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the BEEF CYCLE

EXTENSION SERVICE
UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE AND HOME ECONOMICS
AND U. S. DEPARTMENT OF AGRICULTURE COOPERATING
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The Beef Cycle

By Arnold Nordquist and Howard Ottoson[1]

There is much interest in the price situation of the beef industry, competing products, beef supplies, and in future prospects. There is an underlying phenomenon—the beef cycle—which helps explain the fortunes of the beef industry in a broad sense. However, not all price fluctuations for fed beef and feeder cattle can be attributed to the beef cycle. Many other factors operate in the market. Our purpose is to describe the characteristics of the beef cycle, and how it applies to the current situation.

Generally, cattle numbers have increased with the growth of the country and its population. After the cattle industry expanded to the western areas of the country, cattle numbers began to alternately increase and decrease. These recurring upswings and downswings have been called "cattle cycles," or sometimes, "beef cycles" (Figure 1). Since 1880 six successive swings have been completed and the seventh is now in progress. The high point for each cycle was a new record

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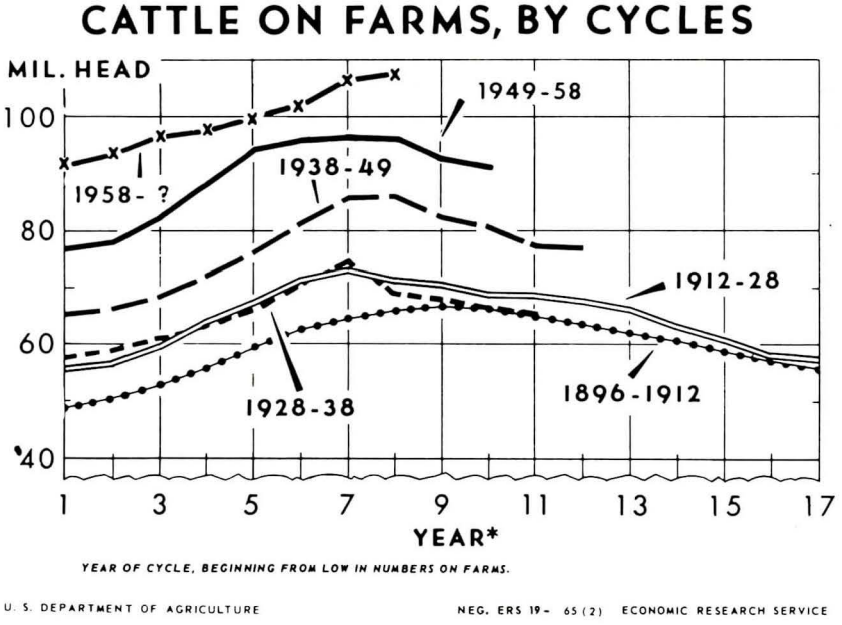

Figure 1. Cattle on farms in the United States, by cycles, 1896–1964. Source: USDA data.

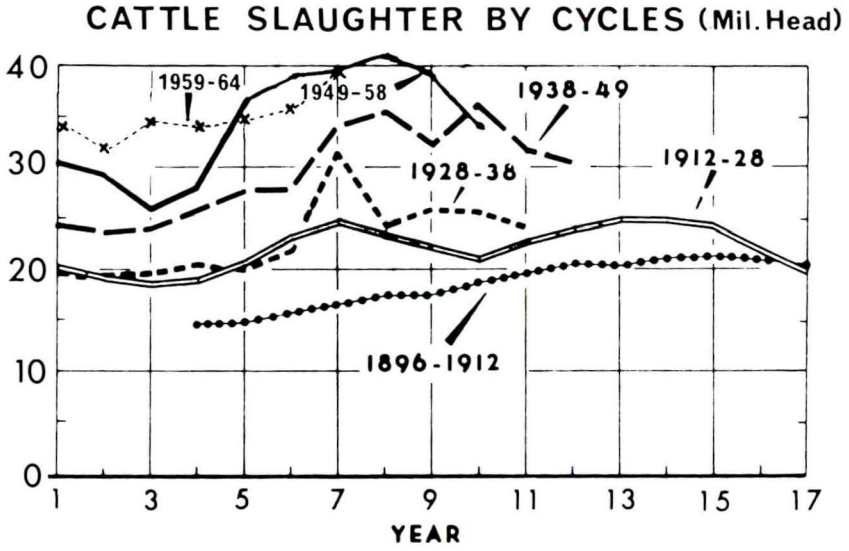

Figure 2. Cattle slaughter, by cycles, in the United States, 1896–1963. Source: USDA data.

high in numbers to that date, whereas the low point did not reach the previous low.

The build-up stage of a cycle is characterized by progressively larger calf crops, relatively low marketings and slaughter, (Figure 2) and rising prices. The cut-back stage is featured by large marketings, declining prices, and smaller calf crops. Slaughter during the rising trends includes relatively fewer cows and calves but, as inventory numbers decrease, cow and calf slaughter gets larger.

The average live weight of cattle slaughtered increases quickly in the early stages of a cyclic build-up of numbers. Feeders aim for heavier weight and added tonnage while cattle slaughter is down and prices are rising. Later in the cycle, average weights become lighter as marketings increase. At the cyclic peak, however, weights increase again temporarily. Numbers are held back during the first signs of weak prices in hopes of the market gaining some strength.[2]

Although there has been much similarity in the seven cycles, no two have been exactly alike. All have been influenced by different conditions and factors. Furthermore, the various cattle producing states and areas have shown different trends and cyclic behavior. These differences reflect variations in the influence which major factors have in different parts of the country. For example, a severe drought

[2] *The Inventory Cycle and Slaughter Weight of Steers.* Article by Forest E. Walters. *The Livestock and Meat Situation,* March 1964 Economic Research Service, U.S. Department of Agriculture.

might cause heavy liquidation in one area but might cause a build-up in another area which has ample or surplus feed resources to take care of the shifting numbers.

Length of Cycles

Previous upswings in U.S. cattle numbers have lasted at least seven years. The 1896–1912 cycle showed nine successive years of increase before the decline began. The cycles that peaked in 1934 and '55 had seven years of rising inventories. The one that hit a peak in 1945 had eight successive increases. On the other hand, the length of the decline shows more variation. The most protracted decline followed the peak in 1918; the shortest downturn was the three-year decline following the 1955 peak.

Composition of Cattle Population

Statistical detail on the composition of cattle numbers in the early cycles is lacking, but evidence is rather conclusive that marketings consisted mainly of veal calves, aged beef steers, and cows. Not many of the steers were fed grain for the slaughter market. Most of the beef was grass finished and cow-beef represented a fairly large part of the beef supply.

In the early 40's dairy cattle contributed more than 40 percent of the U.S. beef and veal production. Milk cows represented 63 percent of the total cow population in 1920; 71 percent in 1930; 70 percent in 1940; 59 percent in 1950. In 1955, at the peak of the last cycle, milk cows represented only 48 percent of the total number of cows. As the number of dairy cows in the nation decreases, the production of manufacture-type beef and veal is reduced. Since the end of the decline in milk cow numbers is not in sight, further reductions are expected in production of veal and manufacture-type beef from dairy cattle.

Steers made up a larger proportion of the cattle population 40–50 years ago than they do now. In 1920 they accounted for 14 percent of the total. At more recent cyclical peaks they represented only 8–10 percent.

Beef heifers showed a slight gain in the percentage of total cattle between 1945 and 1955. Calves gained from about 16 percent of the total January 1 holdings in 1934 to nearly 20 percent of the total in 1955.

Major Causes of Cyclical Movements

Factors causing the periodic swings in cattle numbers have been both physical and economic. The biological characteristics of cattle production also exercise an influence. In some instances numbers have

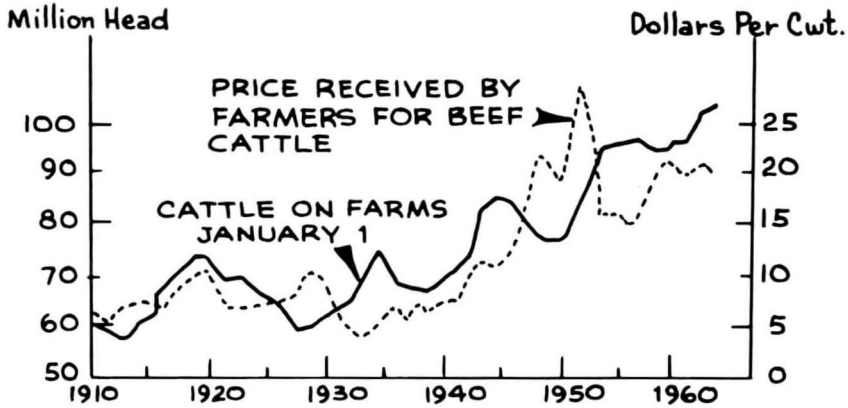

Figure 3. Cattle numbers and prices in the United States, 1910–1963. Source: USDA data.

exceeded grazing and feed resources. This triggered increased marketings and slaughter, and put pressure on prices. As price levels dropped marketings accelerated, bringing further reductions (Figure 3).

Most observers attributed the downtrend in the early 90's to the expansion of cattle numbers beyond the feed resources available. Again in 1918, cattle numbers were too high for the grazing capacity. Drought in 1934 and in 1936 set in motion a severe liquidation that lasted about four years. Drought in the mid-50's again contributed to a decrease in cattle inventories. The roughage consuming units in 1955 had reached a fairly high level—nearly as high as was reached toward the end of World War II. Without drought, cattle numbers could have continued upward to the 100 million mark without taxing normal feed resources.

From 1918 until 1955, the general expansion in cattle numbers was accompanied by a steady decrease of 20 million head in horses and mules. To a lesser extent grazing and feed resources for sheep have been shifted to cattle. More recently, the rise in the level of milk production per cow and the shrinking numbers of dairy cows have released grassland and other feed resources for beef production.

On several occasions wars, accompanied by rising prices stimulated by inflation and a strong demand for meat, have set the stage for upswings in cattle numbers. The end of hostilities has been followed by declines in the general price level, slow downs of business activity, and declines in consumer expenditures. These conditions led to downtrends in inventories, mounting slaughter and beef production and sagging price levels.

The change from the upswing to the downswing in 1945 was apparently due to factors other than the lack of feed resources or price behavior. Grazing resources were ample for the cattle inven-

tories and prices were quite favorable by past comparisons. The end of World War II may have caused uncertainty in the minds of cattlemen concerning the ability of cattle to hold the then current price level. Numbers were nearly 10 million head above the previous peak and inventories had been building up at the rate of 4 and 5 million head a year during years of price control.

Features of the Current Cycle

The current upward trend in cattle numbers which started in 1958 has several features that are different from previous upswings. Production of beef has increased much faster than the inventories of all cattle, cows or the calf crop. Calves have made up a smaller proportion of the total slaughter while the percentage of slaughter stock coming from feed lots keeps hitting new record highs. In the period 1940–49, the ratio of the total number of cattle fed during the year to the January 1 inventory of cattle on feed was 1.51. By 1961 this ratio had increased to 1.83 and in 1962, it was 1.93. This gain depicts the trend to year-round feeding especially by the large, specialized feeding establishments.

Total cattle inventories have moved upward about 11 percent in the present uptrend. During a similar period in the previous cycle, cattle numbers increased 23 percent. The modest rise is reflected in the increase in the number of all cows and in the total calf crop. The calf crop has increased about the same as the civilian population since 1958.

Increases in cattle numbers since 1958 have been the greatest in the Great Plains and West Coast states. Numbers in Texas shattered the record high mark reached back in 1890. In Central Plains—Nebraska, Kansas and Oklahoma—cattle inventories have increased 46 percent since the low in 1957. Inventories are up about one-fourth in the Dakotas and slightly more than one-fourth in the West Coast states.

In contrast, the gain in cattle numbers from the recent low point is less than 10 percent in the eastern half of the country. Numbers in the North Atlantic states, largely dictated by trends in dairy stock, are the lowest since 1949. The Eastern Corn Belt and the Lake states are up only slightly. The marked increase shown by the South Atlantic and South Central states (excluding Texas and Oklahoma) during the 1949–57 upswing was not sustained in the current cycle. Inventories in the South Atlantic states have increased only 4 percent; those in the South Central group about 14 percent.

Although total cow population has been increasing moderately since 1958, the number of beef cows has increased 31 percent while milk cows dropped 15 percent. The 10 Great Plains states had 65 percent of all the beef cows in the U.S. in 1934, 58 percent in 1945 and 51 percent in 1964. These same 10 states had about 39 percent

of all cattle and calves in the U.S. in 1934, 37 percent in 1945, and 34 percent at the peak of the previous cycle in 1956. On January 1, 1964 the Plains states had regained much of their importance nationally, holding nearly 38 percent of the total.

Marked increases in beef cows have occurred in Iowa, Missouri and Illinois. These states now have more beef cows than do many of traditional Western Range states. More recently beef cow numbers have expanded in the traditional dairy states, Minnesota and Wisconsin.

A large part of the total inventory of cattle and calves is made up of beef-type calves. In 1945, they constituted 15 percent of the January 1 number and in 1964, about 23 percent. This increase reflects the small slaughter of calves and low production of veal. The low production of veal is the result of declining dairy cow numbers and the increasing demand for dairy steers and dairy-beef type crossbreeds for feeding purposes. The large supply of beef-type calves provides more feeder stock for the feed lots. The increased percentage of heifers and steers one-year old and over, most of which are yearlings, reflects the higher level of cattle feeding.

Productivity of Cattle and Feed Resources Rising

Cattle productivity has been increasing due to higher calving rates and lower mortality rates. Death losses have been lowered by better disease and predator control and through improved nutrition. The liveweight production of cattle and calves per head of all cattle on hand January 1[3] was 312 pounds for 1963. It was 287 pounds at the peak of the previous cycle, 228 pounds in 1945, and 196 pounds in 1934.

Similarly, marked strides have been made in the output of beef and veal per head slaughtered. In 1950, average carcass weight was around 370 pounds. By 1963, it had increased to about 490 pounds. This increase is due mainly to a larger proportion of the kill being slaughtered as mature cattle. To a lesser extent it is due to cattle being fed to heavier weights.

Pasture and range feed conditions in the country have been mostly favorable since the drought year of 1956, although the Northern Plains experienced short grass supplies in 1961, as did the Southern Plains in 1963 and 1964. Some liquidation of beef cattle occurred in both instances, but basic breeding herds were maintained. Grazing resources have been increased through reseeding with improved varieties of grasses. Tonnage output as well as nutritive value of pasture and range forage has been increased. Better pasture and range management practices as well as increased use of commercial fertilizer for pastures and hay crops have contributed to the upward

[3] Live weight produced divided by number on hand at beginning of year.

trend in productivity. Production of hay and forage is about a fourth larger than it was in 1947–49 although less acreage is now devoted to these crops.

No exact measurement of potential cattle carrying-capacity for grass and hay resources can be made. During recent years it appears that productivity of grasslands has kept pace with cattle productivity per head which has been measured at about three percent per year.[4]

During the current cattle cycle, per capita consumption of beef has been at record levels but per capita consumption of veal has declined. The low level of cow slaughter in this country since 1958 has held down the supply of cow beef. In addition, smaller production of lower grade beef from grass-fed steers and heifers has resulted from increased feeding. Prices for grass-fed beef have attracted beef and veal imports which reached a record high volume in 1962 and 1963, representing about 10 percent of domestic beef and veal production during 1963. The equivalent of 1.7 billion pounds of carcass beef was imported in 1963. This is equal to about three million cattle. Assuming that this was mostly cow beef and added to Federally inspected cow slaughter, the 1963 equivalent number of cows would be about 7.3 million head—far above any previous record of cow slaughter in this country.

There has been a strong demand for feeder cattle from Mexico and Canada during the current cycle. Imports of live cattle reached a record high in 1962 and were the fourth largest in 1963. Live cattle imports in 1962 represented about 8 percent of the total cattle placed on feed that year.

Cow slaughter showed an increase in 1964. However, the decreasing percentage of dairy cows in the national cow herd will limit the increase in cow slaughter. Culling rates for dairy cows have been greater than for beef cows, so fewer cows will be marketed per 100 cows in the inventory than in previous cycles.

The average liveweight of cattle slaughter in the current build-up has exceeded 1,000 pounds each year. This is a further reflection of the larger percentage of the slaughter coming from feed lots. In 1963, the weight of cattle slaughter under Federal inspection averaged 1,046 pounds, the highest on record. In 1964, the weight per head was even higher.

[4] Donald Seaborg, *Cattle Productivity. The Livestock and Meat Situation,* July 1961, Economic Research Service, U.S. Department of Agriculture.

The Nature of Price Formation

To understand the formation of beef prices, we must look at the demand side and the various factors which affect the quantities of beef which consumers will take from the market at various prices. But first, let us consider the way demand and supply interact.

When we speak of prices we have to specify the time period. Most beef producers look at the average beef price for the year to gauge whether general trends are favorable or unfavorable. The average price for any time period is determined by the interaction of the supply and demand for the same period. Feeders are also interested in seasonal prices, which are the result of seasonal variation in the supply of finished or feeder beef moving to market. Day-to-day prices are also affected by fluctuations in the number sent to market.

About 85 percent of the variation in beef production from year to year can be explained by the numbers of cattle and calves on hand on January 1. The rest of the variation occurs because of variations in the percent of calf crop, range and pasture conditions, and changes in supplies or prices of feed grains and other similar factors. Ninety-eight percent of the variation of consumption from year to year is explained by variations in production. Hence, 85 percent of the variation in consumption can be explained by the livestock numbers on hand at the beginning of the year. This means that we can gauge pretty well the amount of beef that will be consumed. Consumers

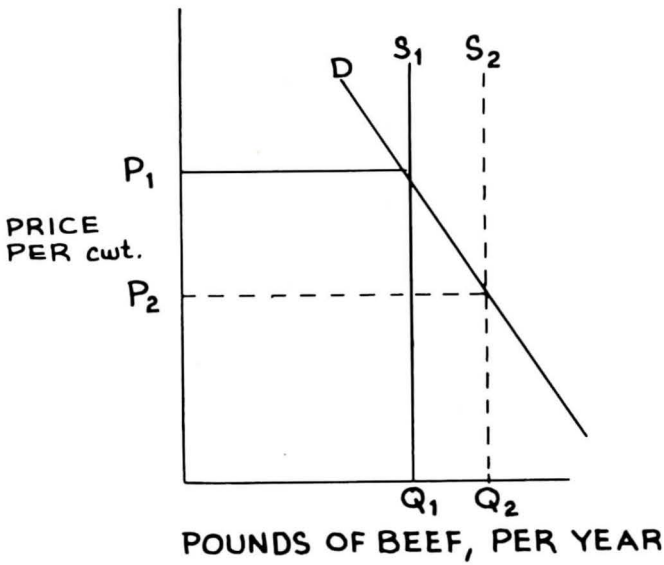

Figure 4. Supply, demand, prices, and quantities of beef consumed per year (hypothetical).

will consume the beef offered and the price of beef depends on whether the supply is high or low (Figure 4).

The curve D is a demand curve, showing the pounds of beef which consumers will buy per year at various prices. The line S_1 is a relatively small supply of beef available while S_2 is a relatively larger supply of beef for the year. P_1 is the higher price which results with smaller supply; P_2 is the much lower price which results with a larger supply for the year. This demand is inelastic, because a given change in the quantity of beef available gives a relatively larger percentage change of price in the opposite direction. The index of elasticity of demand for beef at the farm level is about −.8. Any index of less than 1.0 is inelastic. This means that a one percent change in supply gives a 1.2% or 1.3% change in price (1 percent divided by .8 equals 1.25). The chart shows the economic effect of the beef cycle. As cattle numbers and marketings increase, prices will drop with no change in demand. As numbers and marketings decrease, prices will rise if demand is unchanged.

It is true, of course, that unusual and unpredictable demand or supply changes can take place *within* a particular year. For example, beef prices rose sharply in 1950 and 1951 due to the Korean War; this represented a new demand factor. On the supply side, nearly everyone greatly underestimated the build-up of cattle numbers in 1951, and was surprised when the bottom fell out of beef prices in mid-1952.

Even though the consumption may remain stable, demand may change from one year to the next (Figure 5).

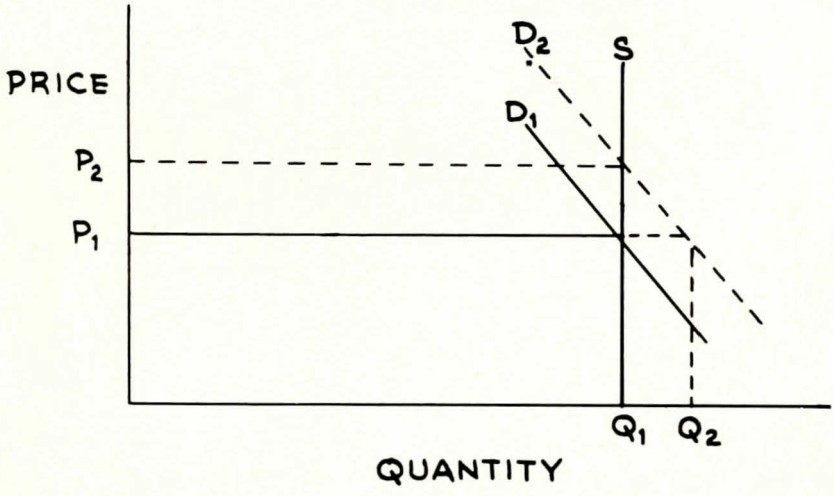

Figure 5. Effect of a change in demand on prices and quantities of beef consumed per year (hypothetical).

Here D_2 represents a movement of the whole demand schedule to the right. This means that something has happened to cause consumers to pay a higher price (P_2) than before, *for the same quantity of beef* (Q_1), or to take more beef (Q_2) at the same price (P_1).

Factors which cause such demand shifts include (1) change in population; (2) change in real income of consumers; (3) prices of competing products; (4) advertising and (5) market technologies. Let us discuss these factors in more detail.

Population Increase

An increase in population is an obvious demand growth factor for the beef industry. Population has been increasing at about 1.7 percent per year, compounded (in contrast the supplies of beef increased 9 percent from 1962 to 1963). Thus, population growth has been a major reason why we have been able to consume the ever increasing production of beef, all the way from about 7 billion pounds in 1940 to 17½ billion pounds in 1963.

Change in Consumer Income

The evidence suggests that a 10 percent increase in consumer income increases the quantity of beef consumed per person about 2 percent, and the price paid about 1.5 percent. In other words, each person would spend about 3 percent more for beef, partly as a result of eating more pounds, and partly because of a higher price. An increase in income also affects the type of meat eaten. Steaks are consumed in greatly increased quantity, ground meat is relatively unaffected and less stew meat is consumed as income increases.

Prices of Competing Products

When the supplies of competing foods, particularly other meats, are changed, prices of these foods are affected and consumers will shift their demand for beef accordingly. Changes in the supply of a competing meat such as pork probably have one fourth to one third as much effect on beef prices as a comparable change in the supply of beef. During the past few years the consumption of poultry meat per capita has increased as its price has declined. Per capita consumption of pork and veal has declined about as much as consumption of poultry has increased. Hence, the per capita consumption of meat other than beef has remained at the same level.

Beef imports have had an effect on beef prices; however, these effects need to be kept in perspective. Imports have contributed to, but are not the major factor behind, beef price declines of the past 18 months.

The cow beef market is a separate market from that for fed beef in this country. The competition between choice beef and cow beef is quite similar to that between choice beef and pork, or choice beef and broilers. USDA research indicates that a ten percent aggregate change in the supply of cow beef plus imported beef and veal, changes the price of choice beef by about 3 percent (in the opposite direction). This effect is about one third as great as would result from a comparable change in the supply of choice beef. Of course, the price of cow beef is also affected directly by imports; the same research indicates that a ten percent change in the supply of cow beef plus imports of beef and veal induced a 7.4 percent change (opposite direction) in the price of utility cows. The demand for cow beef is more elastic than the demand for choice beef. In other words, the effect of a change in the supply of cow beef is less, percentage-wise, than the effect of a change in the supply of choice beef on its price.

Advertising

The effects of advertising on beef consumption are hard to measure. Advertising probably does not affect the total consumption of meat. However, advertising probably does affect the consumption of one meat compared to another, such as pork versus beef. There is reason to think that beef may be more responsive to advertising than other meats.

Market Technologies

Several kinds of technologies have contributed to the increase in the demand for beef. They include refrigeration, self-service facilities in supermarkets, grading, and packaging.

In general, the total demand for beef has been increasing about four percent per year. This rate of growth is likely to continue. Most of this growth has occurred because of population growth and increase in consumer income.

In short, current price difficulties in the beef industry have not arisen from the demand side. The demand factors have been quite stable. The recent price slump originated from the cyclic increases in supply.

The Future of the Present Cycle

What happens during the months ahead as far as the beef cycle is concerned depends on decisions still to be made by millions of producers. The cycle is at a critical stage now. Is it at a peak and about to level off and turn down, or will it go yet higher?

Let us review the cycle variables and examine data which indicate its present stage of development.

1. The economic climate in which a new cycle generates.

Inventories were liquidated too heavily in relation to demand in the latter phase of the past cycle.

Slaughter prices moved up vigorously late in 1957 and prices of feeder cattle followed early in 1958. Food was plentiful and cheap, and general economic conditions improved after the business slump in 1957. A spirit of optimism prevailed in the cattle industry.

2. During periods of high beef prices and low numbers, producers hold more heifers for breeding and cull less rigorously.

Prices for slaughter beef rose sharply in 1958; cattle numbers responded, marking the beginning of the present cycle. The numbers of heifers rose sharply in 1959 and 1960, while the production of cow and heifer beef dropped by almost 30 percent between 1957 and 1959, remaining at a low level since that time.

3. The price of cows is affected during the early phase of the buildup as cows are held back for breeding.

The price of cows rose sharply in 1958 and has remained high in relation to the price of fed beef since that time. However, cow beef prices fell again in late 1963. A decline in cow beef prices usually occurs early in the build-up phase of the cycle. It has been slow in coming this time.

4. The supply of slaughter beef is reduced, and the prices for beef are pushed higher.

The production of beef dropped 7 percent between 1957 and 1958, and remained low in 1959. The prices of slaughter cattle rose in 1958 and again in 1959. The number of cattle and calves slaughtered has remained quite stable since 1960, as increases in cattle slaughter have been offset by decreases in calf slaughter. The proportion of calves in the total of calves and cattle slaughtered dropped from 25.4 percent in 1959 to 20 percent in 1963.

5. Inventory numbers of cattle begin to build up.

Total cattle numbers began to build up in 1958, increased rapidly in 1959, and have then increased quite steadily at an average rate of about 2.6 percent per year for the six year period. They rose 3 percent in 1963, while beef cattle increased by 5 percent and beef cow numbers rose 6 percent in 1963.

6. The upswing brings changes in the composition of the cattle inventory. The percentage of calves increases, while the proportion of cows decreases.

The percentage of calves, already high in 1959 at 26.7 percent, increased to 27.6 percent by 1964. The proportion of cows decreased from 48.5 percent in 1959 to 46.8 percent in 1964.

So far the data are characteristic of the increasing phase of the cycle. What are the symptoms of a downswing in the cattle numbers cycle?

1. Obviously, less favorable economic relations in the cattle industry are the factor which turns the beef cycle down.

The price break for slaughter steers in early 1963 was the first signal. The reaction in the feeder market was slower in coming, but prices slowly moved downward in 1963, and continued to do so in 1964. With the much less favorable beef-feed ratio, feeder prices will likely continue under pressure.

2. The percentage of calves in the cattle inventory declines.

The last cycle did not slow this tendency, however,—a fact which helps explain why the last downswing ended so soon.

3. Later in the cycle the proportion of cow inventory increases.

Cows are the last to be liquidated, as producers cut back on their herds. There is no such tendency yet in this cycle. While cow slaughter has increased recently, it is not quite at a level indicating liquidation.

4. The proportion of beef steers in the total slaughter increases as the cycle reaches a peak.

This has been happening. After the peak it declines, while the percentage of calves increases, followed by cows and heifers. Herds are culled more vigorously, and fewer young stock are saved for breeding. There is no reflection of the latter developments in slaughter numbers as yet.

5. Average slaughter weights decline as the cycle peaks.

So far there is little evidence that this is happening. In fact, average slaughter weight reached a new high in 1963 and was only down slightly for 1964. This increase has been a significant factor contributing to the increase of total beef supplies.

Some Observations on the Near Future

The general conclusion is that the buildup in cattle numbers will continue for a few more years, barring drought or other unforeseen major circumstances.

The 1964 calf crop is a record high. Some further increase or at least a high level of cow numbers seems probable for the next few years, so future calf crops will be large.

The increase in slaughter for 1964 is substantial, but it is not at a rate that will cause a decrease in cattle inventories. Nor has cow slaughter been at rates that will check the expansion of the breeding herd. Imports of live cattle will be down from the level of the last few years.

Total slaughter for 1964 reached 39 million head. This would still allow January 1, 1965 cattle numbers to increase slightly. In 1965, slaughter at about 40 million head will still permit a small gain in cattle numbers.

Beef and veal production was close to 19.0 billion pounds in 1964, and will possibly be 19.5 billion in 1965, which would place per capita

consumption of beef and veal at near 105 pounds, about as large as the record indicated for 1964. Future beef and veal production will stay close to 20 million pounds and would exceed that figure if numbers turn downward in 1967. The large beef production in 1964 and 1965 will be offset to some extent by moderate supplies of pork. Poultry meat production is expected to keep moving upward and periodically outrun the gain in civilian population.

The stage was set in 1963 for a couple of years of expansion in cattle numbers. Should this take place, it seems likely that numbers would reach a peak in 1966 somewhat near 107 million head. Numbers might well remain at a plateau for a few years and then resume an upward trend, barring drought and poor feed conditions.

Heavy slaughter in 1964 kept pressure on prices but it will also limit expansion in 1965, which should give the civilian population a chance to catch up with beef production. Packers increased purchases of two-way cattle as the increase in steer and heifer slaughter is greater than the increase in fed cattle marketings. Some strength in fed beef prices could change demand, and feeders would be again active in bidding for feeder cattle. Strong factors in strengthening the price of feeder cattle will be the continuous year-round demand from large specialized feeding operations. Also, the cattle producer is in a strong financial position because individual holdings are large, by past comparisons, and big investments in capital equipment offer lending institutions attractive security.