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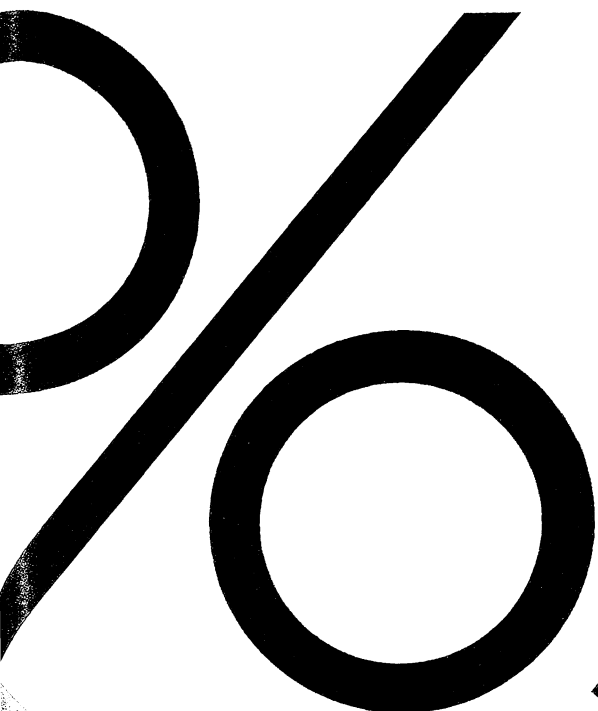
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# What Determines Beef Prices?

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Minnesota ranked ninth in numbers of cattle and calves on feed for January 1978.<sup>†</sup> Many firms in Minnesota are beef processors and merchandizers. Consequently, many people besides consumers are concerned about beef prices.

In this article research on monthly retail, wholesale, and farm prices for beef is discussed. The research employed statistical methods to identify the important factors affecting beef prices. A glance at the general structure of the U.S. beef industry provides background for the research findings.

## THE U.S. BEEF INDUSTRY: AN OVERVIEW

Figure 1 provides a simple outline of the beef industry's structure. It also shows the average monthly quantities which moved along the marketing chain in the 1970-77 period and identifies major pricing points. All quantities are expressed on a carcass weight basis in figure 1. For example the carcass beef production from steers and heifers (1,534 million pounds) averaged more than four times the production from all other domestic sources, namely cows, bulls, and stags (371 million pounds). For purposes of this study, call these other domestic sources, cow beef (cows are the main source of the supply).

The farm price is established between the producers and the packers. The packers slaughter and dress the animals and transport carcasses from the production areas to the populated consumption areas. The packers sell the offal, hides, and other by-products as well as the meat.

Beef imports, mainly low quality grade lean meat in frozen form,

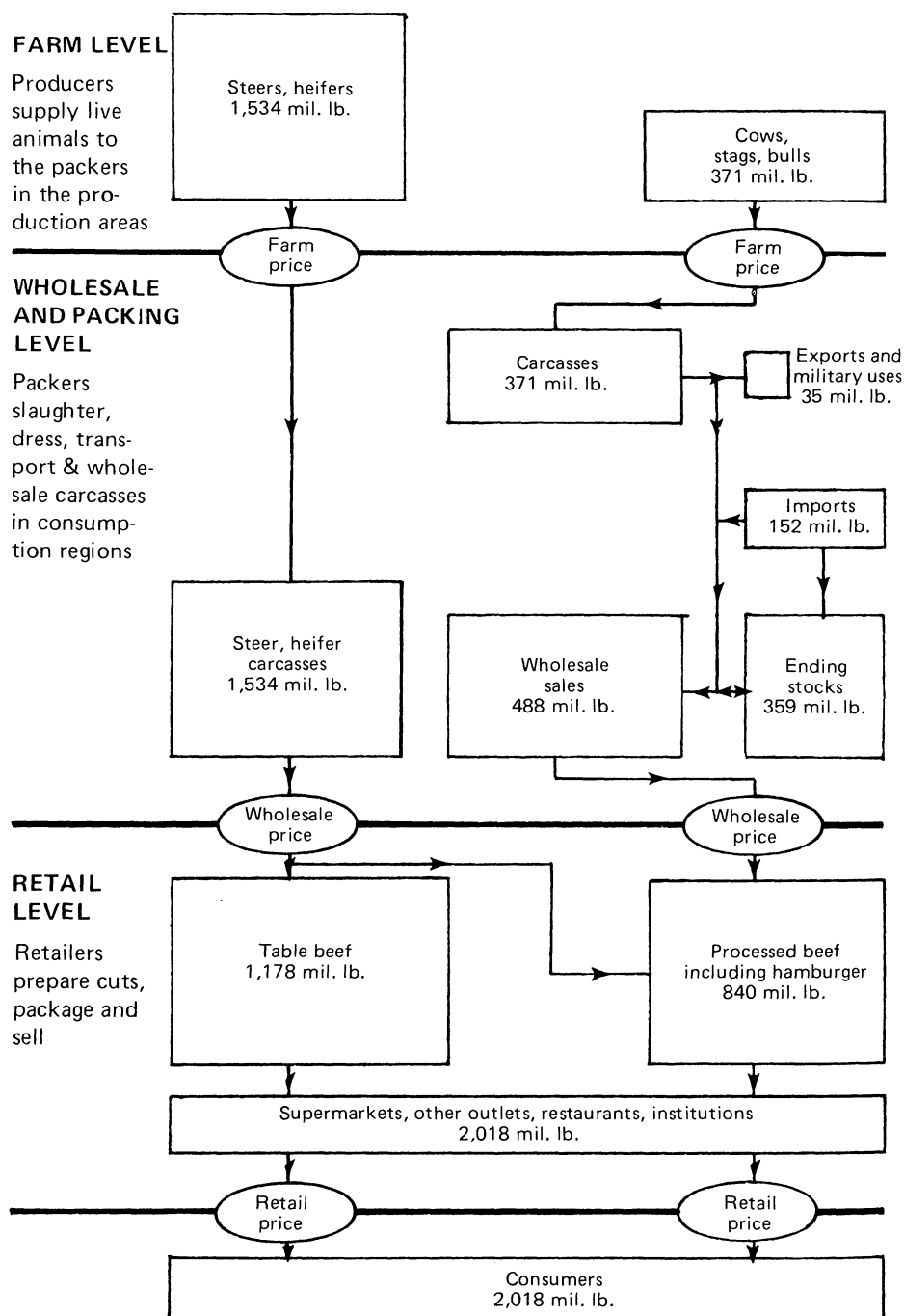
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†These states ranked ahead: Texas, Nebraska, Iowa, Kansas, Colorado, California, Illinois, and Arizona.

compete with domestic cow beef at the wholesale market level. Monthly imports averaged 152 million pounds or only about 7 percent of total beef consumption. Imports are a much higher percentage of

cow beef production (figure 1). The cow beef and beef imports either go immediately into consumption or into cold storage stocks. (A minor amount of beef is exported by the U.S. or used by the military.) Because steer and heifer beef are seldom held longer than a month, cold storage stocks are assumed to consist entirely of cow and imported beef. On the average, 488 million pounds of cow plus imported beef are sold on the wholesale market compared with 1,534 million

Figure 1. A simplified structure of the U.S. beef industry\*



\*Quantities are carcass weight basis.

pounds of steer and heifer carcass beef.

The wholesale price is established between the packer (or wholesalers) and the retail buyers in cities where the meat is sold to consumers. Traditionally, retailers buy carcasses as sides or quarters and have butchers break these wholesale cuts into retail cuts which are packaged and sold. The high quality cuts, called here, table beef, such as steaks and roasts from a steer or heifer carcass, are sold through supermarkets, other retail outlets, and quality restaurants. The lower quality cuts from steer and heifer carcasses compete with cow and imported beef. The hotel, restaurant, and institutional trade, which includes the fast food outlets and school lunch programs are large users of this beef, called here, processed beef. Figure 1 shows that an average of 1,178 million pounds (carcass weight equivalent) of table beef was consumed compared to 840 million pounds of processed beef. In total an average of 2,018 million pounds of beef was consumed each month of this study.

The retail price is established between the final market outlets and the consumer. The consumer closely watches prices of beef cuts and makes a decision to purchase this cut or that cut or perhaps to switch to another type of meat. The amount of purchasing power, or income the consumer has will affect his/her beef buying decisions. The retail grocer also closely watches the amount of beef sold and will alter the price to encourage sales of particular cuts.

## RESEARCH RESULTS

The first step in the research was to identify factors influencing beef prices at the retail, wholesale, and farm levels by systematically examining monthly prices from January 1970 to July 1977. Some temporary factors were important. For example, the 1973 beef price ceilings disrupted the usual process of determining market prices. In addition, other factors might influence beef prices at any of the marketing levels. However, only the factors which systematically influenced beef prices and which this author found important are reported here.

## Retail Prices

The retail price of table beef, which is an average price for the expensive choice steer cuts, decreases as the available supply increases, and increases as personal income and population increase. The price further depends on the price consumers paid in the previous month: the higher last month's price, the higher this month's price. There are also seasonal influences on retail prices. For example, in November turkeys are eaten in preference to beef, and retail beef prices are lower; in summer, beef is used for barbecues and prices are higher. Table 1 (upper half) lists influences.

The same factors influence the retail price of processed beef (hamburger), but the magnitude of the effect is different (see lower half, table 1). Hamburger prices are in-

**Table 1. Factors affecting monthly retail beef prices**

Table beef prices <sup>a</sup>	Effect <sup>b</sup>
Supply	-
Personal income	+
Population	+
Price in previous month	+
Month of year	+/-
Processed (hamburger) beef prices	
Supply	-
Personal income	+
Population	+
Price in previous month	+
Table beef price	+
Chicken price	+
Price of other goods	-
Month of year	+/-

<sup>a</sup>Table beef is the high quality (roasts and steaks) cuts from a choice steer carcass.

<sup>b</sup>Minus (-) indicates a negative influence and plus (+) a positive influence on price.

fluenced by table beef prices and chicken prices. Over the study period, hamburger prices rose less rapidly than did an average of all nondurable goods (excluding food).

## Wholesale Prices

The wholesale price for a choice steer carcass increases with the price retailers expect to get from consumers. It decreases, however, as supplies increase and as costs, particularly retail wages, rise. Table 2 lists these factors and also the factors which influence wholesale

**Table 2. Factors affecting monthly wholesale beef prices**

Choice steer carcass price	Effect <sup>a</sup>
Expected retail price	+
Supply	-
Costs (wages, interest)	-
Month of year	+/-
Wholesale cow beef	
Expected retail price	+
Supply	-
Costs (wages, interest)	-
Wholesale pork price	+
Steer/heifer supply	+
Month of year	+/-

<sup>a</sup>Minus (-) indicates a negative influence and plus (+) a positive influence on price.

cow prices. The cow prices are influenced by the same set of factors and in addition by the wholesale price of pork and the steer and heifer supply. Pork competes with low quality beef in uses such as bologna and sausages. As pork prices rise, more cow or imported beef is eaten as a pork substitute and this increases the wholesale cow price. The fat trimmings from steer and heifer carcasses are mixed with the lean cow or imported beef to get a ground beef which satisfies the legal requirements for fat content. The larger the steer and heifer supply, the more trimmings are available and the higher the demand and price for wholesale cow beef.

## Cold Storage Stocks at End of Month

The quantities of beef in cold storage at the end of the month, which are assumed to consist entirely of cow or imported beef, increase as the wholesale cow price expected in the following month increases (table 3). These end-of-

**Table 3. Factors affecting monthly levels of beef held in cold storage**

Factors	Effect <sup>a</sup>
Expected wholesale cow price next month	+
Expected steer/heifer supply next month	+
Import quantities	+
Stocks in cold storage at beginning of the month	+
Month of year	+/-

<sup>a</sup>Minus (-) indicates a negative influence and plus (+) a positive influence on price.

month stocks also increase if the next month's steer and heifer supplies are expected to increase, because more lean beef will be required for mixing purposes. The imported, frozen beef goes immediately into cold storage and the larger imports are in any month, the larger the end-of-month stocks. Also, the larger stocks are at the beginning of the month, the larger they are at the end of the month. End-of-month stocks regularly increase in the last 3 months of the year and are reduced over spring and summer.

Farm Prices

The farm price for choice steer increases as the wholesale price increases and as the value of the by-products increase (table 4). The farm price decreases as more pressure is placed on the capacity of the slaughter plants. This pressure is indicated by the overtime hours worked in packing plants. Seasonal factors also influence the farm price.

Table 4. Factors affecting monthly farm beef prices

Choice steer price	Effect <sup>a</sup>
Wholesale steer price	+
Packers' overtime hours (a measure of plant capacity pressure)	-
By-products value	+
Month of year	+/-
Utility cow price	
Wholesale cow price	+
Packers' overtime hours (a measure of plant capacity pressure)	-
By-products value	+
Other packer costs	-
Beef supply	-
Seasonal factors	+/-

<sup>a</sup>Minus (-) indicates a negative influence and plus (+) a positive influence on price.

The utility cow price is affected by the same set of factors in a similar way. However, slaughter beef quantities and a weighted index of fuel, labor, and transportation costs borne by packers also affect the cow price (table 4).

THE IMPACTS OF CHANGES IN KEY FACTORS

After having identified factors influencing beef prices, selected fac-

tors can be looked at to see what effects these have on beef prices. The factors looked at here are beef supply sources: steer and heifer beef, cow beef, and beef imports.

A Change in Steer and Heifer Supply

Since steer and heifer beef are held in storage for no more than a month, an increased supply means that consumers must buy more. The increased consumption is achieved through lower retail prices. Then, because the retailers get less per pound of beef, they offer less to the packers, who in turn offer less to the producers.

If steer and heifer supplies increase 10 percent, the overall retail price for choice steers is estimated to fall 10.1 cents per pound. (The overall beef price is an average price for all meat from a steer carcass not just the high quality table beef cuts.) During 1977 that would be a 7.4 percent decline in retail prices. The consequent decline in wholesale price is 4.6 cents per pound or 7.2 percent and in farm price is \$2.60 per hundredweight or 7.6 percent (table 5.)

The estimated effects on cow beef prices also appear in table 5. The retail price is estimated to fall by 7.5 cents per pound or 8.7 percent. This decrease comes from two causes: first, the increased supply of processed beef from the steer and heifer lower quality cuts pushes down the retail price; and second, the competitive effect from lower table beef prices pushes down processed beef retail prices.

At the wholesale level are two opposing forces. First, the increased

supply of steer and heifer beef leads to an increased demand for the leaner cow beef and imported beef for mixing purposes. This increases the wholesale price of processed beef. Second, the increased supply leads to a lower, expected retail price which depresses the wholesale price. The net effect is to reduce the wholesale cow price by 5.5 percent.

Two opposing forces also are acting on cold storage stocks. The lowered wholesale price makes stock holding less attractive. The increased demand for lean beef for mixing purposes, however, acts to increase the level of stocks. The net effect, is for stocks to increase slightly, 2-3 percent.

The farm price for utility cows is estimated to drop 5.2 percent as the lower wholesale price is reflected at the producer level. This decrease in farm cow price highlights the inter-relationships between the different beef types and shows how a changed supply of one beef source will affect the price of another. Any additional culling of cows from beef breeding herds, caused by the lower prices received for steers and heifers, which would further depress farm cow prices is not included in the effects in table 5.

The impacts of a decrease in steer and heifer supply have the direct opposite effects to those in table 5. Prices at all market levels would rise.

A Change in Processed Beef Supply

The lower quality beef supplies may be increased without increas-

Table 5. Effects of a sustained 10 percent change in steer and heifer beef supply on prices after 10 months

Monthly average supply (1977)	1,646 mil. lb.
Change of 10 percent causes a change in	165 mil. lb.
Choice steers	
Retail beef price	- 10.1 ¢/lb (-7.4%)
Wholesale price	- 4.6 ¢/lb (-7.2%)
Farm price	- 2.6 \$/cwt (-7.6%)
Cow beef	
Hamburger price	- 7.5 ¢/lb (-8.7%)
Wholesale price	- 2.8 ¢/lb (-5.5%)
Cow price	- 1.4 \$/cwt (-5.2%)

ing the supply of high quality beef, by increasing the production of cow beef or by increasing imports. A 10 percent increase in either of these supply sources has different effects on beef prices at the various market levels. The reason for the different effects is that imports come in at the wholesale level while cow beef, of course, comes in at the farm level. Also, a 10 percent increase in cow beef production is a larger increase in actual meat quantities than is a 10 percent increase in imports. Ten percent of the 1977 monthly production of cow beef is 44 million pounds, while a 10 percent increase in imports is only a 16 million pound increase.

Table 6 shows the effects of a sustained 10 percent increase in the domestic supply of cow beef. Hamburger prices are depressed by 2.5 cents per pound (2.9 percent). Retail choice steer prices, however, are only slightly affected due to the hamburger price drop. The wholesale and farm prices of choice steers change by only very small amounts. The main price effect falls on the cow beef market. Both wholesale and farm cow prices fall by about 5 percent. The wholesale price falls because of lower retail prices and because of the increased quantities of beef moving through the wholesale level. The farm price falls as the packers pass the lower prices along to the producers and as cow slaughter increases. There are small declines in the cow beef in cold storage at the end of the month.

A decrease in the cow beef production would have opposite effects to those in table 6. Prices at all marketing levels would increase.

## THE EFFECTS OF INCREASING BEEF IMPORT QUOTAS

In June 1978, President Carter announced that import quotas for the remainder of 1978 would be increased by 200 million pounds. Prior to the announcement, Secretary of Agriculture Bergland had stated that the increase would reduce the expected rise in 1978 beef prices by 4 cents per pound. It was not clear whether the Secretary was referring to choice beef price or to hamburger (processed beef) price. Presum-

**Table 6. Effects of a sustained 10 percent change in cow beef supply on prices after 10 months**

Monthly average supply (1977)	436 mil. lb.
Change of 10 percent causes a change in	44 mil. lb.
Choice steers	
Retail beef price	-0.58 ¢/lb (-0.4%)
Wholesale price	-0.06 ¢/lb (-0.1%)
Farm price	-0.03 \$/cwt (-0.1%)
Cow beef	
Hamburger price	-2.5 ¢/lb (-2.9%)
Wholesale price	-2.5 ¢/lb (-4.9%)
Utility cow price	-1.4 \$/cwt (-5.2%)

**Table 7. Effect of a 33 million pound per month increase in U.S. beef import quotas<sup>a</sup>**

	A change in the amount shown in		
	1st month	6th month	10th month
Choice steers			
Retail beef price (¢/lb)	- 0.07	- 0.27	- 0.34
Wholesale price (¢/lb)	0	- 0.02	- 0.03
Farm price (\$/cwt)	0	- 0.01	- 0.02
Cow beef			
Hamburger price (¢/lb)	- 0.29	- 1.15	- 1.47
Wholesale price (¢/lb)	- 0.75	- 1.28	- 1.50
Utility cow price (\$/cwt)	- 0.34	- 0.63	- 0.74
Processed beef			
consumption (mil.lb)	21.26	25.87	28.07
Beef ending stocks (mil.lb)	11.74	55.09	77.85

<sup>a</sup>A sustained change of 33 million pounds per month causes the shown change in the prices in the 1st, 6th, and 10th months.

ably, he was referring to hamburger.

Consider the probable effects according to this study. Imports in the first half of 1978 were running over the quota level, so that in fact the 200 million pound increase is spread over more than a 6-month period. Assume, however, that the 200 million pound increase does occur evenly over 6 months. Monthly imports rise by 33 million pounds, a more than 20 percent increase over monthly average 1977 imports. Effects can be checked in the first and sixth month and then in ten months, to show what would happen if imports were kept at the higher levels (table 7).

In the first month, one-third of the increase goes into cold storage stocks. (Recall that beef imports are largely in frozen form.) The rest goes into consumption. To get consumers to purchase the extra processed beef, the retail price falls by 0.29 cents per pound below what it would have been if the quota had not been increased. The overall re-

tail beef price falls slightly because the price of one of its two components, hamburger (processed beef) has fallen. The wholesale beef cow and farm prices both fall as the lower retail prices are passed back along the marketing chain.

By month 6, consumers have increased consumption of processed beef by almost 26 million pounds. The remainder of the 33 million pounds of imports is stored. With additions each month, cold storage stocks are 55 million pounds higher than they would have been without the quota increase. The retail price of hamburger has now fallen by 1.15 cents per pound and the wholesale and farm cow prices have fallen even further than in the first month. The overall retail beef price is now 0.27 cents per pound lower and some very small decreases in wholesale and farm choice steer prices are starting to occur.

By month 10, the price decreases have just about settled down to new levels. Consumption has increased by 28 million pounds with the re-

maining 5 million pounds still moving into storage. Cold storage stocks are very slow to adjust to changed conditions. When they have fully adjusted, no further monthly additions will be made to stocks and the full 33 million pounds will move through to the consumers each month.

The main impacts of the increased imports is in the lower quality beef market. Hamburger prices are estimated to fall by 1.47 cents per pound. Wholesale cow prices are estimated to decline by 1.5 cents per pound and farm cow utility prices by \$0.74 per hundredweight. The estimated decrease in hamburger prices is much less than the 4 cents decline given by Secretary Bergland.

The effects on choice steer prices are very small. Part of the reason for this is that in the study months, hamburger prices were not found to have any effect on the retail prices of the high quality table beef cuts of

meat, steaks and roasts. Consequently, the fall in hamburger prices did not affect the high quality table beef prices. Choice steer prices declined slightly, because the prices received for the lower quality cuts from the steer carcasses declined.

Previous studies have reported larger price depressing effects on cow beef and on choice steer prices from increased imports. Their estimates, however, are still less than Secretary Bergland's. The authors of these previous research studies have not permitted the lower quality steer and heifer cuts to affect the price of hamburger. Figure 1 indicates almost as much beef comes from this source (1,534 minus 1,178 = 356 million pounds) as from cow beef and imports (488 million pounds). Furthermore, many of these studies were conducted before the development of the fast food industry—a large user of processed beef. This use has helped pre-

vent large decreases in hamburger prices as cow beef from the liquidation of breeding herds moved onto the market.

The effects of a decrease in the import quota of 200 million pounds or of 33 million pounds per month are directly opposite to the effects given for the increase in the quota.

#### **CONCLUDING COMMENTS**

This study suggests that beef prices depend on how much beef is produced, imported, and how much income consumers have. The study also suggests that prices respond differently to changes in supplies of steers and heifers than to changes in cow beef production or to imports. For example, an increase in steer and heifers supplies has a large impact on both hamburger and retail choice steer prices. In contrast, an increase in cow beef production or in the level of imports affects hamburger and cow prices much more than it affects choice steer prices.

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