Chapter 5

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*Supply Function—Some Facts and Notions**

HISTORICAL perspective is ordinarily desirable; for this conference it is essential if we are to avoid repetition of past work and concentrate on areas requiring further development. Space limitations do not permit an historical recounting of works on supply responses in this paper. As, unfortunately, I am unaware of a suitable reference to cite, the long footnote below sketches, hastily, some of the main contributions in recent decades.[1]

*Michigan Agricultural Experiment Station Paper 2049. This paper is based on work done at the Michigan Agricultural Experiment Station and at the Giannini Foundation, University of California, Berkeley, California.

[1]In 1938, Galbraith and Black published an article which reviewed the then-current explanations of the maintenance of agricultural production during depression years. (See Galbraith, J. K., and Black, John D., "Maintenance of agricultural production during depression: the explanations reviewed," Jour. Polit. Econ., Vol. 46, 1938, pp. 305-23.) After reviewing and, for the most part, rejecting the explanations, they advanced their own explanation of continued high-level production during depression. As they saw it, and in accordance with classical and neo-classical theory, fixed assets but not fixed charges contribute to the maintenance of output during depressions. The role played by fixed assets in their explanation was the poorly understood role which fixed assets play in neo-classical theory. In other words the "whys" of asset fixity or variability were not fully explained by either the Galbraith-Black article or the neo-classical theory used therein.

In 1945, T. W. Schultz published his Agriculture in an Unstable Economy, McGraw-Hill, New York, an excellent secular analysis of differential rates of growth in supply and demand for farm products, the intellectual roots of which are to be found in the works of Mill, J. S., Principles of Political Economy, Longmans, Green and Co., London, Book IV, ed. W. J. Ashley, 1923. Mill, in turn, built on the works of Malthus. Schultz modified the Malthus-Mill analysis by introducing labor saving, technological growth, and capital accumulation as upward shifters of supply curves for farm products, both individually and in the aggregate. He concluded that, secularly, (1) the growth of supply for farm products tends to exceed the growth in demand, particularly for the high-calorie, low-income-demand elasticity products with adverse effects on the terms of exchange between farmers and others, and (2) the need to transfer capital into and labor out of agriculture depresses labor earnings and maintains capital earnings in farming.

Also in 1945, Johnson, D. Gale, Forward Pricing for Agriculture, The University of Chicago Press, Chicago, concentrated on price instabilities. His work too, had respectable, though younger, ancestors; it was based on Knight's and Hart's earlier works on risk, uncertainty, and profits. (See Knight, Frank H., Risk, Uncertainty and Profits, Houghton Mifflin Co., Boston and New York, 1921; and Hart, A. G., "Risk, uncertainty and the unprofitability of compounding probabilities," Readings in the Theory of Income Distribution, The Blakiston Co., Philadelphia, 1946, and "Anticipations, uncertainty, and dynamic planning," Studies in Business Administration, Vol. 11, No. 1, The University of Chicago Press, Chicago, 1940.) Both short-run and business cycle price instabilities were considered. Capital rationing, as a consequence of price risks, was envisioned as a major restriction on supply responses which deters agriculture from reaching optimum economic adjustment as defined in static equilibrium economics. The forward price proposal is essentially a method

When studying the works of Galbraith and Black, Schultz, D. Gale Johnson, Cochrane, Brewster and Parsons, the reader finds himself in general empirical agreement with the input-output facts presented by authors trying to explain supply responses. As far as short-run changes in the supply of individual products are concerned, economists appear to be in substantial agreement both conceptually and empirically as to the factors affecting supply and their quantitative influences. Even

for removing price risks to enable the economy to attain more fully the benefits of reaching static optima. Harold Halcrow also studied weather risk and crop insurance. (See "Actuarial structures for crop insurance," Jour. Farm Econ., Vol. 31, Aug., 1949).

Two papers, one by Brewster and Parsons in 1946 and another by Ellickson and Parsons in 1947, stressed the roles of technology and "workman like" as contrasted with "business like," determinants of agricultural productivity. (See Brewster, John M., and Parsons, Howard L., "Can prices allocate resources in American agriculture?" Jour. Farm Econ., Vol. 28, Nov., 1946, pp. 938f., and Ellickson, John C., and Brewster, John M., "Technological advance and the structure of American agriculture," Jour. Farm Econ., Vol. 29, Nov., 1947, pp. 827f.)

Cochrane began to write on the subject of supply responses in 1947. (See Cochrane, Willard W., "Farm price gyrations – an aggregative hypothesis," Jour. Farm Econ., Vol. 29, May, 1947, pp. 383f., and Wilcox, Walter W., and Cochrane, Willard W., Economics of American Agriculture, Prentice-Hall, Inc., New York, 1951, Chap. 24, Cochrane, Willard W., and Butz, William T., "Output resources of farm firms," Jour. Farm Econ., Vol. 33, Nov., 1951, pp. 445f.) With respect to supply responses for individual commodities within agriculture, he placed heavy reliance on the classical, marginal principle of opportunity cost. He uses this principle to explain the allocation of assets fixed for firms among the different products. He does not explain why such assets are fixed for the firm but not for individual enterprises; but then, neither did Marshall. Supply responses to completely variable inputs were not carefully considered either. The burden of explaining change or lack of change in aggregate farm output is placed almost entirely on technology. While technological advance explains *part* of the *expansions* in aggregate output, it (technology, not Cochrane's analysis) does not appear to explain failures of aggregate output to contract or some of the resource flows both into and out of agriculture which, fortunately for Cochrane's analysis, have tended to cancel each other. We need a better set of hypotheses to explain when assets are fixed, when they become variable upward, and when they become variable downward for firms and for industries as well as between the enterprises of multiple enterprise firms.

In 1950, D. Gale Johnson specifically examined the supply function for agriculture. (See Johnson, D. Gale, "The nature of the supply function for agriculture products," Amer. Econ. Rev., Vol. 40, pp. 539f.) He related his analysis to the earlier Galbraith-Black article and emphasized the difference between supply responses under depression and prosperity conditions. While he rejected as invalid the belief that high fixed costs are responsible for the failure of farmers to reduce output during a depression, he did consider how the availability of different classes of productive resources to the agricultural industry vary under depression and prosperity conditions and, hence, have differential impacts on the amounts of farm products produced. While Johnson's analysis represented a distinct improvement over earlier analyses, the treatment of fixed assets was not complete enough to explain why they do or do not flow between the farm and nonfarm sectors under different conditions.

T. W. Schultz has made three more recent contributions to the literature on supply responses. (See Schultz, T. W., The Economic Organization of Agriculture, McGraw-Hill, New York, 1953; "Reflections on agricultural production, output and supply," Jour. Farm Econ., Vol. 38, Aug., 1956, pp. 748f; and a paper read at the 1956 annual meetings of the American Farm Economic Association at Asilomar, Pacific Grove, California). As his thinking is changing rapidly, his current position is difficult to determine. By and large, however, it seems safe to say that it is moving in the direction of the Cochranian analysis, i.e., the major burden for explaining changes in the aggregate output of American agriculture is placed on technology and education (improvement in the quality of the human agent) rather than on changes in resources used.

In 1955, Earl Heady presented a paper on the supply of farm products at full employment. (See Heady, Earl O., "The supply of farm products under conditions of full employment," Amer. Econ. Rev., Vol. 45, May, 1955, pp. 228f.) Heady, like Galbraith and Black earlier, and D. Gale Johnson later, stuck close to neo-classical marginal analysis. His

T. W. Schultz in his more critical moods has not really questioned the adequacy of our quantitative knowledge of supply responses for individual products; instead, he has stressed the inadequacy of our knowledge concerning changes in the aggregate supply of farm products. Galbraith-Black's depression presentation, D. Gale Johnson's depression-prosperity contrast, and Heady's more detailed examination of the full-employment situation seem lacking, conceptually, in explaining asset fixities and their influences on the aggregate supply function. The Cochrane and Schultz technological analyses do little to remedy the situation, though the earlier secular analysis of growth in the supply and demand for farm products, made by Schultz, appears to remain very satisfactory. Thus, what follows is based on the conviction that the deficiency in our past attempts to understand agriculture's aggregate supply function is not in omitted variables; instead, the difficulty appears to be primarily in the analytical apparatus.[2]

A slightly modified form of neo-classical marginal analysis is available and promises to handle fixed assets, quasi-rents, capital gains, marginal costs and supply responses more adequately than the unmodified neo-classical analysis used by Galbraith-Black, D. Gale Johnson and Heady. This analysis, in turn, can be combined with analyses which include technology, education, capital growth, risk, etc.

THE MODIFIED ANALYSIS

The most neglected aspect of current aggregative supply analysis

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analysis of the supply of individual farm products closely resembles Cochrane's. Both analyses explain short-run supply changes for individual products largely in terms of opportunity costs in the allocation of fixed inputs in multiple enterprise firms. The two analyses, however, part ways when the aggregate supply of farm products is considered. Heady, in disagreement with Cochrane and in some disagreement with Schultz (at least as to emphasis) finds in his full employment analysis much greater possibilities for aggregate output to respond positively and negatively to changes in "factor/product price ratios."

While Heady's paper is not empirical, he does marshal enough evidence of aggregate resource flows (both in and out of the agricultural sector) in response to price changes under full employment to suggest strongly that a properly identified aggregate supply function would have a positive slope. He agrees that the elasticity of the supply function is low, though not as low as it appears. Heady explains the low elasticity of the aggregate supply curve in terms of: (1) low reservation prices for family labor in farming, (2) capital limitations, including capital rationing, resulting from risk discounting, (3) asset fixities and miscellaneous forces such as "the close bonds between the firm and household," low reservation prices on particular resources, and a greater degree of short-run fixed costs. Forces contributing to an "apparent" inelasticity of the aggregate supply function include, in addition to Working's and Frisch's "identification problem,": (1) flexibility in factor prices, (2) technical change, and (3) capital accumulation and redistribution of assets. While Heady identifies more of the relevant variables than D. Gale Johnson and appears to have judged the situation better than Cochrane and Schultz, his analysis still seems somewhat short insofar as the theory of asset fixity is concerned.

[2]Schultz feels that we have neglected technology and education, yet Heady considered technology in terms which do not preclude education to "improve the quality of the human agent" — so did Galbraith and D. Gale Johnson. As a matter of fact, so did Schultz himself in his book, Agriculture in an Unstable Economy; if he had not, he would have produced another of book 4 in J. S. Mill's Principles of Political Economy.

for agriculture is the theory of fixed assets. This neglect can be traced back into the classical and neo-classical marginal apparatus on which many of the existing supply analyses are based. Analytically, the law of diminishing returns (or of variable proportions) operates when different amounts of variable inputs are used in conjunction with a set of fixed assets. The law of diminishing returns, in turn, determines the nature of the marginal cost curve for individual enterprises and, ultimately, of the aggregate supply curve for an industry. The rate at which the marginal productivity of variable inputs declines depends on the proportion of fixed inputs, the levels at which they are fixed, and the degree of substitutability or complementarity between fixed and variable resources. Thus, it is extremely important that the framework employed in analyzing supply problems be capable of determining: (1) which assets are fixed and (2) the levels at which they are fixed. Furthermore, it is important that the analytical framework define fixity with respect to: (1) assets used in multiple-product firms, (2) single-product firms, (3) single-product industries, and (4) multiple-product industries.

The neo-classical, marginal apparatus includes the opportunity cost principle for purposes of pricing multiple-use, fixed assets within multiple enterprise firms.[3]

Similarly, neo-classical analysis has a well developed body of theory for treating land as an asset which is fixed for the agricultural industry as a whole. The neo-classical framework, however, is almost devoid of explanations as to why assets are fixed for a firm, making it necessary to apply the opportunity cost principle. Similarly, it does not explain why assets become fixed for industries but not for firms within industry. When it became apparent in the development of economic thought that land and fixed capital goods have many things in common, this difficulty was met, in part, with the concept of quasi-rents. After that, came the question of whether quasi-rents could be negative as well as positive. Stigler has argued this question without producing a worthwhile conceptual solution.[4]

Micro-production economists conducting empirical work in the field of farm management also encountered related problems involving fixed assets. First, it is clear that a different sub-production function exists out of, say, $y = f(x_1, \ldots, x_i \ldots, x_n)$ for each of the infinite number of combinations of x_i and levels at which the x_i can be fixed. Instead of (1) an ultimate short run in which all are fixed, (2) a short run in which some are fixed, and (3) an ultimate long run in which no assets are fixed,[5] there is a multiplicity of lengths of run. Secondly, it is also clear that there is more than just a short and a long run in the pricing of fixed assets. In the short run, farmers do not stay in production

[3]This principle has been used effectively by Galbraith-Black, D. Gale Johnson, Cochrane, and Heady in analyzing supply responses for individual products produced by multiple enterprise firms.

[4]Marshall, Alfred, Principles of Economics, 8th ed., Macmillan, London, 1920, p. 426n., and Stigler, G. J., The Theory of Competitive Price, The MacMillan Co., New York, p. 180n.

[5]See Marshall, Alfred, Principles of Economics, Macmillan and Co. Ltd., London, 1946, pp. 376-7.

until marginal revenue equals marginal cost at the minimum point on the average variable cost curve.[6] In milk production, the number of cows in a herd is sometimes fixed and sometimes variable. Furthermore, the quasi-rents on cows sometimes appear to be both positive and negative simultaneously; in 1953 quasi-rents appeared negative with respect to what had been paid for cows in 1952 but positive with respect to what the nonfarm economy would pay for them in 1953. Cows become variable when they are worth less in the herd than they are to someone else, either another farmer or the packing house. Hence, farmers shift from the "length of run" in which cows are fixed to the one in which they are variable, long before marginal costs equal average variable costs on the particular sub-set of cost curves which treats cows as fixed assets.[7] If cows flow from farm to farm, both the supply of milk and the aggregate supply curve for agriculture are unaffected. However, if they flow from farm to packing house, both the milk supply function and the aggregate supply function shift downward because of less milk and upward because of more meat unless changes in the dairy cow inventory are taken into account.

These questions involving fixed assets, lengths of run, negative and positive quasi-rents[8] tend to be avoided in the neo-classical analysis by assuming either perfect factor markets[9] (i.e. markets in which firms can buy and sell or industry acquire and dispose of inputs at the same price) or completely imperfect markets (i.e. markets in which the costs of acquisition are infinitely high and salvage values are zero for economies.)

At the individual firm level, most factor markets are perfect in the sense that firms can buy and sell factors, including land, at the same price. If for some reason a factor market is imperfect and market prices are inappropriate, the principle of opportunity cost is used to price the factor within firms. The neo-classical analysis does not explain clearly how or why resources move into or out of industries as variable inputs, and then become fixed. For purposes of explaining aggregate supply responses in agriculture under condition of widely fluctuating absolute prices and price relatives it seems essential that our analytical apparatus be capable of dealing with such problems.

In what follows, an asset will be defined, very simply and crudely, as fixed "if it ain't worth varying." More elegantly stated, an asset will be defined as fixed so long as its marginal value productivity in its present use neither justifies acquisition of more of it or its disposition.[10]

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[6]Contrary to Marshall, *ibid.*, p. 376.

[7]Schuh, George E., The supply of milk in the Detroit milk shed as affected by cost of production, Mich. Agr. Exp. Sta. Tech. Bul. 259, Mar., 1957.

[8]Also of capital gains and losses.

[9]Stigler, *op. cit.*, pp. 104f, 180n.

[10]Johnson, Glenn L., and Hardin, Lowell S., "Economics of forage evaluation," Purdue Agr. Exp. Sta. Bul. 623, Apr., 1955. This definition of a fixed asset is sufficiently flexible to define: (1) an asset fixed in one enterprise such as a corn picker, (2) an asset fixed for a farm but variable between enterprises according to the principle of opportunity costs, such as family labor or a tractor on a general crop and livestock farm, (3) an asset fixed for an industry in the production of one product or type of product but variable between firms, such

If the acquisition cost and salvage value[11] of an asset are substantially different, the asset can remain fixed while the price of the product it produces varies both absolutely and relatively over wide ranges. If on the other hand, as is commonly assumed in using the marginal apparatus, the acquisition cost of an asset is equal to its salvage value, any variation in product price relative to the price of the asset will cause either acquisition or disposal of the asset.

THE PROBLEM AT HAND

Our examination of previous work on supply responses has indicated that the work on individual commodities is more adequate than that on the aggregative response of the farm sector.[12] Furthermore, it indicated that the main difficulty is of a conceptual nature, involving the treatment of asset fixities as they depend on shifts in the acquisition costs, salvage values, and expected marginal value productivities of assets. Thus, the problem at hand appears to be improving the conceptual treatment of fixed assets, analyzing existing data, and explaining changes in the aggregate inputs and output for the farm economy as a whole.

A CLASSIFICATION OF PRODUCTIVE RESOURCES

For purposes of this conference, it appears desirable to classify the inputs used in the agricultural economy into categories which are reasonably homogeneous with respect to the behavior of acquisition costs, salvage values, and marginal value productivity. Since the object is to explain aggregate output, the primary interest is in the movement of

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as a self-propelled combine in the Great Plains, or (4) an asset such as land which may be fixed for an economic sector producing a variety of vastly different products, such as peppermint oil, milk, beans, celery, and pulp wood. Using this definition, quasi-rents are negative if figured with respect to acquisition value, positive if figured with respect to salvage value, and zero if figured with respect to their marginal value productivity.

[11] Appropriately adjusted for the life expectation of the assets, for operating costs, to a net, at-the-firm basis, and for risk and uncertainty (economic, institutional, and technological). A fixed asset is fully employed (or it is not fixed); its expected MVP is, of course, dependent on the amount of variable inputs associated with it in most instances.

[12] In his doctoral dissertation, "Economic structure in American agriculture," Dept. Agr. Econ., Michigan State University, 1957, W. A. Cromarty concluded that his estimates of supply elasticities for product categories within agriculture were more reliable than his expected estimates of demand elasticities for the same product categories. While this is contrary to some recently dramatized conclusions, many demand studies appear to be subject to shortcomings and to lack independence, a factor which decreases the importance of agreement among them. Total (not per capita demand estimates) have, of course, been no better than population, war, and prosperity estimates. An example of the consequences of poor demand estimates in the case of wheat is found in T. W. Schultz's Agriculture in an Unstable Economy, p. 246. Writing in 1945, he stated that, "The level of wheat storages in central markets of the world has in recent years been excessively large." In 1946 international wheat allocations were made to divide limited supplies among countries. In evaluating the reliability of demand estimates it is desirable to read George Mehren's paper, pp. 61 to 73, in this book.

resources between the farm and nonfarm sectors as contrasted with movements within the farm sector. Acquisition costs and salvage values for the farm sector, rather than within the farm sector, are relevant considerations in setting up the input classifications. Each category in the following classification includes resources which are reasonably homogeneous in the above respect:

1. Nonfarm produced durables — tractors, combines, tiling, etc.
2. Unspecialized farm durables — fence posts, pasture seedings, soil improvements, etc.
3. Specialized farm durables — dairy cows, orchards, sows, ewes, beef breeding stock, etc.
4. Unspecialized farm expendables — corn, hay, etc.
5. Specialized farm expendables — seed corn, grass seeds, etc.
6. Nonfarm expendables — fuel, oil, and commercial fertilizers, etc.
7. Hired labor
8. Family and operator's labor
9. Land

THREE FACTS CONCERNING PRICES AND THE GENERAL LEVEL OF EMPLOYMENT AND BUSINESS ACTIVITY

First, the terms of exchange between the farm and nonfarm sectors are related positively to the general level of employment and business activity with wars and increased foreign or domestic demands tending to strengthen the terms of exchange and vice versa. (See Table 5.2.) Second, farm product prices (measured in current dollars) are related positively to the same factors. Third, prices of farm products relative to each other, though far from stable, tend to be independent of the general level of employment and business activity. [13]

SOME HYPOTHESES ABOUT RESOURCE EMPLOYMENT AND THE GENERAL LEVEL OF EMPLOYMENT AND BUSINESS ACTIVITY

Table 5.1, below, has been set up to present some hypotheses about relationships among acquisition costs, salvage values, and expected marginal value productivities as they influence resource employment in agriculture. Influences of technological growth on employment are indicated with pluses or minuses as the case may be. Economic growth (excluding technology) can generally be expected to cause resource employment to be higher, i.e., expanding instead of stable, more expanding than indicated, less contracting than indicated and, possibly, expanding instead of contracting.

[13] Johnson, Glenn L., "Allocative efficiency of agricultural prices — as affected by changes in the general level of employment," Ph.D. Dissertation, Dept. Econ., University of Chicago, 1949, pp. 62-70.

For instance, a 20 percent expansion of population in a 10 or 15 year period keeps the marginal value productivities over all levels of employment and business activity of farm inputs high relative to what they would be in the absence of such growth. This, in turn, stimulates resource flows into and retards resource flows out of the agricultural economy. This influence is particularly noticeable in the resource employment data, 1946 to date.

The Employment Hypotheses Tested

Table 5.2 contains data on the employment of 12 different resources, at least one for each of the nine resource categories. Each chart shows the ratio of prices paid to prices received by farmers.

The resource employment hypotheses advanced in Table 5.1 were tested against the data. Table 5.2 of the thirty-six hypotheses concerning resource employment all are verified in the sense of being generally consistent with the resource employment data in this table.

CONCLUSIONS ABOUT RESOURCE USE, AGGREGATE OUTPUT, AND CHANGES IN THE GENERAL LEVEL OF EMPLOYMENT AND BUSINESS ACTIVITY

Under conditions of increasing prosperity with the terms of exchange moving in favor of agriculture, the hypotheses call for no expansion in the employment of five resource categories and stability or slight expansion in the employment of a sixth. One case calls for expanded employment and two for contraction. The expansion occurs for nonfarm expendables while the contractions occur for (1) hired labor and (2) family and operator's labor. In general, the verified hypotheses indicate little change in aggregate input under conditions of increased prosperity, ceteris paribus; if considerable growth is occurring, as in the period 1946 to date, input use may change considerably.

Under full prosperity conditions, the situation is not much different. Three hypotheses call for stable employment, three for stable or expanding employment, one for expansion, one for stability or contraction, and one for contraction. With three categories which are stable, four which are stable or expanding, and two which are stable or contracting, little increase in output is likely, ceteris paribus.

With declining prosperity, five hypotheses call for stable employment and two for stable or decreasing employment, with two uncertain. The indications are that aggregate output is stable or slightly contracting, ceteris paribus.

Under depression conditions, four hypotheses call for stable resource employment, two for stable or decreasing employment, and one for decreases, and two are uncertain. No hypothesis calls for expansion. Clearly, curtailed production is indicated under depression conditions,

Table 5.1. Some Hypotheses About Acquisition Costs, Salvage Values, and Expected Marginal Value Productivities in Relation to the General Level of Employment and Business Activity, by Resource Categories

Resource category	Recovery	Prosperity	Recession	Depression
Nonfarm Durables				
Acq., MVP, Salv.[a]	$MVP \leqq Acq.$	$MVP > Acq.$	$Acq. \geqq MVP > Salv.$	$MVP \leqq Salv.$
Employment[b]	Stable +	Expanding +	Stable +	Stab. or Contr. +
Unspec. Farm Durables				
Acq., MVP, Salv.[a]	$Salv. \leqq MVP \leqq Acq.$	$Salv. \leqq MVP \leqq Acq.$	$Salv. \leqq MVP \leqq Acq.$	$Salv. \leqq MVP \leqq Acq.$
Employment[b]	Stable +	Stable +	Stable +	Stable +
Spec. Farm Durables				
Acq., MVP, Salv.[a]	$Salv. < MVP \geqq Acq.$	$Salv. < MVP > Acq.$	$Salv. < MVP \leqq Acq.$	$Salv. < MVP \leqq Acq.$
Employment[b]	Stab. or Exp. -	Stab. or Exp. -	Stable -	Stable -
Unspec. Farm Expend.				
Acq., MVP, Salv.[a]	$MVP \geqq Acq.$	$MVP \geqq Acq.$	$MVP \leqq Acq.$	$MVP \leqq Acq.$
Employment[b]	Stab. or Exp. -	Stab. or Exp. -	Stab. or Contr. -	Stab. or Contr. -
Spec. Farm Expend.				
Acq., MVP, Salv.[a]	$Salv. < MVP = Acq.$	$Salv. < MVP = Acq.$	$Salv. < MVP = Acq.$	$Salv. < MVP = Acq.$
Employment[b]	Stable +	Stable +	Stable +	Stable +
Nonfarm Expend.				
Acq., MVP, Salv.[a]	$MVP > Acq.$	$MVP \geqq Acq.$	$MVP \leqq Acq.$	$MVP < Acq.$
Employment[b]	Increasing +	Stab. or Exp. +	Stab. or Exp. +	Contracting +
Hired Labor				
Acq., MVP, Salv.[a]	$Salv. \leqq MVP < Acq.$	$Salv. < MVP < Acq.$	$Salv. \leqq MVP \leqq Acq.$	$Salv. \leqq MVP \leqq Acq.$
Employment[b]	Stab. or Contr. -	Stab. or Contr. -	Uncertain -	Uncertain -
Fam. and Opr.'s Labor				
Acq., MVP, Salv.[a]	$Salv. > MVP$	$Salv. > MVP$	$Salv. \gtrless MVP$	$Salv \gtrless MVP$
Employment[b]	Contracting -	Contracting -	Uncertain -	Uncertain -
Land				
Acq., MVP, Salv.[a]	$Salv. < MVP < Acq.$	$Salv. < MVP < Acq.$	$Salv. < MVP < Acq.$	$Salv. < MVP < Acq.$
Employment[b]	Stable	Stable	Stable	Stable

[a] All acquisition costs, salvage values, and expected marginal value productivities apply to agriculture as an industry. The MVP's are the present value of the expected future stream of annual MVP's in the case of durable resources.

The three price generalizations, page 80, support the following generalizations about the behavior of acquisition costs, salvage values, and marginal value productivities for the nine resource categories:

The *expected* marginal value productivities of all nine of the input categories will move up and down with the changes in product prices (measured in current dollars) over the business cycle as modified by the presence or absence of war and abnormal domestic and foreign demands.

Acquisition prices for both nonfarm durables and expendables rise less rapidly with prosperity than their expected marginal value productivities. Salvage values for nonfarm, specialized durables are, essentially, zero or if not, are determined by their value in non-specialized uses, i.e. scrap iron for tractors.

Salvage values for nonfarm expendables are largely irrelevant as farmers do not carry significant stocks; the same is true for farm-produced, specialized expendables. However, salvage values for unspecialized farm expendables (such as corn) are relevant; these salvage values rise and fall with their expected marginal value productivities and with farm product prices.

Both salvage and acquisition values for unspecialized farm durables rise and fall with farm product prices and their expected marginal value productivities as these change over the business cycle.

Salvage values for specialized farm durables are, essentially, zero; their acquisition costs, however, rise with the costs of items used in their production and, as nonfarm inputs are also used in their production, rise and fall more slowly than farm product prices and their MVP's but more rapidly than nonfarm prices.

The acquisition price of land is much above its marginal value productivity while its salvage price is zero (except in rural-urban fringe areas).

The acquisition price for family and operator's labor is, if relevant, generally above its marginal value productivity while its salvage value (appropriately adjusted for risk and personal wants and preferences) is below its marginal value productivity in depressions but above it during prosperity. As hired labor is a substitute for family and, operator's labor, the acquisition cost of hired labor is relevant here.

The acquisition price of hired labor, in addition to containing a secular upward trend, rises and falls faster than its marginal value productivity (on farms) with respect to changes in the general level of employment and business activity. Similarly its salvage value rises faster than its marginal value productivity when going into a prosperity period; its effective salvage value, however, may not fall as rapidly as its MVP due to certain institutional restrictions on the hiring of labor by nonfarm employers.

[b] In addition to the influence of the business cycle on acquisition costs, salvage values, and marginal value productivities, consideration should also be given to the influence of technological advance. For any given set of price relationships, improvements in technology increase the marginal value productivity of the inputs concerned relative to their acquisition costs and salvage value. Plus or minus signs denote influence of technological advance on employment.

Table 5.2. Ratio of Prices Received to Paid, Percent of Labor Force Employed and the Employment of Twelve Resource Categories, 1910 to Date

Year	Ratio prices rec'd./paid	Percent of labor force employed	Resource categories: Durables: Non-farm: Tractors	Durables: Non-farm: Machinery and equipment	Durables: Farm: Unspec.: Livestock	Durables: Farm: Spec.: Fruit and nut trees	Expendables: Farm: Spec.: Seed bought	Expendables: Farm: Unspec.: Feed fed	Expendables: Non-farm: Fertilizer and lime	Expendables: Non-farm: Operation of motor vehicles	Expendables: Non-farm: Other expenses	Land: Planted	Labor: Family	Labor: Hired
	1910-14=100 Percent	Percent	1,000's	Billions of 1910-14 dollars		Millions	Billions of 1910-14 dollars					Million acres	1910-14=100 Percent	
1911	96	97	4	1.5	6.0		65		166	12	569		100	99
12	98	98	8	1.5	5.1		74		161	20	595		100	100
13	101	99	14	1.6	5.4		62		182	27	625		100	100
14	98	95	17	1.7	5.7		62		208	35	645		99	101
15	94	94	25	1.7	6.2		62		172	46	648		99	101
1916	103	96	37	1.8	5.4		76		179	74	718		99	103
17	120	102	51	1.6	4.3		122		236	132	869		97	101
18	119	105	85	1.6	4.4		132		317	190	1,033		93	98
19	110	100	158	2.0	4.4	4.8	138		347	232	1,129		91	96
20	99	96	246	2.3	4.5	4.8	178		382	296	1,314		93	100
1921	80	87	343	2.6	5.0	4.8	123		221	254	1,098		93	100
22	87	90	372	2.4	4.0	4.9	109		212	252	1,057		93	101
23	89	96	428	1.9	4.2	5.0	111		230	271	1,065		93	100
24	89	94	496	1.9	4.0	5.0	120		231	305	1,049		93	99
25	95	95	549	1.9	3.4	5.0	136		250	377	1,056		94	100

1926	91	96	621	2.0	3.6	5.1	142	103.4	250	444	1,075		93	104
27	88	95	693	2.0	3.8	5.1	140	107.7	230	443	1,003		90	102
28	91	95	782	2.0	3.9	5.1	134	107.2	292	477	1,029		91	102
29	92	97	827	2.1	4.1	5.1	122	104.9	293	509	1,024	363	91	103
30	83	91	920	2.3	4.9	5.0	124	95.7	288	496	951	369	91	98
1931	67	84	997	2.2	5.0	5.0	177	103.8	202	420	873	370	93	93
32	58	77	1,022	2.1	4.9	5.0	79	111.0	125	384	735	375	96	87
33	64	75	1,019	1.8	4.3	5.0	65	91.8	128	374	679	373	97	86
34	75	78	1,016	1.5	3.9	4.1*	104	71.3	158	406	675	338	97	84
35	88	80	1,048	1.5	3.1	4.0*	108	94.1	177	435	667	361	100	87
1936	92	83	1,125	1.6	4.4	3.9*	147	75.4	196	459	687	360	98	94
37	93	86	1,231	1.7	4.0	3.9*	194	97.0	248	521	757	363	97	97
38	78	81	1,368	1.9	4.5	3.8*	206	98.9	226	533	750	354	97	97
39	77	83	1,447	2.1	4.8	3.8*	169	102.1	240	564	730	342	85	80
40	81	85	1,545	2.1	4.7	3.8*	197	108.0	261	584	766	347	82	79
1941	93	92	1,675	2.3	3.9	3.8*	203	118.7	292	645	858	347	79	78
42	105	101	1,885	2.8	4.1	3.8*	301	142.0	352	812	975	351	78	75
43	113	109	2,100	3.2	4.9	3.7*	406	138.8	423	932	1,041	361	79	72
44	108	111	2,215	3.3	4.9	3.7*	440	128.8	476	1,068	1,070	365	79	66
45	109	108	2,422	3.6	4.3	3.7*	435	132.8	562	1,048	1,103	356	78	62
1946	113	98	2,560	3.5	4.0	3.8*	428	122.6	675	1,295	1,257	352	80	64
47	115	98	2,735	3.4	4.1	3.8*	514	110.4	746	1,505	1,546	355	80	67
48	110	99	2,980	3.8	4.2	3.8*	81	120.0	811	1,697	1,678	359	79	69
49	100	95	3,315	4.4	5.3	3.4*	544	127.3	882	1,735	1,775	364	76	66
50	101	95	3,609	5.2	4.6	3.1*	536	129.8	927	1,901	1,810	353	71	61
1951	107	97	3,940	5.1	5.1	3.3*	646	131.6	1,022	2,045	2,125		69	58
52	100	98	4,170	5.7	6.4	3.3*		122.8					66	57
53	92	98	4,400[a]	5.9	5.4	3.2*		125.7					65	57
54		95												

*Commercial apples only.
[a]Preliminary.

insofar as resource use is concerned, ceteris paribus. This set of hypotheses is the least verified of the four sets dealing with the general level of employment and business activity as we have not had long periods of prolonged depression to use for testing. During the years 1921-29, agriculture, rather than the general economy, was primarily depressed. From 1929 to 1932, we were going into a depression. After 1937 or so we were recovering. How much contraction would occur under prolonged conditions similar to those that prevailed from 1933 to 1936 is not observable.

In general, the analysis indicates a stable supply of agricultural products over the business cycle given the price, acquisition cost, and salvage value patterns which usually occur. This does not mean that the elasticity of the aggregate supply curve is zero. It merely means that resource use and, hence, changes in output due to changes in resource use, ceteris paribus, do not change much in agriculture over the business cycle.

THE AGGREGATE SUPPLY CURVE FOR AGRICULTURAL PRODUCTS

While the above analysis explained the stability of aggregate agricultural output over the business cycle but told us essentially nothing about the aggregate supply curve, this general approach can yield some information about the supply curve itself.

We can, for instance, inquire about the consequences of, say, doubling farm product prices, ceteris paribus, for each of the four stages in the business cycle. Also we can inquire concerning the consequences of halving farm product prices at each of the four stages. While the available data do not permit hypothetical answers to these questions to be tested empirically as was done for Table 5.1, analysis in that case lends some confidence to the answers.

In Table 5.3 are the hypothesized relationships among acquisition costs, salvage values, and marginal value productivities with doubled "normal" farm product prices for each of four levels of business activity for each of the nine resource categories.

In Table 5.4 are the hypothesized relationships among acquisition costs, salvage values, and marginal value productivities with halved "normal" farm product prices for each of the four levels of business activity for each of the nine resource categories.

Tables 5.3 and 5.4 indicate that, ceteris paribus, the aggregate supply curve for agriculture:

1. Has an elasticity greater than zero at all of the four different levels of employment and business activity considered.
2. Is more elastic upward than downward.
3. Is more elastic upward at full prosperity and during recovery than during recessions and depressions.

Table 5.3. Some Hypotheses About Acquisition Costs, Salvage Values and Expected Marginal Value Productivities with "Normal" Farm Product Prices Doubled, for Different General Levels of Employment and Business Activity, by Resource Categories

Resource category	Recovery	Prosperity	Recession	Depression
Non-farm Durables				
Acq., MVP., Salv.[a]	MVP>Acq.	MVP>Acq.	Acq.$\overset{=}{<}$MVP>Salv.	Acq.$\overset{>}{=}$MVP>Salv.
Employment[b]	Expanding +	Expanding +	Stab. or Exp. +	Stab. or Exp. +
Unspec. Farm Durables				
Acq., MVP, Salv.[a]	Salv.$\overset{<}{=}$MVP$\overset{<}{=}$Acq.	Salv.$\overset{<}{=}$MVP<Acq.	Salv.$\overset{<}{=}$MVP$\overset{<}{=}$Acq.	Salv.$\overset{<}{=}$MVP$\overset{<}{=}$Acq.
Employment[b]	Stable +	Stable +	Stable +	Stable +
Spec. Farm Durables				
Acq., MVP, Salv.[a]	Salv.<MVP>Acq.	Salv.<MVP>Acq.	Salv.<MVP>Acq.	Salv.<MVP>Acq.
Employment[b]	Expanding -	Expanding -	Expanding -	Expanding -
Unspec. Farm Expend.				
Acq., MVP, Salv.[a]	MVP$\overset{>}{=}$Acq.	MVP$\overset{>}{=}$Acq.	MVP$\overset{<}{=}$Acq.	MVP$\overset{<}{=}$Acq.
Employment[b]	Stab. or Exp. -	Stab. or Exp. -	Stab. or Contr. -	Stab. or Contr. -
Spec. Farm Expend.				
Acq., MVP, Salv.[a]	Salv.<MVP=Acq.	Salv.<MVP=Acq.	Salv.<MVP=Acq.	Salv.<MVP=Acq.
Employment[b]	Stable +	Stable +	Stable +	Stable +
Non-Farm Expend.				
Acq., MVP, Salv.[a]	MVP>Acq.	MVP>Acq.	MVP$\overset{>}{=}$Acq.	MVP$\overset{>}{=}$Acq.
Employment[b]	Expanding +	Expanding +	Stab. or Exp. +	Stab. or Exp. +
Hired Labor				
Acq., MVP, Salv.[a]	Salv.<MVP$\overset{>}{=}$Acq.	Salv.<MVP$\overset{>}{=}$Acq.	Salv.<MVP$\overset{>}{=}$Acq.	Salv.<MVP$\overset{>}{=}$Acq.
Employment[b]	Expanding -	Expanding -	Stab. or Exp. -	Stab. or Exp. -
Fam. & Opr.'s Labor				
Acq., MVP, Salv.[a]	Salv.$\overset{<}{=}$MVP	Salv.$\overset{<}{=}$MVP	Salv.<MVP	Salv.<MVP
Employment[b]	Stable -	Stable -	Stable -	Stable -
Land				
Acq., MVP, Salv.[a]	Salv.<MVP<Acq.	Salv.<MVP<Acq.	Salv.<MVP<Acq.	Salv.<MVP<Acq.
Employment[b]	Stable	Stable	Stable	Stable

[a] See para. 1, note [a] Table 5.1.
[b] See note [b] Table 5.1.

Table 5.4. Some Hypotheses About Acquisition Costs, Salvage Values and Expected Marginal Value Productivities With "Normal" Farm Product Prices Halved for Different General Levels of Employment and Business Activity, by Resource Categories

Resource category	Recovery	Prosperity	Recession	Depression
Non-farm Durables				
Acq., MVP, Salv.[a]	MVP<Acq.	MVP<Acq.	MVP≦Acq.	MVP<Salv.
Employment[b]	Stable +	Stable +	Stable +	Stable +
Unspec. Farm Durables				
Acq., MVP, Salv.[a]	Salv.≦MVP≦Acq.	Salv.≦MVP≦Acq.	Salv.≦MVP≦Acq.	Salv.≦MVP≦Acq.
Employment[b]	Stable +	Stable +	Stable +	Stable +
Spec. Farm Durables				
Acq., MVP, Salv.[a]	Salv.<MVP≦Acq.	Salv.<MVP≦Acq.	Salv.<MVP<Acq.	Salv.<MVP<Acq.
Employment[b]	Stable -	Stable -	Stable -	Stable -
Unspec. Farm Expend.				
Acq., MVP, Salv.[a]	MVP≦Acq.	MVP≦Acq.	MVP<Acq.	MVP<Acq.
Employment[b]	Stab. or Contr. -	Stab. or Contr. -	Contracting -	Contracting -
Spec. Farm Expend.				
Acq., MVP, Salv.[a]	Salv.<MVP=Acq.	Salv.<MVP=Acq.	Salv.<MVP=Acq.	Salv.<MVP=Acq.
Employment[b]	Stable +	Stable +	Stable +	Stable +
Non-Farm Expend.				
Acq., MVP, Salv.[a]	MVP≷Acq.	MVP≷Acq.	MVP<Acq.	MVP<Acq.
Employment[b]	Uncertain +	Uncertain +	Contracting +	Contracting +
Hired Labor				
Acq., MVP, Salv.[a]	Salv.>MVP<Acq.	Salv.>MVP<Acq.	Salv.≧MVP<Acq.	Salv.≧MVP<Acq.
Employment[b]	Contracting -	Contracting -	Stab. or Contr. -	Stab. or Contr. -
Fam. & Opr.'s Labor				
Acq., MVP, Salv.[a]	Salv.>MVP	Salv.>MVP	Salv.≧MVP	Salv.≧MVP
Employment[b]	Contracting -	Contracting -	Stab. or Contr. -	Stab. or Contr. -
Land				
Acq., MVP, Salv.[a]	Salv.<MVP<Acq.	Salv.<MVP<Acq.	Salv.<MVP<Acq.	Salv.<MVP<Acq.
Employment[b]	Stable	Stable	Stable	Stable

[a] See para. 1, note [a] Table 5.1.
[b] See note [b] Table 5.1.

4. Is less elastic downward during prosperity and recovery than in recession and depression.

These generalizations can be checked against the 72 resource employment hypotheses in Tables 5.3 and 5.4.

SOME IMPORTANT FACTORS AFFECTING THE AGGREGATE SUPPLY CURVE FOR FARM PRODUCTS

In addition to cyclical instability which was considered in detail above, the aggregate supply function is affected by:

1. Technology
2. Intra-sector resource movements: (a) between geographic regions, (b) between firms, and (c) between enterprises within firms.
3. Changes in risk.
4. Redistributions of asset (rights, property and skill) ownership as a result of: (a) direct governmental action, (b) inflation and deflation, and (c) capital accumulation.

When the object is to predict output instead of to isolate the supply function, these supply shifters must be considered also. While space and time precludes adequate treatment, cursory analysis seems preferable to omission.

These supply shifters have a tendency to move together. Hence it is discouragingly difficult to differentiate empirically their separate influences. Technological advance makes inter-sector specialization and resource flows possible and necessary. It does the same thing with respect to intra-sector flows. Risk and technology, too, are related, as much technological advance is risk-reducing as is apparent when insecticides, fungicides, pesticides and vaccines are considered, not to mention timeliness and large-scale, fast, high-powered machinery. Technology, too, is an asset – it cannot be produced and used without influencing asset ownership patterns.

Technological Advance and Intersector Resource Flows

Both technological advance and specialization between the farm and nonfarm sectors can produce increases in agricultural output with no net increase in inputs.[14] Thus, the ratios of incremental output over incremental input which Schultz observes to be greater than one may be due to technology,[15] specialization, or a combination of the two.

[14]Reder, M. W., Studies in the Theory of Welfare Economics, Columbia University Press, New York, 1947, Chap. 2. The possibilities of increasing output without increasing inputs with constant technology through specialization as a result of applying the principle of comparative advantage are illustrated.

[15]Schultz, T. W., "Reflections on agricultural production, output and supply," Jour. Farm Econ., Vol. 38, Aug., 1956, pp. 748f.

Probably both are involved with the specialization often following technological change but with specialization sometimes being a precondition for adoption of a technological advance. Only a moment's reflection is needed to see how important inter-sector specialization has become in agriculture. Dean Young delivered a paper at the Helsinki meeting of the International Conference of Agricultural Economists which stressed the importance of supplying industries in achieving the productive level which U. S. agriculture has reached. At last winter's joint meeting of the American Economic Association and the American Farm Economic Association, John Davis stressed the inter-sector specialization (he called it vertical integration) which has occurred between the farm and nonfarm sectors in the production of marketing service. Whereas, a few years ago many marketing services were performed by farmers who prepared products for market, transported them to market and, sometimes, retailed them, many of these services are now being performed by the nonfarm sector.

Intra-sector Resource Flows

Geographic specialization as well as inter-sector specialization is also capable of increasing output without increased input. This has been known since before the days of Adam Smith.[16] While technological advance may encourage regional specialization and inter-firm specialization, it is by no means a prerequisite for it; in fact, specialization can be a prerequisite for adoption of a technological advance. The empirical importance of this shifter is shown in census reports for 1950,[17] presenting scatter diagrams for major farm products which indicate a large amount of regional specialization in recent decades.

While less adequate data are available to support the assertion, it is also clear that significant amounts of inter-firm specialization is occurring. Generally speaking, farms are less self-sufficing than formerly insofar as milk, eggs, vegetables and fruit, and possibly meat production, are concerned.

Risk and Capital Rationing

The discussion of the influence of risk on the aggregate supply curve for farm products must be very cursory. Certain points are worthy of speculation, however.

Of the many risks besetting agriculture, price risks associated with the business cycle are of prime importance. D. Gale Johnson and Schultz have placed great emphasis on price risks as a cause of capital

[16]Smith, Adam, The Wealth of Nations, The Modern Library, New York, ed. Edwin Cannan, pp. 415f.

[17]Agriculture 1950, A Graphic Summary, Special Reports, Vol. 5, p. 6.

rationing. In terms of the fixed asset definition employed in this paper, such risks can be interpreted as adding subjectively to acquisition costs thereby making acquisition costs greater than salvage value for a farmer even in a market as perfect as the one for money. Risk, then, becomes a basic cause of capital rationing.

It then follows that elimination of price risk eliminates asset fixities, thus making production more responsive, especially upward. In our economy, a significant reduction in price risks occurred in the late thirties as a result of price control programs and some recovery optimism. A further reduction in price uncertainty occurred with the outbreak of World War II and the Steagall Amendment. Some writers have attributed the expansions in agricultural production which occurred during these periods to widespread adoption of new technology. Inasmuch as these were periods in which (1) reduced price risk helped eliminate capital rationing and (2) considerable amounts of specialization occurred, all of the expansion in output probably cannot be attributed to technology.

Inflation, Asset Ownership Redistribution, and Capital Rationing

Capital rationing, as a general form of asset fixity, may be overcome in a number of ways, any one of which is capable of expanding output through: (1) permitting the use of more resources and (2) specialization in the use of the same quantity of resources. From 1933 to 1952, inflation has served repeatedly to overcome capital rationing, making possible both specialization and expanded resource use. Some of this expanded production was achieved through long available but unadopted technology. Economic conditions had to be conducive to adoption of the technology. Thus, in a sense, the expansion of production has more in the nature of an economic than a technological adjustment.[18,19] Technologies are not automatically adopted even if profitable and communicated to farmers; the "wherewithal" must be available.

Asset fixities may be overcome in other ways. The right to produce a product may gain value under production control programs and then be redistributed, thereby overcoming capital limitations.[20] Also, agencies such as the AAA, SCS, TVA, and PMA may redistribute rights,

[18]See Hendrix, W. E., "Availability of capital and production innovations on low-income farms," Jour. Farm Econ., Vol. 33, 1951, pp. 66f., for discussion of economic conditions necessary for adoption of technology.

[19]If technological change is to be distinguished from economic adjustment, it seems desirable to define a change in technology as occurring when a new input is discovered. If x_i inputs, $i=1,\ldots,n$ are known to be useful in producing y, then for $y=f(x_1,\ldots,x_d|x_{d+1},\ldots,x_n)$, changes in the use of $x_1,\ldots,x_d$ are the subject matter of economics. In turn we have seen that the question of which inputs should be treated as variable is also economic. Defining technological change as the discovery of a new input which, like all other known inputs, is fixed or variable depending on economic conditions, yields an unambiguous distinction between technological change and economic adjustment in resource use. If ideas are regarded as inputs, as indeed they are, then new organizations can be regarded as technological changes.

[20]Thompson, James F., "Inter-farm and inter-area shifts in burley tobacco acreages under government control programs," Ky. Agr. Exp. Sta. Bul. 590, 1952.

income, and assets, thus overcoming certain asset fixities and capital limitation. The land-grant system should not be forgotten in this connection as an institution designed to produce and distribute information at public expense.[21] These asset redistributions can increase output by increasing inputs or without (if they make it possible to specialize) increasing inputs. Again we find more than one factor affecting the aggregate supply function often tending to shift the supply function in the same direction.

Summary

The general conclusion is that the supply shifters are numerous with highly inter-related impacts on the aggregate supply curve for agriculture.

Clearly, it is extremely hazardous for anyone to attribute the shifts in the aggregate supply function which have occurred in recent decades to any one of these shifters alone. It is also clear that further upward shifts in the supply curve are easily brought about.

The fixed asset theory used herein would indicate that a high proportion of the influence of these shifts on the aggregate supply function is only partially reversible.

SOME PROSPECTS FOR THE FUTURE

The above analysis indicates that:

1. Output should not be expected to change much as a net result of the complex set of price changes occurring with inflation, deflation, prosperity, and depression.
2. Farm output can be increased by raising farm prices, ceteris paribus.
3. Farm output could be reduced somewhat by lowering farm prices, ceteris paribus; however, the price reductions required to reduce output are larger than those required to bring about a corresponding increase in output.
4. Shifters play important but individually undetermined roles.
5. Shifters and the elasticity of the aggregate supply function are jointly capable of bringing about considerable expansions in output for the foreseeable future (Bonnen treats this matter, pages 116-27, in this volume.)
6. Expansions in production brought about by both the elasticity of the aggregate supply function and the shifters are difficult to reverse.

[21] Schultz, T. W., The Economic Organization of Agriculture, McGraw-Hill, New York, 1953, Chap. 7, and Johnson, Glenn L., "Agriculture's technological revolution," U. S. Agriculture — Perspective and Prospects, Columbia University, New York, 1955, pp. 27f.

7. Instead of contractions in production, large-scale capital losses can be imposed on the owners of fixed assets (or assets which become fixed) as a consequence of losses in demand after production is expanded in response to war demands, temporary foreign demands, and price supports. The imposition of these gains and losses on farmers cannot be supported in terms of efficiency or general welfare criteria, a point, largely neglected elsewhere in this volume.

8. Needed empirical research on aggregative supply responses must consider the partial irreversibility of the aggregate supply function. This applies whether the simultaneous equations approach of Cromarty, the "synthetic" approach of Bonnen, or the Leontief approach of Carter is used. Also, it will be necessary to take into account the shifters (technology, redistributions of asset ownership, risk and specialization). Because of high inter-correlation among the shifters, the synthetic approach may be very useful.

9. Additional empirical research is needed with respect to the incidence on owners of fixed agricultural resources of gains and losses resulting from fluctuations in the demand for farm products.

10. Still other needed research would evolve institutional arrangements to reduce the incidence of capital losses on owners of fixed agricultural resources.