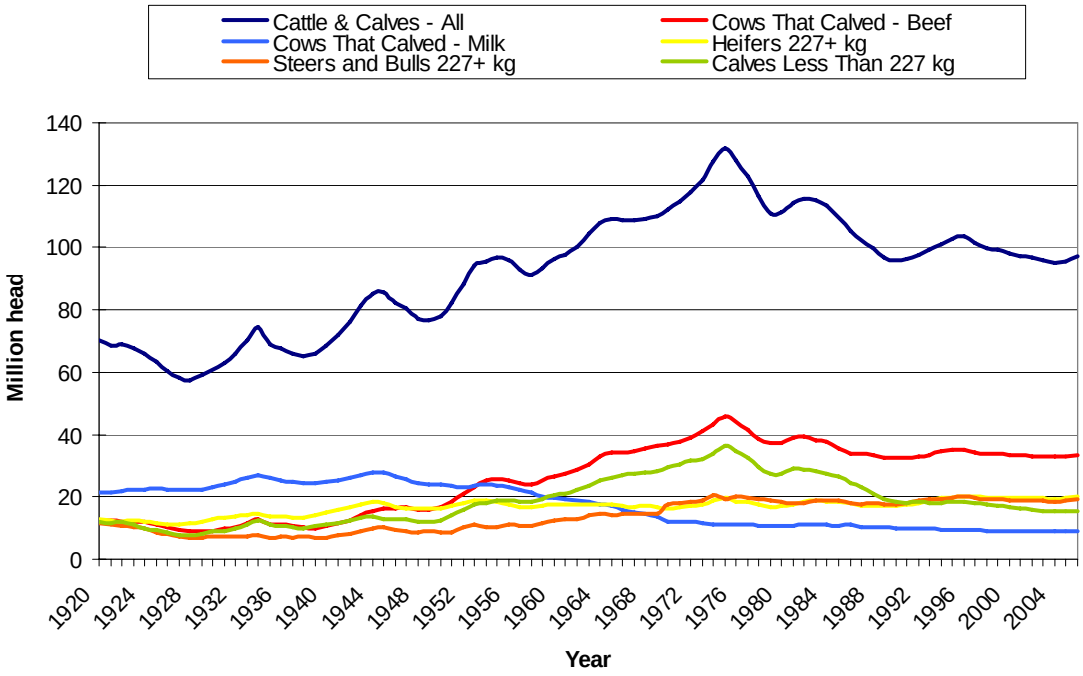


2.3 The cattle inventory

Development and cattle cycle

The cattle husbandry has a very traditional history in the U.S. and has changed from a commodity paradigm with cowboys on the trail drives in the late 1800s toward a value added, consumer driven business (FIELD and TAYLOR 2003). As a result of this change there has been a noteworthy shift in cattle inventory. The following line graph reflects its development since the beginning of the 20th century.

Fig. 2.2: Development of the U.S. cattle inventory on January 1 (own illustration based on USDA NASS (2006a)).



As can be seen above, there is a moderate increase from the 1920s to the 1970s resulting in a cattle inventory maximum of about 130 billion animals in 1975. The following 20 years show a decrease of approximately 30 billion head ending in a stable cattle inventory of about 90 to 100 billion head in the recent years.

In addition to this development over decades and centuries, it is also interesting to examine the medium-term fluctuation. The line graph indicates a periodical change in cattle numbers every 10 to 14 years. This fluctuation is called “cattle cycle” and is defined by FEUZ and UMBERGER (2003) as the period of time from the lowest cattle inventory to the next lowest cattle inventory in the United States. The cycle itself consists of three periods: An **expanding** phase of about 6 to 7 years followed by **consolidation** of about 1 to 2 years and ending in a **declining** phase of 3 to 4

years (CROM 1981; MATHEWS et al. 1999). During the expansion phase, cow-calf producers cull fewer cows and retain more replacement heifers. After the consolidation phase with a stable cattle inventory, the cow-calf producers reduce their herds by selling more cows during the liquidation phase (or declining phase). These cyclical changes are a response of cow-calf producers to profitable or unprofitable calf prices and economic losses (FEUZ and UMBERGER 2003). In other words, these cycles reflect the profitable and unprofitable periods of the cattle industry (FIELD and TAYLOR 2003).

In general, overall U.S. cow and heifer slaughter rates as a percentage of January 1 cow inventory are predictors of the cow herd's future size and are indicative of the current phase of the cattle cycle. Cow and heifer slaughter rates of greater than 38 percent of January one cow inventory, typically indicate herd liquidation, whereas cow slaughter less than 37 percent indicates herd expansion (FEUZ and UMBERGER 2003). Based on data provided by USDA NASS (2006a) about 41.9 million head of beef cows were kept on January 1, 2005. Beef cows and heifers slaughtered reached approximately 12.3 million head. The resulting slaughter rate of 29 percent indicates a herd expansion which is slightly shown by Figure 2.2.

The severity of the cycle can be influenced by several factors. On the one hand, CROM (1981) lists seven factors:

- weather,
- feed grain exports,
- feed prices,
- consumer income and expenditures,
- inflation,
- changing consumer preferences, and
- the structure of cattle feeding.

On the other hand MATHEWS et al. (1999) additionally mentions the effects of

- beef trade,
- cropping and commodity programs, and
- beef industry structure.

Any combinations of these factors impact the severity of the cattle cycle. It is interesting to see in the previous graph, that this severity seems to deviate in

duration and strength of fluctuation in different years. While FEUZ and UMBERGER (2003) expect the cattle cycle to lengthen, FIELD and TAYLOR (2003) still assume that the cycle nature of the industry will continue, but will show less dramatic and shorter swings in cow numbers. In fact, the last cycle from 1990 to 2004 was the longest, with about 14 years.

The following example is given to illustrate the influence on the cattle cycle of an important biologic factor – the weather.

Weather mainly impacts the pasture, forage, and crop production. First, limited snow and rainfall during the winter time and second droughts throughout the year can reduce the availability of feed. The cow-calf producers are able to react in two ways.

- *One solution is to reduce the herd size by selling mature and premature cattle, resulting in a higher cattle supply and a pressure on cattle prices. Finally lower slaughter weights and lower prices result in lower returns and profitability.*

- *The second solution would be to compensate the reduced feed supply by feeding supplement harvested forages. Higher amounts of feed given and higher prices for feed from increased demand and drought-induced lower supplies enlarge the operating costs and decrease the profitability.*

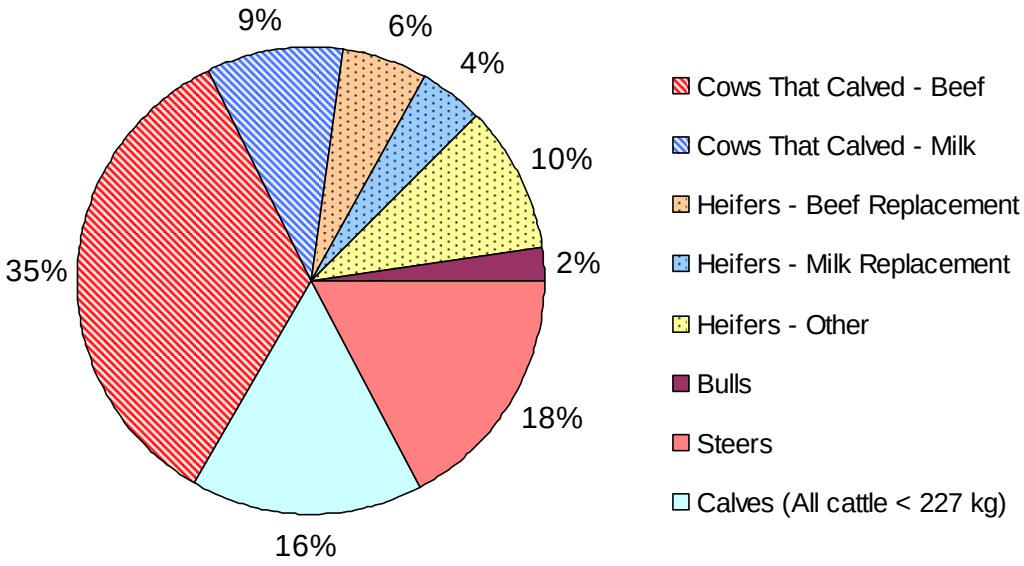
Consequently, either of these strategies has negative short run effects on the beef cattle operation (MATHEWS et al. 1999). However the cattle cycle is influenced, there is a biological lag of about 3 years between the producer's decision to expand his cow herd and the first increased beef supply. Furthermore there is an increased impact of the cattle inventory on the beef supply because of a higher productivity (FEUZ and UMBERGER 2003).

Composition of the inventory

Over several years the composition of the inventory changed. Figure 2.2 shows a decrease of milk cows. Higher productivity and constant milk supply are one of the major causes for this levelling off (FIELD AND TAYLOR 2003). The beef cow inventory increased until 1975, followed by a decrease and a constant beef supply remaining steady in recent years. To provide more specific information about the current composition, a pie-chart is chosen in Figure 2.3, displaying the average of the years 2004 to 2006. About 30 percent of the cattle inventory is male and approximately 70 percent of the inventory is female. Referring to the female

inventory it should be highlighted that close to 45 percent of the total cattle number are cows of which rounded 79 percent (or 35 percent points) are beef- and only 21 percent (or 9 percent points) are milk-cows. This high share of beef-cows demonstrates that the cattle husbandry is mainly geared to beef production. On the male side we can find 30 percent of the total inventory consisting of steers and bulls. Bulls are mainly used for breeding, whereas steers are kept for finishing together with the heifers not needed for replacement. The often used category "cattle on feed," which is defined by USDA NASS (2004 p. A-8) as "cattle and calves being fed a grain or concentrate ration (for the slaughter market) which is expected to produce a carcass that will grade select or better", is not used in this pie-chart. With about 15 percent of the total inventory those animals present close to 50 percent of the "steers" and "other heifers" presented in Figure 2.3.

Fig. 2.3: Composition of the cattle inventory, average of the years 2004 to 2006 (own illustration based on USDA NASS (2006a)).



2.4 Important issues and challenges

At this point present issues and challenges discussed in the literature are listed. According to the necessarity and intersections of other chapters, an examination is done. As important issues and changes facing the contemporary beef supply chain MUTH et al. (2005) lists the

- BSE found in North American cattle,
- development of the National Animal Identification System (NAIS),
- proposed requirements for the country of origin labelling (COOL),
- current strong demand for beef, the current stage of the cattle cycle,
- introduction of mandatory price reporting,
- increased use of non-price vertical coordination and finally the
- increased concentration throughout the beef supply chain.

CATTLE-FAX (2005a) additionally mentions the

- increased competition due to globalization,
- consolidation of the retail and food service,
- increased product branding, differentiation and accountability and
- market access.

BSE (Bovine Spongiform Enzephalopathy)

After the first BSE diagnosis in Great Britain in 1986, there have been more than 180 thousand cases worldwide, of which 95 percent occurred in the United Kingdom (USDA FSIS 2004). In North America the first BSE case was confirmed in Canada in May 2003. Six month later, in December 2003, a dairy cow which had been imported from Canada was confirmed as the first case of BSE in the U.S. (VANDERVEER 2005). The second case of BSE, an approximately 12-years-old Brahman cross cow native to Texas, was proved positive in June 2005 after an originally negative classification in November 2004 (USDA APHIS 2005). The latest BSE case, confirmed in March 2006, was placed in Alabama whereas the USDA was not able to locate the herd of origin. The animal was a crossbred beef cow estimated to be approximately 10-years-old (USDA APHIS 2006a). In the following paragraphs the consequences of these incidents are summarized.

In the first BSE case in Canada, the U.S. Government reacted by prohibiting the imports of ruminants and ruminant products from Canada into the U.S. from May

2003 onwards (MUTH et al. 2005). Prior to this restriction, Canada imported approximately 70 thousand to 100 thousand head per month primarily for slaughter. Together with a cyclical impact, a tight cattle supply resulted within the U.S. (MUTH et al. 2005; USDA GIPSA 2006a). After beef imports from Canada resumed for boneless products of cattle less than 30 month of age in August 2003, the first live cattle under 30 month of age for immediate slaughter or finishing crossed the U.S. border in July 2005 (VANDEVEER 2005). The markets between the two countries were beginning to adjust to imbalances in cattle numbers, slaughter capacity and price differences (USDA GIPSA 2006a).

The first U.S. BSE case which was related to Canada led many countries to restrict cattle and beef imports from the United States. Prior to BSE, the top four export markets were Japan as the largest export market followed by Mexico as the second largest market, South Korea as a fast-growing market and Canada in fourth place with gradually declining importance.

Mexico re-opened its border within a matter of months, therefore becoming the leading export country. Canada imported only small amounts because of its own BSE-related trade disruptions and large domestic supply of the country (VANDERVEER 2005). The biggest U.S. export markets with about 800 to 1,600 million EUR were Japan and South Korea. Unexpectedly, retail prices remained relatively high after this export reduction because of strong domestic demand for beef and the mentioned tight cattle supply (MUTH et al. 2005). The strong domestic demand is likely to be caused by upcoming low-carbohydrate diets.

“On December 12, 2005 Japan announced it would accept beef and beef offal and veal and veal offal derived from animals 20 months of age or younger subject to certain conditions (USDA APHIS 2006b). As of January 20, 2006, the Government of Japan has suspended import procedures for all beef from the United States. LAWRENCE highlights in an interview that the long term task for the U.S. has to be to earn back the Asian market. Most recent developments indicate a reopening of Japanese and South Korean borders.

National Animal Identification System (NAIS)

“The National Animal Identification System (NAIS) […] is a national program to provide uniform animal identification in the industry” (USDA GIPSA 2006a p. 6). It was designed for rapid containment of animal diseases strongly promoted after the BSE and foot-and-mouth disease outbreaks in the European Union (MUTH et al.

2005). A second goal is to use the information for marketing purposes. The system is voluntary at this moment and still in a developing process and has three key components:

1. Premises Identification,
2. Animal Identification and
3. Animal Tracking.

While the premises registration accounts already 10 percent of the national total since its implementation in 2004 and the animal identification phase is being implemented in March 2006, the animal tracking phase challenges the integration of already existing private and state animal tracking databases and will allow producers to participate in the very near future (USDA APHIS 2006c).

Country of Origin Labelling (COOL)

COOL has the intention to provide information where “covered commodities” (“covered commodities” are beef, lamb, pork, fish, perishable agriculture commodities and peanuts) have been produced and processed, was introduced as part of the 2002 Farm Bill and became mandatory in September 2004 (MUTH et al. 2005).

Retailers of those defined commodities are in charge to inform consumers about the country of origin by signage that is “clear and visible” at point of sale. Even though farmers are not directly effected because livestock are not covered commodities, the lack of competitive agriculture markets (particularly in livestock) creates the potential for the COOL to be pushed downstream to individual producers (MCEOWN 2003).

While consumers may benefit through increased information at the point of purchase, U.S. producers could benefit if a label which deems the US origin increased the demand for their products (KRISSOFF 2002).

EU hormone ban

The European community has a prohibition on the use of the following six hormonal substances for animal growth promotion (EU 2006):

- 17ß oestradiol
- Progesterone
- Testosterone
- Zeranol
- Trenbalone Acetate (TBA)
- Melengesterol Acetate (MGA)

The prohibition applied to all member states of the EU, as well as to imports from third countries as from January 1, 1989. Countries wishing to export bovine meat and meat products to the EU had either to have equivalent legislations or a hormone free cattle programme (EU 2006).

Growth hormones are commonly used in the U.S. beef industry. According to a survey summarized by REUTER et al. (2005), 99 percent of all feedlot cattle are implanted and 90 percent of the stocker producers implant their calves. Hormones implied as implants increase growth rate, protein deposition, and improve feed efficiency. This results in about seven percent overall cost reductions to produce beef.

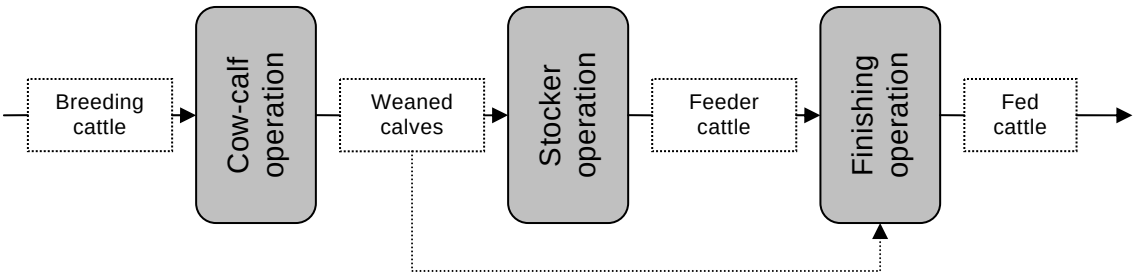
Because of the common usage of hormones, U.S. beef couldn’t be exported to the EU since the mentioned prohibition in 1989. Since then, a long debate about the legality of the EU trade ban and applied U.S. measures has taken place. Until today the export of U.S. beef from animals raised with the mentioned growth hormones to the EU is still banned.

3 Production on farm-level

3.1 Introduction

The production on farm level can be divided into three parts: cow-calf, backgrounding and finishing. Typically, cow-calf producers sell their weaned calves to stocker cattle operations. These primarily add weight to the animals and sell them to the feedlot where the final finishing prior to slaughter is done. Figure 3.1 illustrates the flow of cattle from the cow-calf to the finishing operation.

Fig. 3.1: Production stages on farm-level (own illustration).



This flow-chart does not consider the marketing of cull bulls, cows and heifers of the cow-calf operation which are sold to finishing operations or go directly to slaughter. Furthermore some heavier weaned calves (more than 227 kg) may go directly to the feedlot, thereby by-passing the backgrounding phases (FIELD AND TAYLOR 2003). In the following chapters each production stage on farm level is further investigated.

To ensure the comprehensibility, some terms used in this and the following chapters are further explained. The term “operation” and “farm” can be used equivalent. The term “family farm” refers to farms operated by individuals or a family. The term commercial (for example “commercial feedyard”) refers to larger establishments, often operated as cooperation.

3.2 Cow-calf operation

3.2.1 Introduction

Data available from USDA measure the suckler-cow inventory in “beef-cows that calved”. The term “beef-cow” refers to cows particularly kept to produce calves for beef production, and does not refer to the beef produced by culled cows. The average beef-cow inventory of the years 2004 to 2006 is about 33 million head, representing 34 percent of the total cattle. These cows are kept by approximately 770 thousand cow-calf producers, which represent a share of 36 percent of the total 2.1 million U.S. farms. Accordingly, the average beef-cow herd counts 42 head (USDA NASS 2006a). As can be expected due to the small average cow herd size, a major part is operated by part-time farmers and kept mainly on pasture (FIELD and TAYLOR 2003). In the subsequent part of this chapter the regional distribution, farm-structure, production systems, and profitability are researched.

3.2.2 Regional distribution

Map 3.1 and 3.2 show the regional distribution of beef-cow operations and beef-cows within the United States. Map 3.1 illustrates that there is a relatively high concentration of cow-calf **operations** in the Southern Plains and Appalachia. While Texas holds nearly 15 percent of total cow-calf operations, Oklahoma, Montana, Kentucky, and Tennessee each contribute between four and six percent.

In terms of **inventory**, map 3.2 provides a detailed picture on the distribution of the cow-calf inventory. With an inventory of 5.5 million head, Texas has the biggest beef-cow herd, and a 16 percent share of the total U.S. beef-cow inventory. The second to fifth largest states are Missouri, Oklahoma, Nebraska, and South Dakota, each keeping around two million head and about 6 percent of the U.S. inventory. In addition to the differences between states, it can be seen that there are significant variations of beef-cow inventories between different counties within a state.

When grouping the inventory by U.S. farm production regions (Annex Fig. A-1), the Northern and Southern Plains are the most important area with approximately 41 percent of the total beef-cow inventory. Together the Mountain States and the Pacific States, represent about 20 percent of the inventory, while the Corn Belt, Appalachia, the Delta States, and the Southeast together account for 36 percent.

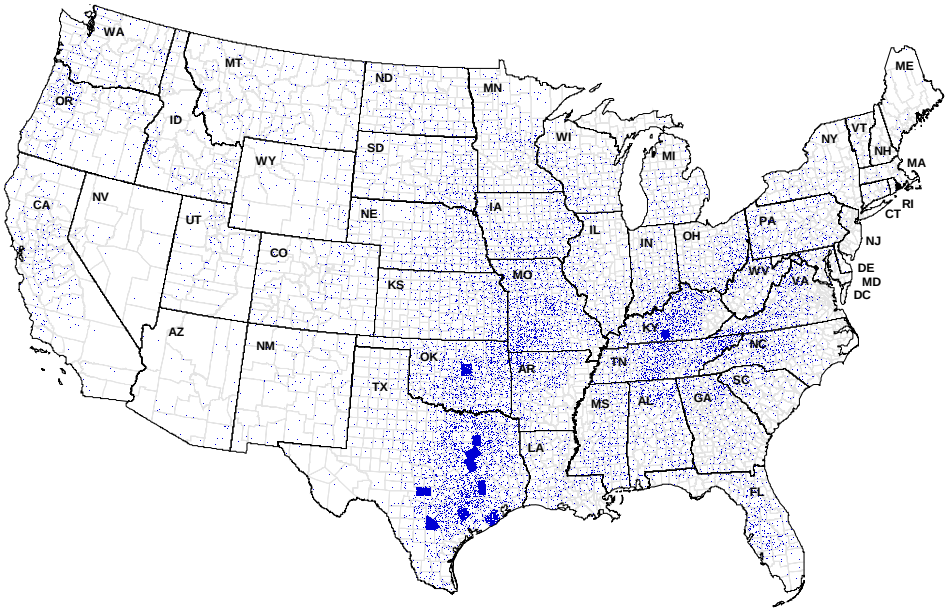
The reason for the different distribution of production on the regional, state, and county level is the supply of grass and hay which is related to the climate conditions. The plains region is well suited for cow-calf production because of its grass and hay supply, as well as additional opportunities like wheat fields, corn stalk, or other crop residues. The Mountain States are characterized by low productivity, but due to minimal management applied, and few purchase inputs used, the costs per kg of calf weaned do not differ from the national level. In crop-intensive areas, like the Corn Belt, cattle production complements the cropping systems. Here, usually small areas of pasture land that is not suitable for cropping is grazed (FEUZ and UMBERGER 2003).

Shift of regional distribution

To show whether there has been a shift in the regional distribution of the cow-calf herd, the inventory from 1920 to 2006 is analyzed. As an indicator, the percentage share of the state's inventory in the total inventory was calculated for each year. The annual change of each state's percentage share in the total beef-cow inventory was lower than two percent points throughout the whole period of consideration. Consequently, changes in regional distribution were rather low and occurred slowly.

After the estimation of the annual change, the total change from 1920 to 2006 is investigated. During this period, Texas, Arizona, and New Mexico lost about five to six percent points of their share in the U.S. beef-cow inventory. Arkansas, Kentucky, Missouri, Oklahoma, and Tennessee have been the states gaining between two and four percent points. According to FIELD and TAYLOR (2003), regional movements occurred due to economic conditions and forage supply which can be influenced by climate, renovation of unproductive land, and conversion of cropland to forage production and vice versa. If we consider the change during the last 10 years only, no shift higher than one percent point occurred, which confirms a stable beef-cow distribution over the last decade.

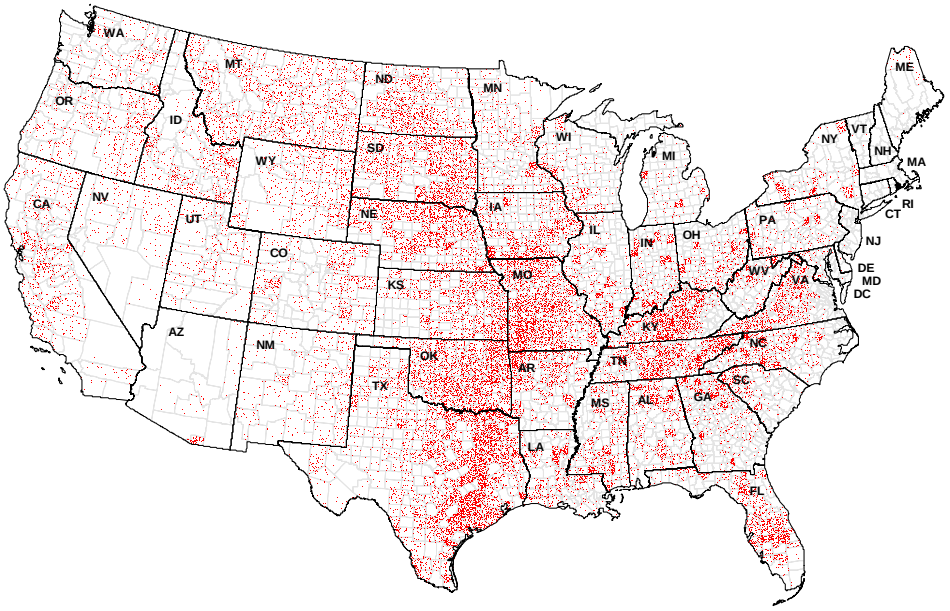
Map 3.1: Beef-cow operations in 2002 by county (own illustration based on USDA NASS (2004)).



● 1Dot = 50 cow-calf farms

Source: USDA NASS 2004.

Map 3.2: Beef-cow inventory in 2002 by county (own illustration based on USDA NASS (2004)).



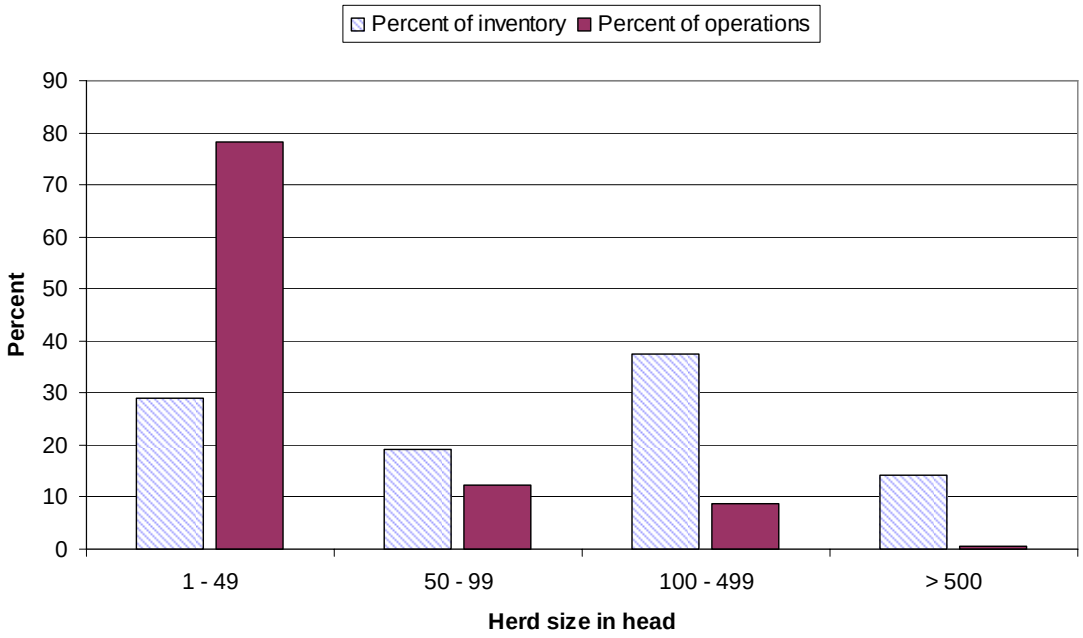
● 1Dot = 1 000 beef cows

Source: USDA NASS 2004.

3.2.3 Structure

As already mentioned, the U.S. has circa 33 million beef-cows and 772 thousand beef-cow operations with an average herd size of 42 head. Figure 3.2 shows the distribution of the cow-calf operations and the cow-calf inventory on herd size classes. The bar chart displays a high share of small operations. Approximately 90 percent of the cow-calf operations have a herd smaller than 100 head and represent about 50 percent of the cow-calf inventory. The other 50 percent of the cows are in herds of more than 100 head and account for only 10 percent of all enterprises.

Fig. 3.2: U.S. cow-calf sector structure (own illustration based on FEUZ and UMBERGER (2003)).



Smaller operations (fewer than 50 head) are largely part of multiple enterprises, or supplemental to off-farm employment (GUSTAFSON 2003). In the case of multiple enterprises, FEUZ and UMBERGER (2003) comment that the importance of the cow-calf production enterprise for the overall farm operation varies from region to region, caused by variations in environmental conditions and forage resources. Therefore cow-calf enterprises in the plain states and the western states have a share of 35 to 41 percent of the total value of production, whereas in the north central and south eastern regions the shares are 31 and 23 percent, respectively. Furthermore DOUD stated in an interview that operations in Colorado and Montana tend to have larger herds with about 100 head or more.

Historical change in farm structure

While there were about one million cow-calf farms in 1986, the number of farms decreased to 770 thousand in 2005 – a reduction of nearly 25 percent according to data of USDA NASS (2006a). Based on a shorter period (1993 to 2005) the reduction accounts for about 14 percent, mainly caused by a reduction of small farms with less than 50 head. The main regions of farm reduction are Tennessee (-13,000 / -24 percent), North Carolina (-8,000 / -30 percent), Missouri (-8,200 / -13 percent), Mississippi (-8,000 / -30percent), Alabama (-9,000 / -28 percent) while Texas (+1,000 / +1%) and Wisconsin (+2,900 / +36 percent) gained farms.

3.2.4 Production systems

While some cow-calf operations keep their cows in confinement the entire year, the majority are extensively managed. This means that the cows are kept outside year-round without any barns, as is the calf until it is weaned (FIELD and TAYLOR 2003). The feed sources of this extensive system, the prevalent breeds, the dominant calving seasons, and the weaning weight are further illustrated.

Feed sources

Typically cow-calf operations use grasses, legumes, and other feed sources that can be efficiently utilized by ruminants, combined with very little, if any, grain input.

In many wheat and other small grain-producing areas, the cows graze green growth in the fall and early spring, then graze straw aftermath following the harvesting of grain. Major corn growing regions, for example Iowa, provide cornstalk aftermath for grazing in the fall (FIELD and TAYLOR 2003).

Finally the supply of grass and hay has to be considered as the main feed source for cow-calf operations. These grasslands include the tracts of public land in Montana, the vast private grasslands of the Nebraska sand hills, the small hilly and wooded acreage of the Missouri Ozarks, or the swampy lowlands of Florida.

The number of cows kept per ha of pasture is influenced by the climate, soil condition and intensity of management. Cow-calf operations extensively managed in high mountain valleys, plains, and desert areas keep about 0.03 to 0.08 cows per ha (12 to 40 ha per cow), while on more intensively grazed areas 0.5 to 2.5 cows per ha (0.4 to 2.0 ha per cow) are possible (FIELD and TAYLOR 2003).

Furthermore, the Pennsylvania State University (PSU 2001) summarizes that relatively low-quality forages can be fed to breeding cows after calves have been weaned, while feed quality has to be increased two months before calving. This allows the cow to gain weight, rebreed quickly, and produce milk to yield a heavy calf at weaning. In addition, loose salt and mineral sources have to be provided throughout the year by free-choice (PSU 2001).

Breeds

Over 100 breeds and breed combinations of beef cattle in the U.S. are reported by FEUZ and UMBERGER (2003). Those breeds descend from two main species: *Bos taurus* (breeds from Europe and often subgrouped as British and Continental cattle) and *Bos indicus* (breeds from tropical environments). In terms of regional breed distribution, *bos taurus* tends to be the most economical breed for the central and northern U.S. while crosses with *bos indicus* are more important further south because of its adaptation to tropical climate. Irrespective of the weather conditions, diverse breeds are required to improve the efficiency of beef production and to match genetic potential of cattle with diverse market preferences and feed resources. (FEUZ and UMBERGER 2003)

Based on interviews conducted by DEBLITZ (1994), Angus and Hereford are the basis of the U.S. beef-cattle inventory, representing about 50 percent. Furthermore crosses of these two prevailing breeds with Braham, Charolais, Simmental, and Limousin are used to increase the total meat supply.

Because of trade-offs resulting from antagonistic genetic relationships among breeds, it is impossible to excel in all characteristics of economic importance. Research at the “Meat Animal Research Centre” concludes that the “use of crossbreeding systems that exploit complementarities by terminal crossing of sire breeds noted for lean tissue growth efficiency, with crossbred cows of small to medium size and optimum of milk production provide the most effective averages of managing trade-offs that result from genetic antagonisms” (CUNDIFF 1999, p. 1).

Calving season

The calving season of the U.S. cow-calf herds varies in terms of point of time and length, both further investigated subsequently.

Research of FEUZ and UMBERGER (2003) based on the USDA APHIS (1998) survey summarizes that the **length of calving season** varies more than the time of calving. A two month to three month calving season is most frequently used, while about one fourth of the operations had a five month or longer calving season.

Figure 3.3 is chosen to illustrate the **time of calving.** The figure shows the share of beef calves born by month based on a survey published by USDA APHIS (1998). While the data of the year 1992/1993 is based on the “lower 48” states, the data for the year 1997 represent only 23 states. The 23 states included represented about 86 percent of the U.S. beef-cow inventory on January 1, 1997 and about 78 percent of the beef-cow operations (USDA APHIS 1998). Therefore the provided data represent the main part of the cow-calf sector. Although the data are nearly 10 years old they are the most recent available.

Fig. 3.3: Percent of beef calves born by month (USDA APHIS (1998)).

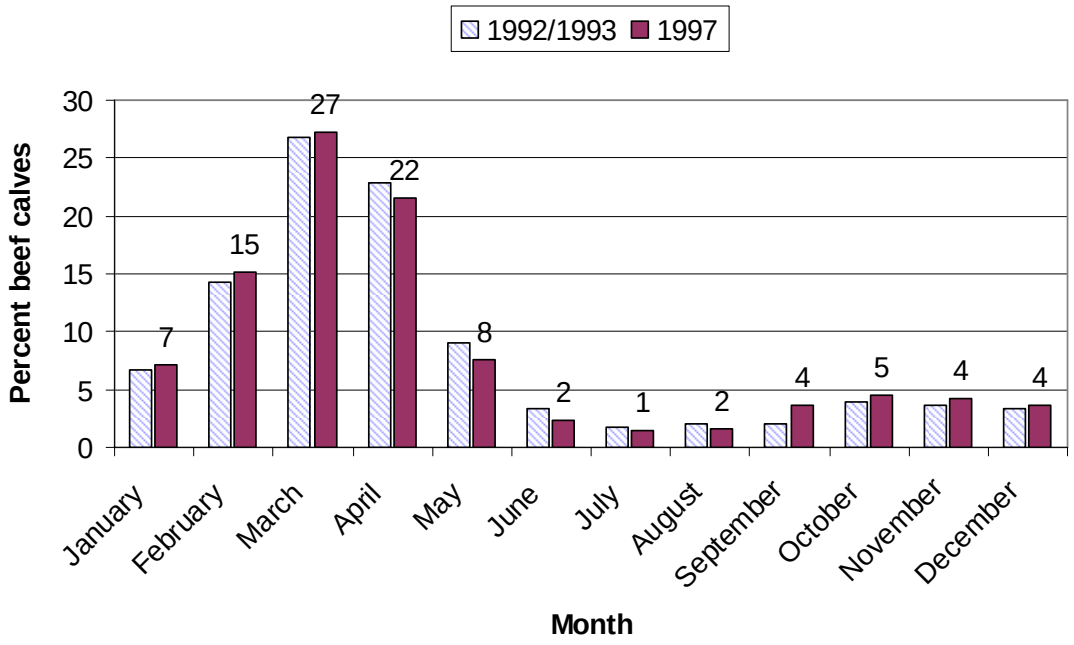


Figure 3.3 shows that the majority of the calves – almost 64 percent – are born in the spring, especially from February to March. The monthly distribution between the two years tends to remain relatively constant. Factors influencing the choice of the calving season are further investigated.

According to USDA APHIS (1998), weather patterns (~39 percent) and tradition (~30 percent), followed by forage availability (~10 percent), market cycle (~7 percent), increasing weights (~6 percent) and labour availability (~4 percent) are the prevailing reasons for the timing of the calving season. FIELD and TAYLOR (2003) mention a reduction of calf losses and a complementation with the forage production as reasons affecting the time of calving.

Furthermore SELK and BARNES (2005) advise that larger cow-calf herds should consider two calving seasons. This would offer economic advantages caused by reduced bull inputs, older replacement heifers, and two marketing windows for weaned calves.

Sale weight and age

The USDA APHIS (1998) survey also investigated that the average weaning weight for all calves was about 234 kg with an average age of 221 days in 1997. In comparison to an earlier analyses done from 1992 to 1993, the weight and age of weaned animals increased by 5.9 kg and 7 days, respectively (USDA APHIS 1998). FEUZ and UMBERGER (2003) state, that this increase in weaning weight is attributable to the increased age and not to the change in genetics. While male calves are usually all sold for backgrounding and finishing, nearly 16 percent of the female animals are held back for replacement (MUTH et al. 2005).

3.2.5 Profitability

The profitability of cow-calf production is highly variable from year to year and among enterprises (FEUZ and UMBERGER 2003). The variation is caused by different returns or different costs resulting in a different profitability. Returns, costs, and profitability are further reviewed in this chapter.

Revenues

The total revenues of the cow-calf enterprise include revenues for sold weaners, breeding bulls, cows and heifers. All these categories can be sold for slaughter (for example cull bulls, cows and heifers), breeding and for further finishing (DEBLITZ et al. 2006). They depend on the number of animals sold, their weight, and their market price (per kg of sale weight). To illustrate the revenues, Table 3.1 is chosen.

Tab. 3.1: Revenues of cow-calf operation (own illustration based on OSU (2006b)).

	Produced kg per cow	Price in EUR per 100 kg LW	Produced value per cow in EUR	Percent of total revenues
Revenues				
Steer calves	99	191	189	50
Heifer calves	37	177	66	17
Cull cows	45	150	67	18
Cull Replacement Heifers	63	79	49	13
Cull bulls	8	104	8	2
Total Revenues	252		380	100

Notes: February calving percentage 81.1%; calf death loss 3.8%; heifer replacment rate 25%; 210 day weaning; native forage.

Table 3.1 presents revenues based on a cow-calf budget provided by the Oklahoma State University (OSU 2006b). The total revenues reach about 380 EUR per cow. The sold steers have the highest share with 50 percent. The heifers represent only 17 percent because most are needed for replacement. Consequently the sale of weaned steers and heifers together represent about 67 percent of the total revenues. Furthermore cull animals as replacement heifers, cows and bulls stand for the remaining 33 percent of the returns.

These numbers should be considered as an approximation because the weight produced per cow, and the prices tend to vary. According to FEUZ and UMBERGER (2003) the price is one of the major factors accounting for the variations in total revenues. Because steer and heifer revenues are dominating, the annual and seasonal fluctuations in feeder cattle prices are further illustrated. Therefore Figure 3.4 and 3.5 show long-term and seasonal price developments.

Fig. 3.4: Average price for Kansas steers and heifers of 227 to 272 kg from 1992 to 2006 (own illustration based on KSU (2006)).

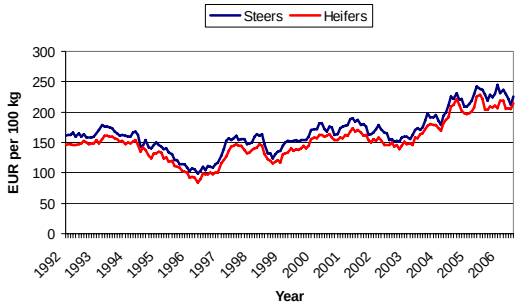


Fig. 3.5: Seasonal price index for Kansas steers of 227 to 272 kg (own illustration based on KSU (2006)).

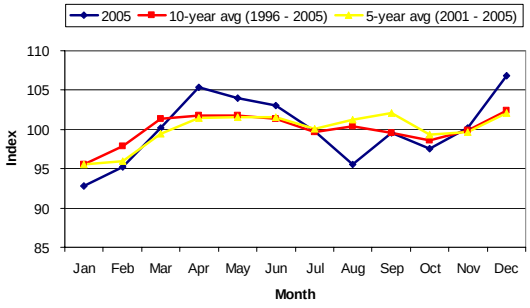


Figure 3.4 shows the **long-term fluctuation** of prices for steers and heifers typically sold by cow-calf producers with a weight of 227 to 272 kg. Even though heifer prices are lower, they fluctuate in the same way than steer prices do. The increase in

recent years might be caused by limited cattle supply, correlated to the impacts of the cattle cycle (Chapter 2.3). In addition to these long term fluctuations, Figure 3.5 shows **seasonal variation** of prices on the basis of the example of steers. Lower prices in the fall tend to be related to the high share of spring calving herds, which wean in fall and cause a higher cattle supply and consequently lower prices from August to November.

After estimating possible revenues, the revenues structure and the impact of price developments, the costs which have to be covered by these revenues are further investigated.

Costs

To illustrate the cost structure, the cow-calf enterprise budget used to illustrate the revenues is used. Table 3.2 shows the variable costs and fixed costs base on data provided by OSU (2006b).

Tab. 3.2: Costs of cow-calf operation (own illustration based on OSU (2006b)).

	EUR per cow	EUR per 100 kg LW sold	Percent of total costs
Operating inputs			
Pasture	*100*	*40*	*28*
Hay	*28*	*11*	*8*
Grain	*0*	*0*	*0*
Protein supplement	*27*	*11*	*8*
Salt	*2*	*1*	*1*
Minerals	*11*	*4*	*3*
Vet services / medicine	*5*	*2*	*1*
Vet supplies	*1*	*0*	*0*
Marketing	*6*	*2*	*2*
Mach / equip fuel, lube, repairs	*19*	*8*	*5*
Machinery / equipment labor	*20*	*8*	*6*
Other labor	*22*	*9*	*6*
Annual operating capital	*12*	*5*	*3*
Total operating costs	**253**	**100**	**71**
Fixed costs			
Machinery equipment	*14*	*5*	*4*
Livestock	*90*	*36*	*25*
Land	*0*	*0*	*0*
Total fixed costs	**104**	**41**	***29***
Total costs (operating + fixed)	**357**	**142**	**100**

Notes: February calving percentage 81.1%; calf death loss 3.8%; heifer replacment rate 25%; 210 day weaning; Forage: native-leased.

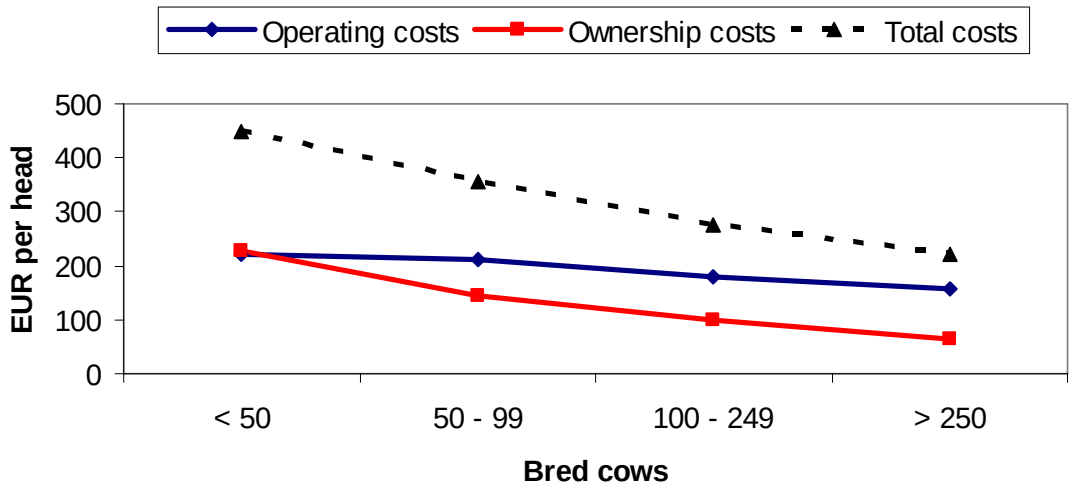
The table shows that the operating costs dominate with about 253 EUR per cow or 70 percent of the total costs. Within the operating costs, expenses for pasture reach 100 EUR per cow or nearly 30 percent of the total costs. The fix costs include interest, taxes, insurance and deprecation for machinery and livestock. The primary forage source is native-leased pasture. These illustrated costs are only exemplary

and differ throughout the U.S., but can indicate a high share of operating costs and less important fixed costs.

Further research done by SHORT (2001), focuses on production costs impacted by region and enterprises size. Although the data are based on the year 1996, they are the most recent available. Even though the costs in general might have changed, their composition and relationship to regional and size factors can be deflected.

Cow-calf costs are influenced by **regional factors**. The main reasons for the differences are the climate conditions. Cow-calf operations in the Southern Plains and in the West profit from longer vegetation periods, while operations in the Northern Plains and the North Central have to manage harsher climates and therefore need more supplemental feed and forage. Cow-calf producers in the South East are also disadvantaged because of fluctuations in temperature and moisture which result in variation of growth and nutritive content of pasture and range plants. In addition to weather conditions, the farm size, which tends to be bigger in the Southern Plains than in the northern states, impacts the costs and profitability (SHORT 2001).

Fig. 3.6: Costs per bred cow by farm size (own illustration based on SHORT (2001)).



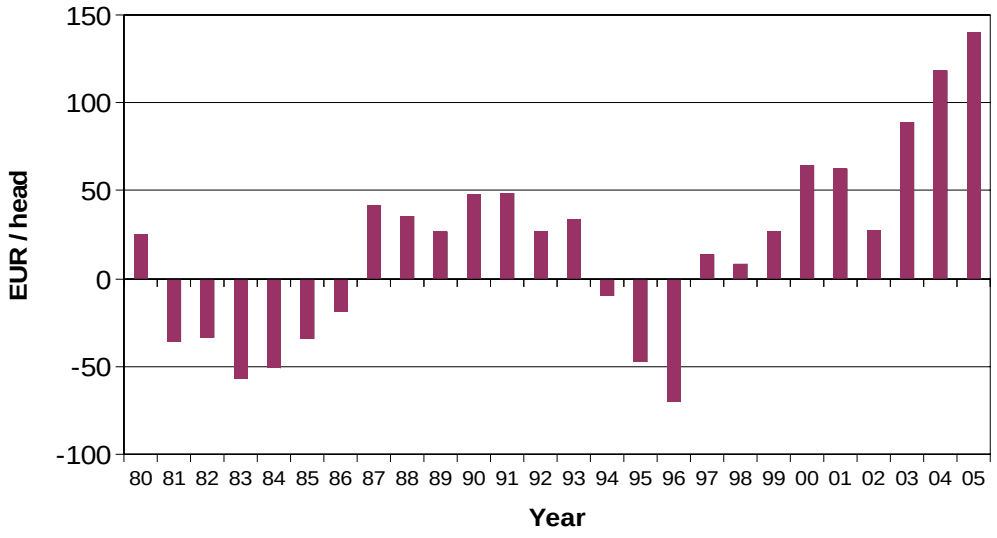
Declining total, operating costs, and ownership costs (capital recovery and non-real-estate property taxes and insurance) with increased **enterprise size** are indicated by SHORT (2001). To illustrate this, SHORT (2001) divided the cow-calf operations into four enterprise-size groups and calculated the cost per head in each group. Figure 3.6 shows the result of this estimation and approves lower costs of larger

producers. The decline is related to the location of larger producers, as well as to economies of scale. Larger operations tend to feed less harvested forage per bred cow. This is caused by the location of larger operations in the Southern Plains where climate reduces the need of supplemental feeding as explained above (SHORT 2001).

Profitability

The previous paragraphs illustrated differences in revenues and costs among enterprises and over time. Because general data on the profitability of U.S. cow-calf operations were not available, Figure 3.7 shows the fluctuation of cash returns **over time** based on data provided by CATTLE-FAX (2006). Cash returns are not overall profitability because they do not include depreciation or returns to management. Furthermore KALOUS (2006) comments that these cow-calf returns data tends to be more positive than for the entire U.S. because the sample includes larger more progressive operations in the United States.

Fig. 3.7: Cow-calf cash returns from 1980 to 2005 (own illustration based on CATTLE-FAX (2006)).



The Figure 3.7 shows fluctuations, which tend to be related to the cattle cycle (Chapter 2.3). While in the early 1980s and mid 1990s negative cash returns can be observed, positive cash returns occurred from 1987 to 1993 and increased in recent years. In 2005, the cash return reached a value of about 140 EUR per cow, indicating profitable cow-calf operations. Also another study published by CATTLE-FAX (2005b) reports record high profitability of cow-calf producers in recent years.

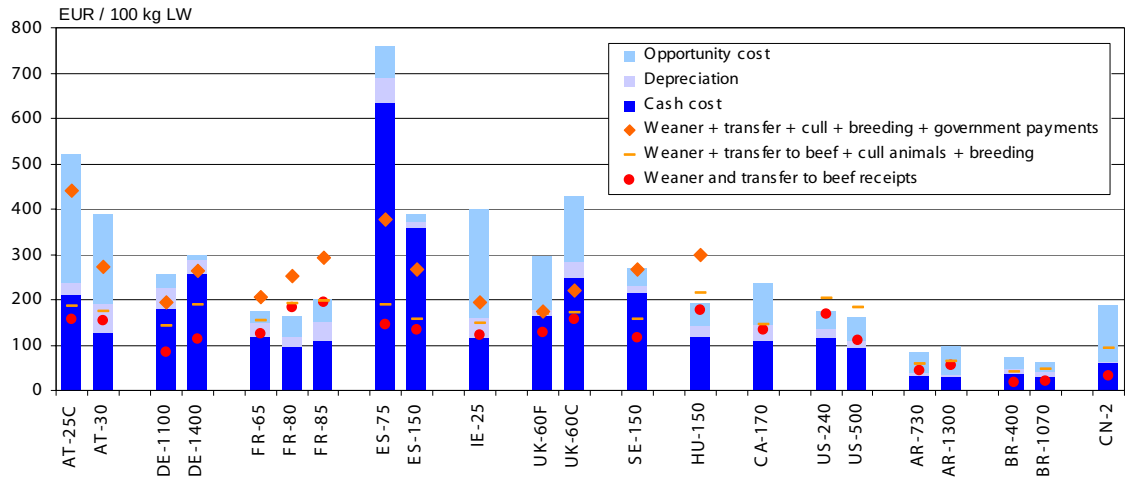
Cow-calf production in international comparison

To illustrate the costs and returns of the U.S. cow-calf operations in comparison to other countries, results published by DEBLITZ et al. (2006) were chosen. Figure 3.8 illustrates cost and return per 100 kg LW sold. The farm names, for example "US-500", include the abbreviation for each country (US) and the number of cows kept (500 cows). Furthermore the costs are split up into cash costs, depreciation and opportunity costs. These costs are compared with total returns consisting of animal sales of different types plus government payments, if any. The result is the short, medium and long term profitability which is characterised by the difference between the total returns and the three cost levels mentioned.

In terms of long-term profitability, the figure shows that total costs are covered by the U.S., French, Swedish, Hungarian and Chinese farms, while European farms mostly cover costs only with the help of livestock and/or environmental payments (DEBLITZ et al. 2006).

While top performers like the Austrian, French, and Irish farms generate the most money on a per live-weight basis, larger farms with smaller margins per 100 kg LW generate significantly higher income, like, for example, the U.S. farms (DEBLITZ et al. 2006).

Fig. 3.8: Cash and non-cash cost, returns and profitability of cow-calf operations – situation 2005 ff. (DEBLITZ et al. (2006)).



Finally Figure 3.8 shows that the short-term profitability differs only slightly from the mid-term, caused by the low share of depreciation costs as a result of cow-calf being the more extensive production system.

3.2.6 Conclusions

The cow-calf inventory of about 33 million head is located throughout the whole U.S. with a higher concentration in the region between the Missouri River and the Rocky Mountains (Beef belt). The cow-calf operations are located accordingly with a concentration in the Southern Plains. About 90 percent of the operations are smaller than 100 head and keep about 50 percent of the inventory. The other 50 percent are kept by operations with more than 100 head. This results in an average herd size of 42 head. The majority of the farms are operated as part time farms, or farm with multiple enterprises. Typically the calves are born in spring and weaned in fall with a weight of about 224 kg and an age of about 7 months. The profitability varies over time and among farms. Regional cost advantages depend on climate and herd size distribution. However in 2005 the cash return reached about 140 EUR per cow. Further analysis on international level shows, that the costs of the illustrated U.S. farm are on a low level and can be totally covered.

3.3 Stocker cattle operations

3.3.1 Introduction

The stocker cattle operations can be seen as the connection between cow-calf operations and the feedlots. The activity is also termed “backgrounding”. While some specialised stocker cattle operations exist, they are mostly a part of a farm with multiple enterprises and a surplus of forage (FIELD and TAYLOR 2005). Typically, stocker operations buy about 8-month old, 227 kg heavy weaned calves, keep them for around seven months and finally sell them with a weight of around 363 kg and 15 months. According to PEEL (2003) and LINKER (2006), stocker cattle operations provide a combination of marketing system function and value adding.

The **marketing system function** includes the assembling and sorting of animals into larger groups of similar size and type. Furthermore, they offset the seasonally typically large Fall marketing of calves and allocate feeder cattle supplies over time PEEL (2006).

The **adding of value** is based on added weight and further animal management. The weight is added due to animal growth rather than fattening. In other words, the animals primarily grow bone frame and some muscle (MUTH et al. 2005). Animal management includes dehorning, castrating, vaccinations, and parasite treatments, if not done at the cow-calf level PEEL (2006).

It should be considered that the majority of calves are backgrounded, but especially heavier weaning calves can go directly to the finishing operation.

3.3.2 Regional distribution

It is difficult to measure the stocker industry because it is not defined by a specific age or size of cattle. Further PEEL (2003 p. 366) defines stocker cattle as “weaned calves not yet placed in feedlots but intended for sale as feeder cattle”. Therefore in this study, the stocker cattle inventory is assumed as the difference between the inventory of steers and heifers (not needed for replacement) over 227 kg and the cattle on feed inventory.

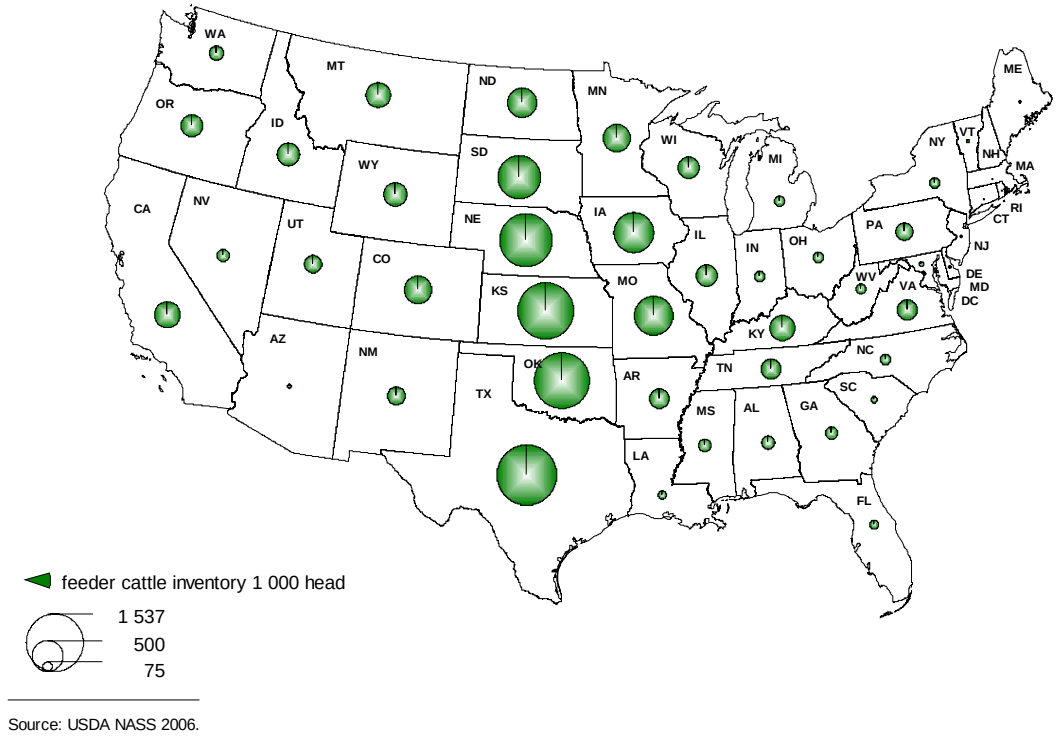
Stocker cattle = (steers > 227 kg + other heifers >227 kg) – cattle on feed

As the stocker cattle with less than 227 kg live weight are not considered, the inventory obtained is only an approximation. But because the average weaning weight is about 234 kg as mentioned in Chapter 3.2.3, this approximation might be nearly representative.

Based on the previous formula, there are about 12.5 million head of stocker cattle on average of the years 2004 to 2006, which would represent about 13 percent of the total average inventory. According to PEEL (2003) considerably variations in stocker cattle inventory occurs seasonally and annually.

To illustrate the regional distribution of the stocker cattle segment, map 3.3 shows each state's inventory based on the approximation.

Map 3.3: Regional distribution of feeder cattle (own illustration based on USDA NASS (2006)).



Source: USDA NASS 2006.

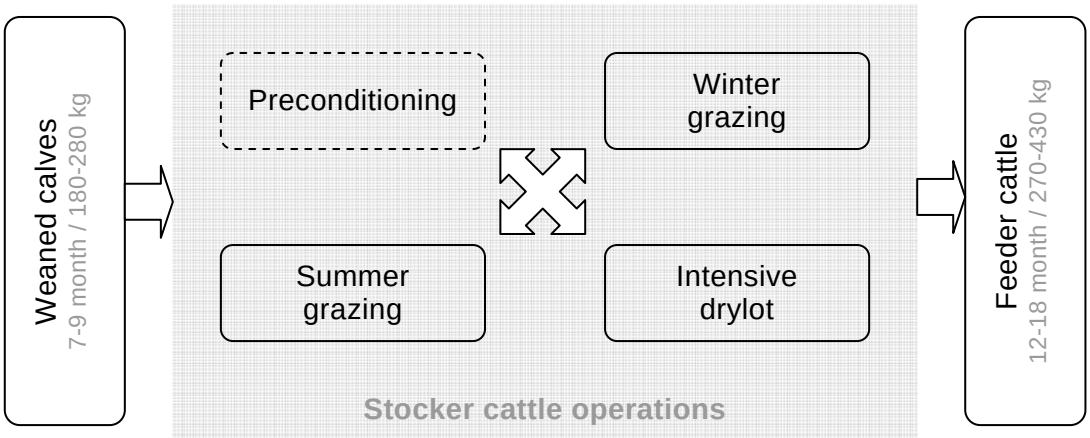
About 65 percent of the total stocker cattle inventory is located in the Northern Plains, Southern Plains and the Corn Belt. Because it is more effective to move the cattle to the forage than the forage to the cattle, many calves in the northern states are shipped south for pasturing in the fall (MUTH et al. 2005). Winter pasture systems are mainly established in the southern parts of the United States. Especially winter wheat grazing systems are located in Kansas, Oklahoma, and Texas – states which represent about 34 percent of the stocker cattle inventory –

whereas grass pasturing is more common in the south eastern states (MUTH et al. 2005). These different production systems are further investigated in the next chapter.

3.3.3 Production systems

Figure 3.9 illustrates the different production systems discussed below and used by the stocker cattle operations. On the left side the weaned calves demonstrate the input, the feeder cattle on the right side the output. The grey shaded area represents the production systems of the stocker cattle operations.

Fig. 3.9: Prevalent systems of stocker cattle operations (own illustration).



Because of the different calving seasons (Chapter 3.2.4), forage supply, and climate conditions within the U.S. the systems used in stocker cattle operations vary from confinement grain-based systems to non-confinement forage-based grazing systems. There are three prevalent backgrounding systems: winter grazing systems, summer grazing systems, and intensive backgrounding systems. MUTH et al. (2005) additionally mention preconditioning lots. These four types of backgrounding systems are further investigated in the following paragraphs.

Winter grazing

According to the high share of spring calving herds (Chapter 3.2.4) there is a high supply of calves available for stocker cattle operations in the fall. Therefore the prevailing system is to put those heavy calves (~230 kg) on winter wheat pasture for about six months, mainly located in the Southern Plains (MUTH et al. 2005). In an interview, JONES mentioned that winter wheat pasture, hay and crop residues (e.g. corn stalk, sorghum stalk) or dormant native ranges are additionally used.

If the farmer is planning to harvest the wheat after grazing, the wheat physiological condition determines when cattle are pulled off the winter wheat pasture. The cattle have to be pulled off before the joint stage is reached, which typically happens in early March (PEEL and WARD 1999). If the wheat is not supposed to be harvested, it can be grazed out.

Depending on the location and the length of the grazing period, producers expect weight gains of about 130 kg (NN 2006). The average daily weight gain varies between 680 g and nearly 1 kg per day (KSU 2006). The feeder cattle can be sold in the spring with a weight of around 300 kg (MUTH et al. 2005). Animals sold in spring are also referred to as “short-yearlings”. The overall goal of this backgrounding system is to minimize winter feeding costs while keeping cattle healthy and add weight at low cost.

Summer grazing

Instead of selling the animals in spring they can be kept for a further 4 to 5 months for an additional summer grazing season. Typically, native grass pastures or introduced warm season pastures like Bermuda grass are used as forage source, (PEEL 2003). During this grazing period compensatory gain often results in cheap gains. Compensatory gain is defined as “greater than normal growth rate sometimes observed following nutritional restriction that slows, only maintains or reduces the weight of the animals on which it is imposed for a sufficient enough period of time to allow for adaptation to the lower nutritive state” (RYAN 1990; SIMUKALI 1999). Higher forage availability and warmer climate allow cattle to compensate lower gains in the harsher winter. The cattle are sold in fall at an age of about 15 to 20 months and are often referred to as “long-yearlings” (LARDY 1998).

Whether cattle are sold as short yearlings or long yearlings depends on several factors. The primary reason is the availability of forage and the weight of the animals in spring. Hence, lighter animals tend to be kept for an additional grazing season, while heavier animals are sold to feedlots. Secondly, the price of high-energy-feed also impacts an animal’s path. Especially high corn prices encourage farmers to keep more cattle in grazing systems and fewer in feedlots (MUTH et al. 2005). Finally, farmers may sell the yearlings in spring when seasonal prices for grass cattle are favourable (LARDY 1998).

Intensive Dry lot

In an interview, SCHROEDER mentions that intensive dry lot systems are mainly based on corn. Furthermore some forage, like hay or corn silage, is fed inter alia. LARDY (1998) further highlights the utilization of feedstuffs that were raised on the farm or the use of relatively inexpensive by-products available locally. Confinement is not obligatory, but is often used, according to MUTH et al. (2005). Advantages are the performance and a standardized process resulting in shorter feeding periods. Disadvantages are higher feed costs for feed, and the investment into additional machinery, equipment, and facilities to keep the cattle and produce the forage.

Preconditioning

Preconditioning can be done independently, but is mainly a part of the other production systems. Therefore it is difficult to make a clear distinction with other systems described. Preconditioning is defined by LARDY (1998) as a backgrounding system which prepares calves to enter a feedlot at another location. This lasts about 30 to 45 days and involves the weaning of the calf, vaccinations, and the acclimatisation to eating from a feed bunk, as well as, drinking from fountain waterers (LARDY 1998). Further treatments are dehorning and castration if not already done (DAVIS 2006). Main feed sources are long stemmed hay and some nutritional and protein supplements. Main advantage of preconditioning cattle is the reduction of risk of disease problems in the feedlots. Furthermore, the animals are less stressed and start directly to eat out of a bunk after placement.

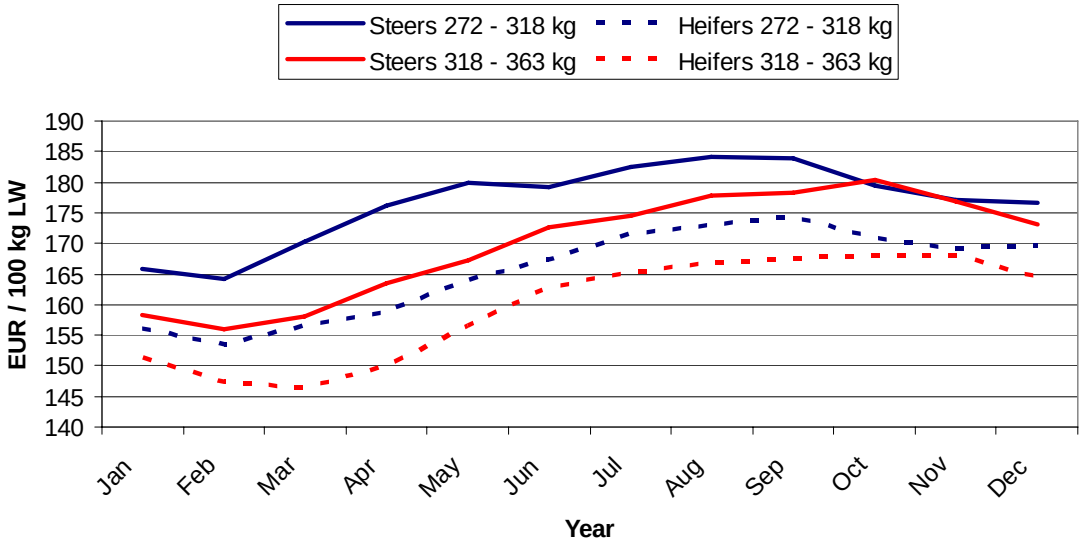
3.3.4 Profitability

To illustrate the profitability of the stocker cattle production, first the revenues and prices for feeder cattle are investigated. Then the cost structure is further investigated, followed by a long-term overview of the profitability.

Revenues

The revenues of the feeder cattle operation vary according to the feeder cattle price. Figure 3.10 shows the 5-year average for steers and heifers of different weight categories in Kansas, one of the top three stocker cattle states.

Fig. 3.10: Seasonal price development in average of the years 2001 to 2005 (own illustration based on KSU (2006)).



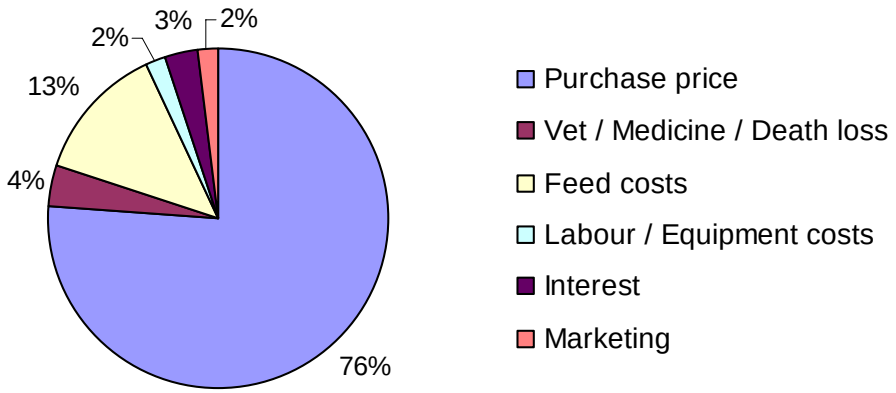
The price per kg of liveweight tends to decline as weight increases. Furthermore, heifer prices tend to be lower than prices for steers. Finally, a seasonal price development can be observed. Prices tend to be lower at the beginning of the year and increase from March until September. In addition to this seasonal price fluctuation, prices fluctuate annually and cyclically. Therefore, recognizing market trends at any point in time is an important management consideration. Even stocker cattle operations cannot influence the market trend; the consideration of these trends may influence the length of time and program intensity for stocker production (PEEL 2003). The total returns per head vary between 600 and 720 EUR, assuming a weight of 318 to 363 kg and an average price in 2005 of 188 EUR per 100 kg LW for heifers and 198 EUR per 100 kg LW for steers.

Costs

According to PEEL (2003) the costs of stocker operations vary considerably. However, this Chapter includes general information on cost composition and costs of different production systems used.

To reflect the **composition of costs**, Figure 3.11 is based on data provided by PEEL (2003) and shows the percentage share of different cost items.

Fig. 3.11: Cost composition of a typical stocker cattle operation (own illustration based on PEEL (2006)).



The figure shows that animal purchase costs are dominant with about 76 percent of the total costs, followed by feed costs (13 percent), veterinary, medicine, and death loss costs (4 percent), interest (3 percent), and finally, labour and equipment, and marketing costs with each two percent. Consequently, the animal purchase costs and the feed costs have the greatest impact on the total costs of stocker cattle operations. The costs for animal purchased are determined by the market value for weaned calves, which again is affected by their price per kg, their weight, and their quality. The costs for feed are related to the amount of feed used and the price to purchase are the costs to produce it, which also differs between different production systems, regions, and years.

After an overview about the cost composition of backgrounding operations in general, the **costs of different production systems** are investigated. For their purpose data from the Kansas State University are used, which are based on projections for the year 2006. While these data might not be representative for the whole U.S., they reflect an important backgrounding region. Furthermore differences between various productions systems can be concluded.

Tab. 3.3: Costs of different stocker cattle production systems in EUR per 100 kg LW sold, in 2006 (own illustration based on KSU (2006)).

	SG[1] wKS	SG[2] eKS	WWG[3] pull KS	WWG[4] graze out KS	DL BG[5] KS
Animal purchase	163	157	145	124	154
Death loss	3	3	4	3	2
Pasture	12	13	10	17	0
Harvested forage	0	0	2	2	6
Grain	0	0	3	3	5
Supplements	1	1	2	3	5
Other costs[6]	14	14	18	19	24
Total costs / kg LW sold	**193**	**188**	**183**	**170**	**195**
Weight gained in kg	75	88	103	155	85
Costs per kg of gain	**1.30**	**1.18**	**1.13**	**1.07**	**1.52**

[1] Summer grazing in west Kansas

[2] Summer grazing in east Kansas

[3] Winter wheat grazing, pulled before joint stage is reached

[4] Winter wheat grazing in Kansas, graze out

[5] Drylot Backgrounding in Kansas

[6] Includes labor, veterinary, markting, fuel, repair, depreciation, interest, insurance, taxes, and miscellaneous costs.

Table 3.3 shows that the total costs per 100 kg of LW sold vary between the production systems. While the summer grazing and dry lot systems have the highest total costs per kg of LW sold, the winter wheat grazing system tends to be less expensive. Dry lot backgrounding and summer grazing are characterized by higher animal purchase costs because of heavier purchase weights in comparison to the winter wheat grazing systems. But the winter grazing system tends to have higher feed costs, so that animal purchase costs and feed costs partially compensate each other. In terms of feed costs, expenses for pasture dominate in the grazing systems, while expenses for harvested forage, grain, and supplements are higher in the dry lot system.

In addition to the total costs, the costs per kg of gain are estimated. Therefore the total costs per head, excluding the costs for animal purchases are divided by the amount of weight added. This results in lowest cost of 1.07 EUR per kg of gain for the “pull off” winter wheat grazing system to highest costs of 1.52 EUR per kg of gain for the dry lot backgrounding system.

Consequently the costs of backgrounding vary considerably between production systems. While grazing systems tend to be cheaper than high-energy dry lot systems, the winter grazing systems tend to be less expensive than the summer grazing systems.

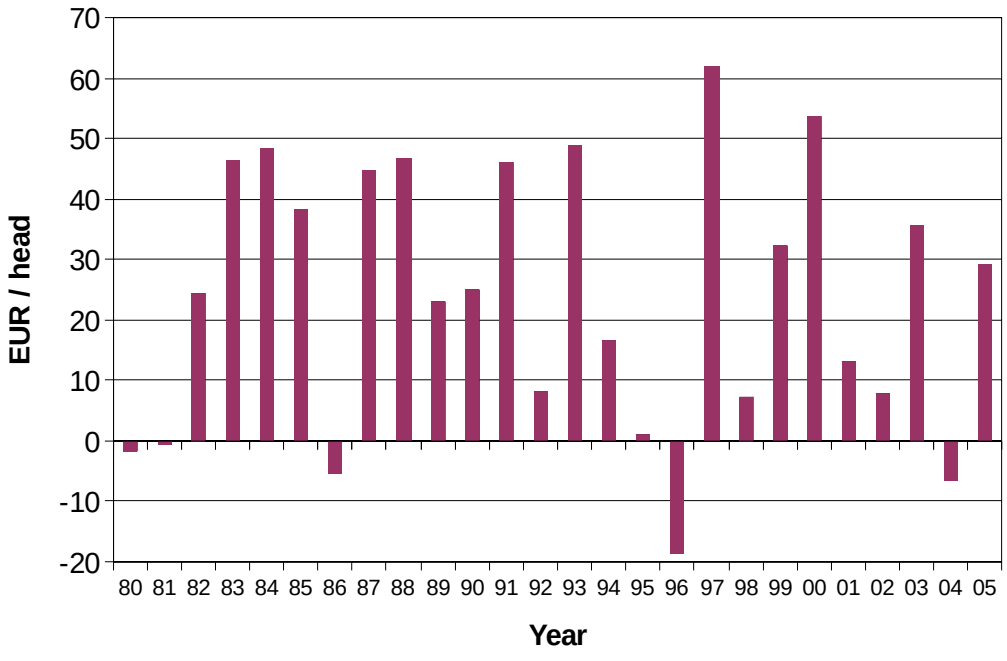
Profitability

After the revenues and costs are discussed and estimated, the relationships between factors affecting the profitability are discussed in this chapter, followed by a long-term overview of the profitability.

According to PEEL (2003), the most important factor affecting the stocker cattle profitability is the relationship between purchase price and sale price. The difference between the sale price and the purchase price reflects the value of gain. This value of gain varies over time and between different classes of cattle (PEEL 2003). Data of KSU (2006) show values of about 1.18 EUR to 1.56 EUR for steers or heifers of different weight categories in 2005. PEEL (2003) mentions a long-term average of about 0.88 EUR per kg of gain.

A second important factor affecting the stocker cattle profitability is the length of the backgrounding period. Because animal purchase costs represent the main part of the total costs (as explained in the previous chapter) the break-even selling price for cattle declines with additional weight. The speed of decline depends on the daily weight gain. PEEL (2003) further mentions an average period of 90 to 100 days to become profitable.

Fig. 3.12: Profit and Loss of stocker cattle operations (non-cash costs are not included) from 1980 to 2005 (CATTLE-FAX 2006).



Finally, a long-term overview about the profitability from 1980 to 2005 is given based on data provided by CATTLE-FAX (2006). According to KALOUS (2006), “most of the data are approximations based on calculated budgets which are adjusted depending on market conditions in each of the years […]. For the most part the data are representative of the entire U.S. […]”. Based on these data, Figure 3.12 shows that the stocker cattle operations were mainly profitable, with exceptions in single years, while LAWRENCE and PETTY (2006) summarize that especially drylot background has not been a profitable situation the past decade in Iowa. This underlines the high differences between production systems and within the United States.

3.3.5 Conclusions

The stocker cattle enterprises have two important roles in the beef industry. Firstly the **marketing system function** including the assembling and sorting of animals, as well as the offsetting of seasonal high cattle supplies. Secondly the production of **value based** on weight gain and animal management services.

As the stocker cattle inventory is not reported by USDA statistics, they are calculated. The approximation shows, that stocker cattle is concentrated in the Northern and Southern Plains, and the Corn Belt, and together represent around 65 percent of the inventory. Important states are Kansas, Oklahoma, and Texas, together representing about 34 percent of the total inventory.

Prevailing production systems used are dry lot backgrounding, summer grazing, winter grazing and finally preconditioning, of which the latter can be considered to be part of other production systems.

In accordance to the different production systems, the profitability varies considerably. The costs mainly consist of animal purchase and feed expenses, while the revenue is affected by seasonal price patterns. However, the major operations have been able to obtain profits over the last decade.

3.4 Finishing operations

3.4.1 Introduction

In the U.S., beef finishing operations can be defined as the last stage of cattle on farm-level prior to slaughter and are also referred to as feedlots or feedyards. Feeder cattle with around 360 kg LW are placed in outdoor confinements for about 90 to 150 days and fed a high energy (mainly grain-based) ration. Normally the cattle are marketed at an age of 18 to 24 months and a final weight of circa 550 kg. The inventory and regional distribution of these cattle, the production systems used and the farm structure, as well as the profitability and productivity are investigated in this chapter.

3.4.2 Development of Inventory

The inventory of cattle placed in beef finishing operations can be described by the Cattle on feed (COF) inventory. “Cattle on feed is defined as cattle and calves being fed a grain or concentrate ration (for the slaughter market) which is expected to produce a carcass that will grade select or better” (USDA NASS 2004 p. A-8). In average of the years 2005 to 2006 the COF inventory on January 1 counts 14 million head and represents almost 15 percent of the total inventory. This number includes steers, heifers, bulls, and cows. While cows and bulls have a share of less than 1 percent, steers and heifers represent around 63 and 36 percent, respectively, based on the inventory in feedlots over 1,000 head capacity (USDA NASS 2006a). The lower share of heifers is presumably caused by replacement heifers not available for finishing.

According to feedlots industry development, FIELD and TAYLOR (2003) mention an increase of the feedlot industry which mainly occurred from 1945 to 1972 and levelled off from 1973 until today. To provide a more detailed overview about this development, the line-graph in Figure 3.13 is chosen. The COF and total inventory of the U.S. and the top five regions are presented as an indicator for the feedlots industry development for the years 1965 to 2006. The graph contains two y-axes whereas the left one refers to the COF inventories and the right one to the total inventory including all categories of cattle.

The figure illustrates the changes in the COF inventory for the entire U.S., as well as in COF inventories of different regions. After an increase of around 4 million head from 1965 to 1973, the COF inventory shows a peak with over 14 million head in

1973. Cheap feed grains and relatively cheap fossil fuels are the main reasons for this growth (FIELD and TAYLOR 2003). A sharp decline of about 4 million head follows, resulting in a minimum in 1975 with nearly 10 million head. It is probable that a part of these large fluctuations in the COF inventory from 1965 to 1982 refer to the cattle cycle (Chapter 2.3) which also is displayed by the crossed line indicating the total cattle numbers. A total inventory high was probably related to a COF inventory low. However, these high fluctuations seem to level off in the time from 1982 until today, where an upward trend in total COF inventory can be seen. It is likely that this upward trend, in times of a decreasing total inventory, refers to increased feeder cattle supplies due to higher productivity of cow-calf operations. Finally this results in an inventory of about 14 million head in 2006 almost recovering the COF maximum in 1973.

Figure 3.14 shows the seasonal fluctuation of the **cattle inventory**. The highest inventory is shown during the winter months from November to February. The cattle inventory declines from March resulting in its lowest level in August. The lines reflecting the COF placed and COF marketed are used to explain this development.

The number of **cattle placed** peaks in October. This might be caused by the ending summer grazing season and the high share of spring calving cow-calf herds (Chapter 3.2.4), which sell their heavier calves directly to feeding operations. But also during the spring, from April until June, the number of cattle placed in feedlots shows a local maximum. This increase is likely to be related to the ending winter grazing season, whereby cattle are pulled off the pasture and sold to finishing operations (Chapter 3.3.3).

The number of **COF marketed** by feedlots tends to fluctuate less within a year. Even for cattle placed mainly in the spring and fall, the marketing of COF seems to be more evenly distributed due to different placement weights. This would further meet the requirement of slaughter facilities of a constant cattle supply throughout the year. More information on the slaughter segment is provided in Chapter 5.

Fig. 3.13: Development of U.S. and top 5 regions COF inventory on January 1 by year (own illustration based on USDA NASS (2006a)).

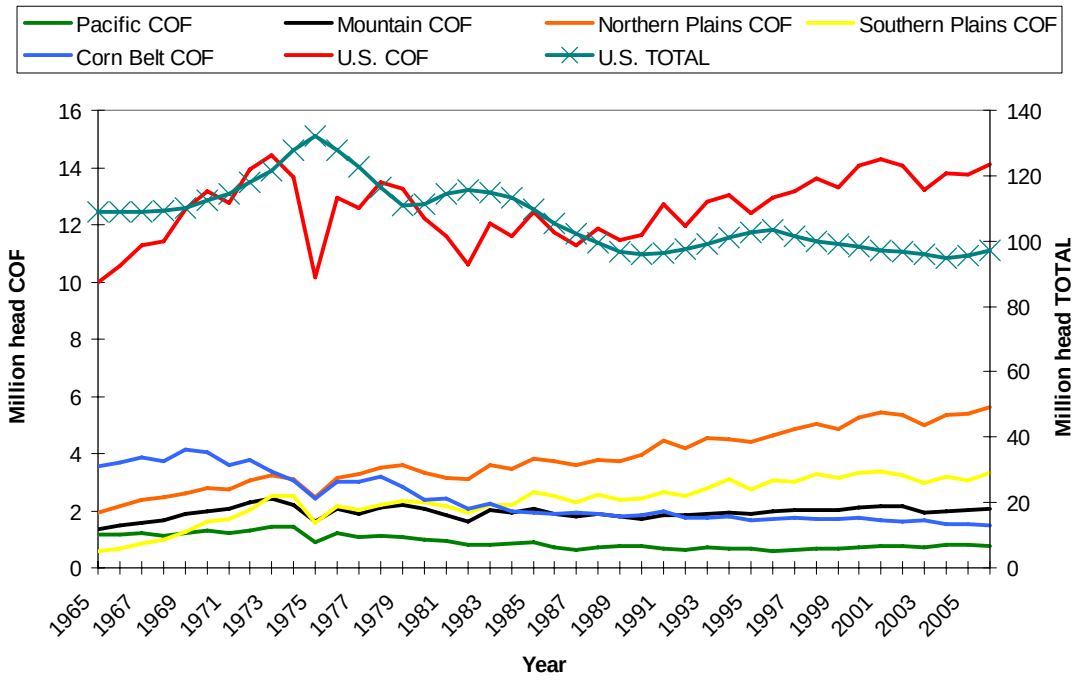
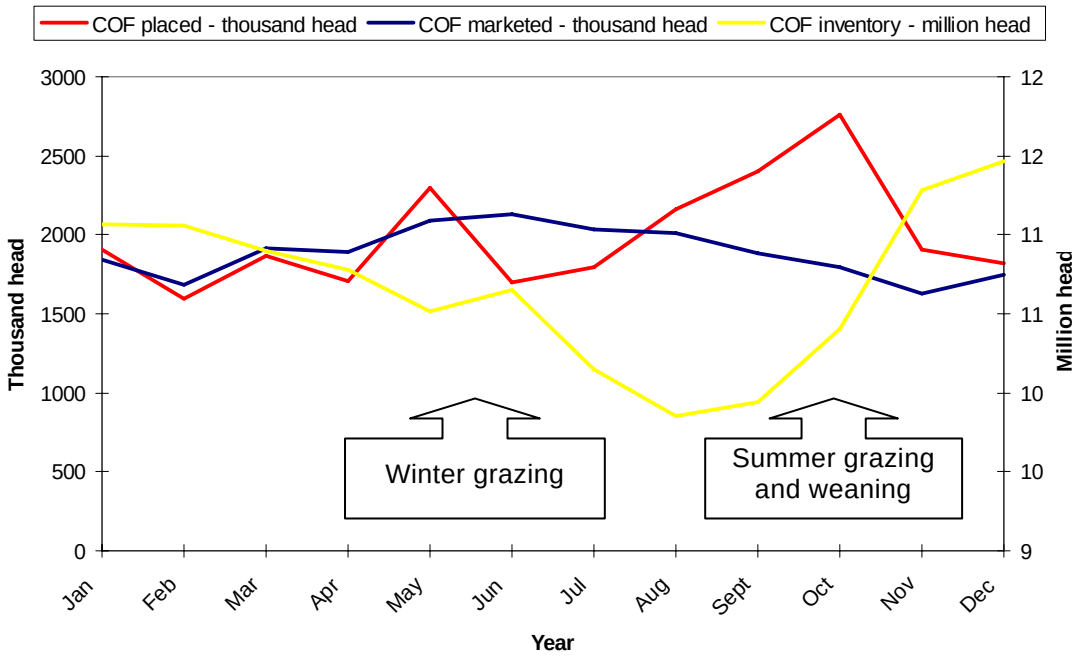


Fig. 3.14: Cattle on feed inventory and in average of the years 2003 to 2005 by month (own illustration based on USDA NASS (2006a)).



3.4.3 Regional distribution

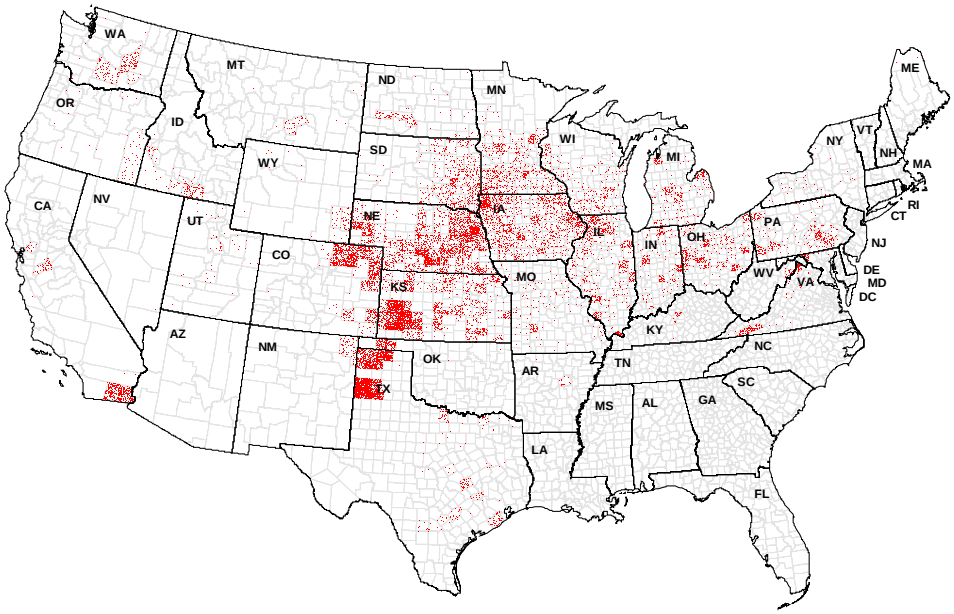
The main part of the COF inventory is located in the Southern Plains, High Plains and the Midwest (MUTH et al. 2005). Map 3.4 indicates that especially the Texas Panhandle, east Colorado, southeast Nebraska, western Kansas, and the Oklahoma Panhandle are the main feeding areas. On average of the years 2004 to 2006, these states represent approximately two thirds of the total cattle inventory. According to (GOODWIN and CROW 1973) the location of feed grain supplies is of critical importance for the location of feeding operations. This is why the Corn Belt states were the predominating cattle feeding area back in the 1950s. The states Iowa, Illinois, and Minnesota for example kept about 30 percent of the COF inventory in 1965. In the following two decades a regional shift of finishing operations towards the Southern States occurred (MINTERT 2003). Until 2006 the share of the "old" finishing states mentioned above decreased to nine percent in favour of the Southern States. MUTH et al. (2006) writes that the main advantages of the southern feeding area are the climate conditions. Dry climate allows better cattle performance and easier waste management. The development of crop irrigation increased the regional grain supply, resulting in lower feed and transport costs. Furthermore FIELD and TAYLOR (2003) note the regionally high slaughter capacity which also may result in lower transport costs.

Map 3.5 shows the regional distribution of finishing farms. They are higher concentrated in the Corn Belt and lower concentrated in the main feeding area located in the Texas Panhandle, east Colorado, southeast Nebraska, western Kansas, and the Oklahoma Panhandle.

On the one hand, a high farm concentration together with a low concentration of COF indicates smaller operations in the Corn Belt area. On the other hand, the few farms located and the high COF placed in the main feeding area indicate larger operations often operated by multiple feedyard companies.

The structure of the finishing operations and finishing companies is further investigated in the following chapter.

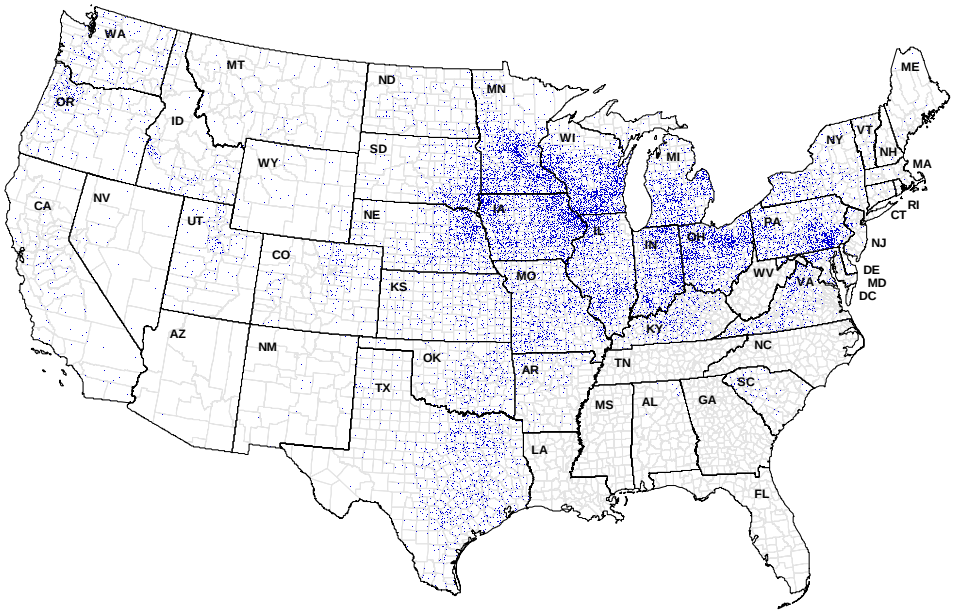
Map 3.4: Number of cattle on feed in 2002 (own illustration based on USDA NASS (2004)).



● 1Dot = 1 000 head cattle on feed

Source: USDA NASS 2004.

Map 3.5: Number of finishing operations in 2002 (own illustration based on USDA NASS (2004)).



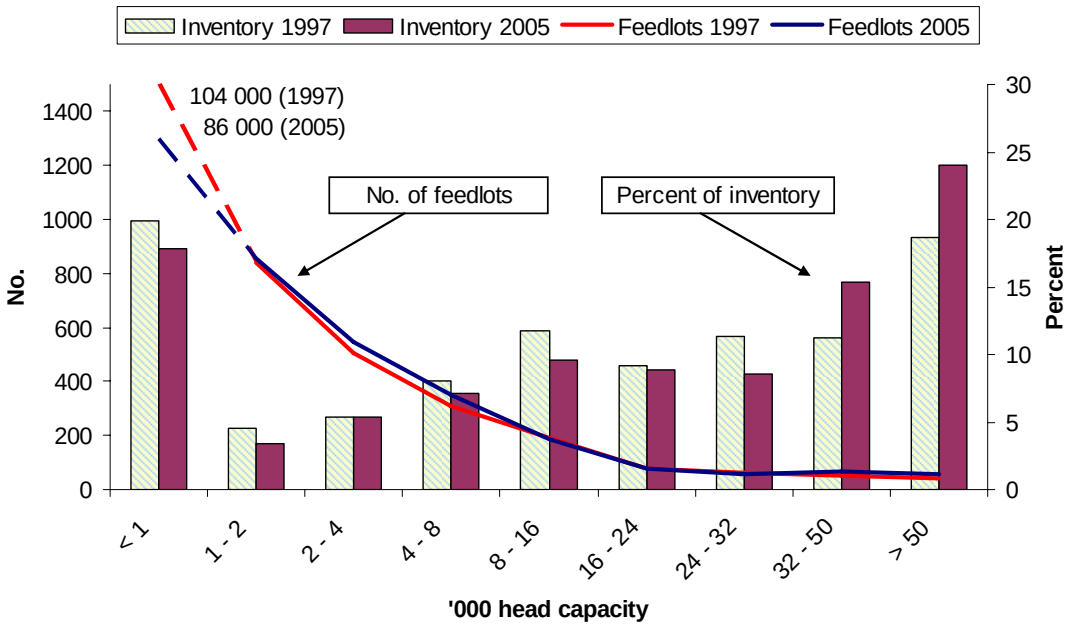
● 1Dot = 5 finishing farms

Source: USDA NASS 2004.

3.4.4 Structure

In the average of the years 2003 to 2005 the U.S. counted around 91 thousand feedlots with a capacity of nearly 14 million head. Consequently the average feedlot has a capacity of around 150 head. Excluding the inventory kept in operations smaller than one thousand head, the average capacity increases to five thousand head. But even this estimation would not be representative for the structure of the feedlot industry. Therefore the following bar-chart is chosen.

Fig. 3.15: Structure of US finishing operations in average of the years 2003 to 2005 (own illustration based on USDA NASS (2006a)).



The chart presents different size classes of feedlot capacities from one thousand to over 50 thousand head on the x-axis abscissas. The two y-axes show how many farms or what percent of the cattle is represented by each size class, respectively. It can be seen that about 86 thousand feedlots have a capacity of lower than one thousand head and represent 98 percent of all finishing operations. These smaller operations keep about 19 percent of the total COF inventory. Corresponding to the high number of small operations, only two percent (2,200) of the feedyards have a capacity of over one thousand head and keep 81 percent of the total inventory. Further there are only 123 feedlots (0.14 percent) reported with a capacity of more than 32 thousand head. With an inventory of about five million head they have a share of 40 percent. This comparison illustrates the big differences inside the feedlot industry where the feedlots organisation ranges from small family operated part time farms to large specialized commercial operations, often owned by multiple feedyard companies and vertically integrated (CME 2005).

Thirty years ago, the industry was structured differently. MINTERT (2003) states that there were about 105 thousand feedyards in the 13 primary cattle feeding states which marketed nearly 24 million cattle in 1972. Thirteen years later approximately 42 thousand feedyards marketed about the same amount of cattle. MINTERT (2003) concludes that the average feedyard size was growing over time. Furthermore, GUSTAFSON (2004) argues that the industry continues to shift toward a small number of large specialized feedlots, increasingly vertically integrated. Also a NASS USDA (2006a) data comparison shows that the feedlots with less than one thousand head decreased in terms of number and inventory share. In contrast, feedlots with over 32 thousand head capacity expanded in both.

In addition to single feeding facilities, there are large cattle feeding companies that own and operate multiple feedyards (MINTERT 2003). Table 3.4, based on Cattle Buyers Weekly (CBW (2005)) data, shows the five largest cattle feeding companies in 2005 and 2000.

Tab. 3.4: Ranking of the top five cattle feeders in 2005 and 2000 (CBW 2005).

2005			2000		
Company Name	**One time capacity**	**Number of feedlots**	**Company Name**	**One time capacity**	**Number of feedlots**
Five Rivers Ranch Cattle Feeding LLC Boulder, Colorado	811,000	10	Cactus Feeders, Inc. Amarillo, Texas	465,000	9
Cactus Feeders LLC Amarillo, Texas	520,000	10	ContiBeef LLC Boulder, Colorado	425,000	6
Cargill Cattle Feeders LLC Wichita, Kansas	300,000	4	ConAgra Beef Company Greely, Colorado	420,000	5
Friona Industries LP Amarillo, Texas	275,000	4	Caprock Industries Amarillo, Texas	285,000	4
AzTx Cattle Co. Hereford, Texas	232,000	5	J. R. Simplot Co. Boise, Idaho	270,000	3

Due to joint ventures and cooperation, the ranking has changed from 2000 to 2005. The most important alternation is that *ContiBeef LLC* and *Smithfield Foods* (who was not under the top five in 2000) merged and operate as *Five Rivers Ranch Cattle Feeding LLC* since 2005. However, if we assume a typical inventory turnover rate, the top five companies with an inventory of approximately two million head in 2005 might have marketed about four to six million cattle, or 16 to 24 percent of the 25 million fed cattle sold in 2005. MINTERT (2003) comments, that the shift toward large feedyards might be driven by economies of size. Furthermore BORCK mentioned in an interview, that challenges of companies operating multiple

feedyards, are specialized and more efficiently working employees. In addition, the growth in multi-feedyard companies likely indicates managerial economics assuming that management staff and activities can be used for multiple locations and enterprises (MINTERT 2003).

3.4.5 Production systems

According to the Chicago Mercantile Exchange (CME (2005)), there are two prevailing types of cattle feeding operations, the commercial feeder and the farmer feeder. The farmer-feeders are mainly family farms with multiple enterprises and a capacity of less than one thousand head. Commercial feeders are those with more than one thousand head one-time capacity and are commonly owned by corporations, especially as feedlot size increases (FIELD and TAYLOR 2003).

In addition to these differences in organisation and size, the facilities and equipment used differ. **Farmer feeder** facilities vary from unpaved, wood-fenced pens to paved lots with shelter. Especially total confinement is often combined with manure collection pits under the cattle. This type of feeding operation is prevailingly located in the Corn Belt as already shown by Map 3.5. Larger **commercial feeding operations** tend to be located in the Southern Plains because weather conditions are easier to handle. According to FIELD and TAYLOR (2005) they can be further specified by the following characteristics:

- They mainly use equipment and facilities like an open lot with unpaved dirt pens and an own feedmill.
- The pens are built out of poles, cables or pipes, are mounded in the centre to provide the cattle a dry resting area, and have a capacity from 100 to 500 head.
- Fence-lined bunks are used with concrete aprons inside the pens, where the cattle stand while eating.
- The feed can be mixed in the specialized feed truck, as well as in the feedmill itself, and is provided two to four times a day.

Table 3.5 shows further frame numbers and specifications of a commercial feedlot. Furthermore, an overview about a typical outdoor feedlot design prevalently used by commercial feedyards is given in the Figures 3.16 to 3.18. The data in the figures are only available in the non-metric system.

Tab. 3.5: Site specifications for feedyards (FIELD and TAYLOR 2003).

Factor	Specification
Land slope	2 - 5 percent
Soil type	>= 25 percent clay
Land mass	4 ha / 1000 head for pens, alleys, and feed roads
Pen size	20 - 30 m² / head depending on climate
Feedbunk type	Fence-line feeders with 4 m concrete aprons
Bunk space	Arriving cattle 60 cm / head Backgrounding cattle (227-318 kg) - 50 cm / head Finishing cattle - 20 to 30 cm / head
Other considerations	Minimum distances from bunk to water channels: 120 m - from bunk to back of pen: 60 to 80 m - from back of pen to nearest water channel: 70 m

Fig. 3.16: Cross-section of feed bunk and apron (HARNER and MURPHY 1998).

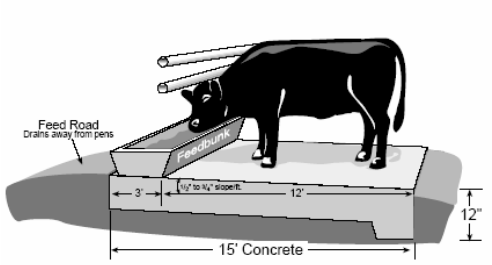


Fig. 3.17: Cross-section of a mound (HARNER and MURPHY 1998).

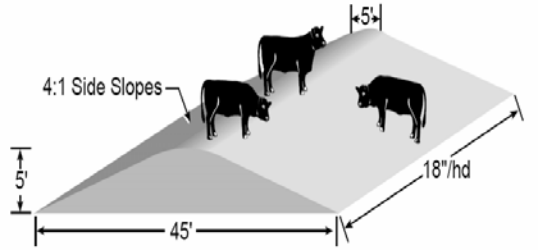
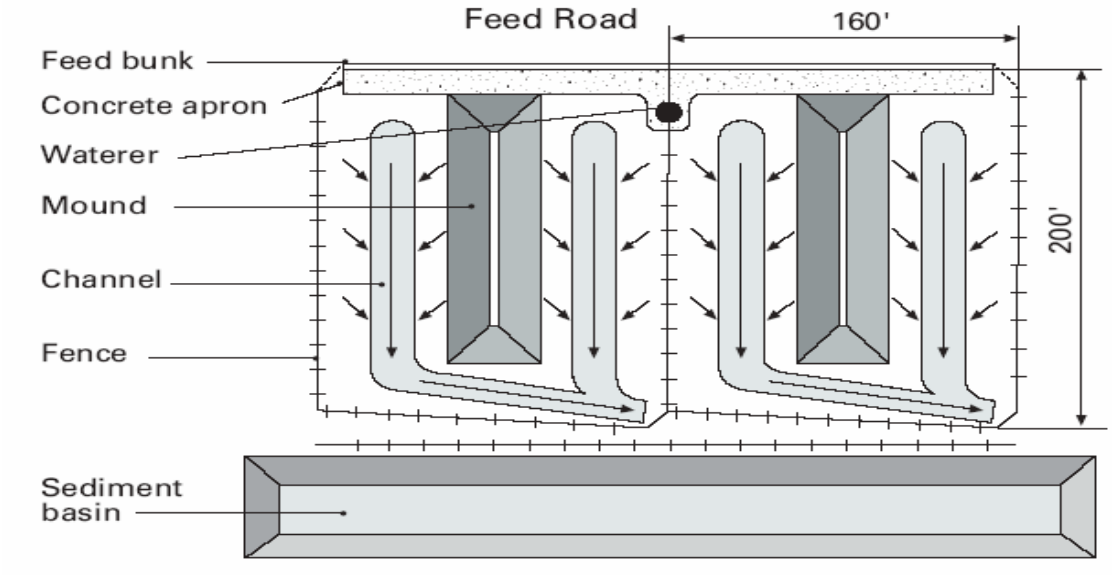


Fig. 3.18: Top-view of single-row feedlot design (LPES 2006).



Even though there are differences in size, animal husbandry, organisation, facilities and equipment used, the main task of all feedyards is to promote rapid weight gain with high energy feed rations (CME 2005).

Typical feed rations

According to GUSTAFSON (2005) average feed rations contain 70 to 90 percent of grain and protein concentrates fed for 150 days on average to market high quality cattle which grade select or higher (Chapter 4.4). Table 3.6 exemplarily shows three feeding rations fed in U.S. feedlots.

Tab. 3.6: Feeding rations (based on different interview partners).

Ingredients	Grower Ration	Finishing Ration I	Finishing Ration II
Corn	40%	81%	38%
Alfalfa hay	44%	8%	5%
Steep	12%	4%	x
Fat	0%	1%	x
Supplements	4%	6%	5%
Distillers grain	x	x	10%
Corn silage	x	x	13%
High moisture milo	x	x	30%

The “Grower Ration” is fed to cattle entering the feedlot. According to interview partners, cattle bought from pasture-based backgrounding systems have to be broken to grain-based finishing rations within three weeks after placement. The amount of hay decreases over time, ending in the high energy ration illustrated by “Finishing Ration I”. While corn is the main energy source, Alfalfa is used because of its nutrient value and to provide enough crude fiber to avoid acidosis. “Finishing Ration II” furthermore includes Distiller’s Grain as a protein source, which is a by-product of the ethanol production and therefore prevailingly used in the Mid-West, where ethanol production is prevailingly located. Further ingredients used are corn silage and milo. Whichever components the feeding rations include, typically the U.S. feed high energy rations based on corn to produce high-quality meat (VANDERVEER 2005).

Environmental issues

According to FIELD and TAYLOR (2003) the four primary management issues with regard to environment are dust, odor, flies, and water quality.

Dust management can be accomplished via pen maintenance like manure removal with scrapers and via maintaining the recommended moisture rate of 25 to 35 percent in the soil by overhead sprinkling (FIELD and TAYLOR 2003).

Odor can additionally be reduced by correctly constructed and maintained runoff holding ponds and proper nutritional management to avoid phosphorus overfeeding.

Flies can be controlled chemically and biologically. While the costly chemical control can increase risk of human or environmental chemical exposure, biological control uses fly-parasites and has been successfully adopted in the industry.

In terms of **water quality,** the management of the manure and of the feedlot runoff is important. Incorrect handling, storage or land application of manure may result in contamination of surface or groundwater (FIELD and TAYLOR 2003).

Especially the illustrated open lot feedlots have to obtain environmental permits. Certain regulations, restrictions, and design specifications must be considered in each state. The feedlots have to comply with environmental regulations for feedlot runoff. These regulations are specified by the state and the United States Environmental Protection Agency (USEPA). The USEPA enacted federal regulations for all feedlots over one thousand animal units (AU) – one beef animal presents one AU – but also state regulations have to be complied with, and often impact feedlots with 200 to 900 AUs. At present, the feedlot runoff from the rainfall amount, based on the 25-year / 24-hour storm must be contained. The size and the type of runoff system which can be used is determined by the size (drainage area, number and size of animals fed) and the location (proximity of streams or ground water, precipitation, upland or bottom land) of the feedlot. Additionally the feedlot square footage for earthen lots is impacted by precipitation and is specified with approximately 33 m^2 / head (270 to 640 kg) for 635 to 889 mm rainfall areas. LPES (2006)

Furthermore the amount of **ammonia emission** is discussed in literature. According to the Environmental Protection Agency (USEPA 2004), the total amount of ammonia emitted by livestock husbandry operations in the U.S. accounts for 2.4 million tonnes, of which poultry and beef animals represent the highest share with 27 percent each, followed by dairy animals (23 percent), swine (18 percent) and others (5 percent). Based on analysis done by OSTERBERG and MELVIN (2002 p. 186), “air quality has not been the driving force behind government action. Existing laws and programs have mostly emerged out of a long-standing concern over surface water impacts, which, while valid, have meant that air, groundwater and other emerging issues are not adequately factored into government decision-making.”

3.4.6 Profitability

This chapter discusses these different factors affecting costs and revenues of a beef finishing operation, describes annual and monthly changes in profitability, and finally shows an international comparison.

Revenues

The sale of fed cattle and manure as a by-product are the two sources of returns for a beef finishing operations (FIELD and TAYLOR 2003). Manure as a minor source of income might be sold after composting to home lawns or gardens to farmers or to contract haulers. The fed cattle revenues have the most significant effect on total dollars received in the cattle feeding operation. To determine the revenue, fed cattle is typically sold on a liveweight basis. But also the importance of alternative marketing arrangements increases (Chapter 4.3). Furthermore, the cattle revenue fluctuates widely between years and month. The impact of these fluctuations is further described subsequent.

Costs

The **total costs** of the feedlot operation can be divided into different subgroups like feeder costs, feed costs, and nonfeed costs. Nonfeed costs include variable costs (e.g., labor, veterinary, utilities) and ownership costs (e.g., depreciation, interest, insurance, taxes). To provide a better overview, Table 3.7 shows the single cost items.

Tab. 3.7: Costs per head of a 2000 head feedlot (FIELD and TAYLOR 2003).

	Total costs per head in EUR	Percent of total
Feeder cattle costs	513.73	74.3 %
Feed	136.77	19.8 %
Nonfeed costs	41.29	5.9 %
Interest	21.67	*3.1 %*
Death Loss	5.14	*0.7 %*
Vet-Med	4.83	*0.7 %*
Overhead	9.65	*1.4 %*
Total costs	691.79	100 %

Feeder cattle costs are easily determined by the weight and the price of feeder cattle purchased. They vary considerably between months and over several years (MINTERT 2003). Because they represent a high share of the total costs, they have a noteworthy impact on the cattle feeding profitability.

To determine the **feed costs**, different factors have to be considered to a greater extent. Feed costs are mainly affected by the type of feed used, the price of feed, and the cattle performance which includes the daily weight gain (DWG) and feed conversion. The feed conversion refers to the amount of feed needed to add one kg of gain. Both, daily weight gain and feed conversion likely refer to cattle quality, feed quality, management, and weather conditions inter alia. According to GUSTAFSON (2004), animals gain about 1 to 1.8 kg per day on about 6 kg of dry-matter feed per kg of gain in average. Depending on grain prices, the average feed cost per kg of gain results in 0.70 EUR per kg, which is confirmed by different interview partners.

Among **non-feed costs,** gaining ability, health, and interest rate are the most important. The higher the DWG is the fewer days are required to accumulate a given amount of weight, resulting in less overhead costs per head. Healthy cattle require neither additional labor for treatment nor medication can achieve a higher net return of approximately 70 EUR per head which also confirms the importance of preconditioning (Chapter 3.3.3). Because beef finishing is a capital intensive business, the influence of interest rates is high. An interest rate increase of one percentage point would increase the cost per head by 3.50 EUR based on 150 days on feed (FIELD and TAYLOR 2003). However, the non-feed costs are about 0.20 EUR per kg of gain, resulting in total costs of gain of about 0.90 EUR per kg.

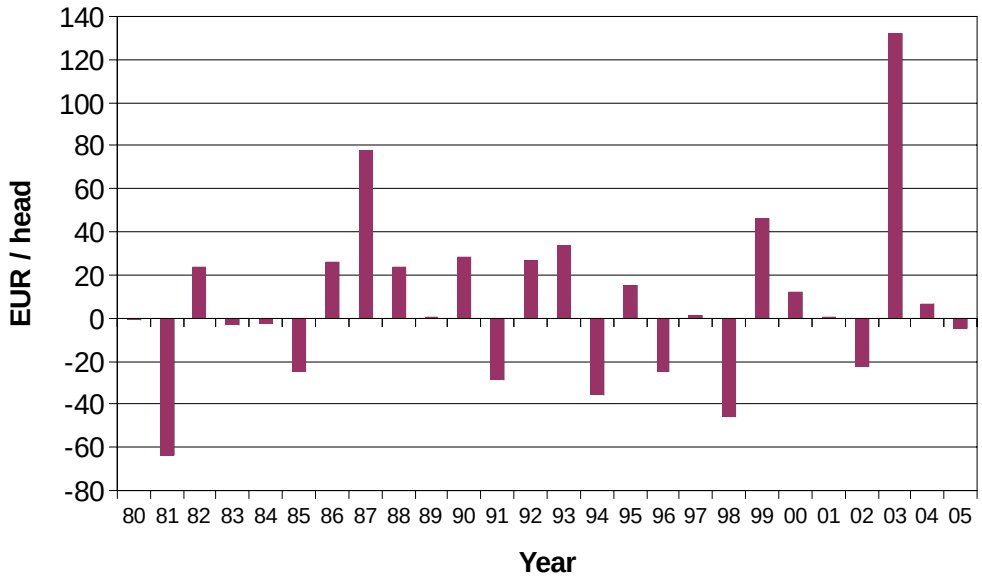
Profitability

After estimating the revenues and costs of the feeding sector, the profitability is further estimated. The profitability of feeding operations varies, which exposes feedlots to economic risk. In general, variations in fed and feeder cattle prices, feed prices, animal performance, interest rates can be specified as key factors for the profitability. MINTERT (2003) mentions that there were sustainable changes in the profitability of feedlots from year to year, as well as, from month to month. He furthermore indicates a seasonal pattern within a year. Both, long-term profitability and seasonal patterns are further described subsequent.

The **long-term** annual fluctuation from 1986 to 1997 is displayed in Figure 3.19. The figure shows that the profitability changed from year to year, but likely without a specific pattern. The profit fluctuated between plus 130 EUR and minus 60 EUR per head on an average annual basis. MARK et al. (2002) furthermore mention fluctuations of between plus 110 EUR and minus 118 EUR per head on an average monthly basis, but are not displayed in Figure 3.19.

In other words, feeding returns exhibited extended periods of profits and losses. This high fluctuation might indicate the high risk connected to cattle feeding. However, FIELD and TAYLOR (2003) state that well-managed cattle feeding operations will have fewer years of losses and more years of profit than are shown in Figure 3.19.

Fig. 3.19: Fed cattle profit and loss, 2005 projected (own illustration based on CATTLE-FAX 2006).



In addition to the fluctuation over years, a **seasonal pattern** in profitability tends to exist within a year (MARK et al. 2002). The net returns seem to correlate to the month of placement. MINTERT (2003) mentions that average profits are lower for winter placements and higher for summer placements. To illustrate this seasonal pattern in more detail, Figure 3.20 and Figure 3.21 are chosen.

Fig. 3.20: Feeder prices, fed cattle prices by month and profit of steers depending on the month of placement (own illustration based on KSU (2006); JONES (2005)).

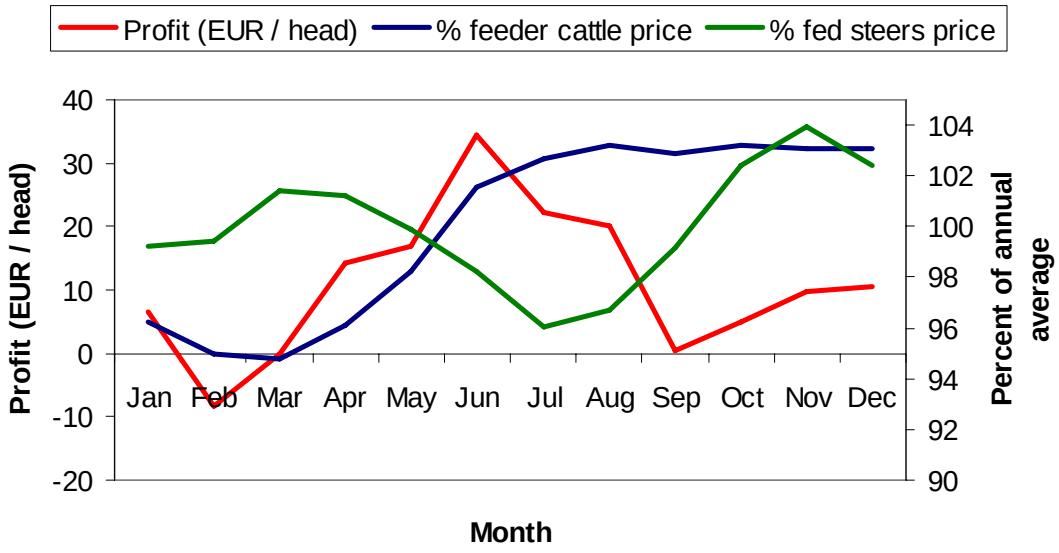


Fig. 3.21: Average daily weight gain, cost of gain by month and profit of steers depending on the month of placement (own illustration based on KSU (2006)).

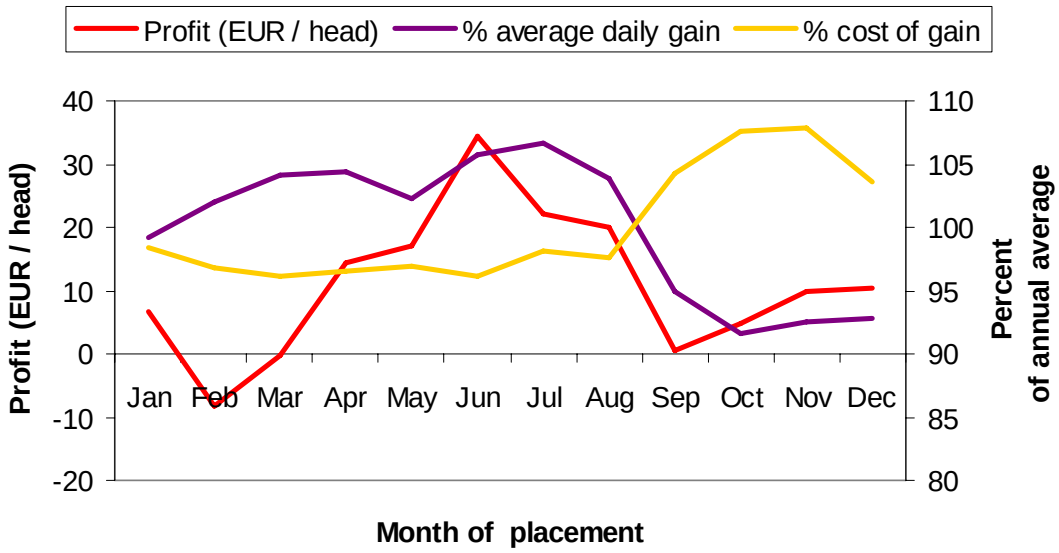


Figure 3.20 shows the profitability of steers (avg. 1985 to 1999). The seasonal variation in profit is partly attributed to feeder and fed cattle prices both following seasonal patterns (MINTERT 2003). Therefore the development of the Kansas feeder and fed cattle price index is also shown. “The price index reveals how prices vary within a year around the annual average price for that year” (MINTERT 2003 p. 390).

Fed cattle prices tend to be higher from October through May and decline during late spring and early summer, bottoming in July. According to MINTERT (2003), cattle feeding programs tend to be more profitable when placing the cattle in time to capture seasonal peaks. He further summarizes that about 80 percent of the variability in cattle feeding profits might be explained by fed cattle prices. If we assume a feeding period of 150 days in average, cattle placed in June and November would be sold when prices are seasonal high. While June placements seem to have the most profits, November placements tend to have a lower profit despite high fed cattle prices.

The **feeder steer prices** seem to follow a controversial seasonal pattern. They tend to be higher in midsummer and early winter and lower in spring and fall. It is likely that the seasonal low in spring – especially March and April – and fall may be related to higher feeder cattle supply due to ending winter-wheat and summer-grass grazing seasons (Chapter 3.3). However, high feeder cattle prices in winter help to explain why winter placements tend to be less profitable (MINTERT 2003). Conversely, cattle purchased at seasonal low prices and additionally sold during increasing fed cattle prices are more profitable (MARK et al. 2002).

The **performance of cattle** also affects the profitability. Therefore Figure 3.21 depicts the average daily weight gain and cost of gain. The two lines show an opposite development.

Average daily weight gain is higher for most of the spring and summer placements, decreases for cattle placed in August and September and is at its lowest level for winter placements.

Lower costs of gain are shown for spring and summer placements followed by an increase for cattle placed in fall and winter. According to MINTERT (2003) cost of gain of fall-placed steers are 10 percent higher in comparison to steers placed from

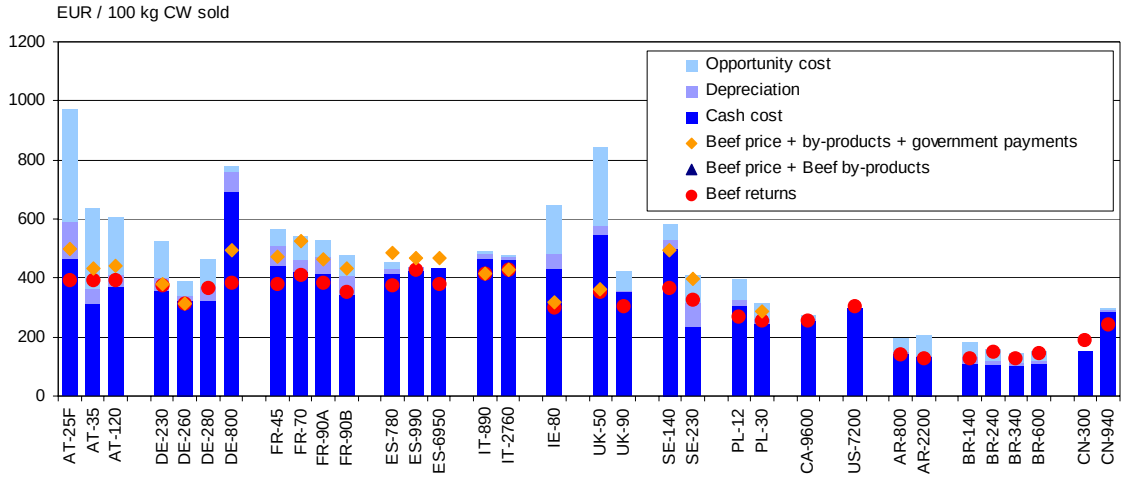
March to August. MARK et al. (2002) additionally mention a 14 percent higher requirement of feed for cattle placed in fall than placed in spring.

MARK and SCHROEDER (2002) investigated that in terms of weather effects, cattle feeding performance and profits were most influenced by temperature, temperature variability, heat stress, and precipitation especially at the beginning and end of the feeding period. While during cold months increasing temperature is beneficial, increasing temperature during warmer periods tend to be detrimental. Their results indicate that cattle perform better and realize higher profits when weather conditions remain relatively stable over the feeding period (MARK and SCHROEDER 2002). Therefore suboptimal weather conditions might be the reason for decreasing average daily weight gains for spring and fall placements as shown in Figure 3.21.

Beef finishing in international comparison

To illustrate the costs and returns of the U.S. beef finishing operations in comparison to other countries, results of the Beef Report 2006 are chosen. Figure 3.22 shows different cost items and returns of typical farms for each country. The costs and returns are measured in EUR per 100 kg of carcass weight (CW) sold. The farm names, for example, “US-7200”, include the abbreviation for each country (US) and the number of animals sold per year (7200 head).

Fig. 3.22: Cash and non-cash cost, returns and profitability of beef finishing – situation 2005 ff. (DEBLITZ et al. 2006).



In comparison to typical beef-finishing operations of other countries, the U.S. feedlot has relatively mid costs. The farms showing lower total costs are located in South America (Brazil and Argentina), Canada and China. The farms located in Germany, for example, tend to have 1.3 to 2.5 higher costs than the U.S. feedlot.

By comparing the cost composition, it can be seen that the U.S. feedlot has relatively high cash costs, and relatively low opportunity and depreciation costs. This is caused by the high amount of hired labor and the high share of bought feed in comparison to European farms, which use mainly unpaid family labor and grow their forage prevailingly on owned land.

If the beef price – illustrated by a red dot – exceeds the cost, the beef enterprise makes a profit. The figure shows that the majority of the farms do not operate profitably, whereby some farms can cover their total costs with government payments. Finally the U.S. feedlot makes a small profit per 100 kg CW, which results in a small to moderate profit provided by the huge number of cattle finished.

3.4.7 Conclusions

About 15 percent (14 million head) of the U.S. cattle inventory is kept by about 91 thousand beef finishing operations feeding a high energy ration to produce cattle grade select or higher.

Nearly two third of the COF is located in the main feeding area including Texas, Colorado, Nebraska, Kansas, and Oklahoma. The operations located in these regions tend to be larger specialised finishing operations. Larger finishing operations with more than one thousand head one time capacity represent two percent of all finishing facilities but keep about 80 percent of the total COF. The smaller facilities with less than one thousand head represent 98 percent of the finishing operations but keep only 20 percent of the inventory. Furthermore large cattle feeding companies can own multiple feedyards. The top five operations have a capacity of about two million head and represent around 15 percent of the total COF including the largest company with about 800 thousand animals.

The prevailing production system is used by larger commercial feeding operations. The cattle are kept in open lots with unpaved dirt pens the whole year, getting a high energy ration consisting of around 80 percent of corn. The main environmental

issues the feedlot has to face are dust, odor, flies, and water quality. Related regulations are specified by state and the USEPA.

The profitability of the feeding sector fluctuated between minus 60 EUR per head and plus 130 EUR from 1980 until 2005, which results in high risk related to cattle feeding. Furthermore profit varies seasonally, caused by prices for feeder cattle and fed cattle as well as fluctuations of animal performance related to weather conditions. Profits tend to be highest for cattle placed during the summer months. The cost dominant components are the costs for animal purchases with about 75 percent and the feed costs with about 20 percent of total costs. On a “per kg of gain basis” the U.S. operations calculate with 0.90 EUR per kg of gain, including 0.70 EUR for feed and 0.20 EUR for non-feed expenses.

In an international comparison, the U.S. feeders show relatively low total costs with a high share of cash costs. Beef prices covering the total costs resulted in small or moderate profits in 2005 caused by high number of animals sold.

4 Marketing of cattle

4.1 Introduction

“Marketing is the physical movement, transformation, and pricing of goods and services, with numerous buyers and sellers working to move cattle and beef products from the point of production to the point of consumption” (FIELD and TAYLOR 2003 p. 238). The marketing of cattle on the international and national level, as well as the market channels, ownership, and pricing methods used is further outlined in this chapter.

4.2 Live cattle movement and transportation

International live cattle trade

On the international level, Canada and Mexico are the only significant cattle trading partners of the U.S. because of their geographical proximity and the similarity of their cattle and beef sectors (BRUNKE 2002).

- The U.S. imported about 1.2 million head of cattle in average of the years 1998 to 2002, 57 percent from Canada and 43 percent from Mexico (USDA FAS 2006a). According to HAHN et al. (2005) imports from Mexico are primarily feeder calves. Imports from Canada tended to be animals for immediate slaughter, primarily steers (VANDERVEER 2005).

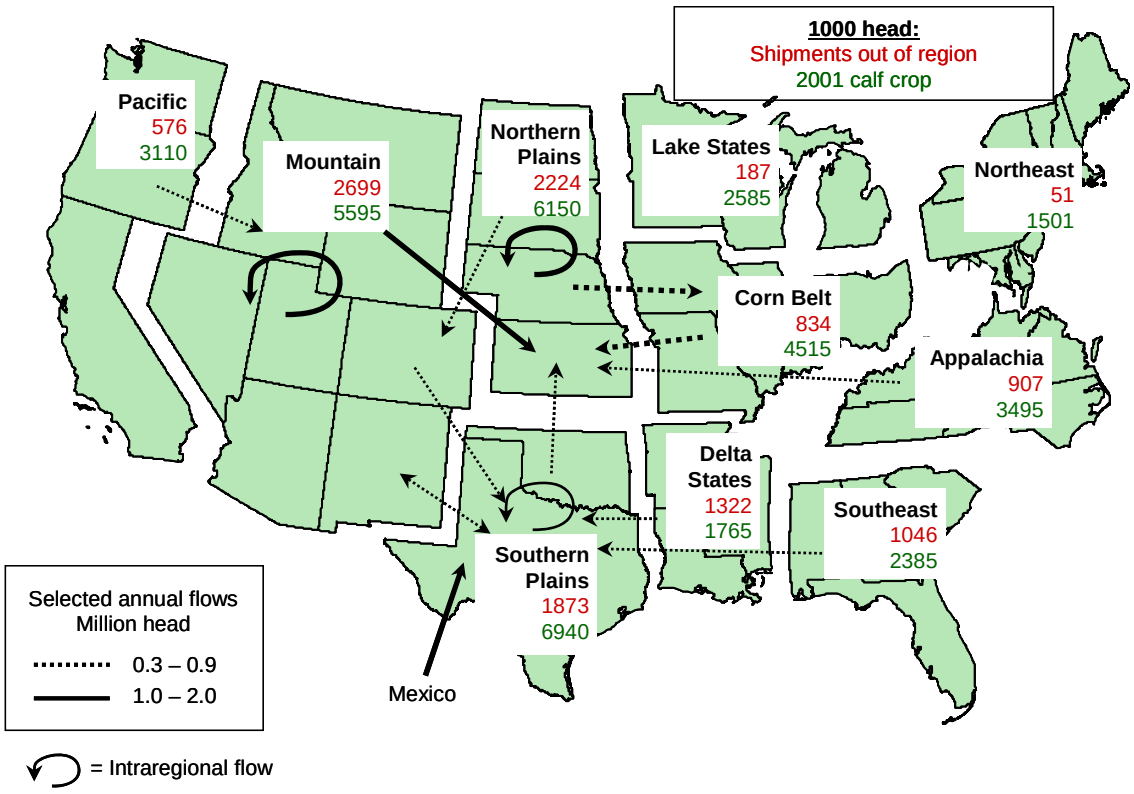
- The export reached about 166 thousand head in average of the years 1998 to 2002, of which 57 percent were sold to Canada and 43 percent to Mexico (USDA FAS 2006a). Historically these exports to both countries are primarily cattle for slaughter (VANDERVEER 2005).

With respect to international live cattle trade, the impact of BSE should be considered. Because of the first discovery of BSE in Canada on May 20, 2003, the U.S. banned Canadian cattle imports. Consequently imports from Canada nearly disappeared in 2004. After about two years, on July 18, 2005 Canadian fed cattle under 30 month of age and feeder cattle that will be placed in feedlots and slaughtered at under 30 month of age, began to cross the U.S. border (MATHEWS et al. 2006). In 2005 cattle imports from Canada reached 574 thousand head, about 70 percent of cattle imported in 2002.

Interstate cattle movement

In addition to the international level, cattle are traded on an intrastate and on an interstate level of which the latter is further described. Map 4.1 provides information on the regions between which cattle is traded. The calf crop and the amount of cattle shipped out of the region are given in numbers. The boldness of the arrows represents how many cattle are shipped to a specific region.

Map 4.1: Regional flow of cattle (based on state certificate data compiled by ERS USDA; published by SHIELDS and MATHEWS (2003)).



The greatest movement of cattle to be fed or grazed occurs within and into the Northern Plains. But many feeder cattle also enter Texas from the Southern U.S. and Mexico, mainly Zebu (Brahman) cattle because of their better performance in warmer regions. Cattle shipments from the Northeast and Lake States are often dairy breeds. To illustrate the extent of cattle movements, the shipped cattle can be compared with the calf-crop. In the whole U.S., the average shipment relative to the calf crop is 31 percent. With 75 percent, the Delta States ship the most calves relative to its calf crop, followed by the Mountain region (48 percent), the South East (44 percent), Northern Plains (36 percent), the Southern Plains (27 percent), the Appalachia (26 percent), the Pacific and Corn Belt (both 18 percent), the Lake States (7 percent), and finally the Northeast (3 percent) (SHIELD and MATHEWS 2003).

For a better interpretation of this data, it should be stated that data were only available for 29 states but represent about two-thirds of the U.S. cattle inventory. Furthermore it is mentioned that the shipments from Appalachia are underestimated because of limited data availability. (SHIELD and MATHEWS 2003)

Economics of Livestock movements

The three factors affecting the economics of livestock movement are the geographical differences in forage availability and prices for fed cattle, the relative costs of transportation, and the industry structure (SHIELD and MATHEWS 2003).

- **Geographical differences** in forage availability depend on climate, time of the year, and production technology. Price differences of feeder cattle might be influenced by weight and quality. For example, a demand for lighter weight cattle lifts the feeder cattle price in major feeding areas, resulting in an inflow of cattle from other regions.

- The second economic factor, the relative **costs of transportation**, refers to the transportation costs of animals versus feed/forage required to reach slaughter weight. Transporting an animal might be less costly because the weight of the animal is less than the total feed it will consume.

- The **industry structure** is affected by specialisation. Because of specialisation, firms take advantage of regional cost advantages related to climate, proximity to feed sources, regulatory differences, or proximity to processing facilities. The specialisation of feeding operations along with the development of irrigated feed grain crops has resulted in areas of concentrated beef cattle feeding in the Great Plains, while backgrounding is concentrated in Kansas and Oklahoma, and cow-calf operations are still distributed throughout the whole United States. This geographical distinction of production stages enforces the shipment of cattle. (SHIELD and MATHEWS 2003)

While in history, cattle was transported first by ship or rail, today cattle is primarily transported on the road by semi-trailer truck, according to SWANSON and MORROW-TESCH (2001) and interview statements. The costs of cattle transportation depend on the quantity of cattle loaded and on the distance transported. CATTLE-FAX (2005c) mentions a cost of around 1.50 EUR per loaded km (affirmed by SNYDER in an interview), which would result in freight discounts of 5 to 14 EUR per 100 kg depending on the distance. According to SHIELDS and

MATHEWS (2003) and BAILEY et al. (1995) 80 percent of the feeder cattle sold to the feeding areas Texas and Kansas are shipped farther than 320 km. Fed cattle is shipped about 160 km on average (SHIELDS and MATHEWS 2003). In terms of transport distance and destination, BORCK stated in an interview, that climatic differences have to be taken in consideration. In accordance, cattle from warmer regions (e.g. Florida) should not be shipped to colder regions in winter to prevent animal health problems.

After this overview about the amount of live cattle traded nationally and internationally, the following paragraphs should give an outline about the different marketing channels and ways used to connect different stages of the supply chain.

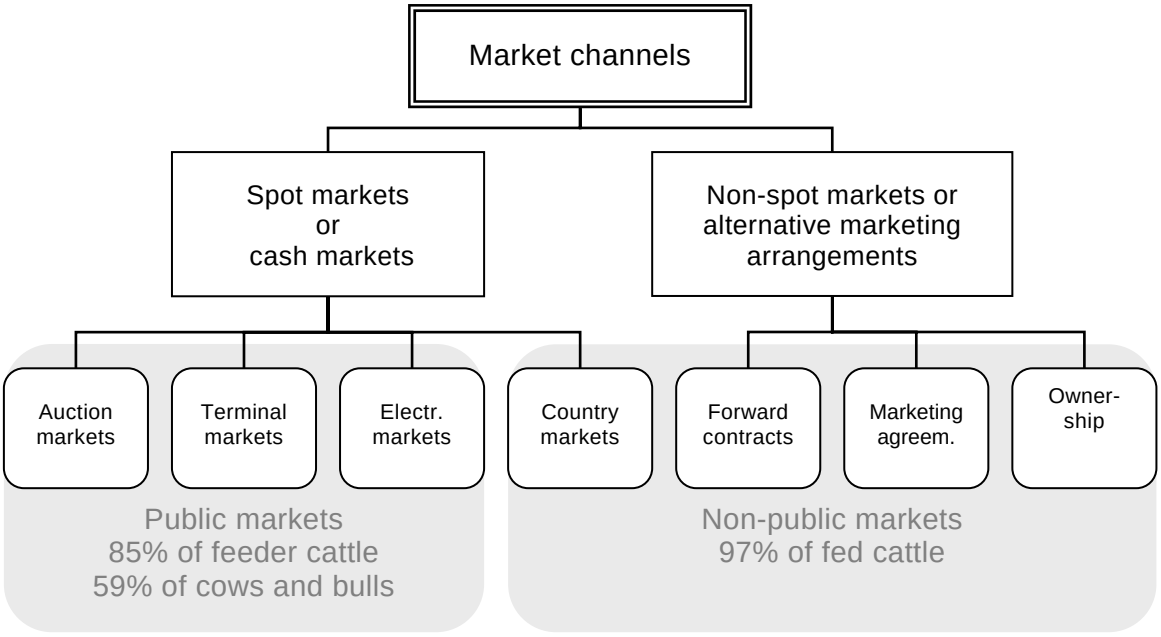
4.3 Market channels and transaction types

FIELD and TAYLOR (2003 p. 250) define market channels as “the pathway through which cattle move from the farm or ranch to feedlots and finally to packing plants”. On this pathway MUTH et al. (2005) identify the following types of cattle traded by producers, stockers, and feedlots:

- Weaned calves to stockers
- Feeder cattle to feedlots
- Fed cattle, cull cows and bulls to packer for slaughter

The markets where these transactions take place can be divided into spot and non-spot markets. Spot-markets refer to transactions that occur immediately (MUTH et al. 2003). Non-spot markets – also termed “alternative marketing arrangements” (AMA) – are defined by MUTH et al. (2005 p. 4-3) as “all possible alternatives to the spot market”. While alternative marketing arrangements can be considered as non-public, the spot markets contain public and non-public markets. According to FIELD and TAYLOR (2003), fed cattle are mainly marketed non-publicly (97 percent of head sold), while feeder cattle (85 percent), and cows and bulls (59 percent) are mainly marketed publicly. The figure 4.1 provides an overview.

Fig. 4.1: Different market channels for cattle in the U.S. (own illustration).



4.3.1 Spot markets

The spot markets (where cattle are traded spontaneously) are the traditional way of cattle trading (MUTH et al. 2005). As already mentioned, spot markets can be distinguished into two types – public and non-public markets – both discussed in the following paragraphs.

Public spot markets

Public spot markets are auction markets, terminal markets, and electronic markets. They are subjected to regulations specified by the "Grain Inspection, Packers and Stockyards Administration" (GIPSA). These regulations ensure properly working markets, fair trade and competition, and correctness of scales (FIELD and TAYLOR 2003).

Auction market

In the U.S., there are about two thousand livestock auction markets, which are also termed sale barns. They are concentrated in areas with greater cow-calf numbers because primarily feeder cattle, cull cows, and cull bulls are marketed. Larger sale barns tend to be in the great plains. The sale barn itself consists of pens, scales, and sale areas which are owned by corporations or individuals. After cattle owners consign their livestock to the auction they are sold in the sale ring by incremental bids from the audience. The bids mostly refer to the price per weight unit of live-

weight. The auction barn usually charges per head. Besides a percentage commission charge on the gross revenue ranging from 1.5 to 4 percent, additional costs occur for feed (cost plus 25 percent), brand and health inspection (0.51 EUR), insurance (0.08 EUR), and beef check-off program (0.80 EUR) which is a program to strengthen the position of beef in the marketplace and to maintain and expand domestic and foreign markets and uses for beef and beef products (FIELD and TAYLOR 2003). For example, the costs for a 250 kg feeder steer may be around 20 EUR.

Terminal market

The terminal market is similar to the auction market. Its additional feature is the availability of multiple sale agents at the terminal market. While the market is accessible for the public, the selling price is determined by private treaty. Commission firms represent the producer. They bargain until a firm price is agreed and charge the producer a fee for this service. Fed and feeder cattle might be traded. Because packing plants moved away from terminal markets and closer to large commercial feedlots, the number of terminal markets declined from 80 in the 1930s to only five major markets in 2000 with a turnover of about 860 thousand EUR for cattle. They are located in Oklahoma City (OK), Sioux Falls (SD), South St. Paul (MN), South St. Joseph (MO), West Fargo (ND) (FIELD and TAYLOR 2003).

Electronic marketing

Using electronic marketing allows buyers to participate without being at the location where pricing occurs. The price is mainly determined at a single location or over a single communication system. The cattle are not moved until they are sold. Video auction and web-based livestock marketing are the prevailing systems used (FIELD and TAYLOR 2003).

In **video auctions** the buyers are shown a video tape which provides the information influencing the price of the cattle and is taken on the farm or ranch of the cattle being offered for sale. After presenting the video (available by satellite hook-up), the auctioneer sells the cattle to the highest bidder. The shipping is arranged by buyer and seller after the auction (FIELD and TAYLOR 2003).

Web-based livestock marketing can be handled in different ways. Some web-sites simply list the cattle being offered for sale, while others use real-time internet auctions which may include video sequences, and hundreds of logged on buyers can bid on the cattle (FIELD and TALYOR 2003). However, according to interview

partners, it is also possible that normal sale-barns establish web-cams to allow logged on buyers to bid on the cattle.

The main advantage of this kind of auction to trade calves, stocker cattle, and feeder cattle is the reduction in transport distance and transport costs (MUTH et al. 2005). According to FIELD and TAYLOR (2003), about 2 million head of cattle were sold via electronic markets, which represents about three percent of total cattle marketing in 2000.

Non-public spot markets

Non-public spot markets are **country markets** which contains order-buyers, commission representatives, or direct marketing (FIELD and TAYLOR 2003). While order buyers and commission representatives act as intermediaries between seller and buyer, on direct markets buyers and sellers negotiate straight (FIELD and TAYLOR 2003). Direct trade tends to occur mainly between larger operations in the supply chain (MUTH et al. 2005).

4.3.2 Non-Spot markets

Fed cattle traded throughout the supply chain via non-spot markets increases (MUTH et al. 2005). According to FIELD and TAYLOR (2003), non-spot markets are marketing agreements, forward contracting, and ownership methods. All of these are non-public.

Marketing agreements

Marketing agreements are defined by FIELD and TAYLOR (2003 p. 256) as a “longer-term relationship for the ongoing delivery of cattle, which is specified by the number of animals, the date and conditions for delivery, performance specifications, and pricing method”. They might be negotiated periodically, be written or oral, and tend to be negotiated every six months, according to interview partners and MUTH et al. (2005). Marketing agreements appear to be the prevailing alternative market arrangement at the feeding stage. Cattle are mainly priced using formula pricing further explained in Chapter 4.4 (MUTH et al. 2005). It is also possible that packers have some partial ownership or capital commitment in the cattle subject to marketing agreements (MUTH et al. 2005).

Forward contracting

According to FIELD and TAYLOR (2003), forward contracts may be a part of a marketing agreement or only a one-time transaction. In forward contracts, the base price is either fixed (flat price) or based on some public reported future price.

In flat price contracts, one party bears the basis risk and therefore receives a premium. Other forward contracts employ a base price in which the contract price is related to the CME live cattle futures price closest to the date of exchange. Because in this case both parties are able to separately lock in prices on the CME by taking opposite positions, both bear basis risk (MUTH et al. 2005).

Calf producers appear to make the largest use of forward contracts which allow them to manage risk created by the small marketing window related to the calving season. But also stocker operations and feedlots use this kind of alternative marketing arrangement (MUTH et al. 2005).

The lengths of these contracts can vary between one month and one year in the cattle sector. In an interview SCHROEDER mentioned periods of three to five month. Cow-calf operations tend to forward contract the sale after calves are born, consequently mainly during spring and summer (calving season in Chapter 3.2.4). Feeding operations likely forward contract their sales after the feeder cattle are placed on feed – typically two to six months prior to slaughter depending on factors affecting the feeding period (Chapter 3.4) (MUTH et al. 2005). These cattle are captive supplies while cattle sold inside the 14-day window prior to slaughter are termed cash cattle (MUTH et al. 2005).

Ownership methods

In addition to the sale of cattle by forward contracts and marketing agreements, there are different ownership methods to move cattle through the supply chain, which can be a part of marketing agreements. Even though these ownership methods may be possible on all production stages, the beef finishing stage is the focus of this section, according to its prevalence.

In the beef finishing sector different ownership variations are possible. According to interview partners, the cattle can be owned totally by the feedyard itself, partly by the feedyard, or totally by an investor.

On the one side, cattle **totally owned by the feedyard** and sold after finishing can not be classified as a ownership method. On the other hand, it is possible that feeding operations retain ownership throughout the slaughtering process. This can be termed custom slaughtering, whereby the packer does not participate in any ownership.

Shared ownership occurs when more than one party has capital commitment. Often feeding operations and packing operations share ownership. In this case, profit sharing arrangements tend to be used. In a profit-sharing agreement, the feedlot (or the cattle owner if different from the feedlot) and the packer are subjected to the feeder cattle and feeding expenses. The feedlot retains ownership of the animals throughout the meat production stage and both the feedlot and packer receive sales revenue less the operating expenses of the processing facility. This interconnection results in an incentive for feedlots to maximize meat sales revenue, and for packers to minimize feeding expenses within the context of beef product requirements (MUTH et al. 2005).

When the feeding operation itself is not involved in the ownership it is termed **custom feeding**. The investor is charged for the service provided by the feeding operation. This service – mainly feeding the cattle – can be charged in three different ways:

- By yardage (fixed amount per head per day)
- By feed provided (feed is sold to the investor)
- By a combination of yardage and sold feed

When the investor is charged by a combination of yardage and feed, interview partners mention a yardage of about 4 to 5 cents. The price charged for the provided feed depends significantly on the grain market. Further expenses for veterinary and death losses are borne by the investor. If it is the packer who has 100 percent of the capital commitment, it can be further specified as packer feeding (MUTH et al. 2005).

Pro and contra of alternative Marketing arrangements

The major advantages of alternative marketing arrangements for the different stages of the beef industry are management of costs, supply, and risk. Producers mention advantages like guaranteed return of value on quality cattle, volume management and secured supply, guaranteed financing or access to additional capital, and

improved facility or capacity utilization. Packers tend to focus on obtaining quantities and qualities desired by consumers and assure a constant delivery of cattle. Further important attributes are health management, source verification, and animal history which have proven to be cost effective and to increase long-term returns and overall efficiency MUTH et al. (2005).

The following comparison according to MUTH et al. (2005), gives an overview about general incentives to choose or to not choose alternative marketing arrangements:

Advantages of alternative marketing arrangements	Advantages of spot-markets
+ Reduced marketing costs	+ Flexibility to manage a diverse portfolio of marketing methods
+ Guaranteed “hotel” for cattle	+ Economic reasons such as higher return
+ Increased bargaining power, knowledge and information when entering the market	+ Maintenance of a relationship and a “handshake” mentality between industry participants
+ Management of production coupled with a focus on desired consumer values and product attributes	
+ The advantage of specialisation	

In addition to these general reasons, there are impacts of the operation’s size. Producers who choose to use alternative marketing arrangements tend to be large producers. Potential benefits of alternative marketing arrangements, relative to the effort required to negotiate a contract, vary with producer size. Larger packers seem to participate to maintain volumes and flows of animals while small packers might secure reliable supplies of specific quality cattle. Larger firms appear to add these alternatives to their portfolio of marketing opportunities and consequently increase the diversification of purchases and sales over time (MUTH et al. 2005).

4.4 Pricing systems

While calves and feeder cattle are priced on a live-weight basis, there are different methods for pricing the fed cattle. MINTERT (2003) discusses the prevailing live-weight pricing and the recently introduced grid-based pricing, while FIELD and TAYLOR (2005) further mention the carcass weight pricing. However, the different pricing systems are complex and are specified below.

Live weight pricing

In the U.S. liveweight pricing is the most common system used. The value of the cattle is determined by live-weight and live-weight price. Transport costs from the feedlot to the packer are typically paid by the packer, who also cuts the feedlot weight of cattle by a fixed amount of four percent (pencil-shrink) (MUTH et al. 2005). To reduce costs and save time associated with cattle sale and procurement, entire lots may be traded at the same time, even though individual pen and animal values differ (MUTH et al. 2005).

According to MINTERT (2003), live weight pricing is easy to understand and reduces cattle feeders' risk related to red meat yield and cattle quality. The feeder also maintains complete flexibility in cattle pricing until the transaction price is established (MUTH et al. 2005). The main disadvantage of liveweight pricing is that it often fails to provide cattle sellers with economic signals regarding the type and quality of cattle desired. Consequently, high quality cattle are often undervalued and low-quality cattle are often overvalued (MUTH et al. 2005).

Dressed weight pricing

To determine the value of the cattle by dressed weight pricing, the "hot" carcass weight (before chilling) is multiplied by an average dressed weight price. This pricing method is also called "flat in the beef" according to the interview partner ROSER. The transport costs are typically paid by the feeder. The main difference to live-weight pricing is that the risk of an incorrect estimation of the dressing percentage is more or less eliminated. But just like live weight pricing, marketing signals tend to be distorted, because all cattle are traded at one average price (MUTH et al. 2005).

Formula / Grid pricing

Grid-pricing has been introduced recently and becomes more important, especially in alternative marketing arrangements (MINTERT 2003). It is a carcass based system, where the carcass value is discovered for each animal individually, unlike

live weight or dressed weight pricing where simply one average price for all animals is used (MUTH et al. 2005). The result is an increase in price efficiency because the price for the raw material is based on its real value. In other words, better quality cattle are rewarded and poorer quality cattle are penalized, which provides incentives to produce desirable types of cattle (MUTH et al. 2005). Consequently, the risk related to the cattle performance is borne by the seller instead of the buyer (MINTERT 2003). Furthermore WARD et al. (2002) mention that this kind of pricing method results in twice as much variability in returns compared to live-weight pricing.

To determine the price for each animal, a base price adjusted by specified premiums and discounts depending on the carcass merit is used (WARD et al. 2001). The premiums and discounts can be displayed in a matrix format which is often termed grid. While the grid may differ substantially between the slaughter companies, they all use the same principle. Each grid contains a basis defined by a specific yield and quality grade and furthermore specifies premiums and discounts for other yield grade combinations (MINTERT 2003).

The **yield grade** measures the quantity of lean beef marketable from a carcass (FIELD and TAYLOR 2003). The higher the yield grade, the higher the fat content, and the higher the discounts. The yield grades are determined from four carcass characteristics:

- Amount of fat over the ribeye muscle – measured in tenths of inches at the twelfth and thirteenth rib interface
- Area of ribeye muscle (REA) – measured in square inches at the twelfth and thirteenth rib interface
- Kidney, pelvic, and heart fat (KPH) – measured as a percentage of carcass weight
- Hot carcass weight – intermuscular fat increases with increased weight

A higher amount of fat over the ribeye muscle, of KPH, and higher hot carcass weight, increases the yield grade, while a higher amount of REA decreases the yield grade.

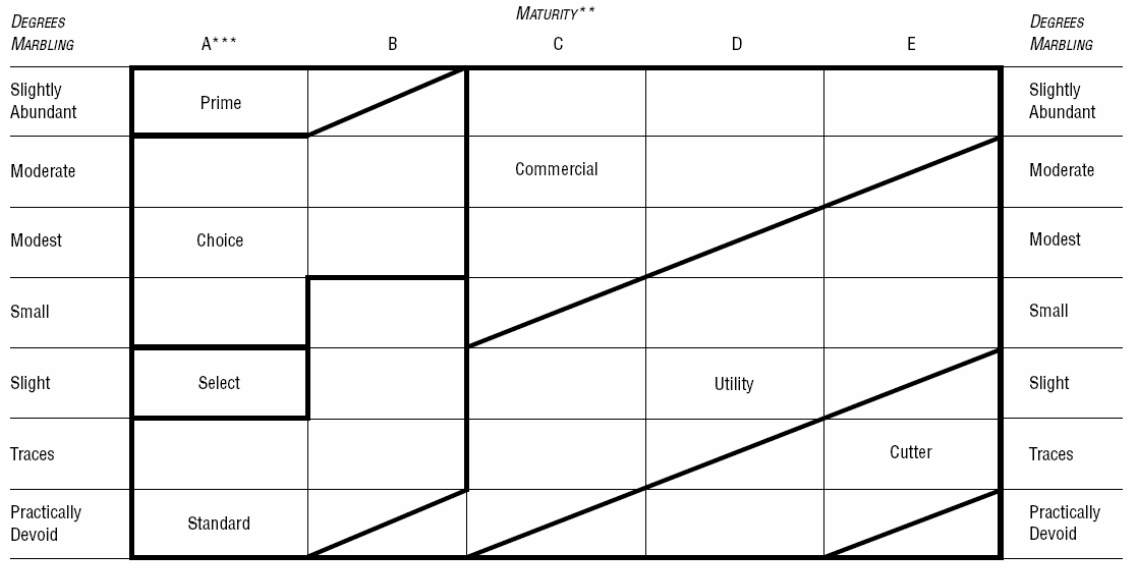
The **quality grade** represents mainly the marbling and maturity of the beef. The higher are marbling and maturity, the higher are the premiums (FIELD and TAYLOR 2003).

- The marbling is visually evaluated at the twelfth and thirteenth rib interface. The nine degrees of marbling vary from abundant to practically devoid, as shown in figure 4.2.

- The maturity reflects the tenderness, which decreases with increased age. The maturity is determined primarily by bone ossification of the vertebrae. The maturity varies from A to E. An A maturity carcass has the highest amount of cartilage on the tips of the vertebrae processes, while complete ossification can be observed at carcasses with E maturity (FIELD and TAYLOR 2003).

The combination of maturity and marbling results in the quality grade. The relationship between marbling, maturity, and carcass quality grade is shown in Figure 4.2.

Fig. 4.2: Relationship between marbling, maturity, and carcass quality grade (USDA AMS 2001).



* Assumes that firmness of lean is comparably developed with the degree of marbling and that the carcass is not a "dark cutter."
** Maturity increases from left to right (A through E).
*** The A maturity portion of the Figure is the only portion applicable to bullock carcasses.

Pricing based on quality and yield grade

To illustrate the premiums and discounts related to quality and yield grade, Table 4.1 shows the single premiums and discount for different quality and yield grades and their combination in a grid. Additionally, discounts tend to be applied for cattle with very dark muscles (dark cutters) and too heavy or light cattle, and premiums for quality programs like Certified Angus Beef (CAB is the largest certified program) (MUTH et al. 2005).

Tab. 4.1: Beef cattle grid, values in EUR per 100 kg dressed weight (own illustration based on MUTH et al. (2005) and WARD et al. (2001)).

				Yield Grade				
				1	**2**	**3**	**4**	**5**
				+9	+5	0	-21	-32
				⇩	⇩	⇩	⇩	⇩
Quality Grade	Prime	+21	⇨	*+30*	*+26*	*+21*	*0*	*-11*
	Choice	0	⇨	*+9*	*+5*	*Base*	*-21*	*-32*
	Select	-11	⇨	*-2*	*-6*	*-11*	*-32*	*-43*
	Standard	-27	⇨	*-18*	*-22*	*-27*	*-48*	*-59*
Certified program					*+4*			
Dark cutters					*-25*			
Light carcasses				*< 270 kg*	*-15*			
Heavy carcasses				*> 408 kg*	*-15*			

Premiums and discounts vary between packers and over time for a single packer. WARD et al. (2001) state, that some premiums or discounts have been found to be very stable over time for a single packer's price grid, while others, such as the Choice-Select price difference, change with changing wholesale and market conditions. The base price can also be estimated differently, for example by negotiation, specific market reports, or by the average price of cattle purchased to harvest in the week prior to or the week of slaughter (SCHROEDER et al. 1997). While typically the cattle quality of one seller is priced on its own merit, in the latter method (plant average grid pricing) the cattle quality is paid on the basis of the seller's cattle quality relative to other cattle slaughtered previously in the same plant (WARD et al. 2001).

The seller of fed cattle should consider several factors when using grid-pricing as a marketing strategy. According to FIELD and TAYLOR (2003), the producer should collect data on a sample of cattle to determine the likely incurred risk instead of selling an entire set of cattle at once if the grid-pricing system was now used before. Analogically, WARD et al. (2001) conclude that cattle feeders must know their cattle

quality and must know how the formula or grid price is calculated. They furthermore mention that even a few lower quality cattle, priced at large discount to higher quality cattle, can offset the premiums of higher quality cattle. Producers are advised not to become so focused on capturing premiums that they forget about the importance of feedlot performance and weight to achieve profitability (FIELD and TAYLOR 2003).

Differences to the European grading system

If we compare the U.S. grading system with the European system, similarities and differences can be observed. In the European system the carcass is valuated by two factors, the conformation class (EUROP) and the degree of fat cover (1 to 5) (DEBLITZ 2002).

The higher the **degree of fat cover** (5 is the highest) the lower the price. Consequently both grading systems, the U.S. and the European, discount too high fat covers. While the European system only measures the fat cover visually, the U.S. system does it in much more detail as described above and is therefore more objective.

The **confirmation class** is prevailingly determined visually and therefore tends not to be objective. There might be a relationship between confirmation class and meat quality, but quality is not measured as accurately as in the U.S. The higher confirmation class (E is the highest), the higher the price.

4.5 Conclusions

The marketing of cattle occurs on the international and national level. Mexico and Canada are the important trading partners, while the U.S. mainly imports feeder cattle from Mexico and fed cattle from Canada. Exports to these countries are prevailingly fed cattle. The confirmation of BSE in North America changed this picture completely. Cattle imports from Canada were totally banned from May 2003 until July 2005, when the U.S. reopened the border for cattle less than 30 month of age.

On the national level, interstate and intrastate cattle trade can be observed. The greatest movement occurred within and into the Northern Plains. The economics of this livestock movement is affected by geographical feed availability and cattle price differences, costs of transport, and the industry structure.

The market channels used to trade the cattle can be divided into spot and non-spot markets. While spot-markets (where cattle are spontaneously traded) are currently most used, non-spot markets (also termed alternative marketing arrangements) become increasingly important. Advantages are a higher exchange of information and a better management of costs, supply, and risk.

While live-weight pricing is dominantly used for calves and feeder cattle, fed cattle are increasingly priced via grid pricing methods. The latter method allows an accurate estimation of the carcass value. It therefore provides cattle sellers with economic signals regarding to the type and quality of cattle desired and increases the long-term efficiency of the entire supply chain.

5 Slaughtering and processing

5.1 Introduction

Slaughter is defined by the USDA NASS (2006b p. 73) as the "[…] killing and butchering of animals primarily for food." The cattle slaughter in the U.S. totalled 32.5 million head in 2005 and resulted in a production of about 11.25 million tonnes of beef. Steers comprised 52.8 percent of the main cattle slaughter, heifers 30.7 percent, dairy cows 7.1 percent, other cows 7.9 percent and bulls 1.9 percent (USDA NASS 2006b). The average live weight of cattle slaughtered in 2005 was 570 kg and the animals dressed about 61 percent resulting in a dressed weight of 349 kg. According to FIELD and TAYLOR (2003), these animals are slaughtered in about 1,250 beef slaughtering facilities, while USDA NASS (2006b) additionally mentions slaughtering on farms primarily for private consumption.

Correspondingly, the total cattle slaughter can be divided into commercial and farm slaughter. Commercial slaughter includes slaughter and meat production in federally inspected and other plants. Federally inspected (FI) plants sell and transport meat on an interstate level and must therefore employ federal inspectors to assure compliance with USDA standards. Non-Federally inspected (NFI) plants sell and transport only intrastate and are inspected by State inspectors to assure compliance with individual State standards. Farm slaughter comprises animals slaughtered on the farm for home consumption or by mobile slaughtering facilities USDA NASS (2006b).

Fig. 5.1: Different slaughter categories (own illustration based on USDA NASS (2006b)).

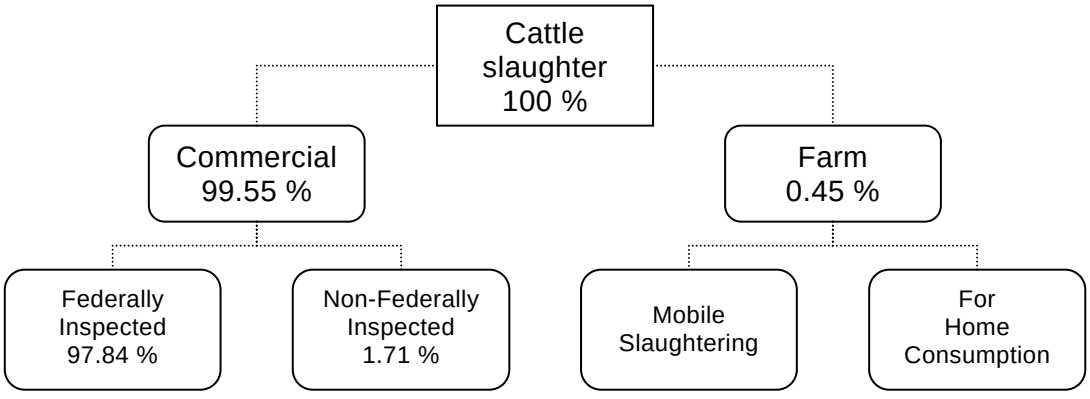
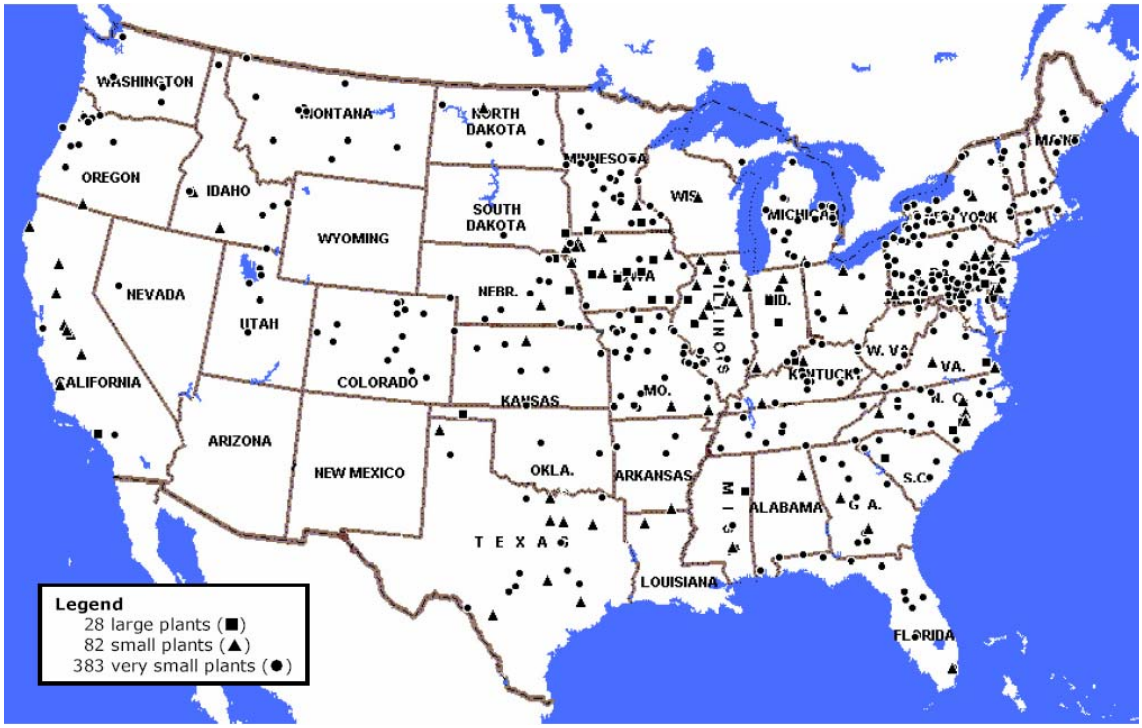


Figure 5.1 illustrates the different slaughter categories. As can be seen, the farm slaughter plays only a minor role, while the commercial slaughter, and especially the FI slaughter, almost represent the total slaughter. For this reason and because of data availability, further analysis is based on FI slaughter data.

5.2 Regional Distribution

The regional distribution of the cattle slaughter industry can be described with two indicators: number of plants and number of cattle slaughtered. Therefore the following map shows the U.S. packing plant by location and size.

Map 5.1: Location of FI plants that slaughter at least 50 head of steers and heifers from October 1, 2003 to September 30, 2004 (RTI 2005; MUTH et al. 2005).



Notes: Large plants have over 500; small plants 10 to 499 and very small fewer than 10 employees.

The majority of the plants are located in the northern urban area, while the main slaughter capacity can be found in the major feeding area: Kansas, Texas, Nebraska and Colorado. This map further indicates larger slaughter facilities in the central feeding area and smaller plants in the North East. This assumption is affirmed by LMIC (2005a), who mentions many small plants in Pennsylvania and New York that concentrate on cow and bull processing. They are supported by the large number of dairies in that area, while steer and heifer slaughter is primarily located in the feeding area. One major reason for this high concentration of

slaughter capacity in the feeding area is the availability of a large and constant cattle supply and the minimization of transport costs (MACDONDALD 2003). Furthermore it is less expensive to transport meat to the place of consumption than cattle. GOODWIN and CROW in 1973 already mentioned a gradual decentralisation from the Northern urban centres to locations of concentrated feed grain production. To underline the regional shift in cattle slaughter the following two figures show the development of cattle slaughter and plant numbers in the top four cattle slaughter states in absolute numbers and relative to the U.S.-total.

Figure 5.2 presents an increase in cattle slaughter from 1975 to 1995 remaining constant until 2005 and decreasing plant numbers from 1975 to 1995, which have remained constant since then as well. The increased cattle slaughter and decreased plant numbers go along with an increase in plant size.

Fig. 5.2: Development of plant numbers and slaughtered cattle in the top four states (own illustration based on USDA Livestock slaughter summary of the years 1976, 1986, 1996, 2006).

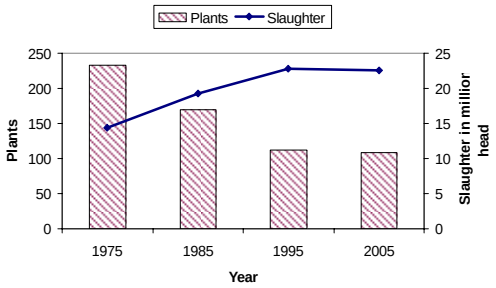


Fig. 5.3: Development of the share in plants and slaughtered cattle in the top four states (own illustration based on USDA Livestock slaughter summary of the years 1976, 1986, 1996, 2006).

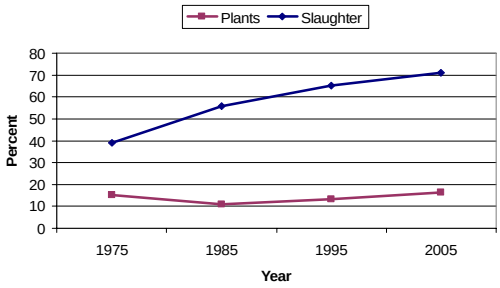


Figure 5.3 shows that the top four states' share in total slaughter increased about 30 percent points from 1975 to 2005. The share in plant numbers remained more or less the same with a slight decrease in 1985. The top four states (KS, TX, NK, and CO) harvested about 71 percent of the total FI cattle slaughter with only 16 percent of FI plants in 2005 which the confirms the concentration of larger plants in this region.

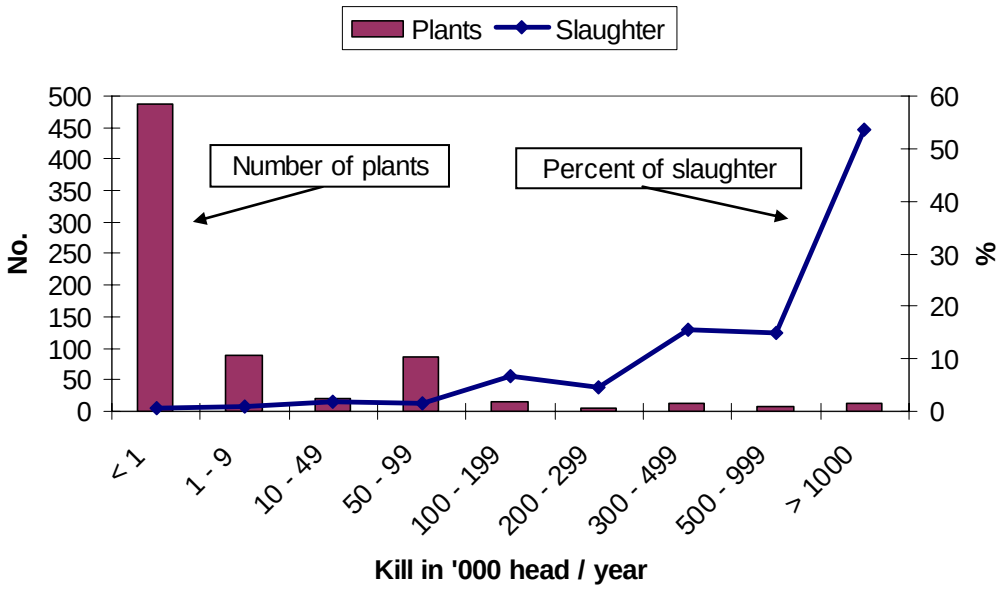
5.3 Structure

The structure of the slaughter industry can be described in terms of plant structure and firm structure which are both discussed in the following section.

Plant Structure

In total there are about 1,250 beef slaughtering facilities in the U.S. (FIELD and TAYLOR 2003). According to USDA NASS (2006b) 657 slaughter plants are FI which represent about 50 percent of the plants and 98 percent of total cattle slaughter. Figure 5.4 shows the structure of the 657 FI slaughter plants.

Fig. 5.4: Structure of FI slaughter plants in U.S. (own illustration based on USDA NASS (2006b)).



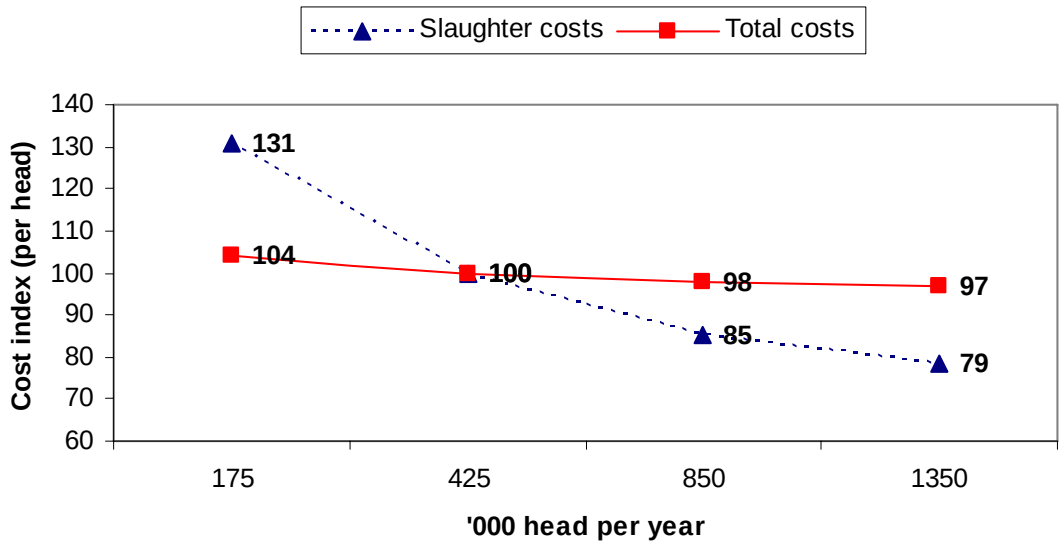
The x-axis displays the slaughter plant by yearly slaughter capacity while the y-axes show the number of plants on the left and the percent of slaughtered cattle on the right. The majority – about 490 plants or 74 percent – of FI plants have a capacity of less than one thousand head per year and slaughter less than one percent of total FI slaughter. Only a few slaughter plants – 13 plants or two percent – have a capacity of over one million head per year, but slaughter over 50 percent of the total cattle slaughter.

According to the Livestock Marketing Information Centre (LMIC 2005), the number of FI plants has declined dramatically as the cattle industry as a whole has consolidated. MACDONALD (2003) also mentions that a shift to much larger plants coincided with increased ownership concentration. USDA GIPSA (2006b) reports

1,411 FI plants in 1980 while USDA NASS (2006b) cites 657 FI plants in 2005. This is a decrease of about 50 percent in 25 years. Mid-sized and larger plants (over 500 thousand head per year) actually increased from 5 plants in 1980 to 23 plants in 2004. The largest plants, over one million head per year, handle about five thousand cattle per day. As main reasons for the increase in plant size the following three points can be mentioned: the economies of scale, changes in labor markets which led to lowered labor costs at large plants, and large and steady flows of uniform livestock assured by larger feeding operations (Chapter 3.4) (MACDONALD 2003).

The **economies of scale** are illustrated in Figure 5.5. The line-graph shows the cost index of total costs and slaughter costs by different plant sizes. According to MACDONALD (2003) the cost index is used to preserve confidentiality of the used data and because relations between size and costs vary little, even if actual costs change. While total costs include animal purchases, slaughter costs exclude them and focus only on labour, materials, and capital costs. As can be seen, small plants (175 thousand head per year) have 65 percent higher slaughter costs than the largest plants (1.35 million head per year). In terms of total costs the scale economies level off because slaughter costs account for only 10 to 15 percent in total costs. Finally it can be seen that scale economies are extensive, in that costs fall continuously as plant sizes expand. (MACDONALD (2003)

Fig. 5.5: Scale economies cattle slaughter (MACDONALD 2003).



Labour market developments were as important as the scale economies. In the 1980s large cattle and hog plants paid 23 percent higher hourly wages than the industry's mean, which is associated with unionized work forces in larger plants. After a reduction in base wages to a level consistent with that in non unionized plants in the early 1980s, strikes, lockouts, and de-unionizations resulted in a reduced union membership of one fifth. The declining unionization coincided with higher and growing shares of immigrants, primarily from Mexico, Central America, and Southeast Asia. The consistent wages spurred consolidation because the disappearance of wage premiums from large plants removed their major cost disadvantage in competing with small plants (MACDONALD 2003).

Firm structure

The plants described in the previous section are owned by several firms. According to MACDONALD (2003), ownership of multiple plants has the following advantages:

- Improved management of livestock flows to operate each plant at full capacity
- Avoidance of diseconomies of scale at very large plants caused by higher shipping costs for livestock and meat
- Economies of scale in the corporate activities of management, livestock procurement, advertising, and product marketing

In the following, the structure and concentration of beef packing firms is investigated. Therefore the "four firm concentration" and the "Herfindahl-Hirshman Index (HHI)" are used. Finally the main reasons for increased concentration are summarized.

Based on the USDA-GIPSA "Packers and Stockyards Statistical Report 2006" there were 689 FI packing firms slaughtering cattle in 2004. About 173 of these plants had to report to GIPSA because they purchased more than US-$ 500 thousand of livestock on an annual basis. The top four firms own 25 plants and slaughter nearly 71 percent of total commercial cattle slaughter (23.2 million head). While USDA data are anonymous and only aggregated top four firm numbers are published, Table 5.1 shows these top four firms by name and in more detail. The data used is from Cattle Buyers Weekly (CBW 2005) and does not accurately match the numbers published by USDA. But they can be used to illustrate the top four beef packers' composition.

Tab. 5.1: Top four U.S. beef packers based on CBW (2005).

	Capacity *head / day*	US plants *number*	Slaughter *million head*	Market share *percent*
Tyson Foods	36,000	10	8.4	25.6
Cargill Meat Solutions	28,300	7	8.5	20.5
Swift and Company	16,759	5	5.0	15.3
National Beef Packing Co. LLC.	13,000	2	3.1	9.5
Top 4	**94,059**	**24**	**24.9**	**70.9**

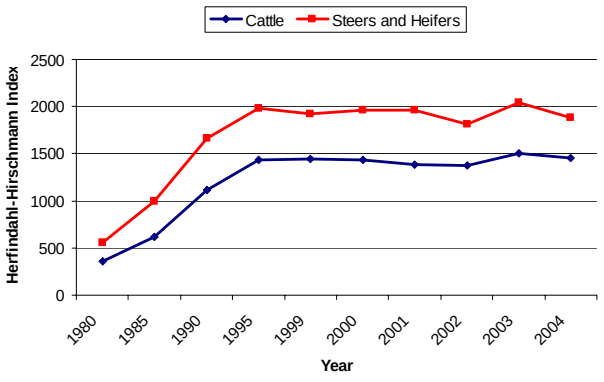
Notes: Slaughter and Market share are based on the year 2004.

If we investigate the development the top four firm concentrations over time, USDA GIPSA (2006b) numbers indicated an increase during the last two decades. While in 1980 the top four firms had a share of about 28 percent of total commercial cattle slaughter, the share increased to about 59 percent in 1990, about 70 percent in 2000, and 71 percent in 2004 (USDA GIPSA 2006b).

In addition to the four firm concentrations, the **Herfindahl-Hirshman Index (HHI)** is used to determine market concentration. Unlike the Four Firms' Concentration Ratio, the HHI reflects both the distribution of the market shares of the top four firms and the composition of the market outside the four firms and gives proportionately greater weight to the market shares of the larger packers. The HHI is calculated as the sum of each firm's squared percentage share in total commercial slaughter. Markets are considered to be not concentrated when the value of the HHI is below 1,000, moderately concentrated between 1,000 and 1,800 and highly concentrated above 1,800 (USDJ and FTC 1997).

Figure 5.6 shows the HHI development from 1980 to 2004 for total cattle slaughter and for steers and heifers slaughter. Both lines show a strong increase from 1980 to 1995 and tend to remain constant until 2004. While the index for cattle slaughter reached an HHI of nearly 1,500 index points, the steer and heifer slaughter seems to be more

Fig. 5.6: Herfindahl-Hirshman Index in selected years (own illustration based on USDA GIPSA (2006b)).



concentrated, exceeding 1,800 index points in 1995, and tends to stay at this high level. In accordance with the United States Department of Justice and the Federal Trade Commission (USDJ and FTC 1997), the cattle slaughter can be termed moderately, and the steer and heifer slaughter highly, concentrated. In addition to the firm concentration, packers increased their use of vertical integration and coordination arrangements, which reduces the role of public markets where the terms of trade are openly visible (USDA GIPSA 1996). Even though there are concerns about effects of concentration, MATHEWS et al. (1999) summarizes that the potential for exercising market power exists, but packers do not appear to be exercising market power and therefore suggest continued monitoring of market concentration.

The **increase in firm concentrations** tends to be related to different factors. The impact of larger plants, decreased demand, multiple plant operations, and mergers are further investigated.

The strong shift to larger plants was accompanied by slight declines in total commercial slaughter. This resulted in strong pressure on smaller, high-cost plants to close. Consequently, concentration grew sharply in response to the combined forces of declining cattle demand and much larger plants (MACDONALD 2003).

Multiplant ownership cannot account for the increase in concentration, because the four largest packers owned the same number of steer and heifer slaughter plants in 1980 as in 2000, whereas the four firm concentration of the steer and heifer slaughter rose 125 percent (from 36 to 82) MACDONALD (2003).

Some mergers were acquisitions of existing plants by firms outside the industry. Such acquisitions change the identity of owners but not the firm’s market share. Furthermore acquisitions of small plants only slightly impact the concentration of the industry, while the top four firms dominate MACDONALD (2003).

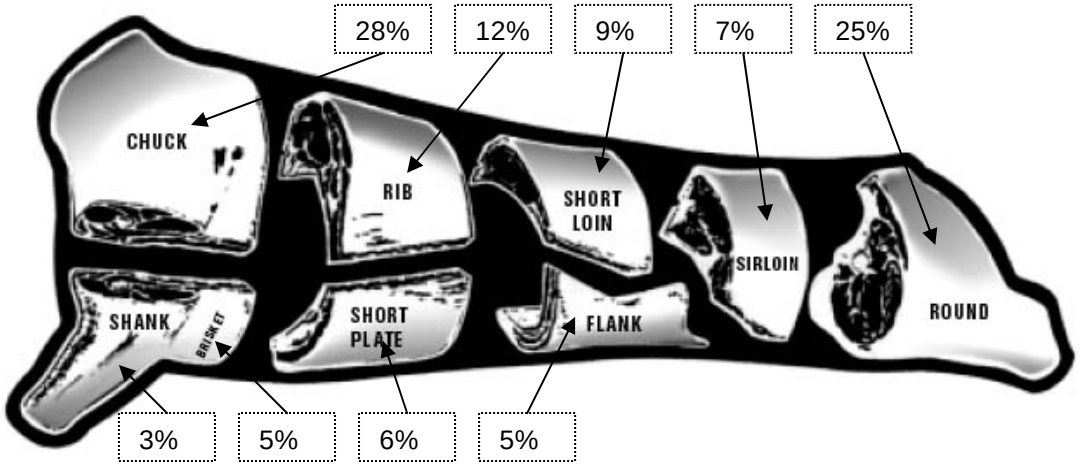
Finally MACDONALD (2003) concludes that **increases in concentration** are mainly caused by increases in plant size and combined with slow demand grows and less by mergers and multiplant operations not increasing enough to have important effects.

5.4 Final products

Before explaining the different products, a brief overview about the slaughter process in the packing plant should be given. The USDA Food Safety and Inspection Service (USDA FSIS 2005), structures a typical slaughter process as follows.

The process starts in the animal holding section. After the animal is stunned and slaughtered, the hide is removed and the animal eviscerated. For better handling the carcass is split down the backbone into two bilateral halves. Then it is washed and trimmed. To improve meat quality, carcasses are chilled for one day (FIELD and TAYLOR 2003). While in the 1970s carcasses were usually shipped to processors, wholesalers and retailers for processing into retail cuts, today the packing plants tend to sell further processed beef themselves (MACDONALD 2003). Further processing includes the reduction of the carcass into quarters, primal and subprimal cuts. Quartering is simply done by dividing each carcass half into forequarter and hindquarter by cutting along the natural curvature between the 12th and 13th ribs. The further cutting into primal cuts is illustrated by Figure 5.7.

Fig. 5.7: Primal cuts and their percentage share (own illustration based on KBC (2006) and CANFAX (2006)).



Boxed Beef

Boxed beef is the method that most meat-packers use to transport large beef cuts to butchers and grocery stores. The primal cuts (Figure 5.7) are further trimmed into subprimal cuts. Therefore they are moved onto fabrication lines to be cut up, than vacuum wrapped and put into boxes. Finally they are shipped as boxed beef to wholesalers and retailers and further processed to beef cuts which consumers purchase (MACDONALD 2003).

FIELD and TAYLOR (2003) list the following advantages of processing beef into subprimal cuts at packing plants and shipping them in boxes:

- Wages tend to be less at packing plants than at retail stores.
- Faster and more efficient cutting because of specialized meat cutters and moving assembly lines.
- Larger volume of retail product can be handled in less space.
- More efficient use of by-products like bones and fat.
- The transport costs are reduced.
- Boxes are easy to handle.

According to MACDONALD (2003), boxed beef production rose from nine percent in 1972 to over 50 percent in 1992. Furthermore FIELD and TAYLOR (2003) state that over 80 percent of the beef slaughtered has been boxed in recent years.

Case-ready products

ANDERSON et al. (2006) define case-ready products as value added fresh meat products that the supermarket purchases in precut packages. Beside fresh meat, FIELD and TAYLOR (2003) additionally mention precooked beef in case-ready merchandize concepts. Case-ready products are often hermetically sealed, and offer trimmed, individually wrapped consistent portions (ANDERSON et al. 2006). According to FIELD and TAYLOR (2003), this concept is a significant development driven by the following advantages:

- Improved control over food safety
- Reduced labour costs
- Improved consistency and yield
- Enhanced inventory control
- Direct delivery of products oriented to consumer preferences

While there is a stronger emphasis on poultry, only 8 percent of grocery outlets in the U.S. offer case-ready ground beef and less than one percent offer case-ready whole muscle cuts. Mainly larger chains, operating on regional and national level, appear to introduce case-ready programs into their stores. Smaller independent outlets tend to have insufficient sales volume NN (2002).

In addition to the carcasses, primal and subprimal cuts and case-ready products, packing plants also produce a variety of by-products. Based on numbers published

by the Oklahoma State University a market steer yields approximately 45 percent of retail beef of its liveweight (OSU 2006a). Nearly all of the remaining weight (65 percent) is recovered as by-products which can be categorized as inedible (hides, fats, bones, horns, hooves) and edible by-products (variety meats, fats, gelatines, intestines).

5.5 Profitability

Availability of financial data about the beef packing industry is restricted. Therefore this chapter focuses on price spreads and financial data reported by USDA GIPSA (2005).

Price spreads

"A price spread is the difference between the cost of an item at one stage of the marketing channel and a different stage" (HAHN 2004 p. 2). Stages of the marketing chain where prices are collected by the USDA ERS are the farm, the packing plant (wholesale), and the grocery store (retail) level.

For this purpose the USDA ERS farm-to-wholesale price spread is used. According to MACDONALD (2003) the farm-to-wholesale price spread is calculated by subtracting reported prices for choice-yield-grade three cattle from a weighted average of wholesale prices for choice beef products. It should be considered that the by-product value is netted out of the price-spread and the weights in each wholesale price are based on a constant mix of products (MACDONALD 2003).

Moreover the price spread is calculated on a per-kg-of-retail product basis. According to USDA ERS (2006c), the assumption is made that it takes 2.40 kg of the standard steer to produce one kg of retail beef USDA ERS (2006c).

In terms of price spread interpretation, HAHN (2004) states on the one hand that price spreads do not equal gross margins and farm-to-wholesale price spreads are unlikely to match average packer margins on livestock exactly. On the other hand he mentions that price spreads and packer gross margins are likely to be highly correlated. Mathews et al. (1999) further clarifies that price spread data include changes in cost efficiency for slaughtering and processing of Choice beef, but it does not provide any direct indication of whether observed price changes are cost-justified, neither measure costs or profits for any one type of firm or industry group. According to MACDONALD (2003) the farm-to-wholesale price spread can be

considered as an estimation of the difference between the farm prices that packers pay for livestock and the wholesale prices that they receive for meats. Consequently price spreads might not exactly reflect the gross margin of a packer, but they can be seen as an approach and therefore are used in Figure 5.8.

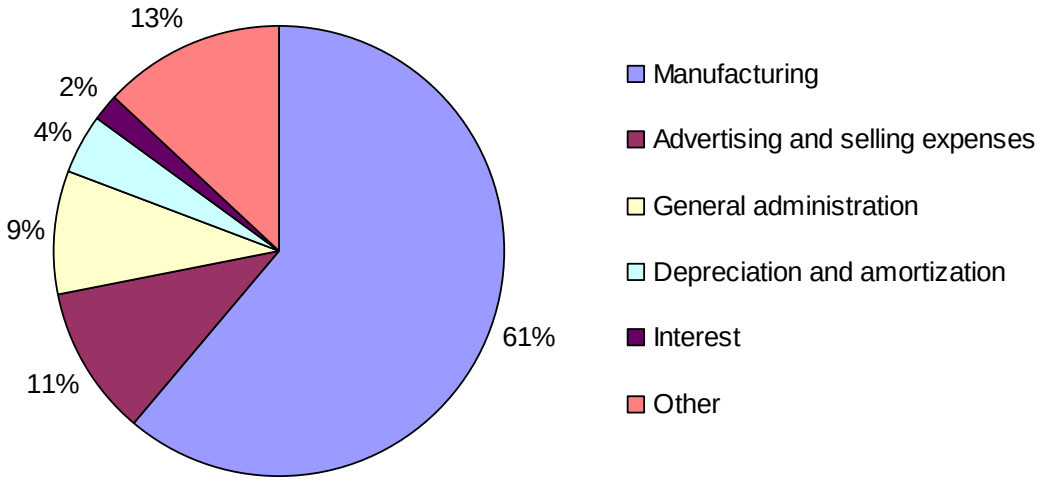
Fig. 5.8: Farm-to-wholesale price spread deflated by the CPI (own illustration based on USDA ERS (2006b) and HAHN (2004)).

Figure 5.8 shows the development of the deflated farm-to-wholesale price spread over time. The decrease from 1980 to 1990 reflects the reduction in production-worker-wages and the productivity gains arising from the realization scale economies already investigated in Chapter 5.3 (MACDONALD 2003). Also HAHN (2004) explains the declining deflated farm-to-wholesale price spread by increased efficiency in meat packing. After fluctuation of the price spreads in the 1990s, an increase occurred in the years from 1998 until today. MACDONALD (2003) mentions higher expenditures caused by intensified food safety concerns, moderately increasing production wages and no further possibility to realize scale economies like they existed in the 1980s.

In addition to the price spread which might partly reflect the gross margin of the beef packing industry, the data provided by USDA GIPSA (2006b) reflects the cost structure of packing firms. These data refer to all livestock packing firms, but they might include information on operations other than meat packing and therefore should be interpreted carefully. Relating to the top 40 packers, about 63 percent of the net sales are livestock purchase costs and about 13 percent further costs of sales. According to MACDONALD (2003), animal purchase expenses account for nearly 85 to 90 percent of total costs at large packing plants and might be caused

by scale economies. The operating costs comprise about 22 percent and are shown in Figure 5.9.

Fig. 5.9: Operating cost structure of top 40 livestock firms (own illustration based on USDA GIPSA (2006b)).



As can be seen, manufacturing cost share about two thirds of total operating costs followed by other costs and advertising and selling expenses. After reduction of all costs, USDA GIPSA (2006b) displays an operating income of 1.66 percent of the net sales. The historical development of the operating income shows a fluctuation between 1.21 percent and 3.69 percent from 1992 to 2004 and consequently remained positive over the whole period (USDA GIPSA 2006b).

5.6 Conclusions

About 32.5 million head of cattle were slaughtered in 2005 in about 1,250 slaughter facilities. While the slaughter plants are prevailingly located in the northern urban area, the majority of the animals are slaughtered in the main feeding area. The slaughter industry faced a strong shift in the 1980s. Plant sizes and firm sizes increased. This resulted in higher productivity and lower costs but does not tend to result in practised market power. Main cost components are animal purchase costs and manufacturing costs including labour. Larger plants are mainly located close to feeding operations in order to reduce transport costs. Furthermore the slaughter industry tends to sell value added products like boxed beef or case ready products instead of whole carcasses.

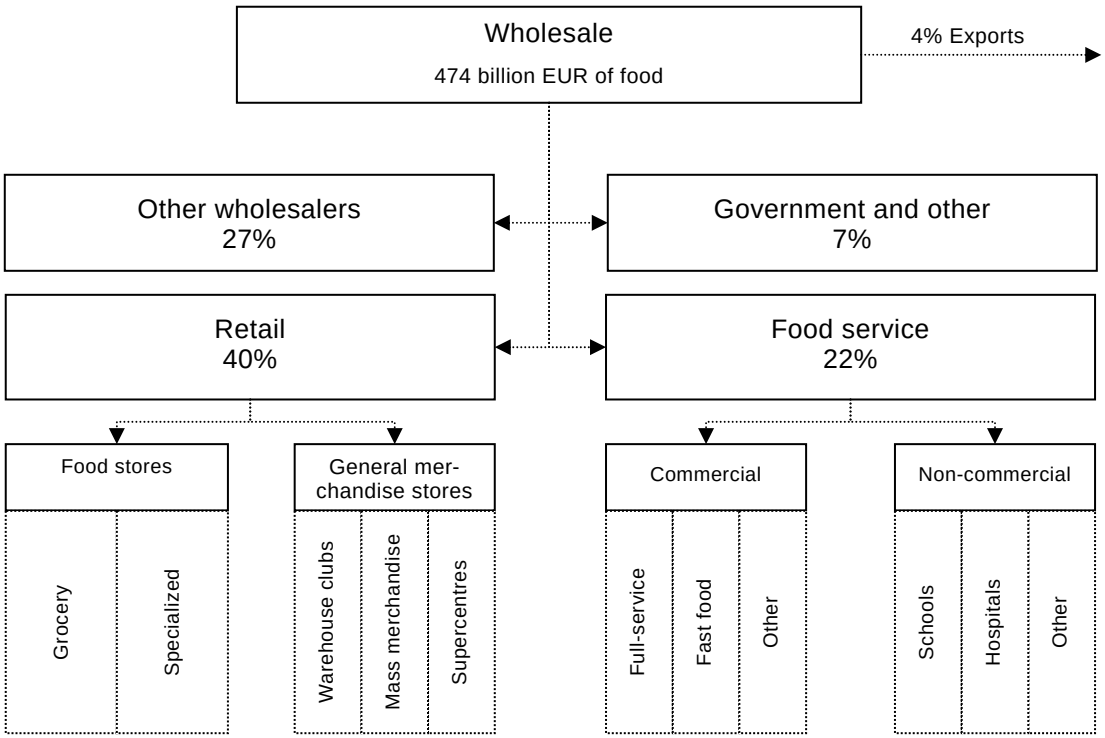
6 Domestic distribution and consumption

In this chapter, an overview of the wholesale, retail, and food service sector in the U.S. is given. The importance of these market channels for food in general and their structure is investigated. Finally key figures about the consumption of beef are shown.

6.1 Overview about wholesale, retail, and foodservice

After cattle are processed in packing plants, the wholesalers, retailers, and foodservice operations connect the packing industry with the final consumer. In this section a general overview about the structure and market shares is given. Thereby it has to be considered that sale values and market shares are based on food in general because specific data for beef were not accessible. Figure 6.1 shows the main structure of this part of the supply chain and is further explained below.

Fig. 6.1: Structure of the wholesale and retail segment for food in general (own illustration).



Wholesale

Wholesale is the part of the food system in which goods are assembled, stored, and transported to retailers, food service organisations, other wholesalers, export, and other types of businesses (HARRIS et al. 2002). According to FIELD and TAYLOR (2003), the wholesale segment can be further divided into purveyors and distributors.

Purveyors buy beef, perform some fabrication, and finally sell them. They are specialized meat processors who provide highly palatable products to food service operators, retail stores, and other customers. They handle about five percent of the total beef and are becoming less important as a separate beef industry segment, because packers are increasing their processing of beef instead of selling whole carcasses.

The **distributors** buy and sell beef without cutting or changing the product. After clarifying the difference between purveyors and distributors, and due to the small and still decreasing market share of purveyors, in the following both are addressed as one group (FIELD and TAYLOR 2003).

In addition, wholesalers can be classified as general line, speciality, or miscellaneous. While general line wholesalers handle a broad line of products and specialized wholesalers focus on single items as frozen foods, dairy products, fish, meat, or fruits e.g., the miscellaneous wholesalers tend to distribute dry groceries such as canned foods, coffee, soft-drinks, or bread (USDA ERS 2005). The speciality grocery wholesalers comprise the highest share with about 43 percent of total wholesale sales (USDA ERS 2005). Finally the wholesalers sold products of about 474 billion EUR of food to the following industry segments:

- Retailers (40 percent),
- Food service operations (22 percent),
- Other wholesalers (27 percent),
- Exports (4 percent),
- Government (2 percent)
- Other (5 percent) (USDA ERS 2005)

Grocery Retail

Total food sales by the retail segment accounted for approximately 405 billion EUR in 2003, which represents about 53 percent of total food sales. The retail segment consist of different types of food retail outlets which buy products from wholesalers, or directly from meat packers, and sells them to the final consumer. HARRIS et al. (2002) structures them into foodstores and general merchandize stores.

Food stores are defined as “a retail outlet having at least 50 percent of sales in food products intended for off-premise preparation and consumption” (HARRIS et al. 2002). Food stores represented about 78 percent of total food product sales in 2000, down from 87 percent in 1990 (USDA ERS 2005).

Foodstores include grocery stores and specialized stores. Grocery stores are supermarkets, superettes, convenience stores, and together account for about 95 percent of total food store sales. Specialised food stores sell primarily single food categories, for example meat, seafood, or dairy products, and represent the remaining 5 percent of total foodstore sales.

General merchandize stores are retail outlets including mass-merchandise stores, warehouse club stores and supercentres (HARRIS et al. 2002). According to USDA ERS (2005) these stores represent about 22 percent of the total food product sales in 2000, up from about 13 percent in 1990 (USDA ERS 2005). Mass merchandiser, supercentres and warehouse club stores are fast growing segments. Their share in total food sales increased from 1.5 percent in 1990 to 8.5 percent in 2000. Wal-Mart is at the forefront of this growth and operates 888 supercentres compared to the second largest K-mart with 104 supercentres (HARRIS et al. 2002).

Retail firm structure

After describing the different types of existing food retail outlets, the firm structure is further researched. Table 6.1 shows the sale values and percentage share of the top four grocery retailers irrespective of their organisation in 2000 and 1997.

Tab. 6.1: Sales of top four U.S. grocery retailers in 2000 and 1997 (own illustration based on HARRIS et al. (2002)).

	Sales[1] 2000 ***billion EUR***	**Percent** ***of total***	**Sales[1] 1997** ***billion EUR***	**Percent** ***of total***
The Kroger Company / Fred Meyer	39.4	10.2	27.3	7.8
Albertson's, Inc. / American Stores, Inc.[2]	25.3	6.5	11.8	3.4
Safeway Stores, Inc.[3]	22.9	5.9	15.4	4.4
Wal-Mart Supercenters[4]	18.4	4.8	9.3	2.6
Top 4	**106**	**27.4**	**63.8**	**18.2**
Total	387.3	100.0	350.1	100.0

[1] Sales exclude nongrocery store sales in the U.S., and all foreign sales.
[2] Excludes sales of drugstores.
[3] Includes sales of Randall's Supermarkets, acquired September 1999.
[4] Sales of food and nonfood grocery items only.

The share of the top four grocery retailers rose by about 9 percent points and consequently doubled. All of the top four retailers became larger, primarily by merging, except Wal-Mart, which grew internally by expanding the number of supercentres outlets since their introduction in 1988 (HARRIS et al. 2002).

Food service

The food service operations receive 358 billion EUR, about 47 percent of total US food spending in 2003. This segment contains the commercial and the non-commercial food service establishments.

- Non-commercial operations – with a share of about 14 percent of food service sales – prepare and serve meals as an adjunct or supportive service in institutional and educational settings (USDA ERS 2005).

- Commercial operations share 86 percent and prepare and serve food to the general public for profit. Full-service and fast food restaurants are the prevailing systems. While full-service establishments have waitstaff and other amenities, fast food restaurants do not (USDA ERS 2005).

Consequently, commercial food service companies represent the main part of the food service industry and therefore are further investigated at this point. To illustrate the firm concentration, Table 6.2 presents the top four restaurant companies in the United States. The top four restaurant companies sell about 50 percent of the total commercial sales and keep about 44 percent of all restaurants.

Tab. 6.2: Top four U.S. restaurant companies and chains by sales and number of units (own illustration based on HARRIS et al. (2002)).

	Sales 2000 *billion EUR*	Percent *of total*	U.S. units *Number*	Percent *of total*
McDonald's Corporation	**16.42**	**20.81**	**13,771**	**12.77**
McDonald's	*15.74*	*19.96*	*12,804*	*11.87*
Other	*0.68*	*0.86*	*967*	*0.90*
Tricon Global Restaurants, Inc.	**11.67**	**14.79**	**20,037**	**18.58**
Taco Bell	*4.10*	*5.20*	*6,749*	*6.26*
Pizza Hut	*4.02*	*5.10*	*7,927*	*7.35*
KFC	*3.55*	*4.49*	*5,364*	*4.97*
Diageo PLC (Burger King)	**6.93**	**8.78**	**8,558**	**7.94**
Burger King	*6.87*	*8.71*	*8,326*	*7.72*
Haagen-Dazs	*0.06*	*0.07*	*230*	*0.21*
Wendy's International, Inc.	**4.69**	**5.94**	**5,215**	**4.84**
Tim Hortons	*0.06*	*0.08*	*120*	*0.11*
Wendy's Old Fashioned Hamburgers	*4.63*	*5.86*	*5,095*	*4.72*
Top 4	**39.70**	**50.32**	**47,581**	**44.12**
Total	78.90	100.00	107,834	100.00

Based on Technomic, Inc.

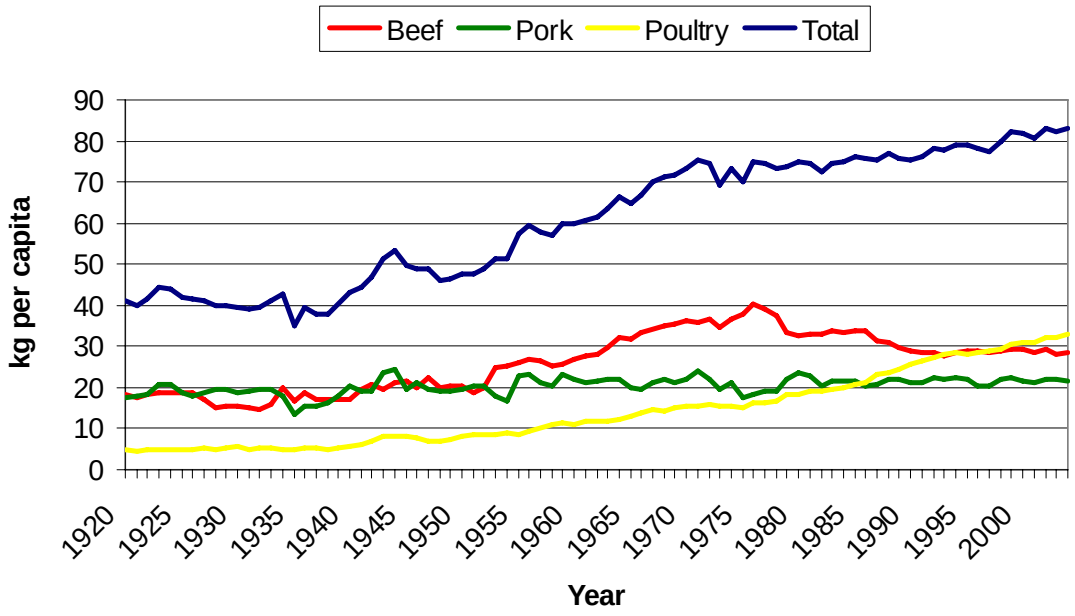
6.2 Consumption of beef

Consumption can be seen as the quantity demanded and is calculated by adding imports to production and subtracting exports (PURCELL and LUSK 2003). It has to be taken in consideration that stocks are not included in this estimation. Nonetheless, the numbers are nearly representative in a long-term perspective. In average of the years 2003 to 2005, about 8 million tones of boneless beef were consumed. But before looking at beef consumption in further detail, a comparison of beef with other meat types is done.

Meat consumption in general

Figure 6.2 shows that the total consumption of red meat increases over the whole period from 1920 to 2004. The choice of consumers between the three red meats beef, pork, and poultry is affected by the price, the broader range of food available, the level of convenience, and concerns about calories, fat, and cholesterol (DAVIS and LIN 2005).

Fig. 6.2: Per capita consumption of boneless meat (own illustration based on USDA ERS (2006d)).

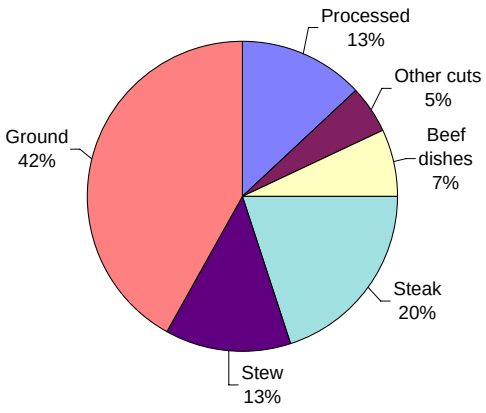


The per capita **pork** consumption remains constant with around 20 kg per capita and year. **Poultry** values increase constantly and reach about 33 kg per capita in 2004. FIELD and TAYLOR (2003) argue that a greater focus on value-added products, the consumer perceptions about healthfulness, and a competitive price are the main reasons for the increase in poultry consumption. The per capita **beef** consumption peaks in 1976, decreases until 1990, and stagnates until 2004 on a level of approximately 28 kg per capita. The decreased beef consumption took place primarily at the expense of beef cuts instead of ground beef (FIELD and TAYLOR 2003).

Beef consumption in detail

Further details about beef consumption were investigated by a DAVIS and LIN (2005). Main aspects are summarized. The total meat consumption consists of processed and fresh beef products. Fresh beef products are purchased from wholesale by food services or from grocery directly by consumers and cooked just before eating. Processed beef products are transformed and, for example, cured,

Fig. 6.3: Share of beef consumption by cuts (DAVIS and LIN 2005).



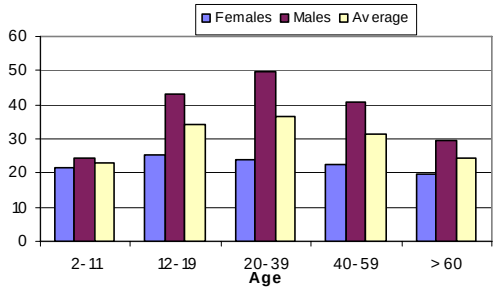
smoked, or seasoned prior to cooking before retail sale. Figure 6.3 shows the distribution. According to DAVIS and LIN (2005) about 87 percent was consumed fresh and 13 percent was processed in 1998. Finally the average beef consumption from 2002 to 2004 was 28.6 kg per capita.

In addition, beef consumption can be categorized as “at home” or “away-from-home”. According to DAVIS and LIN (2005) about 65 percent of the beef is consumed at home which equals beef purchased at retail stores. Beef consumed away from home can be categorized as beef sold by food services and consequently accounts for 35 percent of total beef consumption. The main part (82 percent) of the beef consumed away from home is sold by restaurants, which accounts for 29 percent of total beef consumption. The prevailing beef cut consumed away-from-home, and especially in restaurants, is ground beef with about 62 percent of beef consumed in restaurants. In comparison to Germany, 47 percent of the beef consumed is processed (sausages, convenience foods, etc.), while 53 percent is not. Furthermore 35 percent of the non-processed beef is consumed at home and up to 65 percent away-from-home (MICHELS 2006).

DAVIS and LIN (2005) investigated the relationship between income and beef consumption. Surprisingly, low-income consumers ate more beef than did middle- and high-income consumers, even though retail beef is more expensive than pork or turkey as shown by FIELD and TAYLOR (2003). In accordance to the different beef cuts shown in Figure 6.3, high-income households eat higher amounts of steaks, while middle-income households eat more stew beef, and low-income consumers eat most ground and processed beef (DAVIS and LIN 2005). Low-income consumers eat about 70 percent of their beef at home, more than did middle-income households (67 percent) and upper-income households (60 percent) (DAVIS and LIN 2005).

Figure 6.4 shows that the beef consumption varies greatly by gender and age. Males consume about 1.8 times (about 39 kg) as much beef as females (about 22 kg). The amount of beef consumed per capita by men increases from youth to the age of 20 to 39 years and declines afterwards. On the other hand, this pattern is not noticeable for

Fig. 6.4: Beef consumption by age and gender in kg per capita (own illustration based on DAVIS and LIN (2005)).



female beef consumption, which tends to stay on the same level. In consequence the total consumption follows the male pattern and therefore decreases with age which might result in a lower per capita beef consumption over the next two decades because the population is aging (DAVIS and LIN 2005).

6.3 Conclusions

The wholesale, retail and food service industries connect the packing industry with the final consumer. Wholesalers operate as purveyors (further processing occurs) or distributors. Because slaughter plants increase their processing of beef, purveyors become less important. In 2002 the wholesalers sold products for about 474 billion EUR to retailers (40 percent), food service operations (22 percent), other wholesalers (27 percent), government (2 percent), and other establishments (5 percent), and exported about 4 percent.

The grocery retail segment consists of food stores and general merchandiser stores. While the food stores still sell the most food products, general merchandisers are growing rapidly, forced by supercentre stores such as Wal-Mart. The top four U.S. grocery retailers sell about 30 percent, increased by nearly 10 percent from 1990.

Food service includes commercial and non-commercial operations. Commercial operations dominate the food service market and have a share of 89 percent. The four leading firms represent about 50 percent of the total sales and 44 percent of the restaurant numbers.

Beef is the second most important type of red meat consumed in the U.S., with about 28 kg (35 percent) per capita and year. The prevailing type of beef is ground beef, representing about 42 percent, followed by steaks (20 percent). While 65 percent is consumed at home (sold by the retail segment), 35 percent is consumed away from home prepared by the food service segment. In terms of income, low-income consumers eat more beef than do high income consumers. Finally it has been investigated that males consume 1.8 times as much beef as females.

7 International trade of beef

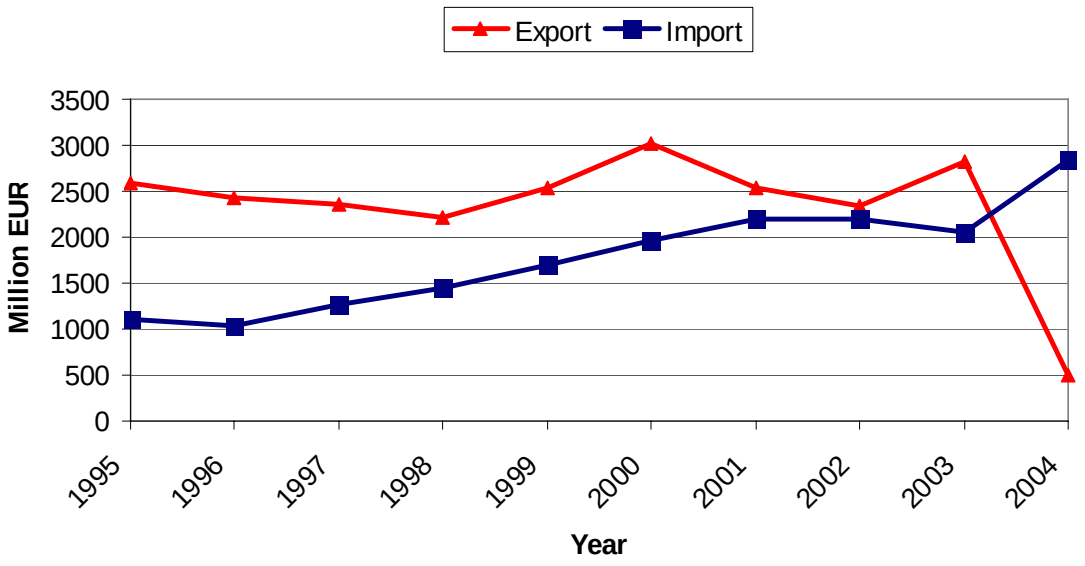
7.1 Introduction

According to data of the United Nations Commodity Trade Statistics Database (UNCOMTRADE), around 8.7 billion EUR or 3.9 million tons of beef were exported world-wide in average of the years 2001 to 2003, whereby intra EU-trade is excluded in these numbers.

The U.S. exported a **value** of about 2.6 billion EUR of beef in average of the years 2001 to 2003, which represents about 30 percent of the world beef exports. The imports of about 2.1 billion EUR equal 24 percent of the world beef imports. Consequently the U.S. is an important trading partner on the world beef market. Furthermore, the U.S. exported about 500 million EUR of beef more than they imported and can therefore be termed a net-beef exporter in terms of traded value. In terms of **quantity**, the U.S. exported about 1.1 million tons of beef in average of the years 2001 to 2003. The imports of approximately 990 thousand tons are lower, whereby the U.S. also has been a net beef exporter in quantity based on data provided by UNCOMTRADE (2005).

This picture changed completely due to the first BSE case discovered in the State of Washington in December 2003. Figure 7.1 illustrates the development of beef exports and imports in million EUR since 1995.

Fig. 7.1: International beef trade of the U.S. in EUR (own illustration, based on UNCOMTRADE (2006)).



It shows the downturn in export values and increasing import values in 2004. The quantity of beef exports, not illustrated in the graph, also decreased in 2004 and reached a low of 246 thousand tons, while imports increased to 1.1 million tons. Consequently the U.S. beef imported more value and quantity of beef than it exported and can be termed a net-importer of beef.

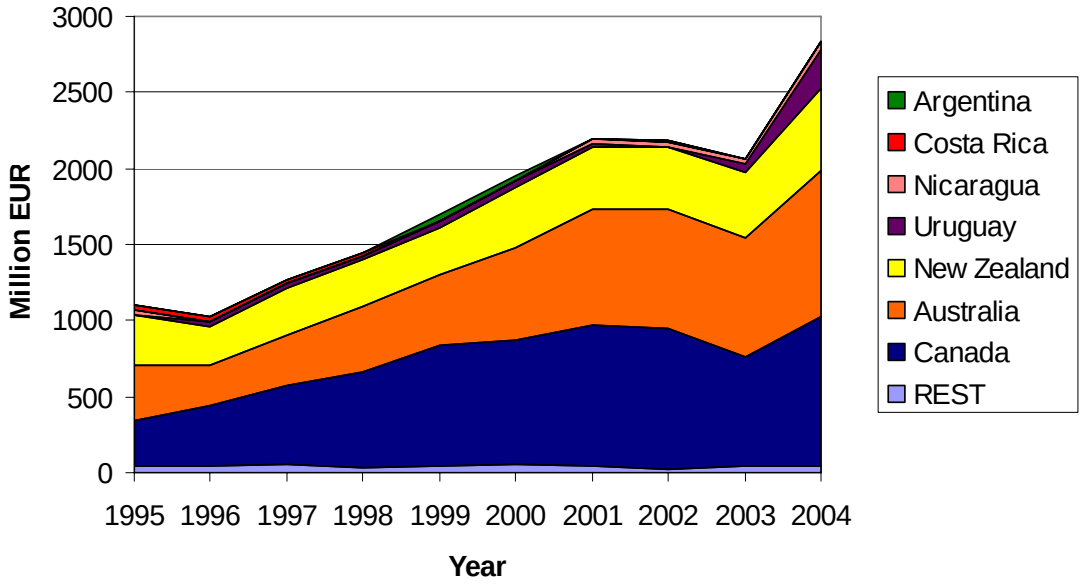
The following chapters furthermore describe important trade partners of the United States, the main types of product traded, detailed information of the impact of BSE and other information affecting the world-trade of beef.

7.2 Beef imports

The beef import from different countries is further investigated. Figure 7.2 shows the composition of the top five importing countries from 1995 until 2004.

The main importers of **value** are Canada with 855 million EUR, Australia with 776 million EUR, and New Zealand with EUR 419 million. They together share about 96 percent of the total beef-value imports in average of the years 2001 to 2003. Even though all three countries further increased the imports, their share decreased to about 88 percent while Uruguay increased to about 9 percent.

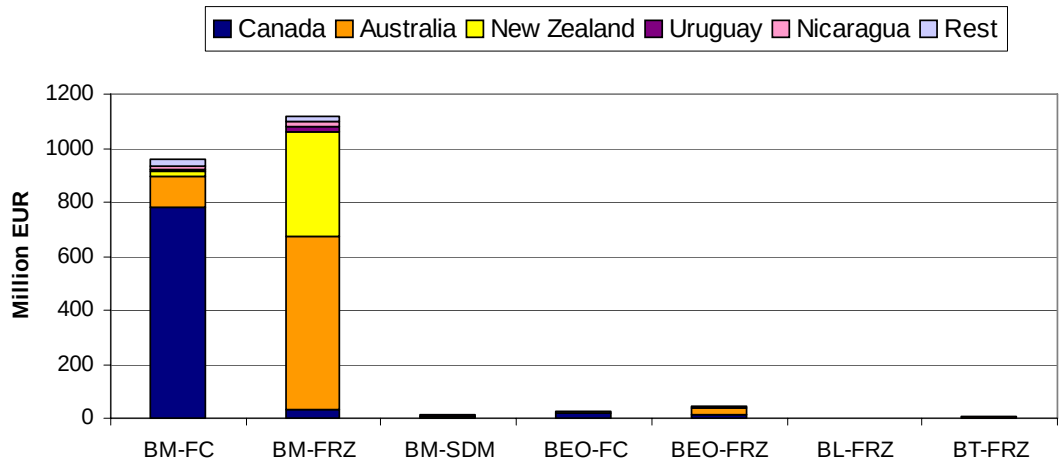
Fig. 7.2: Beef imports by country of origin (based on UNCOMTRADE (2006) and DEBLITZ (2006)).



The **quantity** imported on average of the years 2001 to 2003 tends to be similarly distributed. On average of the years 2001 to 2003, Australia imported 390 thousand tons (39 percent), followed by Canada with 347 thousand tons (35 percent) and New Zealand 209 thousand tons (21 percent). In 2004, the discovery of BSE tended to increase the beef imports, further investigated in Chapter 7.4.

According to VANDERVEER (2005), most beef imported by the U.S. is grass-fed beef, destined for processing, primarily as ground beef. Further data provided by UNCOMTRADE (2006) allows a more detailed estimation. In terms of import composition, the U.S. imports frozen and fresh meat, as well as edible offal. In average of the years 2001 to 2003, meat comprised about 97 percent of the imported value, while edible offal comprised about 3 percent. Furthermore it can be said that about 46 percent was imported fresh or chilled and 54 percent as frozen beef (UNCOMTRADE 2006). Figure 7.3 shows that in terms of value, 82 percent of **bovine meat fresh or chilled** was imported from Canada (783 million EUR / 308 thousand tons). Fresh beef imports from Australia reached only 12 percent (111 thousand EUR / 26 million tons). Imports of **frozen bovine meat** came to 58 percent from Australia (643 thousand EUR / 354 thousand tons) and to 35 percent from New Zealand (389 thousand EUR / 201 thousand tons).

Fig. 7.3: Bovine meat and edible offal imports by country of origin, avg. 2001 to 2003 (own illustration based on UNCOMTRADE (2006)).



BM-FC = Meat of bovine animals, fresh or chilled
BM-FRZ = Meat of bovine animals, frozen
BM-SDM = Bovine meat salted, dried or smoked
BEO-FC = Bovine edible offal, fresh or chilled
BEO-FRZ = Bovine edible offal, frozen except livers and tongues
BL-FRZ = Bovine livers, frozen
BT-FRZ = Bovine tongues, frozen

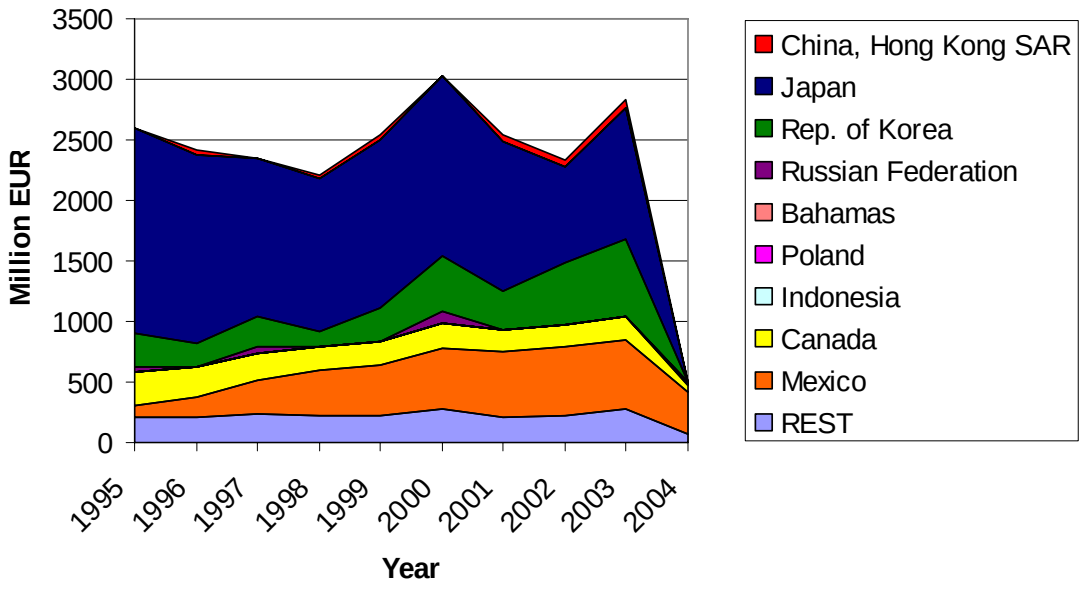
7.3 Beef exports

The export **values** of beef were about 2.6 million EUR on average of the years 2001 to 2003. Figure 7.4 shows the composition of the top five countries of destination for the period 1995 to 2004 (UNCOMTRADE 2006). The top destination country in this time period was Japan, which bought about 1,037 million EUR of beef, or 40 percent of total export value. Further important importers of U.S. beef were Mexico with about 559 million EUR (22 percent) and the Republic of Korea with approximately 486 million EUR (19 percent). The imports of Canada tended to remain stable on a level of around 190 million EUR (8 percent) until the end of 2003.

The **quantity** exported on average of the years 2001 to 2003 totalled 1.1 million tons. The most important destination country was also Japan with 376 thousand tons (33 percent). Further main export partners were Mexico (268 thousand tons or 24 percent) and the Republic of Korea importing 202 thousand tons (18 percent).

In 2004, the U.S. export market for beef changed dramatically, whereby all trading partners banned U.S. beef products, due to the discovery of BSE in December 2003 (Chapter 7.4).

Fig. 7.4: Beef exports by country of destination (based on UNCOMTRADE (2006) and DEBLITZ (2006)).

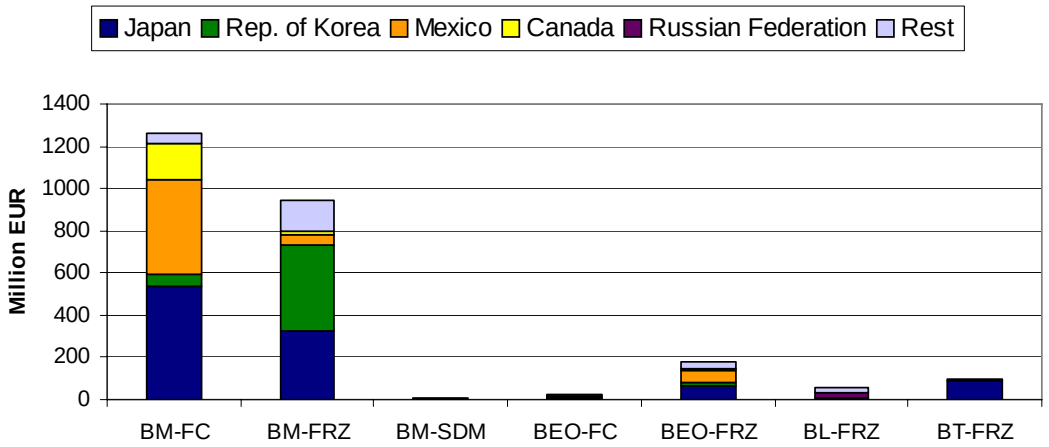


While imports are mainly grass-fed as mentioned above, most beef produced and exported by the U.S. is grain-finished (VANDERVEER 2005).

Figure 7.5 shows that the exported bovine meat (fresh or chilled, frozen, salted, dried and smoked) corresponds the most (86 percent) with the total export value of bovine products based on the years 2001 to 2003. Edible offal and other products only have a share of 14 percent. Furthermore, about 46 percent of the exported bovine product value is fresh or chilled, while the remaining 54 percent is exported frozen (UNCOMTRADE 2006).

Furthermore, main export markets for **bovine meat, fresh or chilled,** are Japan with 43 percent (539 million EUR / 147 thousand tons), Mexico with 35 percent (447 million EUR / 182 thousand tons), and Canada with 13 percent (167 million EUR / 59 thousand tons). The dominating export markets for **bovine meat frozen** are the Republic of Korea with 43 percent (403 million EUR / 164 thousand tons) and Japan with 35 percent (328 million EUR / 146 thousand tons). Export markets for **bovine edible offal** are mainly Japan (34 percent) and Mexico (30 percent). Almost all exported frozen bovine tongue is exported to Japan (91 percent).

Fig. 7.5: Bovine meat and edible offal exports by country of destination, avg. 2001 to 2003 (own illustration based on UNCOMTRADE (2006)).



BM-FC = Meat of bovine animals, fresh or chilled
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BEO-FC = Bovine edible offal, fresh or chilled
BEO-FRZ = Bovine edible offal, frozen except livers and tongues
BL-FRZ = Bovine livers, frozen
BT-FRZ = Bovine tongues, frozen

7.4 The impact of BSE on the U.S. beef trade

The discovery of the first BSE case in the U.S. in December 2003 influenced the imports as well as the exports of U.S. beef and live cattle. While impacts on live cattle are discussed in Chapter 4, the changes in beef trade are further investigated in the following paragraphs. The data used are based on the Foreign Agriculture Service of the USDA and therefore can differ slightly from those published by UNCOMTRADE (2006) used in the previous chapter.

Import

Imports of U.S. beef were already impacted by the discovery of BSE in Canada in March 2003. Canada imported about 4 percent of the U.S. beef production by beef and live cattle. Furthermore it was the only country which could deliver grain-fed high-quality beef demanded by the U.S. market. The U.S. banned beef imports from Canada until August 2003 and reopened it for beef of cattle less than 30 month of age. This reduction in beef and cattle imports, together with increased demand for U.S. beef on the world-market instead of Canadian beef, and a cyclically low cattle supply within the U.S. resulted in record high beef prices in October 2003 (MATHEWS et al. 2006; JONES 2006).

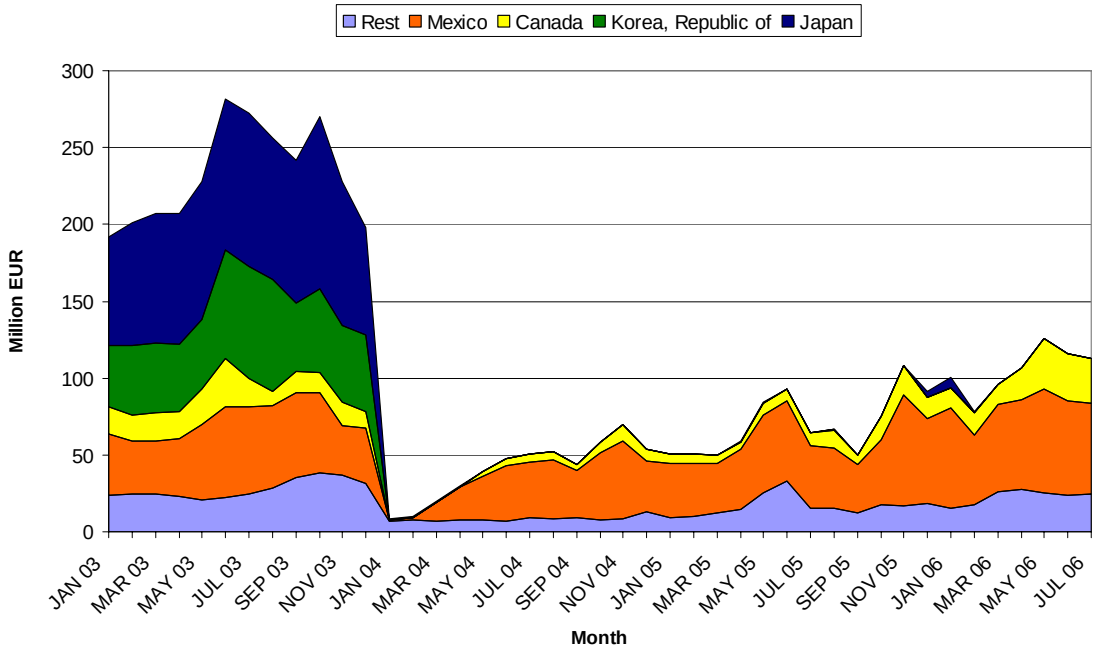
Even though almost all U.S. beef export markets banned U.S. beef in 2004 because of the first BSE case in December 2003, U.S. beef imports increased. Figure 7.2 in the previous chapter shows that, in 2004, all main importers of beef enhanced their import value. Especially Uruguay quintupled its beef imports, forced by exchange rate advantages, but coming from a low level. According to Jones (2006), the loss of cattle imports from Canada and cyclically low U.S. cow slaughter has kept processed beef imports at this high level. While imports increased and exports were mainly banned, the per capita beef disappearance remained at a stable level of 28.5 kg in 2004 in comparison to 28.07 kg in 2003 and 29.26 kg in 2002 based on data of USDA ERS (2006d). This stable consumption of beef tended to be related to the appearance of new nutrition trends like high protein diets, according to an interview of VANDEVEER and MATHEWS.

Export

Figure 7.4 shows that the U.S. beef exports were at a high level prior to BSE. While the import of beef increased in 2003 to an annual amount of 2.8 billion EUR, in 2004 the exports almost disappeared. The export in 2004 reached 483 million EUR, which is about one fifth of the value exported the previous year. Data of USDA FAS

(2006a) furthermore indicates that the U.S. could increase their exports in 2005 to 844 million EUR, but still at a low level compared to the year 2003.
Figure 7.6 provides a more detailed picture of this development, showing the development of the U.S. beef export to the main U.S. trading partners by month from January 2003 until July 2006.

Fig. 7.6: U.S. beef exports by month (own illustration, based on USDA FAS (2006a)).



After the **first mad cow** was confirmed in December 2003, almost all destination countries banned U.S. beef products. While these bans increased the domestic supply of beef in the U.S., the previously dominant U.S. beef importing countries (Japan and Republic of Korea) started to import their beef from Australia, New Zealand, and South America. Canada, Mexico, the Philippines, and Poland were the first countries that allowed U.S. beef – primarily boneless beef from cattle under 30 month of age – to enter again (MATHEWS et al. 2006). Figure 7.6 shows that Mexico became the main trading partner, followed by Canada.

In June 2004 the U.S. confirmed the **second case of BSE**. While JONES (2006) mentions that Taiwan closed its border, opened previously in early in 2005, Figure 7.6 does not indicate U.S. losses in beef value exported.

In November 2005, **Japan** reopened its markets to U.S. beef. Figure 4.6 shows the small increase of Japanese beef imports, which only occurred for a short period of

time. While the bovine meat shipped to Japan met the age requirements, a specific veal shipment did not meet the requirements for removal of bones and specific risk material. Consequently, the meat was not approved for export to Japan, and Japan banned any U.S. beef imports again in January 2006 (JONES 2006).

The **third case of BSE** in the U.S. was confirmed in Alabama in March 2006. The cow was born and raised in the U.S. and estimated to be 10 years old. The Republic of Korea raised concerns regarding the age of the animal. According to MATHEWS et al. (2006) all three BSE-confirmed cattle were born prior to the 1997 feed ban put in place to prevent the spread of BSE.

According to JONES (2006), on July 26, 2006 Japan agreed to reopen its market to U.S. beef after an investigation of the U.S. inspection program. Japan will accept shipments only of beef from a list of 34 approved packing plants and from cattle 20 months or younger (JONES 2006). The Secretary of Agriculture, Mike Johannes, stated on September 7, 2006 that “Korea […] announced that it would resume the importation of U.S. boneless beef from cattle less than 30 month of age” (USDA FAS 2006d).

7.5 Conclusions

Prior to BSE, the U.S. was an important beef importer and exporter, representing about 30 percent of the world beef exported value and 24 percent of the world beef imported value. Main export markets were Japan, the Republic of Korea, Mexico, and Canada, together with a share of about 89 percent (2.2 billion EUR) in terms of value and 82 percent (924 thousand tons) in terms of quantity on average of the years 2001 to 2003. The main importing countries are Australia, Canada, and New Zealand with about 95 percent in terms of value and quantity (2.1 billion EUR / 947 thousand tons). According to data of the United Nations Commodity Trade Statistics, the U.S. exported about 500 million EUR or 135 thousand tons more than it imported (avg. 2001 to 2003), and therefore was a net-exporter of beef until 2003.

In terms of beef products, Japan and Mexico are the main destination countries for fresh or chilled bovine meat. Main frozen bovine meat is exported to the Republic of Korea and to Japan. Imports of fresh or chilled meat are mainly from Canada, while imports of frozen bovine meat are from Australia and New Zealand.

The first BSE case confirmed in the U.S. had large impact on the U.S. international meat trade. It was followed by a second BSE case in June 2005 and the third case in March 2006. The U.S. meat exports almost disappeared in 2004. While the main exports markets like Japan and South Korea closed their border for several years, Canada and especially Mexico allowed U.S. beef imports and became the main destination countries in recent years (75 percent of total exports in 2005). Countries like Japan and South Korea started to primarily import beef from Australia, New Zealand and South America, excluding Brazil because of its Foot and Mouth Disease (FMD) problems. In contrast to the exports, the beef imports of the U.S. increased. This is related to the tight cattle supply caused by cattle cycle and banned cattle imports from Canada. Japan already agreed to reopen their border to specific beef, while negotiations with South Korea are underway.

8 Future perspectives

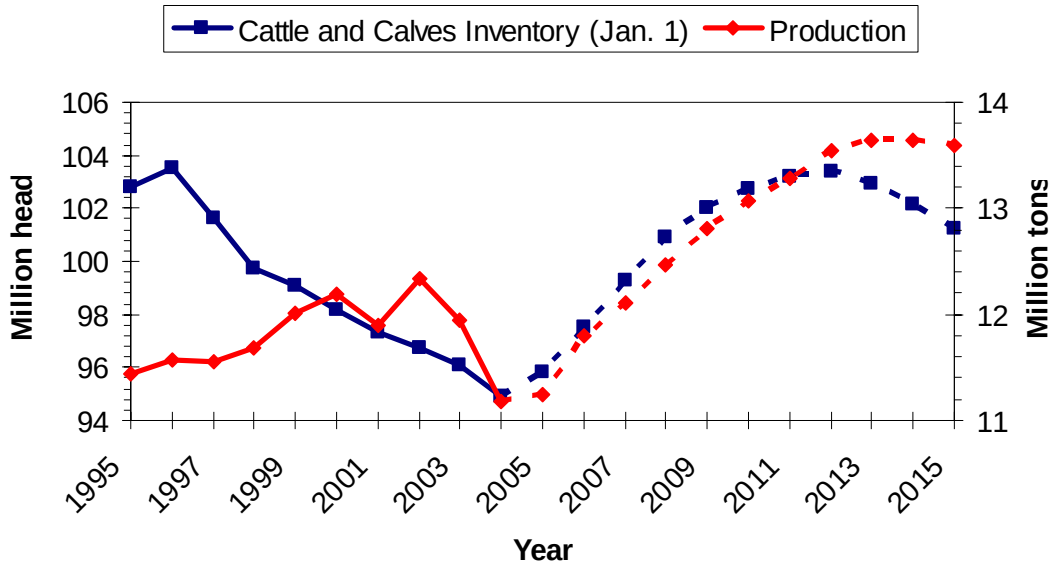
The future perspectives illustrated in this chapter are mainly based on projections done by the Food and Agriculture Policy Research Institute (FAPRI 2006). This baseline includes all shocks and resulting trade bans that occurred up to the end of January 2006 (FAPRI 2006).

Beef production

The **world beef production** is projected to grow 1.7 percent annually reaching 61.9 million tons in 2015 caused by demand recovery. Important growing countries are China (+2.8 million tons), the U.S. (+2.3 million tons), Brazil (+1.8 million tons). Countries significantly reducing their production are the European Union (-445 thousand tons) and Russia (-202 thousand tons) (FAPRI 2006).

Increase in **U.S. beef production** is caused by herd expansion related to the cattle cycle and the resumption of live cattle trade with Canada (FAPRI 2006). USDA FAS (2006c) further expects increased slaughter weights. Figure 8.1 shows the projections of the U.S. beef production and the development of the cattle inventory. The inventory growth is projected to continue until 2012, reaching an inventory of nearly 103.5 million head. The amount of beef produced increases to about 13.6 million tons accordingly.

Fig. 8.1: U.S. cattle and calf inventory and beef production by year (own illustration based on FAPRI (2006)).



Consumption

In the long term view, analysis about the **world beef consumption** done by FAPRI (2006) shows that the consumption increases slightly until 2015, reaching nearly 13 kg per capita. This increase in beef demand is caused by the following:

- The demand recovery from BSE
- Income and population –driven demand expansion in countries like Egypt, Indonesia, Mexico, the Philippines, and Russia
- Countries changing from net exporters to net importers (like the EU and China)

The **consumption of beef in the U.S.** also tends to increase slightly from 29.7 kg retail weight per capita to 30.9 kg per capita in 2012 followed by two years of decrease to 30.4 kg retail weight per capita in 2015 (FAPRI (2006).

While the amount of beef consumed is projected to be constant, the type of beef demanded in the U.S. might change. According to interview partners, the importance of branded beef, certified organic beef, and grass-fed beef programs tends to increase. These programs are summarized as NCBA (2006) as follows:

- Branded beef products are marketed by a company based on product specifications or production standards required for their brand. An example is Certified Angus beef - the most important in the United States.
- Certified organic beef must meet standards prescribed by the USDA. The feed has to be 100 percent organic and growth hormones and antibiotics are prohibited. Further the ruminants have to have access to pasture.
- Finally grass-finished beef comes from cattle that have grazed pastures their entire lives. Grass-finished beef is not necessarily raised organically.

The consumer might change his perception of quality. Currently, quality in the U.S. tends to be associated to grain-fed beef with high marbling. But quality might be increasingly understood as cattle raised in their natural environment, and therefore connected to grass-finished beef. Consequently, this development has to be further observed in future.

Beef trade

According to USDA FAS (2006c) the **world beef trade** in 2006 will be impacted by trade restrictions in an environment of tight supply. The trade is limited by the confinement of BSE in North America, FMD in Brazil, and the 6-month export ban of Argentina announced by its government. The forecasts expect a decrease of total trade of two percent in 2006 in comparison to the year 2005 in terms of volume. Even the increasing trade of the U.S. and New Zealand will not be able to offset the decreases by Brazil and Argentina (USDA FAS 2006c). In the long-term view, FAPRI (2006) projects that the beef trade recovers and grows by an average rate of three percent, ending at 8.6 million tons in 2015.

The **U.S. beef trade**, strongly affected by the discovery of BSE in 2003, faces multiple challenges in the future. In an interview, LAWRENCE stated that the prevailing challenge is to earn back the Asian beef markets. Japan agreed to reopen the border for boneless beef of cattle under 20 months of age from 30 specified processors on July 26, 2006. The Secretary of Agriculture, Mike Johanns, states that South Korea announced that it would resume the import of U.S. boneless beef from cattle less than 30 months of age, which is less restricted (USDA FAS 2006c).

Fig. 8.2: Beef imports and exports quantity, 2005 to 2015 projected (own illustration based on FAPRI (2006)).

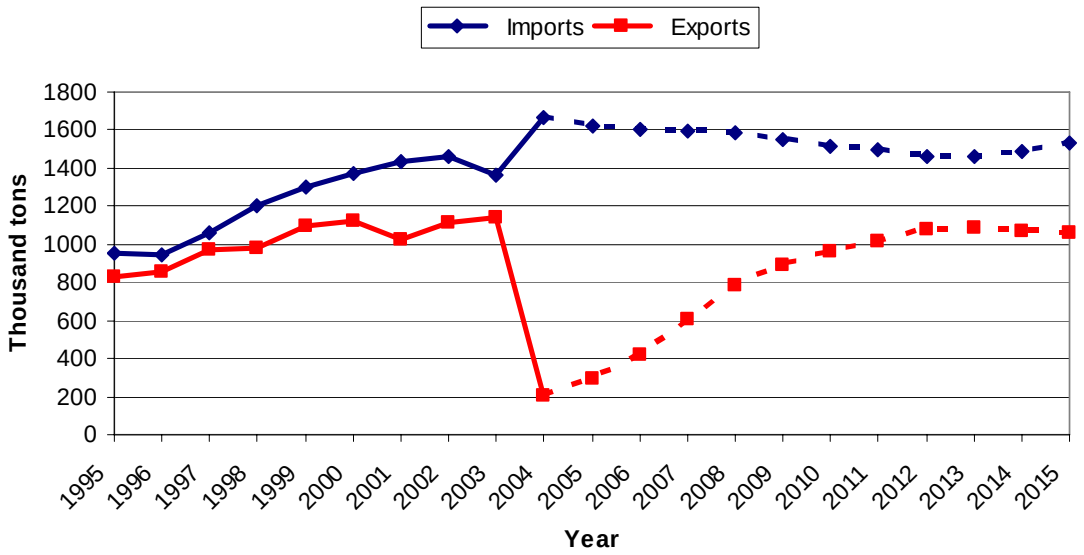


Figure 8.2 shows projections of the import and export quantity based on FAPRI (2006). As mentioned in the introduction of this chapter, these projections do not include the most recent trade agreements. However, the line-graph illustrates that the U.S. will increase their exports and reach pre-BSE volumes in 2012, while imports tend to slightly decrease.

Biofuel

The markets for Biofuel like ethanol and biodiesel in the U.S., Brazil, the EU and Asia are projected to increase, caused by policy developments and higher fossile energy prices. Especially ethanol trade is expected to double in the next decade to 4.5 billion litres while the ethanol price is expected to increase 1.8 percent and to reach about 0.40 EUR per litre in 2015 (FAPRI 2006).

With regard to the U.S., corn is the major resource of the ethanol industry, as well as an important feed stuff for the beef industry. On the one hand, corn prices are expected to increase caused by higher production of ethanol. On the other hand, by-products of the ethanol industry (“distillers grains”) can be used as feed in the beef industry. FAPRI (2006) estimated that the domestic feed use of corn co-products (replacing corn and soybean) now exceeds that of wheat, sorghum, barley, and oats combined.

Consequently the ethanol industry’s impact on the beef industry will increase, while both industries rely on one common resource: corn. Further research is required to determine positive or negative impacts of this coherence.

9 Discussion

This discussion focuses mainly on data and methods used and less on comparing results with other literature, which is prevailingly done in the previous chapters. The objective of this thesis was to constitute a survey of the U.S. beef supply chain. For this purpose, at first a rough overview was given (Chapter 2), followed by further investigations of each supply chain segment (Chapter 3 to 8). These results are based on an extended field trip including interviews, literature reviewed, and data analysed.

The U.S. **field trip** provided valuable information and a general idea of the beef supply chain. The access to different research facilities allowed an accumulation of relevant literature. Furthermore interviews with farmers, managers, lobbyists, and scientists provided access to expert knowledge and exclusive information. It has to be taken into consideration that the information collected and opinions from interviews are based on individuals and might not be representative for the entire United States. They were, however, valuable to identify coherences and to correctly interpret scientifically investigated results.

While **literature reviewed** was partially accessible online, important literature has been collected during the research journey. The literature includes general surveys as well as specific studies related to the beef supply chain. Because of the abundance of research done in the beef sector, literature information tended to be newsworthy and representative. The reliability of specific data used is subsequently discussed further.

Cattle **inventory** estimations are based on a three year average from 2004 to 2006. Even though this three-year average might not consider fluctuations of the cattle cycle, it presents the most current inventory of the discussed animal categories. Furthermore it is pointed out that data used to illustrate the **regional distribution** of beef-cows (Chapter 3.2.2) and cattle on feed (Chapter 3.4.3) only refer to the year 2002. To provide a more accurate picture, rather than a more recent picture of the regional distribution, 2002 data on county level were used instead of 2006 data on state level. Finally it has to be considered that the inventory and regional distribution of stocker-cattle is based on an own approximation because federal estimates do not exist.

In terms of **financial data**, the limitations of this study are obvious. Returns and costs on farm-level tend to focus only on short periods and represent just specific

regions and production systems instead the whole U.S. and entire sector. In addition variations among single farms have to be taken into account. To address these weaknesses, data referring to prevailing production regions and systems were chosen. Furthermore profitability data are based on more general estimations provided by CATTLE-FAX (2006). Despite these approaches, conclusions can only be carefully drawn.

The **international trade** of beef discussed in Chapter 7, is based on two data sources, USDA FAS and UNCOMTRADE. Data of UNCOMTRADE were used to provide an overview about traded value, quantity, and beef products in the last decade. The advantage of the UNCOMTRADE data is that

a) it covers the whole world and
b) it provides bilateral trade flow broken down by product categories.

Data referring to the years 2005 and 2006 were not available by UNCOMTRADE. Therefore the data base of the USDA FAS was used to illustrate the trade in recent years and month. Because the two data sets are not consistent, results should be considered with care.

Especially the approximations of revenues, costs, and profitability on farm-level of different production systems and different production regions indicate the need of further research. Notwithstanding its limitations discussed above, this study gives an general overview of the beef supply chain based on a literature review combined with recent data, and recent information provided by interview partners. The estimated results might not represent the entire supply chain in every detail, but can be considered as a useful approach to analyse the beef sector in the United States.

10 Summary

The U.S. is the largest producer of beef in the world. The production reaches about 12 million tons and the cattle inventory counts nearly 96 million head. Consequently, the U.S. produces about 20 percent of the world beef production with around 6 percent of the world cattle inventory. This large capacity and high productivity is based on a complex and interconnected beef supply chain. Production stages include the production on farm-level including cow-calf, stocker-cattle and beef-finishing operations, as well as slaughtering and processing, wholesaling, retailing, and food service establishments.

There are about 33 million **suckler cows** in the U.S., representing 34 percent of the total inventory. The average herd size is 42 head. About 30 percent of the suckler cows are kept by operations with less than 50 head. These operations represent about 80 percent of the total cow-calf farms. In accordance, about 20 percent of the cow-calf operations keep more than 50 head and represent 70 percent of the cow-calf inventory. Prevailing breeds are British breeds (e.g., Hereford and Angus) crossed with continental and tropical breeds depending on forage source and climate. The cows and calves are kept in grazing systems outdoors the entire year. Two third of the calves are born from February to April. They are weaned after 7 months and sold with around 230 kg in fall. In terms of profitability, revenues fluctuate in accordance to long-term and seasonal price patterns of sold steers, heifers, cull cows and bulls. Costs are related to grain and forage availability and prices, influenced by different climate conditions within the United States and over time. Even though the profitability varies by operation, region and over time, cow-calf operations tended to operate profitably in recent years.

The **stocker-cattle** segment connects the cow-calf segment with the beef-finishing. The main objective is to accumulate cattle into larger homogeneous groups, to offset seasonal large supply of calves and add value by applying further animal management and animal growth rather than fattening. Prevailing production systems used are winter grazing, summer grazing and dry lot backgrounding, whereby preconditioning is often involved. Important forage sources of the grazing systems are native grass pasture, winter wheat, and hay and crop residues, while drylot backgrounding relies on grain. In accordance to the availability of cheap forage, the stocker cattle inventory is predominantly located in the Northern and Southern Plains. Predominating costs are animal purchase costs (75 percent) and feed costs (13 percent), which compensate each other in accordance to the purchase weight.

While drylot backgrounding in the northern area tended to be unprofitable in the last decade, grazing systems tended to make profit in recent years.

Finally the **finishing segment** is the last stage on the farm-level. The 14 million head of cattle on feed represent about 15 percent of the total cattle inventory. A single feedlot in the U.S. keeps around 150 head on average. Approximately 98 percent of the finishing operations have a one time capacity of less than one thousand head and represent 20 percent of the cattle on feed inventory. The two percent larger feedlots with capacities of more than one thousand to over 50 thousand head keep the remaining 80 percent of the cattle on feed. Furthermore single feedlots can be owned by cattle feeding companies. The largest company operates 10 feedlots and has a one time capacity of around 800 thousand head of cattle at one time. The beef-finishing operations place their cattle in large-scale outdoor confinement feedlots and feed high-energy grain-based rations to produce high-quality beef. Environmental issues feedlots have to face are dust, odor, flies, and water quality, but also ammonia emission have become more important in recent years. The main cattle finished are located in the Southern Plains with a dry climate combined with grain supply which comes partly from irrigated crop-land. The profitability fluctuated strongly in the last decade, primarily affected by prices for feeder cattle, grain, and fed cattle. On an international level, the U.S. beef finishing operation tends to have lower costs than European countries, but higher costs than countries located in South America and Asia.

The **live cattle trade** between cow-calf, stocker-cattle, beef finishing and the packing segment occurs on the international and national level. International trading partners are Mexico and Canada, both normally exporting more cattle into the U.S. than they import. On the national level, cattle is mainly shipped from the whole U.S. to the main feeding area, the Northern and the Southern Plains, as it is cheaper to transport cattle to the feed than to transport feed to the cattle. While about 85 percent of the feeder cattle are sold via public markets (e.g., auction markets), 97 percent of the fed cattle are marketed via non-public markets (e.g., direct marketing, alternative marketing arrangements). Especially alternative marketing arrangements (e.g., forward contracts, marketing agreements, and ownership methods) together with pricing systems based on quality and yield grades became increasingly important in a vertically integrated industry increasing its efficiency.

The **slaughtering and processing** industry represents a fairly concentrated part of the supply chain, where the four largest beef packers slaughter about 25 million head annually, representing nearly 71 percent of the total cattle slaughter in 2004.

While the potential for exercising market power exists, packers do not appear to exercise market power. The final products sold by the slaughter plants are primal cuts (e.g., chuck, rib, sirloin), subprimal cuts (e.g., chuck tenders, trimmed strips, bottom round flat) and further processed products. In terms of packaging, the main beef is sold boxed, but also case-ready products become increasingly important and are sold directly or indirectly to the wholesale, retail, or food service establishments.

Of the about 81 kg of meat **consumed** per capita, beef represent around 36 percent with about 29 kg per capita. The beef consumption occurs to 65 percent at home, the remaining 35 percent are eaten “away from home”. In terms of beef type consumed, ground beef dominates with 42 percent of the total beef consumption, followed by steaks with 14 percent. Furthermore low-income consumers ate the most beef, prevailingly ground beef, at home. Consumption by age and gender shows a higher amount of beef consumed by males and by middle-aged consumers.

In terms of **international beef trade**, the U.S. ranked as the largest importer and exporter of beef in terms of volume until 2003. The discovery of BSE in North America, and especially the three BSE cases in the U.S. since December 2003, had a major impact on international trade. Even though the U.S. exports almost disappeared in 2004, a tight domestic cattle supply and constant domestic consumption of beef resulted in only moderate price fluctuations. To recover the lost markets, which include mainly Japan and South Korea, is one of the primary challenges in the near future.

Additional **future challenges** related to the U.S. beef supply chain are the further increase of world and U.S. beef consumption. Especially the future beef consumption in the U.S. might involve a shift of consumer’s perception on quality from grain-fed beef to beef from animals fattened on pasture. Finally the U.S. beef industry tends to be increasingly affected by the growing ethanol industry because both industries rely on one common resource: corn.

11 Abstract

The status, development and perspectives of the United States beef supply chain have been investigated within the scope of a diploma thesis in the year 2006 at the University of Applied Science Osnabrück – Department of Agricultural Sciences and Landscape Architecture. This examination was accompanied by the Federal Agricultural Research Centre in Braunschweig. In addition, a three month research journey was undertaken in the U.S., aimed at generating a maximum of knowledge, data, and information. Therefore researchers, lobbyists and farmers in Washington D.C., Iowa, Kansas, Oklahoma, Texas and Colorado were interviewed. The U.S. as the largest producer of beef in the world and an important trader on the world market, the latter strongly affected by BSE. Most cow-calf, stocker cattle, and beef finishing operations are small structured, whereby the main quantities are produced by large operations. The slaughter, processing, wholesale, retail, and food service segment tend to be concentrated and increasingly vertically integrated. The beef consumption is characterized by a high share of ground beef and stayed on high level irrespective of the discovery of BSE in the United States. Future challenges are related to international beef markets, consumers' perception of quality, and the long-term impact of the ethanol industry.

Im Rahmen einer Diplomarbeit an der Fachhochschule Osnabrück, Fakultät für Agrarwissenschaften und Landschaftsarchitektur, wurde im Jahr 2006 der Status, die Entwicklung und die Perspektiven der Wertschöpfungskette für Rindfleisch in den Vereinigten Staaten von Amerika (USA) erforscht. Diese Untersuchung erfolgte unter Begleitung der Bundesforschungsanstalt für Landwirtschaft (FAL) in Braunschweig. Ein dreimonatiger Forschungsaufenthalt in den USA ermöglichte eine maximale Verfügbarkeit von Fachwissen, Informationen und Daten. Zu deren Erhebung wurden Wissenschaftler, Lobbyisten und Landwirte interviewt. Die USA ist der weltweit größte Rindfleischproduzent und wichtiger Handelspartner auf dem Weltmarkt. Während der U.S. Export stark negativ durch BSE beeinflusst wurde, verblieb der inländische Konsum nahezu konstant. Der hohe Rindfleischkonsum beinhaltet hauptsächlich Hackfleisch. Der überwiegende Teil der Produktion wird von Großbetrieben gestellt, wobei die meisten Betriebe klein strukturiert sind. Der nachgelagerte Bereich ist durch hohe Konzentration und zunehmende vertikale Integration gekennzeichnet. Die Herausforderungen der Zukunft liegen im internationalen Rindfleischmarkt, Konsumentenverständnis für Qualität und den langfristige Einflüssen der Ethanolproduktion in den USA.

12 References

ANDERS et al. (2006)
Anders, V.K.; Anderson, L.; Clause, R.; Holz-Clause, M.; Coyne, M.; Randall, H.K.; Stacy, D.; Stevenson, R.W.; Vanderlinden, St.: Market Analysis.
Cited on August 1, 2006; 01:30 pm
http://www.ciras.iastate.edu/beefmanual/intro.html

BRUNKE (2002)
Brunke, H.: Commodity Profile with an Emphasis on International Trade: Live Cattle.
Agricultural Issues Centre, University of California
Downloaded on August 16, 2006; 10:32 am
http://test.agmrc.org/beef/info/ccplivecattle.pdf

CAMPICHE et al. (2004)
Campiche, J.; Holcomb, R.B.; Ward, C.E.: Impacts of Consumer Characteristics and Perceptions on Willingness to Pay for Natural Beef in the Southern Plains.
Downloaded on August 23, 2005; 11:55 am
http://www.fapc.okstate.edu/researchreports/P1006.pdf

CANFAX (2006)
Canfax: Beef Carcass Break Down.
Cited on August 31, 2006; 09:30 am
http://www.canfax.ca/cca/carcass-breakdown.asp

CASE (1990)
Case, D.: Community Forestry Field Manual 2.
Rome: Food and Agriculture Organization of the United Nations Regional Wood Energy Development Programme in Asia, Bangkok, Thailand 1990
Cited on July 3, 2006; 02:37 pm
http://www.sadl.uleth.ca/nz/collect/faodocs/import/www.fao.org/docrep/x5307e/x5307e00.htm#Contents

CASELLA-EVANS et al. (2002)
Casella-Evans, T.; Hilton, J.; Kiyonaga, N.; Lentlie, G.; Nissen, J.; Thomson, J.; Berg, D.: Knowledge Management / Transfer.
Downloaded on July 1, 2006; 06:03 pm
http://www.cs.state.ny.us/successionplanning/workgroups/knowledgemanagement/KnowledgeMgmtTransferFinalReport.pdf

CATTLE-FAX (2005a)
Cattle-Fax: Outook 2005.
Denver (CO), USA: Cattle Marketing Information Service, Inc.; 2005

CATTLE-FAX (2005b)
Cattle Fax: Cattle Fax Special Edition, June 2005.
Denver (CO), USA: Cattle Marketing Information Service, Inc.; 1-800-825-7525; 2005

CATTLE-FAX (2005c)
Cattle-Fax: Outlook and Strategies 2006.
Denver, (CO), USA: 2006 Long-Term Outlook and Strategies Seminar November 15, 2005

CATTLE-FAX (2006)
Cattle-Fax: Cattle Fax Segment Profitability.
E-mail massage from Tod Kalous (tod@cattle-fax.org)
Received on September 20, 2006; 04:05 pm

CBW (2005)
Cattle Buyers Weekly: Marketing and Business News for the beef Industry.
Cited on December 12, 2005
http://www.cattlebuyersweekly.com

CME (2005)
Chicago Mercantile Exchange: CME Introduction to Livestock and Meat Fundamentals.
Download on October 27, 2005; 03:43 pm
http://www.cme.com/files/LivestockFund.pdf

CROM (1981)
Crom, R. J.: The Cattle Cycle – Looking to the 80's.
ESS Staff Report No. AGESS 810105
Washington D.C.: USDA, Economic and Statistic Service, January 1981

CUNDIFF (1999)
Cundiff, L.: Biological Types of Cattle.
Ames (IA): MidWest Plan Services, Iowa State University, USDA ARS, US Meat Animal Research Centre, Product of Extension Beef Cattle Resource Committee, 1999, BCH-1410

DAVIS (2006)
Davis, E.E.: Backgrounding and Commingled Marketing Opportunities.
Texas A&M University, Department of Agriculture Economics
Downloaded on August 5, 2006; 09:03 pm
http://mastermarketer.tamu.edu/tbrm/confprotoc/BACMOP.pdf

DAVIS and LIN (2005)
Davis C.G.; Lin B-H.: Factors Affecting US Beef consumption.
Download on October 10, 2005; 08:52 am
http://www.ers.usda.gov/publications/ldp/Oct05/ldpm13502/ldpm13502.pdf

DEBLITZ (1994)
Deblitz, C.: Internationaler Vergleich von Systemen extensiver tiergebundener Grünlandnutzung: produktionstechnische und ökonomische Analyse, Wettbewerbsfähigkeit, internationale Übertragbarkeit.
Hemmor; Lewiston (NY): Mellen University Press, 1994

DEBLITZ (2002)
Deblitz, C.: International Farm Comparison Network Beef Conference 2002, Method Workshop.
Braunschweig: Federal Agricultural Research Centre, Institute of Farm Economics, 2002

DEBLITZ (2004)
Deblitz, C.: Status quo and prospects of beef production world-wide.
Braunschweig, Germany: Landbauforschung Völkenrode, 2004, 54 (4): pp. 237-249

DEBLITZ et al. (2006)
Deblitz, C.: Beef Report 2006 (in print).
Braunschweig, Germany: Federal Agricultural Research Centre, Institute of Farm Economics, 2006

DOYE and LALMAN (2005)
Doye, D.; Lalman, D.: Beef cattle Manual.
Stillwater (OK): Oklahoma Cooperative Extension Service, Division of Agriculture Sciences and Natural Resources, Oklahoma State University, 2005

EU (2006)
European Union: Background and History of WTO Dispute.
Download on October 1, 2006; 01:30pm
http://ec.europa.eu/dgs/health_consumer/library/press/press57_en.pdf

FAO (2006)
Food and Agriculture Organisation of the United Nations: Statistical Databases & Data-sets.
http://faostat.fao.org/?alias=faostat

FAPRI (2006)
Food and Agricultural Policy Research Institute: U.S. and World Agriculture Outlook.
Ames (IA): Iowa State University, Universtiy of Missouri-Columbia, January 2006, ISSN 1534-4533

FIELD and TAYLOR (2003)
Field, T.G.; Taylor, R.E.: Beef Production and Management Decisions.
New Jersey: Pearson Education, Inc. 2003

FEUZ and UMBERGER (2003)
Feuz, D.M.; Umberger, W.J.: Beef cow-calf production.
In: The veterinary Clinics of North America: Food Animal Practice 2003, Philadelphia, Pennsylvania, Vol. 19, No. 2, PP. 339-363

GOODWIN and CROW (1973)
Goodwin, J.W.; Crow, J.R.: The Interregional Structure of the American Beef Industry in 1975 and 1980.
Oklahoma Agriculture Experiment Station: Bulletin B-708 July 1973; Oklahoma Station Project No. 1449

GUSTAFSON (2005)
Gustafson, R.: Briefing room cattle.
Cited on October 5, 2005; 11:15 am
http://www.ers.usda.gov/Briefing/Cattle/

HAHN (2004)
Hahn, W.: Beef and Pork Values and Price Spreads Explained.
Washington D.C.: USDA ERS, LDP-M-118-01, May 2004
Downloaded on September 1, 2006; 12:35 pm
http://www.ers.usda.gov/publications/ldp/APR04/ldpm11801/ldpm11801r.pdf

HAHN et al. (2005)
Hahn, W.F.; Haley, M.; Leuck, D.; Miller, J.J.; Perry, J.; Taha, F.; Zahniser, S.: Market Integration of the North American Animal Products Complex.
Washington D.C.: USDA ERS, May 2005, LDP-M-131-01

HARNER and MURPHY (1998)
Harner, J.P.; Murphy, J.P.: Planning Cattle Feedlots.
Manhattan (KS): KSU, Department of Biological and Agriculture Engineering, MF-2316 Livestock Systems.
Downloaded on August 9, 2006; 10:33 pm
http://www.oznet.ksu.edu/library/ageng2/mf2316.pdf

HARRIS et al. (2002)
Harris, J.M.; Kaufmann, Ph.R.; Martinez, St.W.; Price, Ch.: The U.S. Food Marketing System, 2002.
Washington D.C.: USDA ERS, Agricultural Economic Report No. 811, June 2002

JONES (2005)
Jones, R.: Finishing Beef.
Manhattan (KS): KSU, MF-592, 2005
Download on August 10, 2006; 03:15 pm
http://www.agmanager.info/livestock/budgets/projected/default.asp

JONES (2006)
Jones, K.: Animal Products Markets in 2005 and Forecast for 2006.
Washington D.C.: USDA, September 2006, LDP-M-146-01
Downloaded on September 14, 2006; 11:15 am
http://www.ers.usda.gov/Publications/LDP/2006/08Aug/LDPM14601/ldpm14601.pdf

KALOUS (2006)
Kalous T.: Personale e-mail massage.
Received on September 24, 2006; 10:30 am (tod@cattle-fax.org)

KBC (2006)
Kansas Beef Council: A Beef break down.
Downloaded on August 31, 2006; 11:30 pm
http://www.kansasbeef.org/PDF/Break%20Down%20Brochure.pdf

KRISSOFF (2002)
Krissoff B.: ERS Analysis: Country-of-Origin Labelling.
Cited on July 27, 2006; 12:00 am
http://www.ers.usda.gov/Features/farmbill/analysis/cool.htm

KSU (2006)
Kansas State University: Kansas State Research and Extension, Agriculture Manager.
Downloaded on August 4, 2006; 01:01 pm
http://www.agmanager.info/livestock/

LARDY (1998)
Lardy G.: Systems for Backgrounding Cattle.
North Dakota State University, AS-1151, August 1998
Cited on August 1, 2006; 09:50 pm
http://www.ext.nodak.edu/extpubs/ansci/beef/as1151w.htm

LAWRENCE and PETTY (2006)
Lawrence J.D.; Petty D.: How Profitable is Backgrounding Cattle.
Iowa Beef Centre, ISU Extension, 2006
Downloaded on August 3, 2006; 11:06 pm
http://www.econ.iastate.edu/faculty/lawrence/Acrobat/Backgrounding%20Cattle.pdf

LINKER (2006)
Linker, D.: The Backgrounding and Stocker Enterprises.
Virginia Polytechnic Institute and State University, College of Agriculture and Life Sciences, Department of Animal and Poultry Sciences
Cited on August 3, 2006; 11:23 pm
http://www.apsc.vt.edu/staff/Linker/Linker.html

LMIC (2005)
Livestock Marketing Information Center: Structural Change in Livestock Processing: A look at federally inspected plant numbers.
Denver (CO): State Extension Services in Cooperation with USDA; Letter #14, March 31, 2005

LPES (2006)
Livestock and Poultry Environmental Stewardship: Curriculum Lessons.
Cited on August 9, 2006; 09:58 pm
http://www.lpes.org/les_plans.html

MACDONALD (2003)
MacDonald J.M.: Beef and pork packing industries.
In: The veterinary Clinics of North America: Food Animal Practice 2003, Philadelphia, Pennsylvania, Vol. 19, No. 2, PP. 339-363

MARK and SCHROEDER (2002)
Mark D.R.; Schroeder T.C.: Effects of Weather on Average Daily Gain and Profitability.
Manhattan (KS): KSU Report of Progress 890
Downloaded on August 14, 2006; 10:42 am
http://agecon.unl.edu/mark/papers/

MARK et al. (2002)
Mark, D.R.; Jones, R.; Mintert, J.: Seasonal Trends in Steer Feeding Profits, Prices, and Performance.
Manhattan (KS): KSU, Agriculture Experiment Station and Cooperative Extension Service, MF-2547, 2002

MATHEWS et al. (1999)
Mathews, K.H.; Hahn, W.F.; Nelson, K.E.; Duewer, L.A.; Gustafson, R.A.: U.S. Beef Industry: cattle cycles, price spreads and packer concentration.
Washington D.C.: USDA ERS, Technical bulletin 2005; Number 1874

MATHEWS et al. (2006)
Mathews, K.H.; Vandeveer, M.; Gustafson, R.A.: An Economic Chronology of Bovine Spongiform Encephalopathy in North America.
Washington D.C.: USDA ERS, June 2006, LDP-M-143-01
Downloaded on August 01, 2006; 03:30 pm
http://www.ers.usda.gov/publications/AboutPDF.htm

MCEOWEN (2003)
McEowen R.A.: Country of Origin Labeling.
AgDM newsletter article May 2003
Cited on July 27, 2006; 11:26 am
http://www.extension.iastate.edu/agdm/articles/mceowen/McEowMay03.htm

MICHELS (2006)
Michels, P.: Personal e-mail massage.
Received on September 27, 2006; 03:44 am, from Paul.Michels@ZMP.DE

MINTERT (2003)
Mintert, J.: Beef feedlot industry.
In: The veterinary Clinics of North America: Food Animal Practice 2003, Philadelphia, Pennsylvania, Vol. 19, No. 2, PP. 339-363

MUTH et al. (2005)
Muth, M.K.; Brester, G.; Del Roccili, J.; Koontz, St.; Martin, B.; Piggott, N.; Taylor, J.; Vukina, T.; Wohlgenant, M.: Spot and Alternative Marketing Arrangements in the Livestock and Meat Industries.
Downloaded on August 23, 2005; 10:35 am
http://151.121.3.117/psp/issues/livemarketstudy/LMMS_Interim_Report.pdf

NCBA (2006)
National Cattlemen Beef Association: Types of Beef.
Cited on September 30, 2006; 07:00pm
http://www.beef.org/ncbaeconomics.aspx

NN (2002)
Not named: The market for case-ready beef.
Saskatchewan Agriculture Food and Rural Revitalization
Downloaded on August 31, 2006; 06:10 pm
http://www.agr.gov.sk.ca/docs/processing/beef/Case_ReadyBeef.pdf

NN (2006)
Not named: ANSC 5010 – The Stocker / Yearling Enterprise.
Cited on August 1, 2006; 01:16 pm
http://www.ag.auburn.edu/~sschmidt/beef/enterpri/stocker.htm

OSTERBERG and MELVIN (2002)
Osterberg, D.; Melvin S.W.: Relevant Laws, Regulations and Decisions
In: Iowa concentrated Animal Feeding Operations Air Quality Study.
Iowa State University and the University of Iowa Study Group, February 2002

OSU (2006a)
Oklahoma State University: Where is the beef.
Stillwater (OK): OSU, Oklahoma Cooperative Extension Service
Downloaded on August 26, 2006; 03:45 pm
http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1594/N-642_web.pdf

OSU (2006b)
Oklahoma State University: Cow-Calf Enterprise Budget – 100 Cow Unit Size.
Downloaded on September 27, 2006; 05:26 pm
http://www.agecon.okstate.edu/budgets/files/CowCalf2.1spring.pdf

PEEL (2003)
Peel, D.S.: Beef cattle growing and backgrounding programs.
In: The veterinary Clinics of North America: Food Animal Practice 2003, Philadelphia, Pennsylvania, Vol. 19, No. 2, PP. 339-363

PEEL (2006)
Peel D.S.: The Oklahoma Stocker Industry.
OSU, Oklahoma Cooperative Extension Service
Downloaded on August3, 2006; 03:15 pm
http://www.agecon.okstate.edu/livestock/presentations/stkrbasic.ppt

PEEL and WARD (1999)
Peel, D. S.; Ward C. E.: Feeder Cattle Production and Marketing.
OSU, Product of Extension Beef Cattle Resource Committee, BCG-8550
Downloaded on August 3, 2006; 10:18 am
http://www.iowabeefcenter.org/pdfs/bch/08550.pdf

PURCELL and LUSK (2003)
Purcell, W.D.; Lusk, J.: Demand for red meats: principles, res. evidence, in issues.
In: The veterinary Clinics of North America: Food Animal Practice 2003, Philadelphia, Pennsylvania, Vol. 19, No. 2, PP 339-363

PURREL and DUNN (1972)
Purrel, W.; Dunn T.: Economic Implication of Conflict and Inconsistency in the Beef Marketing System: The Feeder-Packer Subsector.

PSU (2001)
Pennsylvania State University: Agriculture Alternatives, Beef Cow-calf Production.
Downloaded on September 26, 2006; 09:15 pm
http://agalternatives.aers.psu.edu/livestock/beef_cow-calf/beef_cow-calf.pdf

REUTER et al. (2005)
Reuter, R.; Highfill, G.; Lalman, D.: Implants and their use in beef cattle production.
In: DOYE and LALMAN (2005)

RTI (2005)
Research Triangle Institute International: Location of Federally Inspected Plants that Slaughter Steers and Heifers.
Research Trianlge Park, NC: RTI, 2005
In: Muth et al. (2005)

RYAN (1990)
Ryan, W.J.: Compensatory growth in cattle and sheep Nutrition Abstracts and Reviews (Series B) 60 1990 C.A.B. International 653 - 664

SELK and BARNES (2005)
Selk, G.; Barnes, K.: Choosing a Calving Season.
In: DOYE and LALMAN (2005)

SCHROEDER et al. (1997)
Schroeder, T.C.; Ward, C.E.; Mintert, J.; Peel, D.S.: Beef Industry Price Discovery: A Look Ahead.
Downloaded on August 18, 2006; 05:13 pm
http://www.agmanager.info/livestock/marketing/bulletins_2/industry/

SCHROEDER et al. (2002)
Schroeder, T.C.; Ward, C.E.; Lawrence, J.; Feuz, D.M.: Fed Cattle Marketing Trends and Concerns: Cattle Feeder Survey Results.
Downloaded on August 23, 2005; 9:06 am
http://www.agmanager.info/livestock/policy/cattlefeedersurvey.pdf

SHIELDS and MATHEWS (2003)
Shields, D.A.; Mathews, K.H.: Interstate Livestock Movement.
Washington D.C.: USDA ERS, June 2003, LDP-M-108-01
Downloaded on July 18, 2006; 02:30 pm
http://www.ers.usda.gov/publications/ldp/jun03/ldpm10801/ldpm10801.pdf

SHORT (2001)
Short, S. S.: Characteristics and production costs of US cow-calf operations.
Washington D.C.: USDA ERS, Statistical Bulletin No. 974-3, 2001
Downloaded on July 31, 2006; 10:30 pm
http://www.ers.usda.gov/publications/sb974-3/sb974-3.pdf

SIMUKALI (1999)
Simukali, W.: Pre-weaning growth performance of hair, mutton sheep crosses and post-weaning growth and physiological reaction in response to different feeding levels and high ambient temperature.
Humboldt Universität zu Berlin, Faculty of Agriculture and Horticulture
Dissertation 1999

SWANSON and MORROW-TESCH (2001)
Swanson, J. C.; Morrow-Tesch, J.: Cattle transport: Historical, research, and future perspectives.
Manhattan (KS): KSU, Department of Animal Science and Industry, 2001
Downloaded on August 18, 2006, 5:21 pm
http://www.asas.org/jas/jas0906.pdf

UNCOMTRADE (2006)
United Nations Commodity Trade Statistics Database
http://unstats.un.org/unsd/comtrade/default.aspx

USEPA (2004)
United States Environmental Protection Agency: National Emission Inventory – Ammonia Emission from Animal Husbandry.
Downloaded on September 20; 2006; 10:20 pm
http://www.epa.gov/ttn/chief/ap42/ch09/related/nh3inventoryfactsheet_jan2004.pdf

USDA (2000)
United States Department of Agriculture: Agriculture Fact Book 1999.
Washington D.C.: USDA, July 2000
Downloaded on October 5, 2006; 12:15 pm
http://www.usda.gov/news/pubs/fbook99/factbook1999.pdf

USDA AMS (2001)
United States Department of Agriculture, Agriculture Marketing Service: Slaughter steers, U.S. quality grades.
Washington D.C.: USDA, July 2001
Downloaded on September 13, 2006; 10:30 pm
http://www.ams.usda.gov/lsg/stand/steerqual.pdf

USDA APHIS (1998)
United States Department of Agriculture, Animal and Plant Health Inspection Service: Part IV: Changes in the U.S. Beef Cow-Calf Industry, 1993-1997.
Washington D.C.: USDA APHIS, May 1998

USDA APHIS (2005)
United States Department of Agriculture, Animal and Plant Health Inspection Service: Texas BSE Investigation, Final Epidemiology Report.
Washington D.C.: USDA APHIS, August 2005
Downloaded on July 25, 2006; 10:02 pm
http://www.aphis.usda.gov/lpa/issues/bse/epi-updates/bse_final_epidemiology_report.pdf

USDA APHIS (2006a)
United States Department of Agriculture, Animal and Plant Health Inspection Service: Alabama BSE Investigation, Final Epidemiology Report.
Washington D.C.: USDA APHIS, May 2, 2006.
Download on July 25, 2006; 09:58 pm
http://www.aphis.usda.gov/newsroom/hot_issues/bse/content/printable_version/EPI_Final.pdf

USDA APHIS (2006b)
United States Department of Agriculture, Animal and Plant Health Inspection Service: BSE Trade Ban Status as of July 13, 2006.
Cited on July 26, 2006; 11:45 am
http://www.aphis.usda.gov/newsroom/hot_issues/bse/bse_trade_ban_status.shtml

USDA APHIS (2006c)
United States Department of Agriculture, Animal and Plant Health Inspection Service: National Animal Identification System (NAIS), Strategies for the Implementation of NAIS.
Washington D.C.: USDA APHIS, April 2006
Download on July 25, 2006; 03:02 pm
http://animalid.aphis.usda.gov/nais/downloads/print/NAIS_Implementation_Plan_April_2006.pdf

USDA CRB (1986)
United States Department of Agriculture, Crop Reporting Board: Livestock Slaughter 1985 Summary.
Washington D.C.: USDA CRB, March 1986, Mt An 1-2-1 (86).
Downloaded on August 27, 2006; 02:35 pm
http://usda.mannlib.cornell.edu/usda/nass/LiveSlauSu//1980s/1986/LiveSlauSu-03-00-1986.pdf

USDA CRB (1976)
United States Department of Agriculture, Crop Reporting Board: Livestock Slaughter 1975, Summary.
Washington DC: USDA CRB, April 1976, Mt An 1-2-1 (76)
Downloaded on August 27, 2006; 03:35 pm
http://usda.mannlib.cornell.edu/usda/nass/LiveSlauSu//1970s/1976/LiveSlauSu-04-00-1976.pdf

USDA ERS (2005)
United States Department of Agriculture, Economic Research Service: Food Market Structures.
Cited on September 3, 2006; 01:30pm
http://www.ers.usda.gov/Briefing/FoodMarketStructures/

USDA ERS (2006a)
United States Department of Agriculture, Economic Research Service: U.S. farm sector cash receipts from sales of agricultural commodities, 2002-2006F.
Cited on July 28, 2006; 11:32 am
http://www.ers.usda.gov/Data/FarmIncome/finfidmu.htm

USDA ERS (2006b)
United States Department of Agriculture, Economic Research Service: Historical monthly price spread data for beef, pork, broilers, turkeys, and eggs.
Downloaded on September 2, 2006; 11:30 am
http://www.ers.usda.gov/Data/MeatPriceSpreads/Data/historicalpricespreads.xls

USDA ERS (2006c)
United States Department of Agriculture, Economic Research Service: Meat price spreads.
Cited on September 1, 2006; 01:50 pm
http://www.ers.usda.gov/Data/meatpricespreads/

USDA ERS (2006d)
United States Department of Agriculture, Economic Research Service: Red Meat Yearbook (94006).
Downloaded on September 1, 2006; 01:30 pm
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1354

USDA FAS (2006a)
United States Department of Agriculture, Foreign Agricultural Service: US Trade Internet.
Downloaded on August 20, 2006; 02:41 pm
http://www.fas.usda.gov/ustrade/

USDA FAS (2006b)
United States Department of Agriculture, Foreign Agricultural Service: Beef and Veal Summary Selected Countries.
Downloaded on September 14, 2006; 08:45 am
http://www.fas.usda.gov/DLP/circular/2006/06-03LP/beef_sum.pdf

USDA FAS (2006c)
United States Department of Agriculture, Foreign Agricultural Service: Beef: 2006 Forecast Overview.
Downloaded on September 14, 2006; 03:40 pm
http://www.fas.usda.gov/dlp/circular/2006/06-03LP/beefoverview.pdf

USDA FAS (2006d)
United States Department of Agriculture, Foreign Agricultural Service: Statement by Agriculture Secretary Mike Johanns Regarding U.S. Beef Trade with Korea.
Washington D.C.: USDA Press Office, September 7, 2006; Release No. 0341.06 September 7, 2006.
Downloaded on September 16, 2006; 04:20 pm
http://www.fas.usda.gov/scriptsw/PressRelease/pressrel_lout.asp

USDA FSIS (2004)
USDA FSIS: Teaching Workshop Bovine Spongiform Encephalopathy (BSE), Overview and Awareness Meetings.
Download on July 25, 2006; 03:51pm
http://www.fsis.usda.gov/PPT/BSE_Overview_Awareness_Alt/index.asp

USDA FSIS (2005)
United States Department of Agriculture, Food Safety and Inspection Service: Model Food Security Plan for Meat and Poultry Slaughter Facilities.
Downloaded on August 29, 2006; 01:45 pm
http://www.fsis.usda.gov/PDF/Model_FoodSec_Plan_Slaughter.pdf

USDA GIPSA (1996)
United States Department of Agriculture; Grain Inspection, Packers and Stockyards Administration: Concentration in the Red Meat Packing Industry.
Washington D.C.: USDA GIPSA, February 1996
Downloaded on August 24, 2006; 11:19 pm
http://archive.gipsa.usda.gov/pubs/packers/conc-rpt.pdf

USDA GIPSA (2005)
United States Department of Agriculture; Grain Inspection, Packers and Stockyards Administration: Assessment of the Cattle, Hog, and Poultry Industries, 2004 Report.
Washington D.C.: USDA GIPSA, 2005

USDA GIPSA (2006a)
United Stats Department of Agriculture; Grain Inspection, Packers and Stockyards Administration: Assessment of the Cattle, Hog, and Poultry Industries, 2005 Report.
Washington D.C.: USDA GIPSA, 2005

USDA GIPSA (2006b)
United States Department of Agriculture; Grain Inspection, Packers and Stockyards Administration: Packers and Stockyards Statistical Report 2004 Reporting Year.
Washington D.C.: USDA GIPSA, SR-06-1, February 2006
Downloaded on August 24, 2006; 09:12 pm
http://archive.gipsa.usda.gov/pubs/stat2004.pdf

USDA NASS (1996)
United States Department of Agriculture, National Agriculture Statistics Service: Livestock Slaughter 1995 Summary.
Washington D.C.: USDA NASS, March 1996, Mt An 1-2-1 (96)
Downloaded on August 27, 2006; 02:40 pm
http://usda.mannlib.cornell.edu/usda/nass/LiveSlauSu//1990s/1996/LiveSlauSu-03-14-1996.pdf

USDA NASS (2004)
United States Department of Agriculture, National Agriculture Statistics Service: 2002 Census of Agriculture.
United States, Summary and State Data, Volume 1, Geographic Area Series; Part 51 AC-02-A-51
Washington D.C.: USDA NASS, 2004

USDA NASS (2005)
United States Department of Agriculture, National Agriculture Statistics Service: 2002 Census of Agriculture, maps and cartographic resources.
Downloaded on October 10, 2005; 04:30 pm
http://www.nass.usda.gov/research/atlas02/atlas-livestock.html

USDA NASS (2006a)
United States Department of Agriculture, National Agriculture Statistics Service: Quick Stats.
Downloaded on June 15, 2006; 09:30 am
http://www.nass.usda.gov:8080/QuickStats/Create_Federal_All.jsp

USDA NASS (2006b)
United States Department of Agriculture, National Agriculture Statistics Service: Livestock Slaughter 2005 Summary.
Washington D.C.: USDA NASS, March 2006, Mt An 1-2-1 (06) a
Downloaded on August 24, 2006; 07:45 pm
http://usda.mannlib.cornell.edu/nass/LiveSlauSu/2000s/2006/LiveSlauSu-03-06-2006_revision.pdf

USDJ and FTC (1997)
United States Department of Justice and Federal Trade Commission: Horizontal Merger Guidelines.
Washington D.C.: USDJ and FTC; Issued on April 2, 1992; Revised: April 8, 1997
Cited on August 26, 2006; 07:34 pm
http://www.usdoj.gov/atr/public/guidelines/hmg.htm#15

USDOL BLS (2006)
United States Department of Labor, Bureau of Labor Statistics: North American Industry Classification System (NAICS) at BLS.
Cited on July 24, 2006; 11:34 am
http://www.bls.gov/bls/naics.htm

VANDERVEER (2005)
Vanderveer, M.: Briefing room cattle: trade.
Cited on October 5, 2005; 11:15 am
http://www.ers.usda.gov/Briefing/Cattle/

WARD et al. (2001)
Ward, C.E.; Feuz, D.; Schroeder, T.C.: Fed Cattle Pricing: Formulas and Grids.
Stillwater (OK): OSU, Oklahoma Cooperative Extension Service, 2001, Extension Facts WF-557

WARD et al. (2002)
Ward, C.E.; Schroeder, T.C.; Feuz, D.M.: Grid Pricing: Risk, Value of Information, and Management Implications; Managing for Todays Market and Beyond 2002.
Download on August 14, 2006; 06:18 pm
http://ag.arizona.edu/AREC/wemc/cattlemarket/Grid_Pricingrisk&management.pdf

13 List of interview partners

Borck Lee
President
Ward Feed Yard Inc.
Larned (KS), U.S.
Interview on December 8, 2005; 03:00 pm MET-7

Burtrum J. Clay
Agriculture Management
Farm Data Services, Inc.
Stillwater (OK), U.S.
Interview on December 21, 2005; 09:00 am MET-7

Colman Paul
Vice President and Director of Customer Relations
Cactus Feeders, Inc.
Amarillo (TX), U.S.

Doud Gregg
Chief Economist
NCBA
Washington D.C.
Interview on November 8, 2005; 10.30 am MET-6

Doye Damona
Regents Professor and Extension Economist
Agricultural Economics Department
Oklahoma State University
Stillwater (OK), U.S.

Durham Norman and Jane
Owner and Manager
Durham Ranch
Stillwater (OK), U.S.

Epstein Jim
Eastern Area Supervisor
USDA Market News Office
Ames (IA), U.S.
Interview on November 22, 2005; 10:00 am MET-7

Fritz Richard
Vice President
USMEF
Denver (CO), U.S.)

Gratt J.
Amana Farms Inc.
Amana (IA), U.S.
Interview on November 15, 2005, 02:00 pm MET-7

Hahn William F.
Agricultural Economist
USDA ERS
Washington D.C.

Johnson Darren
General Manager
Southwest Feedyard, Cactus Feeders, Inc.
Hereford (TX), U.S.
Interview on December 29, 2005; 02:00 pm MET-7

Jones Rodney
Associate Professor
Kansas State University
Manhattan (KS), U.S.
Interview on November 30, 2005; 01:00 am MET-7

Knutson Jens
USDA IAD
Washington D.C., U.S.
Interview on November 10, 2005; 02:30 pm MET-6

Kalous Tod
Economist
Cattle-Fax
Englewood (CO), U.S.

Kirk Sam
Owner and Manager
Tri-State Cattle Feeders
Hereford (TX), U.S.

Lawrence John
Professor Ag.
Iowa State University
Director of the Iowa Beef Center
Ames (IA), U.S.
Interview on November, 11:00 am MET-7

Minx David
Director of Purchasing
Advance Food Company
Enid (OK), U.S.

McKinley Steve
Director for Operations
Oklahoma Cattlemen Association
Oklahoma (OK), U.S.
Interview on December 19, 2005; 09:00 am MET-7

Mathews Kenneth H.
USDA, ERS
Washington D.C.
Interview on November 07, 2005; 09:00 am; MET-6

Payne Kenneth R.
Branch Chief
Marketing Programs Branch, Livestock and Seed Program
USDA AMS
Washington D.C.

Peel Derrell S.
Professor and Extension, Livestock Marketing Specialist
Oklahoma State University
Stillwater (OK), U.S.

Porter Richard
Porter Farms
Reading (KS), U.S.

Preston Warren P.
Chief Economist
Livestock and Seed Program
USDA AMS
Washington D.C.

Ransom Justin R.
Livestock and Meat Marketing Specialist
Standardization Branch, Livestock and Seed Program
USDA AMS
Washington D.C.

Robb James
Center Director
Livestock Marketing Information Center
Lakewood (CO), U.S.
Interview on January 10, 2006; 09:00 am MET-8

Rosa Erica
Agricultural Economist
Livestock Marketing Information Center
Lakewood (CO), U.S.
Interview on January 10, 2006; 09:00 am MET-8

Roser Bill
Manager
Wheeler Bros Feedyard
Interview on December 15, 2005; 03:00 pm MET-7

Sessions William T.
Associate Deputy Administrator
Livestock and Seed Program
USDA AMS
Washington D.C.

Schroeder Ted
Professor and Director of Graduate Program
Kansas State University
Manhattan (KS), U.S.
Interview on November 29, 2005; 09:00 am MET-7

Smith Kerry R.
Livestock and Meat Marketing Specialist
Standardization Branch, Livestock and Seed Program
USDA AMS
Washington D.C.

Snyder Brent
Market Analyst
Amarillo (TX), U.S.
Interview on December 28; 2005; 01:00 am; MET-7

O'Connor Martin
Chief
Standardization Branch, Livestock and Seed Program
USDA AMS
Washington D.C.

Vanderveer Monte
USDA, ERS
Washington D.C.
Interview on November 07, 2005; 09:00 am; MET-6

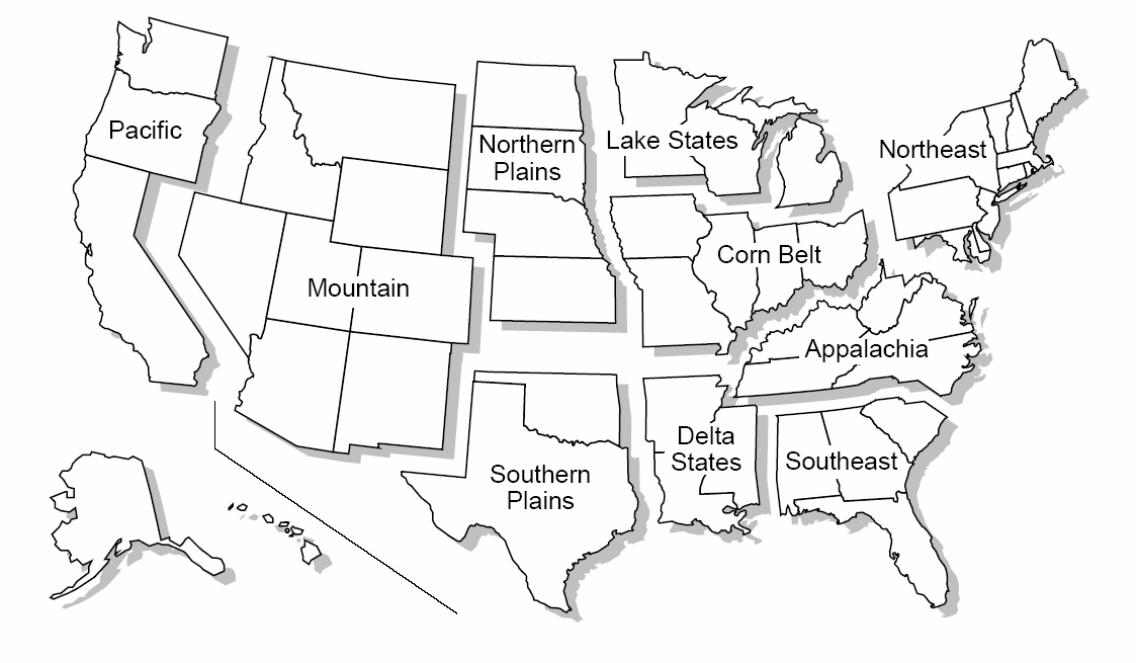
Ward Clement
Professor and Extension Economist
Agricultural Economics Department
Oklahoma State University
Stillwater (OK), U.S.

Williams John and Kay
Owner and Manger
Wilcrest Farms
Coyle (OK), U.S.
Interview on December 18, 2005; 03:00 pm MET-7

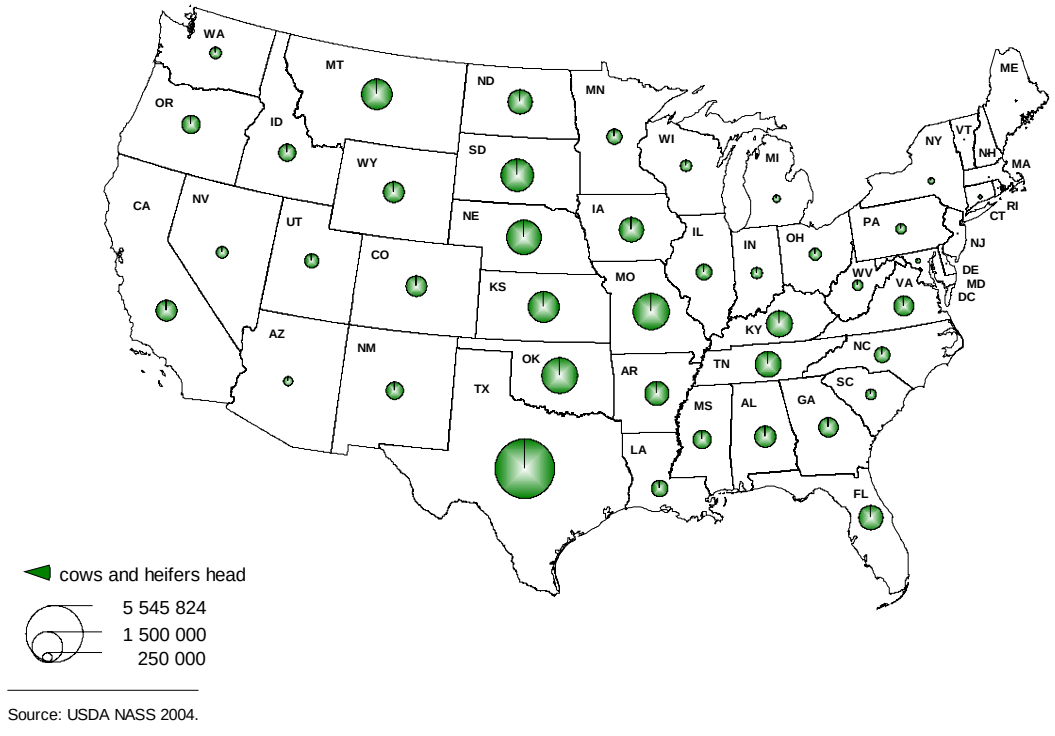
Annex

Annex

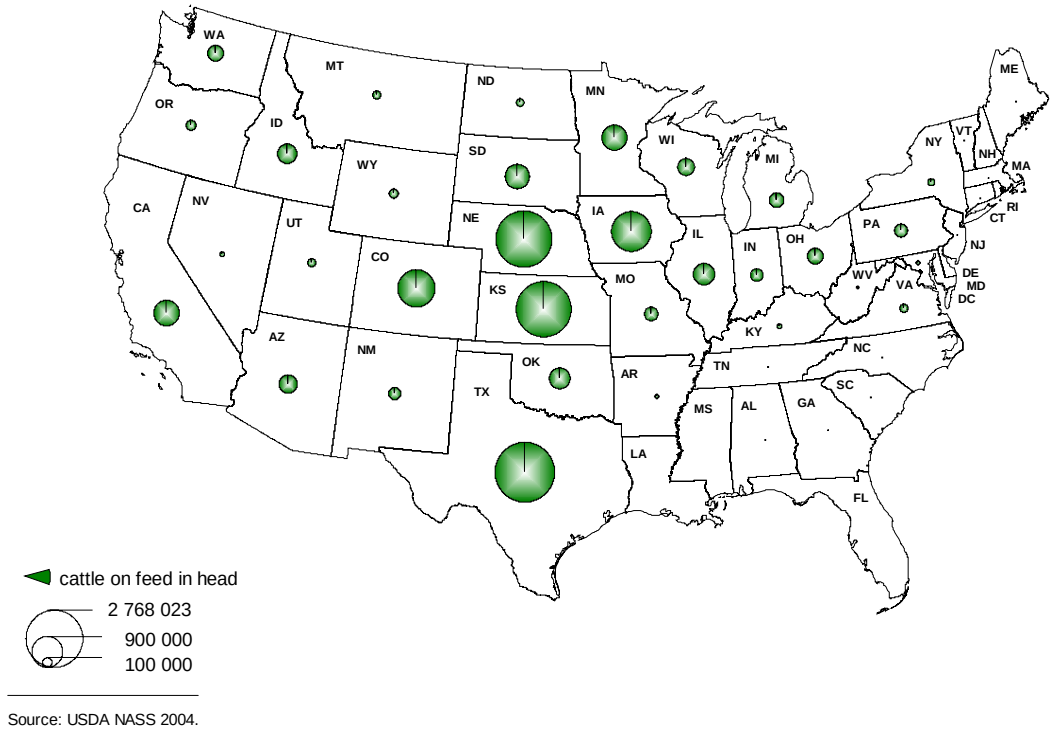
Map A1: U.S. farm production regions (USDA 2000).



Map A2: Beef-cow inventory by state (own illustration based on USDA NASS (2006a)).



Map A3: Cattle on feed inventory by state (own illustration based on USDA NASS (2006a)).



Source: USDA NASS 2004.