Effects of Price Fluctuations in Livestock and Meat Products on Vegetable Protein Markets

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ABSTRACT

The price of meat products will influence sales of vegetable protein in markets where both products compete directly. Fluctuations in livestock product prices have an impact on market growth of vegetable proteins, especially in the short term and for products in the retail consumer market. Initially the market for a vegetable protein product in retail markets may be cyclic, growing only when the price of competing animal protein is high and increasing. The success of a new vegetable protein product may depend to a great extent on the timing of its introduction. High animal protein prices could help the new product achieve enough market penetration or share to become established. Taste and other factors in addition to price would determine its ultimate acceptance. The long term market for vegetable proteins will be affected more by the relative differences between the price fluctuations. Changes in consumer taste, concern over health and food safety, and the ultimate "statue" of vegetable proteins will all help shape the long term growth.

The world market for vegetable protein has increased over the past few years with the United States market for soy protein reaching about 650 million pounds (50% protein equivalent) in 1977. Although soy proteins are not currently major competitors for meat, their use in processed meat is probably the greatest potential existing market. Yet there has been very little research on how prices of animal products affect vegetable protein sales. The primary objective of this paper is to analyze the relationship between the price levels and fluctuations for selected animal products and the changes in production and sales of vegetable protein. The price and quantity relationships analyzed are for soy proteins because they are the major vegetable proteins in the marketplace. The general relationships and conclusions, however, should apply for vegetable proteins as a group.

MARKETS AND PRODUCTS

Markets for soy proteins may be classified in different ways. The classification presented here provides the framework for discussing factors affecting market growth, but the market classifications are not entirely mutually exclusive.

Retail Consumer Markets

This category includes the mass market for products available to consumers through retail foodstores. The products may be: (a) textured soy which the consumer will mix with meat; (b) premixed or blended products such as the soy-beef blends; (c) fabricated products, such as frozen pizza, that have soy proteins mixed with or substituting for meat; (d) complete analogs, such as breakfast links or sausages, made from vegetable proteins and substituting completely for the meat products.

Growth of vegetable proteins in the retail consumer market depends on the price of the vegetable protein products, the price of competing products, income, population and "tastes and preferences." "Tastes and preferences" involve more than physical taste and texture, although these are important. The perceived social status of the product, such as what consumers think of beef steak vs. a vegetable protein choplet, the expected impact on nutrition and food safety, and past experiences with similar products, all affect preference. In some countries with high consumption of animal products, the concern over the level of cholesterol and animal fats in the diet could result in a shift to more vegetable proteins.

In the short run, changes in the relative prices of vegetable protein and competing animal products should influence the markets for vegetable protein products currently competing with meat. In the longer run, changes in other factors along with changes in prices and income will influence market growth for vegetable protein.

Food Service Markets

Establishments in the food service industry may be classified as public and institutional. In the United States, consumers spent about 30% of their food budget in the food service market (1).

Business in the public sector exists to sell a product or service and includes restaurants (separate eating places) and subordinate facilities, such as drug stores, soda fountains, or bowling alley snack bars. One of the fastest growing segments has been the "fast food" establishments. Sales of the franchise industry reached ca. $17 billion in 1977. Vegetable proteins are used to a limited extent in beef patties in some fast food outlets, and a continued growth of fast food service could increase this market.

Establishments in the institutional sector such as universities, sanitariums and prisons render a service with little or no profit. Other operations in government buildings and industrial plants may make a profit but are under contract as service operations. All these institutions conduct mass feeding operations. With fixed operating budgets and pressured by rising food and operating costs, these institutions have made the most extensive use of vegetable proteins as complete or partial replacements for meat.

Vegetable proteins generally cost less than meat, and there is less fluctuation in the price compared to meat. This allows better planning and control of costs in the institutional market. Even small per unit savings are important when large volumes are handled.

All types of vegetable protein products are used in the institutional markets, including proteins to blend with meats and analogs such as simulated chicken or tuna chunks for salads. The institutional market probably responds less to short run fluctuations in animal product prices than does the retail consumer market. Long run trends in the price differences between vegetable and animal protein do influence growth in the institutional market for vegetable proteins.

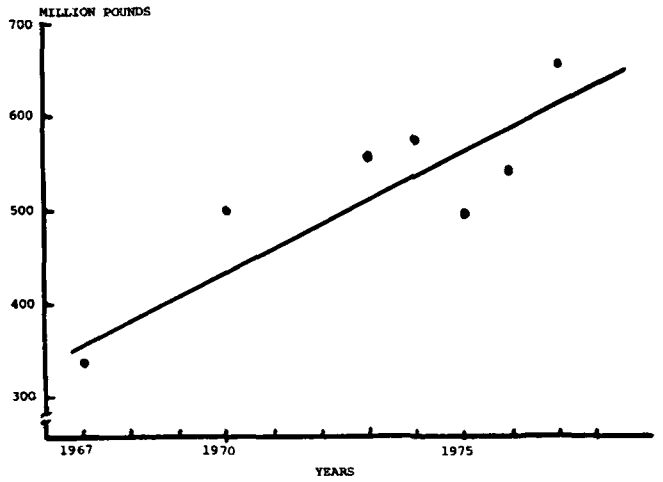

FIG. 1. Estimated production of edible soy protein in the United Sates, selected years.

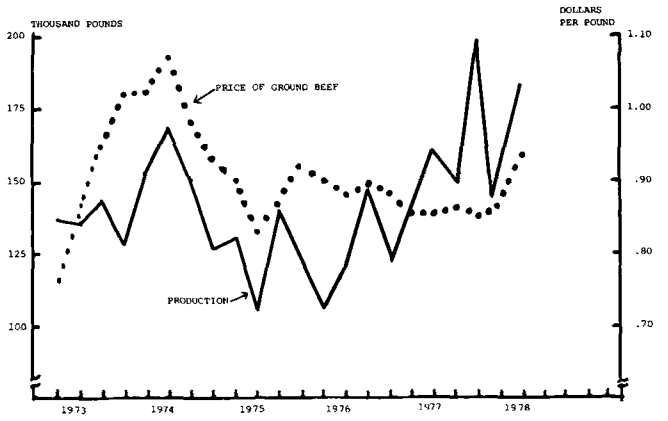

FIG. 2. Production of edible soy and the retail price of ground beef, by quarters, United States, selected years.

Ingredient Market

This is an intermediate market composed of food processors that buy vegetable proteins as ingredients for manufactured food products. They supply products both to the mass consumer and institutional markets. Many baked and canned products contain vegetable proteins but are not recognized as such by consumers. This market segment would be expected to grow regardless of how consumers received the more readily identifiable vegetable protein products.

TRENDS IN MARKET GROWTH FOR EDIBLE SOY PROTEIN

No historical data series show long term trends in the production or consumption of edible soy protein. Figure 1 is based on estimates from several sources, and it includes total production for all markets including exports (2-4). A freehand line drawn through these estimates indicates a generally steady growth in total production and use of edible soy protein. Although these are aggregated estimates, the drop from 1974 to 1975 coincides with a decrease in beef prices which suggests beef price fluctuations did cause a deviation from the growth trend. However, the relative differential between the price of animal and vegetable protein over long periods should affect growth of vegetable protein markets more than short run fluctuations. The long run differences add stability to markets, encourage research and development, and attract capital for the necessary expansion in production and marketing systems.

A U.S. Department of Agriculture survey of soy protein producers in 1977 indicated that production of soy protein could increase 71% by 1985 (5). For this growth to occur, products would have to improve and consumer attitudes toward these products would have to change. The potential for growth is much greater in countries where animal protein is in short supply and expensive. Changes in the perception of vegetable protein as it relates to health and social status will aid in continuing long term market growth in the United States.

EFFECT OF SHORT TERM FLUCTUATIONS IN THE PRICE OF GROUND BEEF ON THE MARKET FOR EDIBLE SOY PROTEIN

Data showing the quantities of soy protein substituting for and used in conjunction with meat products are very limited. This makes it difficult to analyze the relationship between changes in the price of livestock products and growth of the soy protein market. Two sets of data are considered here. The first shows the relationship between the retail price of ground beef and changes in the production of edible soy protein. The second is a case study of the sale of soy-beef blends in grocery stores.

Figure 2 shows the relationship between the production of edible soy protein and the retail price of ground beef. Ground beef prices are used, in this instance, to represent the prices of all animal products (6). Production includes edible soy for all purposes, not just the quantities combined or substituted for beef. Therefore, factors in addition to the price of beef influence the quantities producted. These data, covering slightly more than five years, are not sufficient to establish any long term trends. They do, however, show the rapid increase in ground beef prices and the corresponding increase in edible soy protein production in 1973, and the subsequent decrease in the price of ground beef through 1974 and the reduction in soy protein output. The high production in the first quarter of 1974 probably represents an over-reaction in production, based on expectations that prices for ground beef would remain high and the market for soy protein would expand. The rapid drop in ground beef prices found industry with rapidly increasing inventories and resulted in the low first quarter production in 1975. After 1975, ground beef prices remained relatively low but the production of soy protein recovered and again moved upward. This probably reflects the normal growth in the total market after the reaction to the fluctuation in meat prices. Segments of the market not directly linked to domestic meat prices, such as exports, the baking industry, or snack foods, accounted for a large part of this growth after 1975.

In early 1973, a soy-beef blend was introduced in the United States for sale through grocery stores. The soy-beef blend consisted of 75% ground beef and 25% hydrated soy protein. The product was packaged and handled the same as regular ground beef. A study of product sales covering 46 weeks in three supermarket chains gives an insight into the relationship between the price of ground beef and the sales of the soy-beef blends (7).

Market shares for hamburger (ground beef with up to 30% fat), lean ground beef (generally 20 to 25% fat), and the soy-beef blends are shown in Fig. 3. Although market shares for the soy-beef blends generally declined through the period studied, the market shares for the soy-beef blends were still more than 20% in the 46th week. However, the price of ground beef in March of 1974 was higher than in May of 1973. By November of 1975, the soy-beef blends share was about 10% of the ground beef market for the three supermarket chains.

A regression analysis indicated no significant statistical relationship existed between the price of lean ground beef and the quantiy of soy-beef blends sold. A significant relationship was found between the price of hamburger and the quan-

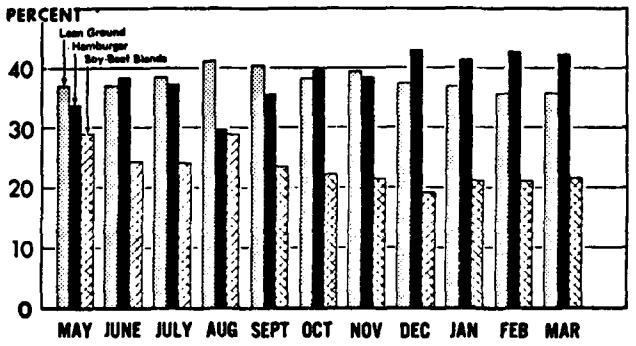

FIG. 3. Market shares for hamburgers, lean ground beef, and soy-ground beef blends, May 1973 to March 1974, in three grocery chains.

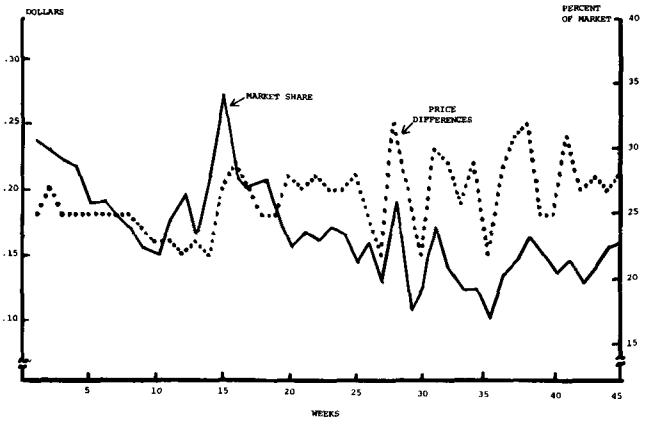

FIG. 4. Price differences between hamburger and soy-beef blends and market share of soy-beef blends, three grocery chains, May 1973 to March 1974.

tity of soy-beef blends sold, probably because the blends were considered a good substitute for hamburger in meat loaf, meat balls, and such prepared dishes, but they were not well accepted as a substitute for lean ground beef in patties. The United States Department of Agriculture conducted taste tests on three of the blends compared with hamburger. When the identity of products was unknown to test panel participants, no difference in preference resulted. When the identity of the products was known prior to the test, the hamburger was preferred to the soy-beef blend. The calculated cross elasticity between the price of hamburger and the quantity soy-beef blend ranged between 1.1 and 1.6, indicating that a 10% increase in the price of hamburger would result in an 11 to 16% increase in the quantity of blend sold. The direct price elasticity for the blend ranged between -1.6 and -1.8, indicating a 10% decrease in the price of the blend would result in a 16 to 18% increase in the quantity of the blend sold.

Figure 4 shows the relationship between changes in the difference between the price of the blend and hamburger, (with hamburger always the highest), and the quantity of soy-beef blend sold. Price differences are shown instead of hamburger prices, because there appeared to be a higher correlation between weekly sales and price differences than between actual price changes for hamburger and quantity changes for the blend. Apparently consumers placed more emphasis on the price difference between the competing products than on the absolute level.

Hamburger averaged 19 cents per pound more than the soy-beef blends for the 46 weeks with the lowest difference between prices of 15 cents and the highest of 25 cents. From week one through week 19, the market share was correlated with the price difference. If the price of hamburger increased relative to the price of the blend, blend sales increased. From week 20 through 45, the differences fluctuated widely. The market share of the blends still responded to the high price differences but not to the same degree as in the earlier periods. Week-to-week changes in soy-beef blend market shares generally coincided with changes in the price difference. One conclusion of the study was that sales of the soy-beef blends in the consumer market were very responsive both to their own prices and the prices of close substitutes such as hamburger.

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