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The Changing Structure of U.S. Agriculture –
Implications for World Trade

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INTRODUCTION

Past changes in the structure of U.S. agriculture have had significant impacts on world trade. And, future changes will have their impacts as well. It is to this line of causality that this article is addressed. We would be remiss, however, not to recognize that both (1) the demand for agricultural products in world markets and (2) the institutional arrangements under which trade occurs, e.g., tariffs, export subsidies, food aid programs, regulations concerning quality and form of products, and the financing of trade (to mention only a few) also have their impacts on the structure of U.S. agriculture. Thus, in the relationships between structure and trade, causality is a two-way street.

We, in the U.S., when we think of agricultural trade, tend to think rather exclusively in terms of our major export commodities. There are, however, a number of agricultural commodities produced domestically, e.g., sugar and wool, for which U.S. producers supply only a modest share of total domestic market requirements. For these commodities, U.S. trade is an import phenomenon. There are still other commodities such as coffee, tea and bananas for which the domestic U.S. market requirements are provided for almost exclusively via imports. Within the terminology of agricultural trade these are commonly referred to as "complementary" commodities. And, finally, there are several livestock and livestock product groups for which most of the domestic market needs are currently supplied by U.S. producers but for which trade (both imports and/or exports but

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1/ This paper is only a slight modification of a forthcoming article by the same title in the May-June 1977 issue of World Development.

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primarily the former) might be modified significantly under certain structural conditions for the domestic production sector. Since our focus in this article is on the structure of U.S. agriculture and its implications for trade, our interest is primarily in those commodities for which U.S. farmers supply at least a substantial portion of the domestic market. This is to say that, though coffee, tea and bananas are important trade commodities, their trade is not much affected by changes in the structure of U.S. agriculture.

Table 1 indicates what the large volume U.S. agricultural export commodities have been in recent years. This list is not complete in that it omits some livestock products and a number of other minor export commodities including some with relatively high unit costs. Clearly, however, feed grains, wheat and flour, and soybeans and soybean products dominate the commodity set of U.S. agricultural exports. And, these are all commodities which are produced in large volume for domestic markets as well.

Among supplementary[3/] agricultural commodities imported to the U.S., only sugar and animal and animal products (including dairy), oilbearing vegetable products and other vegetable products are of any major economic significance. And, of these only sugar, animal products and vegetable oils are of significance in the context of the structure of the U.S. agricultural sector and its implications for trade.

STRUCTURE DEFINED

It appears useful to define briefly those dimensions of agriculture to which the term structure applies. The list presented here is not intended to be

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3/ Supplementary agricultural import products include all agricultural commodities produced commercially in the U.S. together with all other agricultural commodities interchangeable to any significant extent with such U.S. commodities.

an exhaustive one but rather one which highlights those dimensions of structure which could, under some circumstances, impact significantly on trade. These include the size, number and type of firms in both the production and marketing subsectors of the agricultural industry; the source of ownership, control and management of these firms; the source, type and volume of financing for their operations; the mix of capital inputs such as land, durable plant and equipment; the variable purchased inputs such as fertilizer which they utilize; their utilization of labor and management; the degree of technological sophistication with which they operate; and their legal form of organization.

Table 1

U.S. Agricultural Exports:
Volume of Selected Commodities, Fiscal Years 1974, 1975 and 1976

Commodity	1974 July-June	1975 July-June	1976 July-June	Average 1974-76
	- - - - - - - -million metric tons- - - - - -
Wheat and Flour	31.05	28.01	31.46	30.17
Feed Grains	43.74	34.33	46.37	41.48
Rice	1.58	2.23	1.54	1.78
Soybeans	14.05	11.01	15.41	13.49
Vegetable Oils	1.05	1.07	.82	.98
Oilcake and Meal	4.98	4.26	4.63	4.62
Cotton, including linters	1.33	.88	.75	.99
Tobacco	.31	.29	.27	.29
Fresh Fruit	1.10	1.30	1.33	1.24
Animal Fats	1.14	1.16	.89	1.06
TOTAL	100.31	84.53	103.48	96.11

*Decimal figures may not check due to rounding error.

Source: World Agricultural Situation, Economic Research Service, U.S. Department of Agriculture, October 1976.

Several of these dimensions of structure normally exhibit a high degree of multicolinearity. And, one should keep this in mind when attributing causality to specific structural characteristics. The form of legal organization, for example, may be determined in the main by other dimensions of structure such as size, source and type of financing, and degree of technological sophistication. And, legal organization may also be interrelated with commodity type since, for example, larger-than-family scale corporate firms in production agriculture are concentrated more in the production of those commodities which service the less volatile and more lucrative domestic markets than in those produced for export markets. This is not the case on the export marketing side, however, where the large financial, managerial and organizational inputs required for servicing export markets both effectively exclude the small marketing firm, on the one hand, and provide opportunities for profits for the larger, more sophisticated corporate firm, on the other hand.

Finally, by way of structure, as U.S. agriculture has developed in the last four or five decades, and particularly in the post-World War II period, it has become increasingly dependent on purchased inputs from off the farm. In the process, a large and many faceted farm input industry has become an important contributor to the agricultural production process. One could spend a good deal of time and effort describing this purchased farm input sector. But its changing structure has been well described elsewhere. And, with the exception of petrochemicals, purchased farm inputs do not appear to have great potential for affecting future agricultural trade. Even in the case of the petrochemical industry, it is not so much structural change in the industry as the potential for reduced supplies and higher costs which could be critical for future trade. Thus, I have chosen to give very minimal attention in this article to changes in the structure of the purchased farm inputs sector.

THE CHANGING STRUCTURE OF THE AGRICULTURAL SECTOR

Major changes have occurred in the U.S. agricultural sector since the 1930's when the six million or more farms used massive labor inputs and massive amounts of home-produced power (horses and mules) which were fueled largely by home-produced feed supplies. Most farm tasks had, however, been mechanized by the 1950's. And, tractors and other power sources had largely replaced horses and mules by that time. Thus, it is the changes which have occurred in more recent years, together with expected future changes which are probably most relevant to the topic at hand. And, my documentation of historical changes in the structure of U.S. agriculture in this article goes back only to 1960.

As U.S. agriculture has taken on more and more of the characteristics of a "value added" rather than those of an "extractive" or "natural resource based" industry, a larger and larger volume of productive inputs flow through the farm firm on a regular production-cycle basis. For some crops this cycle is an annual calendar-year one. But, the production period varies widely particularly for some livestock and poultry products. We are constrained by most available data to perform our assessment of the structure of agriculture in terms of an "annual" accounting schedule. At the same time we know that in some types of farming the intra-year turnover rate for inputs and products has become an important determinant of business volume and profit rates. For others the critical time period is a multi-year one. Finally, ownership and control of some durable inputs to the production process, particularly land, are still described mainly by the classifications of land tenure and legal organization which do not, in the main, provide effective measures of structure for analytical purposes.

Farm Numbers and Size

Table 2 shows recent changes in numbers and size of farms. These changes summarize to about a 30 percent decline in farm numbers and a 31 percent increase in farm size since 1960. This type of change will probably continue into the future but at a slightly diminished rate. These data tend to mask, however, the rapidity with which change has occurred in the commercial farming sector because of a relatively large number of small, noncommercial farms which changed very little during the post-1960 period. Along with an increase in size, commercial farms have become more specialized, more market oriented, and more price responsive. Most commercial farm operators as of 1976 were probably, for economic survival reasons, pretty well locked into production at or near the capacity level of their fixed factors, particularly land. But, many can and do shift between crops depending on the relative prices and profitability of alternative crops. And, they can and do vary the intensity with which they use variable inputs, such as fertilizer, depending on their profitability in use. Going back to structure, we need to be reminded that farm size, in terms of acres of land, provides us not with a measure of change in output but of change in an input, albeit an important one.

Table 2

U.S. Farms:
Number and Average Size 1960-76

Year	Farms (Thousands)	Average Size (Acres)
1960	3,963	297
1965	3,356	340
1970	2,954	373
1975	2,808	387
1976	2,786	389

Source: 1976 Handbook of Agricultural Charts, Agricultural Handbook No. 504, U.S. Department of Agriculture.

A commonly-used output measure of farm size is that of business volume. Table 3 shows the number of farms within various sizes and sales classes. This table illustrates that farm numbers with sales of $100,000 or more increased in number by about 380 percent from 1960 to 1975 while those with sales under $20,000 dropped by more than one-half. A portion of these changes in sales volume are clearly the result of increases in production per farm. A portion are also due, however, to the price effects associated with the higher commodity prices in 1975 as compared to earlier years.

Table 3

U.S. Farm Numbers by Size of Sales Class, 1960-75

Year	Number of Farms (in thousands) With Sales			
	$100,000 and over	$40,000-99,999	$20,000-39,999	Under $20,000
1960	23	90	227	3,623
1965	36	125	280	3,043
1970	55	178	343	2,378
1975	110	339	565	1,794

Source: 1976 Handbook of Agricultural Charts, Agricultural Handbook No. 504, U.S. Department of Agriculture.

One could cite a number of other changes in the size and number of farms but perhaps the most important implication is already embodied in Table 3. This implication is the one that a rapidly increasing proportion of production now comes from a subset of commercial farms which are large business firms and which have a rapidly increasing exposure to the prices and other conditions of the input and commodity marketplaces and which are dependent on external sources

for servicing their capital and credit needs. In addition, an ever smaller proportion of total farm production is used to serve the captive (on-the-same-farm) markets for feeding livestock and for feeding horses and mules kept as draft animals. An exception is the case of many small to medium size dairy farms which still produce most or all of their needed feed supplies. An increasing proportion of other livestock is located, however, on farms other than those producing most of the feed supplies which they utilize. Thus, the vagaries of the organized marketplace impact increasingly on the well being of most commercial farmers. And, as a result of these shifts in structure, farmers must of economic necessity increasingly respond to the price and profit signals of the marketplace. For an increasing number of major U.S. farm commodities, these prices are now determined in the world, rather than the regional or national marketplace.

Ownership and Control of Farmland

Table 4 shows the current ownership of farmland in the U.S. These numbers indicate that most of the farmland (about 87.5 percent) is owned by individuals, partnerships and estates. A relatively small percentage (about 7.1 percent) is owned by corporations of which a significant portion are family-scale corporations. Thus, about 60 percent of the land is owned by the individuals or firms which operate the land. This is a high percentage, historically, and suggests that land control and operation are not excessively separated. Excessive separation could be exemplified by excessively insecure tenure for operators and/or excessive investment by nonoperators for speculative, as contrasted to productive, purposes. Neither condition appears to be the case currently. In addition, most current purchases of farmland are by farmers who are expanding the size of their operating unit for economic reasons.

Table 4

Ownership of U.S. Farmland

	Acres (millions)	Percent of Total
Land Owned by Operator:		
Individuals	403	43.90
Partnerships	90	9.80
Corporations	49	5.34
Subtotal	542	59.04
Ownership of Land Rented Out by Owner:		
Farm Operators	40	4.36
Individuals, Estates and Partnerships	270	29.41
Corporations	16	1.74
State, Federal and Indian Lands	50	5.45
Subtotal	376	40.96
Total All Farmland	918	100.00

Source: The Food and Fiber System - How It Works, U.S. Department of Agriculture, Economic Research Service, Agriculture Information Bulletin 383, March 1975.

Though not identified in Table 4, a tenure category which has increased significantly in recent years is that of part-owners. Part-owners are farm operators who own some land but who rent in an additional acreage in order both to spread fixed machinery costs and to increase the income generated by their farming operation. The phenomenon of increased part-ownership is explained largely by the increased land prices faced by potential farm operators purchasers on the one hand, and by the desire of retired farmers and other investors to

share in future land value increases through retained ownership, on the other hand. Overall, recent changes in the structure of land ownership and control do not appear to have major implications for world trade. The increase in incidence of part-ownership probably does, however, increase the propensity for production of cash crops as compared to livestock and livestock products. Increased corporate ownership of farmland in the U.S. does not appear to be a major factor affecting trade since (1) its incidence is low in the aggregate and (2) such ownership appears to center principally on land for development purposes or for use mainly in the production of specialty crops to service profitably integrated domestic markets.

Changes in Value of Production Assets

Table 5 illustrates the rapid increases which have occurred in the value of farm production assets since 1960. Magnitudes are shown for total asset values, values per farm and values per farm worker. The major increases in the value of production assets result mainly from much higher values for farm real estate and from a much more expensive complement of machinery and equipment. The increase in value of production assets per worker results both from the large increase in aggregate asset values and from the interrelated decline in the total number of farm workers. The significance of this capital-labor shift will be elaborated further in a later section. Within the several categories of production assets, real estate increased its percentage share of the total from about 73 percent in 1960 to 78 percent in 1976. Livestock's share dropped from 9.7 percent in 1960 to 6.0 percent in 1976 while the share of machinery and motor vehicles held about steady over the same period. Shares of other miscellaneous categories of production assets declined slightly. Livestock assets are the most volatile category of production assets and undergo rather wide swings in value (both up and down)

from year to year. Thus their lower share of total asset value in 1976 may not be significant. In sum, though the value of production assets (the capital base of agriculture) increased dramatically from 1960 to 1976, there were no major inter-category shifts of importance. What we observed happening during this period were the threefold developments to (1) bid up the price of a scarce economic good, farmland, (2) substitute, on a mass scale, capital and new technology for labor in farming and (3) absorb, within agriculture as well as elsewhere, the inflationary pressures which were present in the general economy.

Table 5

Value of U.S. Farm Production Assets:
Total, Per Farm and Per Farm Worker 1960-75

Year	Total Value of Production Assets (billion dollars)	Value Per Farm (dollars)	Value Per Farm Worker (dollars)
1960	157.2	42,585	21,416
1965	188.4	59,885	30,832
1970	249.0	89,447	54,229
1975	430.0	163,885	97,601
1976	490.2	188,360	112,114
% 1976 is of 1960	311.8	442.3	523.5

Source: Balance Sheet of the Farming Sector 1976, Economic Research Service, U.S. Department of Agriculture.

Proprietors Equity in Farm Assets

Despite major increases in the value of production assets between 1960 and 1976, U.S. farmers in the aggregate maintained a strong debt-to-asset balance.

Farm proprietors' equity in farm real estate assets, for example, totaled about 90.8 percent in 1960 and declined only slightly to about 88 percent by 1976. Similarly, proprietors' equity in farm nonreal estate assets stood at 82.7 percent in 1960 and declined to about 75.6 percent in 1976. These are very high equity ratios relative to those in other industries and suggest that farmers are not excessively in debt in an absolute sense. Neither is the agricultural industry excessively in debt to other economic sectors which could be active implementors of trade or protectionism policies. We conclude, therefore, that the aggregate debt-to-asset ratios of farm proprietors for both broad categories of real estate and non-real estate production assets remained at healthy levels in 1976. But, since many proprietors owned their assets debt-free, the equity position of some other farmers could be at vulnerable levels. This could be the case especially for those operators who increased the size of their units rapidly or who made major and costly shifts to new technology. Such vulnerability might be crucial should farm real estate prices or commodity prices fall back significantly from their current levels. Such vulnerability is not unique to the current time period, however. In fact it is almost the case, by definition, in a competitive economic sector in which some firms continuously enter and grow while others exit.

Ownership of Farm Debt

It is often postulated that those who own the debt of farmers also exercise substantial influence on their destiny. Table 6 shows the distribution of farm real estate debt in 1960 and again in 1976. The major proportional shift in lending appears to be in the form of increased lending by the Federal Land Bank over time and a decrease in lending by life insurance companies which generally

Table 6

U.S. Real Estate Farm Debt Outstanding 1960-76

	Federal Land Bank	Farmers Home Administration	Life Insurance Companies	Commercial Banks	Individuals and Others	Total
1960 (million dollars)	2335	676	2820	1523	4828	12,182
Percent of Total	19.17	5.55	23.15	12.50	39.63	100.00
1976 (million dollars)	15,950	3369	6533	6296	18,728	50,876
Percent of Total	31.35	6.62	12.84	12.38	36.81	100.00

Source: Balance Sheet of the Farming Sector 1976, Economic Research Service, U.S. Department of Agriculture.

were able to find more profitable and less risky loans elsewhere. On the non-real estate debt side, commercial banks, farmer-owned cooperatives and governmental lending agencies increased their proportional holdings of farm debt between 1960 and 1976. And, individuals and others have declined in relative importance in non-real estate lending. Thus, one can probably safely conclude that changes in the ownership (structure) of farm debt in the U.S. between 1960 and 1976 had little if any significance either for control of the farming sector or for the future competitive position of U.S. farm commodities in agricultural trade. In fact, some of the external speculative investment capital present in cattle feeding and beef cow herds in the late 1960's and early 1970's had shifted mainly to non-farm areas by the mid-1970's.

Sources of Operating Funds

Measured in terms of the "annual net flow" of new funds into farming, internally generated funds (about $13 billion in 1975) continue to be the single most important net fund source though external borrowing (about $9 billion in 1975) has increased proportionately over time and may soon bypass internal funds in importance. Funding provided by integrators via contractual arrangements with producers is difficult to measure as are other input contributions to the production process made by integrating firms. It appears to be the case, however, that contributions by integrators to the flow of funds have taken on importance only in the production of a few specialty crops, poultry and some other livestock subsectors.

Overall, there seems to be very little evidence that changes in the capital structure of agriculture have or will induce major impacts on agricultural trade. This situation could change, however, as succeeding generations of farm operators

undertake to refinance the extremely high value production assets of the agricultural sector. Clearly, the major increases in capital requirements have resulted from two sources: (1) inflation in land prices and (2) increased use of purchased farm inputs. The latter expenditures totaled $66 billion in 1973[4/] and are still climbing. Though declines in product prices could generate a decline in farm real estate values, such a loss would likely be absorbed internally within the domestic agricultural sector and would not affect trade in any major way. Further increases in the cost of purchased farm inputs, on the other hand, could adversely affect the competitive position of U.S. farm commodities in world trade. The latter, of course, is partially dependent on what happens to input prices in other producing countries.

Changes in Farm Employment

Table 7 depicts the rapid decline in U.S. farm employment which has occurred in recent years. Total worker numbers in 1975 were only 62 percent of 1960 numbers. Much of the recent adjustment in labor use has been by way of increased mechanization and specialization on commercial farms coupled with the dropping of numerous small, and usually inefficient, livestock enterprises on farms where they had survived the 1940's and 1950's. Labor efficiency during the critical production periods is now at extremely high levels on those farms specializing in the production of feed and food grains, cotton and oil crops. These also are the major current U.S. farm export commodities (see Table 1). Producers of these crops are dependent on export markets for a sizeable portion of their output (output from 100 million acres was exported in 1975).[5/] These farmers

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[4/] U.S. Department of Agriculture, The Food and Fiber System - How It Works, Economic Research Service, Agriculture Information Bulletin 383, March 1975, p. 15.

[5/] U.S. Department of Agriculture, 1976 Handbook of Agricultural Charts, Agricultural Handbook No. 504, October 1976, p. 47.

will be extremely reluctant to shift back to livestock enterprises and forage production. In fact, it is due partly to the increased labor costs relative to other inputs that many farmers have shifted to production of cash crops and have substituted capital (in the form of machinery, fertilizer, pesticides, etc.) for labor. Once the shift has been made to these labor-efficient crops and to new labor-efficient production technology, the change is largely irreversible. And, once having left the farm, those workers formerly engaged in farm work will not be easily attracted back into this vocation. Moreover, there is little evidence that agriculture can successfully attract new workers from the non-farm sectors even when unemployment rates are high in these sectors. In sum, many agricultural producers are now locked into the production of a set of commodities which are highly labor-efficient and for which current and expected future production levels require large export markets.

Table 7

U.S. Farm Employment 1960-76

Year	Total Workers (thousands)	Family Workers (thousands)	Hired Workers (thousands)
1960	7,067	5,172	1,885
1965	5,610	4,128	1,482
1970	4,523	3,348	1,175
1975	4,357	3,033	1,324

Source: 1976 Handbook of Agricultural Charts, Agricultural Handbook No. 504, U.S. Department of Agriculture.

Changes in Production Technology

Table 8 describes well in summary, if not in detail, the two key changes which have occurred in agricultural production technology since 1960. These are the rapid decline in labor use and the rapid increase in the use of agricultural chemicals. The latter category of inputs includes mainly fertilizer, fuel products and chemical pesticides. Use of these chemicals is particularly high in the labor-efficient crops, e.g., fertilizers on feed grains, pesticides on cotton and corn, petroleum in field crop production generally, etc. It is quite conceivable that alternative energy sources (e.g., solar energy) or other new technology can reduce materially the petroleum (and natural gas) energy inputs for such tasks as grain drying. But it appears unlikely that effective substitutes will soon be found for (1) petroleum products to fuel labor-efficient power units in the field, (2) fertilizers to maintain production volume (both per acre and in total), or (3) chemical pesticides which permit use of highly labor-efficient technology to produce cash crops for export markets. Some key implications of this dependence on the petrochemical industry for trade will be presented in the final section of this article. The advent in agriculture of more computers, environmentally controlled technology and increasingly sophisticated managerial inputs in farming do not appear to have significant trade related implications.

Table 8

Use of Selected Farm Inputs in the U.S.
(1960=100)

Year	Labor	Farm Real Estate	Mechanical Power and Machinery	Agricultural Chemicals	All Other Inputs	Total Inputs
1960	100	100	100	100	100	100
1965	75	99	97	154	109	98
1970	62	97	102	221	120	102
1975	56	93	107	253	111	100
1976	56	94	106	272	113	102

Source: 1976 Handbook of Agricultural Charts, Agricultural Handbook No. 504, U.S. Department of Agriculture.

Coordination of Production and Marketing

Corporations and producer cooperatives have, in recent years, become active contributors to structural change through their efforts to coordinate the production and marketing of some agricultural products. Table 9 represents a rather crude set of estimates for the incidence of such coordination in 1970. Though difficult to document, it is clear that the incidence of coordination in vegetable crops and turkeys spread rapidly during the decade of the 1960's. And, the same was true for several other specialty enterprises, both crops and livestock. Among the chief export crops, however, only in the case of cotton was there any significant amount of production under contracts or vertical integration by 1970. And, even for cotton such coordination was not very important. Grains, soybeans and cotton are all commodities which are produced by many farmers, are easily bought and sold by standard grades in public markets and do not rapidly deteriorate in quality as they move through the marketing, storage and transportation processes. Thus, there is little incentive to coordinate their production and marketing processes. And, there is little evidence to suggest that structural changes in the coordination of production and marketing will have any significant effect on export trade in these commodities.

Changes in the Structure of Commodity Markets

The farm commodity market sector can be divided into two components. One operates mainly to move farm products into processing and manufacturing to service domestic markets. Some processed products do, of course, also move into foreign trade. The other component of the farm commodity market sector operates mainly to move farm commodities into export markets. Though the domestic market is fairly evenly divided between livestock and crop commodities, grain and soybeans account for nearly 80 percent of the agricultural export market. Active

futures markets as well as cash markets exist for the major grains, soybeans and cotton (the major export commodities). And, a large number of private and cooperative firms provide open markets to which delivery can be made by producers or other intermediaries, both private and cooperative.

Table 9

Methods of Coordinating Production of Selected Agricultural Commodities, And 1970 Estimates of Percent of Production

	Corporate		
Commodity	Vertical Integration	Contracts	Producer Cooperatives
Sugar Cane	60	23	17
Fluid Grade Milk	3	15	80
Broilers	7	85	5
Processing Vegetables	10	69	7
Oil Bearing Crops	0.5	1.0	--
Food Grains	0.5	2.0	--
Feed Grains	0.5	0.1	--
Hay and Forages	--	0.3	--
Cotton	1.0	11.0	--

Source: Contract Production and Vertical Integration in Farming 1960 and 1970, ERS-479, Economic Research Service, U.S. Department of Agriculture, April 1972 and The Food and Fiber System - How It Works, Agriculture Information Bulletin 383, Economic Research Service, U.S. Department of Agriculture, March 1975.

With respect to those commodities moving to export outlets, the commodity marketing sector serves mainly as an intermediary to move commodities (mostly unprocessed) between producers and exporting firms. Thus, though there have been significant structural changes in the domestic marketing and processing sector since 1960, these changes have not affected major export commodities in any significant degree.

The U.S. grain export industry is one in which rapid growth has occurred since 1960, and even since 1972. The capacity of this industry has expanded severalfold in recent years in order to handle the much larger volume of commodities moving into export markets. A recent report[6/] dealing with the structure of this industry indicates that five major grain export firms account for 85 percent of U.S. grain exports. In recent years this includes an estimated 93 percent of the wheat exports, 90 percent of the food grain exports and 86 percent of the soybean exports. These multinational firms have worldwide computerized market intelligence systems and operate complex commodity procurement systems in the U.S. to serve their overseas customers. And, they operate and coordinate complex management systems to effectively merchandize, transport and finance the commodities which they export.

Despite the highly oligopolistic structure which exists in the grain export industry, there are strong incentives for these firms to maximize the volumes of U.S. produced wheat, feed grains and soybeans which they move into export markets. And, there seems to be little interest by or incentive for these firms to integrate backwards into the farm production stage of the commodities which they export since they have no commodity acquisition needs or competitive advantage to do so. Thus, the grain export industry appears to operate mainly to maximize profits from a predetermined supply of commodities by moving these commodities

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[6/] Stanley P. Thurston, Michael J. Phillips, James E. Haskell and David Volkin, Improving the Export Capability of Grain Cooperatives, U.S. Department of Agriculture, Farmer Cooperative Service Research Report 34, June 1976, p. 17.

into their most profitable market outlets. With increased interest from farm cooperatives and other firms to enter the grain export industry, there seems to be little reason to expect that the grain export industry will not operate aggressively and reasonably efficiently in the future. And, it has substantial per unit incentives to expedite future trade in those commodities which have broad based overseas markets and to which large volume exports can be made.

CONCLUSIONS

Several kinds of major conclusions seem to stand out as one assesses implications of the changing structure of U.S. agriculture for trade.

First, production and marketing of most agricultural products, including the major ones in trade, are broad based and reasonably competitive. Exceptions in the production sector are mainly for some specialty crops and for some livestock products which are not important in trade. Exceptions in the marketing sector (though not much studied in this article) are mainly in the processing, manufacturing and distribution of products servicing domestic markets. And, although the grain export industry has an oligopolistic structure, it is probably relatively efficient and aggressive with strong incentives to operate on a large-volume basis. Thus, structure of the agricultural industry as measured by "degree of concentration" does not appear likely to generate major impacts on the U.S. agricultural export trade.

Second, the agricultural production sector, particularly those farms engaged in the production of most large volume export crops (feed and food grains, oil crops and cotton) has become highly labor-efficient. This structural change is the result of high per unit labor costs, expanded off-farm employment opportunities and the availability of labor-efficient production technology. Clearly

these factors are interrelated and have resulted in shifts to use of labor-efficient technology and to the production of labor-efficient crops. Moreover, incentives exist for even further shifts in these directions.

Third, the use of petrochemical inputs (fertilizer, fuel and pesticides) has become intensive in the several labor-efficient, high volume export crops. And, the energy embodiments in chemical fertilizers and pesticides are high. Major increases in energy prices or substantive constraints on the use of petrochemical inputs generally could generate very substantial increases in the cost structure with resulting shifts (upward and to the left) in the supply schedules for grains, soybeans and cotton.[1/] The impact of higher energy prices would be particularly great if, for example, energy prices to U.S. farmers increased not only on an absolute basis but also relative to those for competitive producers in other countries. Thus, more than for any other structural change in agriculture the move to heavy dependency on the petrochemical industry to undergird the production of major export commodities stands out. And, the possibilities of higher prices for energy and inputs with high energy embodiments, the possibility of shortages of petrochemical inputs and/or substantive constraints on the use of these inputs (for economic or environmental reasons) point up the supply vulnerability of these several major export commodities.

Fourth, with respect to most livestock and livestock commodities as well as for some specialty crops (e.g., sugar, fruit and vegetable crops) governmental policies, rather than the structure of the domestic agricultural sector, will be the important determinants of future trade. The U.S. will continue to be a net importer for most of these commodity groups though for some individual commodities,

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[1/] Several studies have shown that modest increases in the prices for fertilizer, pesticides and fuel would not cause major intercommodity production shifts or shifts to alternative production technologies. Thus, very substantial price increases would be needed to reduce the aggregate supply of food and feedgrains and soybeans in the absence of intervention in input or product markets.

e.g., potatoes, U.S. producers may supply a larger proportion of total future export markets. In the case of dairy, this commodity group is one, primarily because of high labor requirements, for which U.S. producers have a comparative disadvantage in world trade. And, the extent of future U.S. imports will be mainly a function of the government import restrictions in force. A similar situation exists for sugar crops and for non-fed beef. Though some fed beef will be traded as an export item, feed grains and protein supplements, rather than fed beef, will be the major export commodities servicing increased future fed beef consumption in export markets. The U.S. sheep industry has the characteristics of a declining industry for which future structural change is not likely to reverse the decline. Finally, U.S. trade in most fruit and vegetable commodities will be limited mainly to imports from Mexico and nearby off-shore supply sources. And, the levels of such imports will depend heavily on future import policies of the U.S. government rather than on the structure of the domestic agricultural sector.

Finally, past structural shifts in the size and capital structure of farming, as measured by size, value of production assets and by the ownership and control of these assets, do not appear to have major implications for trade. Moreover, major declines in the price of these assets, particularly farmland, should they occur, would mainly provide a lower cost structure from which to produce for export markets. The capital loss impacts, though they could be of major consequence to the current owners of the assets, particularly land owners, would be mainly absorbed internally within the domestic agricultural industry.

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