

WILLARD W. COCHRANE
University of Minnesota

Some Additional Views on Demand and Supply

THIS paper is designed to do three things: (1) appraise and evaluate the rather technical papers on demand and supply presented by Collins and Mehren and by Johnson; (2) present some additional material on demand to gain an appreciation of the limitations and potentialities of demand expansion; and (3) make some informal judgments with regard to the outcome of the race between the aggregate demand for and the aggregate supply of farm food products in the years ahead.

COMMENTS ON THE GLENN JOHNSON PAPER

Not often does a man have a new idea, or do we have an opportunity to see a new idea unveiled. In the Glenn Johnson paper we have, I believe, an example of both. Johnson correctly argues that the weak spot in supply analysis has been the lack of a satisfactory theory of fixed inputs. I have had this feeling for some time; I was moving toward this conclusion at the Michigan State meetings in 1955, when with reference to the difficulty of estimating supply relations, I said: "... second, and of greater complexity, the analyst must know which factors the decision maker treats as fixed for the period and unit of inquiry under consideration..."¹ But Johnson has done something about this shortcoming in supply analysis. He has presented us with a conceptual framework involving the relationship of the marginal value product of a factor to its acquisition cost on the one hand and its salvage value on the other. Where the marginal value product of a factor exceeds its acquisition cost, more of it will be added to the production process, for the unit of inquiry under consideration, and where the marginal value product falls below the salvage value it will move out of production. But where a factor's acquisition cost is substantially different from its salvage value, it can remain fixed in the production process while the price of the product it produces varies on wide ranges.

I like this. Here is a useful conceptual device for judging, or appraising, different categories of inputs, in different contexts, with regard

¹"Conceptualizing the supply relation in agriculture," Jour. Farm Econ., Proceedings Number, Nov., 1955.

to their variability, or lack of variability, in the production process. Much as I am impressed with this idea, however, I do not see why it need invalidate all prior explanations of fixed inputs in agriculture. I still think that the fixed cost idea is useful in explaining the sustained employment of family labor and the purchase of inputs on long-term commitments. Also, the lack of alternatives argument, with the consequent perfectly inelastic supply function for the factors, still seems like a good explanation for the sustained use of hired labor and land. And I would not forget the occupational unity of functions argument of Brewster and Parsons. It seems to me that all of these arguments have a role to play in explaining the fixity of inputs in agriculture; they could, for example, play a role in formulating the 36 hypotheses in Table 5.1 of the Johnson paper, which they do not now.

The Johnson analytical framework for analyzing the degree of variability of an input is tidier, and perhaps more general in application, hence more soul-satisfying to economists, than the above more special explanations. Although here it is a little hard for me to see how the acquisition cost — salvage value dichotomy fits, for example, the category of family and operator's labor (and one of the footnotes to Table 5.1 would suggest that Johnson is vague on this point too). Typically we do not think of acquiring and salvaging family labor. I would suggest that the Johnson analytical framework will prove most useful in analyzing his first and third categories of inputs; nonfarm produced durables such as tractors, combines, and lumber on the one hand and specialized farm durables such as dairy cows, orchards, and breeding stock on the other. We customarily think of these inputs as having distinct acquisition costs and salvage values; we do not with respect to family labor, or such nonfarm expendables as gasoline, paint, and insecticides.

Having developed a conceptual framework for dealing with the fixed input problem, Johnson then uses this framework to analyze the aggregate supply function in agriculture. I am happy to say that he gets his unit of inquiry straight (something that many micro analysts do not); each category of resource inputs is appraised with respect to its acquisition costs to the farm sector and its salvage value for the farm sector. But the weak point in Johnson's positive argument is with respect to the hypotheses in Tables 5.1, 5.2, 5.3, and 5.4. These hypotheses rest upon two levels of generalization: one touched upon in the text, and one touched upon in a series of footnotes to Table 5.1. These hypotheses must be made to stand on something more substantial than the casual remarks mentioned above; these hypotheses are crucial to the entire argument and, as they stand now, their formulation is something of a mystery. Further, the formulation of so many of these hypotheses in a loose form (e.g., stable +, stable -, stable to contracting, stable or expanding) makes verification by the empirical analysis something less than convincing. More rigor, more analysis, and an improved presentation in this area are certainly required. In any event, Johnson's conclusions with respect to the aggregate supply relation for farm products over the business cycle are plausible and conventional.

With respect to the slope and position of the aggregate supply function, I would like to return to Johnson's review of earlier works (now reduced to one of the longer footnotes on record). In that review he correctly places, although this may sound strange to some, Schultz and myself in the same canoe. But he concludes that the bark is mighty leaky and that it will not carry us, or anyone else, very far. In fact, he says with complete assurance, referring to my analysis of the aggregate supply function, that "... it does not 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..." Now it may be a coincidence that the flow of labor inputs out of agriculture since 1920 has been just about offset by the flow of capital inputs into agriculture with total inputs holding constant. But the validity of my analysis does not rest on that coincidence, if coincidence it is. If for any one of the periods for which I derive an aggregate supply function, total inputs employed in agriculture increased in response to an increase in the level of farm prices, or decreased with a fall in the level of farm prices, the aggregate supply function would emerge with a positive slope (i.e., a nonzero elasticity). And for the period 1912-21, just such a supply function does emerge.² The aggregate supply function exhibits a positive slope during that period because total inputs employed in agriculture increased over that period in response to rising prices — primarily because of increased land inputs.

In summary, my analysis does not force a perfectly inelastic supply function for agriculture, as Johnson infers, and neither does it rest on a fortunate circumstance; if with the changing resource mix over the past 35 years, total inputs had increased with increasing farm prices, the aggregate supply relation in my analyses would slope upward and to the right as all good supply curves are supposed to do. But the hard facts are that total inputs employed by farmers have remained almost constant since 1920, and the modest changes that have occurred seem to be random in nature, or inversely correlated with price level changes.

Now let us open the real Pandora box in all of this — namely, the question of farm technological advance. Johnson argues that farm technological advance explains, in part, shifts in the aggregate supply over the years, but other shifters have played their roles too — namely, intra-sector resource movements, risk, and redistribution of assets. At this point, I believe, Johnson is confused, hence is wrong. In the above classification of supply shifters, Johnson confuses cause, or incentive, with effect, and he confuses the same phenomena when viewed from different vantage points.

First, what do we mean by farm technological advance? Johnson argues in footnote 19 that a technological advance must always involve the discovery of a new input. I would agree that farm technological advance generally involves the use (at the farm level, discovery does not affect the process under consideration) of inputs new to the production

² *Op. cit.*, p. 1170.

process. But, a new configuration in the use of old inputs, too, can lead to technological advance at the production level. The important thing to keep in mind with respect to farm technological advance is that it must always involve a new organization of inputs which gives rise to a new production function where output per unit of input is increased.

Now this does not mean that farm technological advance is limited to that case of the first farmer in the community, the innovator, who substitutes a general purpose tractor for a team of mules and increases his output per unit of input. Farm technological advance is involved as each farmer in the community makes this substitution and increases his output per unit of input. Innovator versus noninnovator is not the issue here — the key consideration is whether the farmer moves to a new and more productive production function.

Next, farmers who first substituted wheat for cattle grazing and then cotton for wheat on the high Texas plains may have been involved in intrasector resource movements, or regional specialization, but insofar as output per unit of input increased, this change in production practices (assuming constant factor and product prices) resulted in farm technological advance. The celebrated pin manufacturing example of Adam Smith may illustrate the advantages of the division of, or specialization of, labor, but insofar as some advantages did result from the new organization of resources — from the new and more productive production functions — technological advances occurred here, too.

Turning to another question, when do farmers typically adopt new practices that lead to increased output per unit of input? They do so when prices are good, when price and income expectations are good (i.e., risk is minimized) and when the asset position of farmers is good. Now why is this true? A new practice that will reduce costs no doubt is as desirable in hard times as in good times. But the adoption of new practices, involving new input combinations, which increase output per unit of input typically requires the acquisition of additional capital inputs involving additional cash outlays or financial commitments. Reduction of risk provides the incentive to invest in new techniques and production practices, and a good asset position provides the means of financing such investments. In other words, reduction of risk and improved asset position do not in some mysterious way shift the supply function. They speed up the adoption of new techniques and practices, requiring capital expenditures, which in turn increases output per unit of input and shifts the supply function.

In summary, technological advance permeates much, or all, decision-making in American agriculture; it assumes an infinite number of forms; its force stems from a variety of sources (e.g., low priced food policy, profit incentive, scientific achievement, widespread extension service); it is the key variable in American agriculture. As I see it, technological advance is the only real shifter of the supply function.

COMMENTS ON THE COLLINS-MEHREN PAPER

I read this paper twice before writing these comments, and each

time, as I read through the first six pages, I wondered: (1) what the program planners had in mind for this paper, and (2) what purpose Collins and Mehren had in mind when they prepared this paper. The six-page introduction is scholarly; there is no question about that. But I doubt if it contributes much to this conference. Appreciation of this rather extended introduction requires a knowledge of demand theory, familiarity with past empirical efforts to extrapolate into the future, sufficient experience with both to be aware of the many problems involved, and last but not least, thorough enjoyment of obscure writing. Since this is a farm management conference, I doubt that this is the case.

The major point of the first part of the paper, if I get it, is, however, a proper one; namely, because static consumption theory provides little help with respect to the tastes and preferences problem, because we do not have a growth theory which enables us to specify the relevant economic growth model, because the econometric model becomes too complex to handle and to understand where we go into any real detail, and because mortal man is not omniscient, we cannot do a very good job projecting demand, in the aggregate and by commodities, say to 1965, for production people to use. We can make some informed, and I believe useful, guesses with regard to the aggregates, but we do not place much confidence in the individual commodity extrapolations.

Now this should really not surprise us. So long as man is mortal, which will, I believe, be the case for some time to come, he cannot peer into the future and pinpoint future events, or specific relationships in this case. The best that we can do is make some informed judgments concerning the probable future developments based on past relationships and trends.

This is precisely what Collins and Mehren do in the second part of their paper, and in my judgment they do it well. They point out that the major determinant of the demand for food is population growth — "in food-demand projections," they state, "population is the crucial series." But they also point out that current and "reasonable" population projections as of 1965, or 1975, are dangerously wide. The demographers, too, lack omniscience — and the extrapolation of past population trends is a tricky business. With the major determinant of the future demand for food, in the aggregate or by commodities, as of 1975, thus running wild, we cannot project quantities demanded with any assurance. The best that the analyst in charge of projections can do is make estimates of food requirements under "reasonable" but alternative rates of population growth.

Collins and Mehren next point out that the income elasticity for farm food products (i.e., embodied farm resources) is extremely low, $+0.15$ to $+0.20$, and possibly is becoming lower. Hence, changes in average personal disposable income over the next 10 or 25 years, barring a major economic depression, can have little effect on the quantity of food demanded at any level of prices.

Bearing in mind these considerations, Collins and Mehren present in Table 4.2, food consumption estimates as of 1975 under four different

population assumptions (one Daly's, three their own). All suggest that the total demand for food will increase by at least 40 percent by 1975, with the four projections ranging between 40 and 48 percent. Most students of the problem would not quarrel with these estimates. Population growth alone assures estimates of this general magnitude. Further, I would say that such over-all estimates are useful; they provide some general, but needed guideposts for the future. With regard to the individual commodity extrapolations in Table 4.3, I am more dubious. The insoluble problem of changes in tastes and preferences raises its ugly head at this level.

Finally, I like very much the final paragraphs and final sentences of this paper, which slam the door on current daydreams and transcendental thinking with regard to expanding demand as a solution to the farm problem (i.e., eating our way out of the farm surplus problem). Many low-income people in the United States, perhaps 50 to 60 million of them, would increase their consumption of animal products substantially, if by government subsidy, or by some miracle, their incomes were increased substantially. But we have no evidence to suggest that a lot of people in the United States, if told that their diets need improving, or that beef tastes good, will reallocate their expenditures and purchase more high-resource-using food out of their present incomes. Such a development is contrary to all experience; once the consumer has filled his belly, given the cultural context of his society, he seeks new experiences and tries to satisfy other appetites, before refining his tastes and preferences for food.

Thus, I reach the same conclusion as Collins and Mehren: the "adjustment of production is the mechanism to be analyzed." Farmers, and their leaders, and I presume that this includes us, have to find a way to adjust production to demand, commodity by commodity, to yield reasonably good, and stable farm incomes. Consumers are not interested in such adjustments — why should they be? But farmers must be; hence, the burden of adjustment is on them.

THE ADVERTISING APPROACH TO DEMAND EXPANSION³

Farm people and farm leaders are asking more and more often: Can the tools of sales promotion and advertising that have been used so effectively in the nonfarm economy be used with corresponding effectiveness in agriculture? Or as proponents of sales promotion and advertising have stated it: Can agriculture through increased sales promotion and advertising make Americans want more farm products, and thus initiate a movement to eat our way out of the farm surplus problem? More and more this question is being answered affirmatively. Secretary Benson and Jim Roe in a recent issue of Successful Farming⁴ seem to

³Adapted from the brief article "Advertising — fact or fancy," Farm Policy Forum, Vol. 8, No. 5, 1956.

⁴Aug., 1955.

suggest that the answer to these questions is yes. And the various eat-more-egg weeks, eat-more-pork weeks, and so on, sponsored by the U. S. Department of Agriculture represent the sales promotion approach to the surplus problem. But before we make sales promotion and advertising an integral part of farm policy let us take a closer look at this approach.

First, it is reasonable to suppose, given a sufficiently large and persuasive sales promotion and advertising effort: that Idaho potato producers could persuade the average consumer to buy their potatoes instead of potatoes from other regions (to the extent that Idaho producers could supply them); that Swift packed meats could displace the meats of other packers; that oleomargarine could finish the job on butter or that butter could win back its place in the sun; or that any food item could gain a larger place in the average consumer's stomach by replacing close substitutes. But no one knows the cost of any one of these goals, or any part of one of these goals, hence whether it would pay producers to embark on such a policy. Basically this is not what farmers and farm leaders have in mind anyway. Most farm people want to expand the consumption of their product through sales promotion without substituting their product for another farm product.

Second, food processors, through sales promotion and advertising, can sell a lot of nonfood services — packaging, processing, and “ready to eat” meals — along with food itself. They have already done this, and budget studies suggest that they can continue to do it. Domestic kitchen help now comes in this form, and with rising real incomes and more working wives, we can expect families to purchase more and more of these nonfood services — built-in conveniences — along with food itself. But is this what farmers and farm leaders have in mind when they talk about sales promotion? Maybe, but if it is, they are being fooled. Selling spaghetti dinners in the place of dried spaghetti, frozen peas in the place of canned peas, and frozen packaged chicken breasts in the place of whole chicken increases demand and consumption of nonfarm, rather than farm, resources.

Third, consumers do not need to be “informed” about the useful qualities of food; their stomachs inform them of this regularly three times a day. Consumers also do not need to be “informed” about the desirable qualities of, say, pork chops or beef steak or fresh peaches; they know that these expensive food items taste good. The facts are that high income consumers eat all they want of these expensive items, and low income consumers eat them sparingly because they cannot afford to eat more of them. Lack of income, rather than lack of knowledge, limits the consumption of expensive animal products and fruit and vegetables among low-income families.

Fourth, no important consuming groups in the United States are under-consuming food as measured by calories. In short, no widespread group of American consumers need to be informed through a promotional campaign that they are starving, or need to be given food to increase their caloric intake. The average consumer in the United States, and

the average low-income consumer as well, is overeating in terms of calories (perhaps a promotional campaign is needed to make consumers more aware of this fact; however, the medical profession seems to have accepted the challenge of this problem). The diets of many Americans, perhaps 20 to 40 percent, are deficient with respect to calcium, certain vitamins, and protein. But these deficiencies could be corrected in most cases with no increase in the demand for farm products; they could, in fact, be corrected with a considerable contraction in the demand for farm products, hence farm resources. A few calcium tablets, a dash of fish oil, and a shift to whole wheat bread would eliminate the most glaring nutritional deficiencies in American diets.

Much confusion exists with respect to the relationship between the demand for farm food products (i.e., per capita expenditures for food) and the nutritional adequacy of diets. A nutritionally adequate diet need not be expensive. It can be composed of five food items — wheat flour, lard, cheese, cabbage, and carrots — at a cost of less than 40 cents per day per person, or it can be composed of choice cuts of meat, expensive dairy and poultry products, and a variety of fresh fruits and vegetables at a cost of five dollars or more per day per person, or at some level of cost between these extremes. In other words, the goal of nutritionally adequate diets does not insure a strong demand for farm food products. A strong demand for farm food products depends upon consumers wanting a diet heavily weighted with animal products and having the ability to purchase such a diet.

The point at issue is that some 30 to 60 million consumers in the United States (no one knows the exact number) would like to increase their consumption of animal products substantially — and they would do so if by some magic their incomes were increased immediately. But given their present day taste and preference patterns (that is, what they want in each consumption line) and their incomes, they are unable to purchase more red meat, poultry, and dairy products. Thus, the question is: Can sales promotion and advertising change the taste and preference patterns of these low to middle income consumers so that they will increase their consumption of animal products out of existing incomes?

To accomplish the above goal, sales promotion and advertising must cause these consumers: (1) to substitute expensive animal products for inexpensive foods such as bread and baked goods, potatoes, fats, and sugar, with which they are currently filling their stomachs and (2) to decrease their spending in nonfood lines — to buy fewer, or cheaper, TV sets, fishing poles, health insurance plans, clothes, vacation trips, and the like.

The first consumption adjustment is necessary to find a place in the human stomach to put the increased animal products, since even low-income consumers, on the average, are consuming more food, in terms of calories, than good nutrition dictates. The second adjustment is necessary to finance the first adjustment. Granted the necessary income, the first adjustment would take place easily, for this is the substitution

route that consumers do take when their incomes permit. But the second adjustment would be like extracting wisdom teeth — costly and painful. Sales promotion and advertising would need to bear the burden of making consumers want to increase their expenditures for food and decrease their expenditures of nonfood items out of given incomes.

This latter adjustment runs counter to the whole process of economic progress: As real incomes rise consumers first reduce the proportion of their incomes going to necessities (food and shelter) and increase the proportion of their incomes going to manufactured goods; then as real incomes continue to rise consumers reach a point where they cease to allocate any more funds to necessities, the proportion going to manufactured goods declines and the proportion going to all kinds of services increases. With rising real incomes, consumers the world around increase their expenditure allocations first to hard goods and then to services; this is the other side of Engel's celebrated law. Sales promotion and advertising might reverse this process, but it would certainly take a large and costly promotional campaign to do it. And it is a safe guess that advertising and sales promotion will not reverse it.

If we are really serious about increasing the total consumption of farm food products, we should turn to where it can be increased, namely, among the 30 to 60 million low to middle income consumers who would like to increase their consumption of animal products. But, in so doing, we must recognize that lack of purchasing power is the reason that these people are not eating more fresh fruit, meat, and dairy products currently. Hence, we must stand ready to subsidize the increased consumption of these more expensive foods among low-income consumers.

THE FABULOUS MARKET FOR FOOD SERVICES⁵

Expenditures for food in the United States increased dramatically over the 20-year period 1935-55 — by some 400 percent. However, when the effects of inflation are removed from these food expenditure data, the dollar value of the increase is reduced substantially — to some 120 percent. But a real increase in total food expenditures of 120 percent still represents a large expansion in the market for food products. This market expansion resulted from two principal developments: (1) a rapid rate of population increase, and (2) an important increase in consumer incomes.

When these food expenditure data are put on a per capita basis, the increase in food expenditures is reduced still more. Real, per capita expenditures for food increased 68 percent between 1935 and 1946, fell between 1946 and 1948, and have been rising since. Finally, the index of per capita food consumption, which measures the quantity of food consumed (on a value basis, not in pounds), shows only a modest increase for the period, 1935-55. It increased 16 percent between 1935

⁵Adapted from the article "Food services have expanding market," Minnesota Farm Business Notes, No. 375, Sept., 1956.

and 1946 and has been fairly constant since 1946. We conclude, then, that the market for food products narrows sharply once the expanding effects of population increase are removed. The market for raw food products at the farm level for the average consumer expanded only modestly between 1935 and 1946, and not at all since then.

Something must explain the difference between a 68 percent increase in real, per capita expenditures for food, and a 16 percent increase in the consumption of farm food products. That something is food service—those services built into, and associated with, food purchased at the retail level (e.g., storing, transporting, packaging, processing of all kinds, restaurant service, etc.). While the average person in the United States increased his consumption of farm food products 16 percent between 1935 and 1946, he increased his consumption of nonfarm food services by about 50 percent.

Since 1946, real, per capita expenditures for food have not increased. However, farm prices have declined significantly, permitting the consumer to spend an increased share of his food expenditure for food services. With this expanded market for food services and the fierce competition among food distributors and processors for the consumer's food dollar, a steady stream of new food products, new packages, and new methods of handling food have been poured on the market since 1946. Thus, the revolution in the kitchen has continued unabated.

As families move into the \$4,000 to \$5,000 income class they begin to spend their food dollars differently. They eat more expensive foods, of course; but what is significant to agriculture and to the marketing system is that they also begin demanding and buying a lot of processing in their food. Instead of buying a whole chicken to be cut up and apportioned at home, they buy a package of frozen chicken breasts, or better still, go out for a chicken dinner. The modern American family wants not only good food, but convenience built into that food as well.

The relentless pursuit of convenience items has been the most dramatic change in the food market since 1946. Most of the food purchased today is prepackaged. An important share has been precooked and apportioned as well. The American housewife substitutes these conveniences built into food items for kitchen help and tiresome hours spent in the kitchen. Thus, the purchase of services, or conveniences, built into food products is now enabling the housewife to follow the cook and the maid in their flight from the kitchen.

In buying food at retail the consumer really buys two different kinds of products: (1) a bundle of resources developed into a farm food product, and (2) a bundle of resources developed into nonfarm food services. The consumer behaves very differently with respect to these very different products. A recent study at the University of Minnesota,⁶ which breaks the total food bill into two categories, expenditures for farm food products and expenditures for nonfarm food services, makes this

⁶See the article entitled "On the income elasticity of food services" by Bunkers, E. W., and Cochrane, Willard W., *Rev. Econ. and Stat.*, May, 1957.

very clear. The income elasticity for farm food products in the United States runs as low as .25, whereas the income elasticity for nonfarm food services ranges between 1.0 and 1.3.

In other words, the average consumer increases his expenditures for food itself only modestly as his income rises. But he increases his purchase of food services proportionately, or even more than proportionately, to his income increase. The rapidly expanding market in the food field, then, is not for food itself. The fabulous market is to be found in food services.

We are thus forced to the following conclusions. First, rising real incomes in the past have not greatly expanded the market for farm products at the farm level. The big element in expanding demand for farm food products in the past has been population increase. Second, as the incomes of more and more families rise — reach the income level now approximating \$5,000 — further increases in income will have little or no expanding effect on the demand for food itself. After this income level is reached, increased expenditures for food products growing out of increased income go largely into the purchase of more services associated with food. Third, in the foreseeable future, a further widening of the market for total farm food products (raw produce at the farm level) is likely to become dependent on population increase alone.

In short, we are approaching the time in the United States, perhaps by 1975 and certainly by 2000, when the income elasticity for farm food products will have declined to zero, but the proportion of disposable income allocated for food is increasing because consumers are demanding more and more services associated with, and built into, their food.

THE LONG-RUN RACE BETWEEN THE AGGREGATE DEMAND FOR AND THE AGGREGATE SUPPLY OF FARM FOOD PRODUCTS⁷

By way of pulling together the various ideas and relationships under consideration, it is helpful to summate the decisions of all producers of food products into an aggregate supply relation, and the decisions of all consumers into an aggregate demand relation. As is generally recognized, each of these aggregate relations is highly inelastic, and when related in a demand and supply analysis, these highly inelastic relations "explain" the dramatic fluctuations in the farm product price level. Each is so inelastic that a small change in one relative to the other gives rise to a large change in the farm price level. For example, a 4 percent contraction in the aggregate demand for farm food products in a free market situation could cause the farm price level to fall by 40 to 50 percent.

The point to be made is the following: wide swings in the farm price level and in gross returns to farmers are the norm for agriculture.

⁷Adapted from "The agricultural treadmill" in the forthcoming book, *Farm Prices — Myth and Reality*, University of Minnesota Press, 1958, Chap. 5.

Those swings are generated by the highly inelastic aggregate demand and supply relations for farm food products, where one relation shifts only modestly relative to the other.

It would be wrong, however, to visualize these aggregate relations shifting back and forth in a static, no-growth context. Over the long-run, both of these aggregate relations have been expanding; we have had a race between the aggregate demand relation and the aggregate supply relation. Changes in the farm price level growing out of shifts in the relative positions of the aggregate demand and supply relations have most often resulted from unequal rates of expansion in these aggregate relations. The race has rarely been equal, and at times it has been very unequal with extreme income consequences.⁸

Further, as earlier sections of this paper make clear, the long-run race between aggregate demand and aggregate supply in fact is a race between population growth and farm technological advance. Population growth and farm technological advance have in the 1950's become the shifters of aggregate demand and aggregate supply respectively. Since, however, none of us are omniscient, it is impossible to demonstrate that population growth will outrun technological advance between 1955 and 1975, or the converse. Those who are more impressed with the capacity of Americans to reproduce themselves than to create new ways of producing goods and services will probably conclude that population growth will win the race. But others who are more impressed with the inventive genius and the adoptive propensities of Americans than with their procreative efforts will probably put their money on technological advance.

But which wins is extremely important to American farmers. If population growth outraces technological advance, other things being equal, aggregate demand will press against supply and push the level of farm prices upward, as between 1895 and 1915. But if technological advance outraces population growth, other things being equal, aggregate supply will press against demand and drive farm prices downward, as has been the tendency since 1948.

Some evidence can, however, be adduced as to the outcome of the race between aggregate demand and aggregate supply over the period 1955-75, where proof is impossible. Over the period 1951-56 total population in the United States increased by exactly 9 percent. Over the same period the total output of marketable farm products increased by 13 percent. Now the figures in this comparison change somewhat depending upon the exact years chosen and the output index used, but the general picture does not change. The total output of farm products in the first half of the 1950's is outracing population growth. This increase in total farm output occurs in the face of a declining farm price level, and with no significant increase in the total inputs employed.

⁸For a good discussion of the unequal rates of growth between aggregate demand and aggregate supply, see Schultz, T. W., *Agriculture in an Unstable Economy*, McGraw-Hill Book Co., 1945, Chap. 3.

A major study by James T. Bonnen (reported upon elsewhere in this volume) looking forward to 1965, which assesses the output expanding potential of all "known and almost known technology," suggests that the trends of the early 1950's will not be reversed.⁹ Assuming that the farm price level is maintained at the 1955 level, which relatively speaking is a low level, Bonnen estimates that total agricultural production will increase by 30 percent between 1955 and 1965. Using an estimate of a 15 percent increase in population over the period, and a 4 percent increase in per capita food consumption, the Bonnen model indicates that the annual rate of farm surplus which stood at 8 percent of total supply in 1955, would increase to 12 percent as of 1965. In other words, this study which takes a comprehensive forward look to 1965, concludes that output expansion will increase its lead over demand expansion in the years ahead. In terms of the 1955 farm price level, the total farm surplus will increase from 8 percent in 1955 to 12 percent in 1965.

In summary, it is the judgment of this writer that the rate of aggregate output expansion can easily exceed the rate of aggregate demand expansion over the period 1955-75. In this probable event, one of two things must happen: (1) the annual accumulation of surplus stocks by government must increase, or (2) the farm price level must fall precipitously. The capacity to expand farm output beyond the needs of the population is there and, unless counteracted in some effective way, this capacity will further intensify the general income problem in agriculture.

⁹From the paper "The structure of agriculture," presented before the North Central Farm Management Research Committee, Chicago, Mar. 18-19, 1957.