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SOME POLICY IMPLICATIONS RELATIVE TO DEVELOPMENT OF THE UNITED STATES ARTIFICIAL BREEDING INDUSTRY

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Abstract: Major development of the commercial artificial breeding industry in the United States has occurred since its birth in 1939. In 1981, the industry provided semen to breed approximately 70 percent of the national dairy herd and 10 of the national beef herd. A primary concern within the industry is the impact of continued reduction in firm numbers and growth of individual firm size and scale on competitive forces within the total domestic and foreign artificial breeding market. The interactions of adjustments among the farm input supply sector, the farm production sector, and the general economy are expected to continue in the future as U.S. dairy farms become larger but fewer in number and more beef cow farms adopt artificial breeding. Use of artificial insemination for other livestock is expected to continue to increase. Additional realignment and restructuring of the industry can be expected, as the farmer cooperative firms and the privately owned firms continue to merge and consolidate operations to gain efficiency in production and advantages of serving larger markets.

Key Words: policy implications, firm size and efficiency, industry concentration, artificial animal breeding, purchased farm inputs, firm vs. industry growth.

SOME POLICY IMPLICATIONS RELATIVE TO DEVELOPMENT OF THE UNITED STATES ARTIFICIAL BREEDING INDUSTRY

John W. Wysong and Pradeep Ganguly*

INTRODUCTION

The artificial livestock breeding industry has experienced a dramatic industry-wide growth in the United States since its commercial beginnings in 1939. By 1982, over 70 percent of all grade and registered dairy cows were bred artifically. The industry, however, has undergone significant organizational and operational consolidation during the post-World War II period. The United States commercial artificial insemination (AI) industry was oriented primarily toward the breeding of dairy cattle until the 1960's. In recent years, the industry has attempted to expand into beef cattle breeding and some progress has been made. The greater potential for future expansion lies in this direction, because beef cows accounted for 39.4 million of the combined 50.4 million head of milk and beef cows on U.S. farms as of January 1, 1982. A limited amount of artificial breeding on a commercial scale has been developed for swine, sheep and pleasure horses and ponies. These new market areas are expected to increase gradually in the future as economic and technological conditions change and improve to make AI both easier and more profitable for commercial hog producers as well as sheep and equestrian breeders.

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The objectives of this paper are to: 1) examine some of the underlying technological and economic factors affecting past and anticipated numbers and sizes of AI firms, and 2) examine the public policy implicatons of industry growth and the firm level consolidation processes through time.

METHODOLOGY AND SOURCES OF DATA

This study utilized secondary data from such sources as: U.S. Agricultural Statistics, different reports of the Agricultural Research Service, United States Department of Agriculture, and reports from various relevant periodicals. Data on changes over time in numbers of cattle breeding organizations and in various statistical measures of firm size, such as bulls per firm and number of cows bred per firm, were used in the historical portion of this analysis. In addition, articles in various breed publications, and by industry representatives, provided insights into new directions of market expansion, structural change, and interaction with other management programs such as the international, national, regional, state and local dairy and beef herd improvement programs.

TREND TOWARD CONCENTRATION OF THE U.S. A.I. INDUSTRY

The U.S. artificial breeding industry was initially directed toward serving the domestic demand for breeding dairy cattle. In recent years, however, some of the larger AI organizations have developed extensive foreign sales operations to expand the total market for their high-quality semen

production. Some of the larger firms have become major factors in the world market for frozen animal semen that now exists (Heady and Short, p.840).

Types of Organization

The artificial breeding industry consists of two general types of corporate organizations. The first type to be organized was the farmer-owner cooperatives which are still the most numerous. The second type of organization is the private independently owned and operated corporations. Some of these corporations such as American Breeders Service, and Carnation Breeders, have become the largest in size over the years because of aggressive nationwide and worldwide semen market development in the dairy and beef cattle industries. During the latter part of the 1960's, the two largest firms were purchased by conglomerate corporations. They have since operated as independent AI subsidiaries within divisions of these larger, more diversified corporations until the Curtiss Breeders dispersal in 1981. A conglomerate business firm specializes in allocating scarce capital and manpower to expanding market areas of the national and international economy (Sarris and Schmitz, p.832). In so doing, they potentially could lose direct identification for promoting 1) a particular industry, such as artificial animal breeding, and 2) the long-term cattle and animal improvement process on U.S. farms and for production agriculture worldwide.

FACTORS INFLUENCING LONG-RUN ENTRY AND EXIT OF FIRMS

The first and most rapid period of industry growth in the United States was from 1939 to 1950. This rapid expansion in cows bred resulted

from the entry of many new firms into the industry to provide complete geographical coverage of the potential United States market. These firms were predominately farmer-owned and operated cooperatives located throughout the country. This first phase of growth was characterized by more insemination services per firm and per bull as well as more firms, more total bulls and more bulls per breeding stud.

A second and slower phase of industry growth in terms of total cows bred occurred from 1950 to 1960. The exit and merger of existing firms more than offset new firms entering the industry. More breeding services per firm, more cow services per bull and more bulls per stud curtailed the need for net new firms to enter the industry to provide semen for the larger number of cows being bred each year.

A third and more gradual period of industry growth and consolidation occurred after 1960. The large numerical decline in the number of AI breeding firms has already occurred. Fewer absolute numbers of firms will exit from the industry during the coming decade than have done so in the past. The trend toward more bull services and semen sales per firm and more bulls per firm will continue.

The long-term growth in total numbers of combined dairy and beef breeding cattle has not been the primary determinant in AI industry expansion. In 1940, 35 million cows were the major market for artificial breeding services. By 1955, 49 million cows were on United States farms but most of the increase was accounted for by beef brood cows on which herd managers generally did not utilize the newer artificial techniques (Wysong, p.3). On January 1, 1982, there were over 50 million cows that had calved

which constituted the potential market for semen and artificial breeding services. The increase in beef brood cow numbers since 1955 has offset the decline in national dairy cow numbers. This shows the major expansion potentials that exist in beef cattle breeding compared with the long-term contraction in dairy cow numbers to 11 million head in 1982 compared with 25 million in 1945, and the saturation of the dairy cattle breeding market with AI semen.

Trends in Cow Numbers and Size of Herd

The major reduction of total dairy cow numbers in the United States since 1945 has been accompanied by an increase in the average number of cows and heifers per farm and a shift toward larger dairy farm acreages. The total number of farms with dairy cows has declined more sharply than cow numbers during the post-war years. Continued declines in numbers of dairy cow milking and feeding unit sites are expected in the future at least until 1990.

In 1968, the number of beef bull services to beef cows surpassed the number of dairy cows bred to beef bulls for the first time in the history of United States artificial breeding. Expansion of artificial breeding of beef cows in commercial herds has occurred slowly and is expected in the future. Adoption of artificial breeding among the nation's beef cow herd owners and managers has been low to date. However, both artificial breeding and performance testing are expected to increase substantially in the future as commercial beef production becomes more competitive and business-oriented to adjust to higher labor, forage and feed-grain costs.

Improved Utilization of Breeding Bull Capital Investments

Bull capital utiliation rates have improved over time. The average number of cow services per bull in artificial breeding studs increased from 228 per bull in 1939 to 3,630 cows per bull in 1971. Total sires in service expanded from 33 bulls in 1939 to 2,661 bulls in 1954, before decreasing to 2,316 bulls in 1965. In 1982, approximately 1,000 dairy sires are in active service plus other young bulls being sampled.

The huge capital investments in breeding stock bulls and fixed capital facilities and equipment have been spread over ever-increasing numbers of cows bred or units of semen sold. Average cost per cow bred has been kept quite low by both farmer cooperatives and other artificial breeding firms. Cows bred and semen sold per bull in studs will gradually rise as the total number of firms decline, and techniques are developed to more fully utilize the small numbers of top-rated, elite dairy and beef bulls available for artificial breeding in the United States. It has not been necessary to expand the total numbers of sires in breeding service since the early 1950's because of increased efficiency with which bulls and their semen have been utilized by individual studs and the industry as a whole. Because semen collection is now diluted, with extenders and frozen, 30 or 40 thousand or more females can be bred per year per bull.

The potential for expanding average number of cows bred and semen units produced per sire annually, and over the individual sire's natural lifetime and beyond, was greatly increased with the introduction and adoption of frozen semen industry-wide. With existing levels of technology of

sperm dilution and semen preservation, bull semen can be distributed nearly anywhere in the world as well as stored for extended periods of time as frozen semen. This technology has been responsible for a substantial development of international trade and commerce in cattle semen, and, more recently, even frozen fertilized embryos for implantation into receptor females in widely dispersed locations and countries.

FUTURE FIRM CONSOLIDATION AND MARKET EXPANSION

Further consolidation of firm numbers is expected in the future as individual organizations attempt to exploit the potential international markets, and to exploit the technological and market advantages of large size of business. Based on average numbers of cow services and semen unit sales annually by the two largest commercially owned and controlled firms in the industry, a total of ten firms or less could easily provide a complete range of dairy and beef cattle bull and semen services to cattle owners throughout the United States as well as abroad. However, most of the semen and AI firms, or genetic companies as they are increasingly being called, are farmer-owned and operated cooperatives. These firms generally will continue toward servicing local, state or regional needs and at the same time expanding in contrast to the present national and international distribution of semen of the largest firms. Most of the farmer cooperatives have become a part of regionally or nationally coordinated retail distribution systems. Considerable transfer of bull semen from one cooperative to another and large purchases by individual cattle breeders already exists,

and this type of transfer is expected to increase in the future as more market coordination occurs.

A changing combination of technological and economic factors has contributed to the past expansion and growth of individual AI firms and the industry-wide expansion, maturity, and consolidation process (King, p.2). The growth in absolute numbers of cattle bred resulted from (1) an expansion of breeding firms and services geographically throughout the United States, and (2) an increased adoption of artificial breeding techniques by managers at the farm level. The major individual firm consolidation process occurred after reaching the 1954 level of 5.2 million cows bred with no apparent loss of competitiveness in terms of prices changed for semen, prices paid for young bulls sampled or general AI services rendered.

A decline of major proportions has occurred in numbers of dairy cattle on farms in the United States since 1945. This factor combined with the relatively low rate of adoption of artificial breeding on beef cattle farms has slowed the increase in the total realized market for artificial breeding services and semen. The maximum market for domestic cattle breeding services and semen under current conditions is established by the more than 50 million head of beef and dairy cattle on United States farms that had calved on January 1, 1982. Therefore, major inroads will have to be in numbers of beef cattle bred if the market expansion for artificial breeding of cattle is to resume its historical upward path from the record level of semen sales in 1981.

POLICY IMPLICATIONS OF INDUSTRY CONSOLIDATION

Continued consolidation of cattle AI breeding firms in the United States appears highly probably based on the expected cost reductions in bull semen production, processing and distribution for the existing farmer cooperatives and private firms. Also, the higher potential total net returns for the surviving private firms will encourage continued consolidation within the industry. A future public policy issue revolves around the following question: What is the optimum quantity of individual firms needed to assure competitive economic behavior and performance at the international, national, regional and local levels of the industry and adequate amounts of competitively priced semen to individual cattle breeders? Continued industry consolidation into as few as ten firms would not appear to be detrimental either cost-wise at the firm level or to the long-run improvement of dairy and beef cattle and other animal industries in the United States, or to the competitive pricing structure of cattle breeding services and semen units to individual purchasers. It is highly improbable that this extreme level of consolidation will occur as long as farm cooperatives continue to compete and cooperate effectively with each other and other firms, and new beef breeding organizations are formed such as has happened since 1970 (Hummer and Hallberg, p.87).

Publicly funded research, development and educational activities have enabled the private sector to make substantial progress in this AI industry. In the future, it is expected that AI firms will not only take over more of the management but also the costs of R&D. Therefore, increased private costs will help to generate increased social benefits from better animals and lower cost milk and meat production.

The remaining firm consolidation process could occur rather quickly in the future, but there are many potential impediments to the process. The existence of relatively large fixed investments in bull stud and young sire testing programs, fixed plant facilities and equipment, and stud site locations owned by existing farmer cooperatives and other small commercial firms has restricted the physical consolidation of individual studs in the short-run. The number of breeding organizations may continue to decrease at a faster pace in the short-run than the number of bull stud facility sites. Over time, bull semen production, processing and distribution activities in individual firms may become concentrated at one location and the young sire development and testing sites may be located elsewhere, perhaps on former sites of mature bull studs which are no longer needed or utilized for semen production.

The future competitive performance of this dynamic growth industry within the agricultural input sector will be influenced by the present size and potential growth of foreign artificial breeding organizations. In the past, there has been little or no foreign firm penetration of the domestic market for dairy cattle breeding services. In recent years, however, there has been considerable importation of bulls and semen from foreign beef breeds as well as export of bulls and semen from leading domestic breeds such as Holsteins, Angus and Herefords. Over time, the market for AI services and semen will continue to shift from small localized geographical areas to the present-day <u>worldwide</u> market in the continued search for the best animal improving genetic materials wherever they can be found.

REFERENCES

Agricultural Statistics - 1981, U.S.D.A., and various earlier years.

Dahl, Dale C. "Public Policy Changes Needed to Cope with Changing Structure," American Journal of Agricultural Economics, Vol. 57, No. 2, May 1975, pp. 210-211.

Heady, Earl O. and Short, Cameron. "Interrelationship Among Export Markets, Resource Conservation, and Agricultural Productivity", AJAE, December 1981, pp. 840-852.

Hummer, P.D., and Hallberg, M.D. Stimulation of Economic Impact of Mergers of Artificial Breeding Cooperatives. Pennsylvania State University Agr. Expt. Station, A.E. & R.S. 95, July 1971, pp. 87.

King, Richard A. "The Frontier Production Function: A Tool for Improved Decision-Making," J. N.E. Agr. Econ. Council, October 1980, pp. 1-10.

Sarris, Alexander H. and Schmitz, Andrew. "Toward a U.S. Agricultural Export Policy in the 1980's," AJAE, December 1981, pp. 832-839.

Wysong, John W. Growth and Development of the United States Artificial Breeding Industry, University of Maryland, Agr. Expt. Station, MP879, July 1975, p.3.