3

Impact of Economic Development and Relative Factor Returns

THE FOCUS in the last chapter was of an intermediate period, reflecting neither the extreme short-run or transitory problems of income which attach to low price elasticity of demand or the more persistent, and almost permanent, secular lag of per capita income in the agricultural sector behind that of the industrial sector. The view was of American agriculture in an economic development setting of the years since World War I. While war-inspired increases in demand caused the agricultural sector to be profitable relative to the nonagricultural sector for short periods in this span of time, the general trend was toward increase in the supply function and depressed terms of trade of products in the agricultural sector for those in the nonagricultural sector.

But to better understand the economic problems of commercial agriculture, and the policy and institutional mechanisms appropriate for them, we need to turn in two directions: First we review the problems paramount in the short run because of low price elasticity of demand and fluctuations in commodity supply. Second, we make a broader analysis of the agricultural sector, examining its income performance in the greater dimensions of time, and economic development. Clearly, the first, low price elasticities of demand and cobweb fluctuations in production, calls for a specific agricultural policy. This is true because it stems from variables which are peculiar to production and decision-making processes for agricultural commodities. The second, however, more nearly calls for policy which is related to agriculture but which has its orientation in economic growth. Its variables relate more

to interrelationships among national economic growth and the supply of factors, particularly of labor. Because it has been given detailed treatment elsewhere and is the least complex of the two, our treatment of the first is brief in this chapter. But it points up certain policy needs.

SHORT-RUN FLUCTUATIONS

Agriculture in nations well endowed with soil and climatic resources and favored by economic growth has experienced one type of stability; namely, ability for growth in supply to exceed growth in demand. But because sufficient capital also is present in agriculture under this setting, and agriculture is commercial, interyear stability in output of particular products tends to be low. Commodity output fluctuates greatly, in the absence of group or administrative control of price and production, between years or over short periods conforming roughly with the biological period of production. This inter-period instability in output and price arises because the elasticity of supply for individual commodities is relatively great. Coupled with a low price elasticity of demand and fluctuating output, the *high short-run elasticity of supply in respect to price for individual commodities* gives rise to a particular type of income problem in agriculture. It is in contrast to the income problem which arises from the *low short-run elasticity of supply in respect to price for agricultural commodities in aggregate.*

The high short-run supply elasticity for individual products gives rise to fluctuations well known as commodity cycles for potatoes, hogs, beef cattle, poultry and similar products. Fluctuations in output and hence price arise because of the somewhat discontinuous production period involved, the fact that output responds to expected or planned prices, because the production process per se is highly irreversible and because of the particular expectation models prevailing in agriculture.[1]

Consequently, planted acreages for crops such as soybeans, potatoes and fresh vegetables can change greatly between years. Similarly, the number of hogs, turkeys and chickens fluctuates considerably from one year to the next, with a somewhat similar and less explosive change for cattle, sheep and orchard crops over a longer period of time. In livestock particularly, several years are required for commodity cycles to build to peaks and troughs in market supply and price. The length of the period, from peak to peak, is inversely correlated with the intrayear elasticity of supply for the particular produce. If the elasticity is extremely high, in changing inputs and outputs between two years, and if the commodity does not represent an important resource in its own reproduction, output and price changes may be reversed in a single year. But where this is not true, and the commodity produced is withheld in important quantities from market supply to be used in extending output of later

[1] In respect to the latter, see Earl O. Heady, *Economics of Agricultural Production and Resource Use*, Prentice-Hall, New York, 1952, Chaps. 15–17.

periods, several years are required before a cycle in market supply and price is completed.

These fluctuations in commodity supply are but little related to the magnitude of consumer demand and national economic growth. They would occur if the consumer demand function for food grew at rapid rate, technological change did not take place and national economic growth were absent. Evidently the main expectation model employed in planning output for commodities with short-period cycles is one which extends the price of the current period, or recent trend into the future. Also, an aid to this cobweb reaction is pure competition and a supply function which has great intrayear elasticity. The supply path is highly reversible in the sense that output can recede, between production periods, down a particular function as easily as output is expanded along it.

Coupled with this planning basis for commodities with a longer cycle is a lagged distribution of response to price change. The distributed lag, arising because full adjustment to a price change cannot be made in one period, may stem from: (1)uncertainty with which expectations are held and discount of mean expectation of future prices; (2) price expectations which are a function both of "normal" prices and existing prices; (3) fixed costs and specialized equipment limiting short-run flexibility; (4) psychological restraint to sudden or large magnitude of change; and (5) a total complex which causes supply elasticity to increase with time but also causes the supply function to maintain an important degree of short-run irreversibility within production periods. In these two general cases, supply may fluctuate sharply between years as in the more volatile case of vegetables, or build up to peaks and decline to troughs more gradually as in the case of beef cattle.

In addition to the cyclical response of producers to price change phenomena, fluctuation in output and price also occur because of stochastic or random variables associated with climate and nature. These fluctuations are not importantly related to producer behavior, demand changes or economic growth. But because of low demand elasticities for major farm products, they have income effects paralleling the commodity cycles pointed out above. Hence, it is appropriate to consider the two together in this section. The particular or combined magnitudes of these two types of fluctuations are indicated in Table 3.1. Variations in output of both livestock and crops are high when we consider the small magnitude of price elasticities of demand; so great that the consequences in lowered income can be great. For the industry as a whole, a conservative picture since increases between years in one commodity offset decreases in another, variation in output is much greater than variation in input. This difference is due mainly to stochastic or random fluctuations which are not planned by farmers. The stochastic element also causes greater variance for crops than for livestock. The magnitude of change between years in input is major indication of

TABLE 3.1

INTER-YEAR VARIATION IN PRODUCTION. SELECTED FARM PRODUCTS, 1930-60

Commodity	Mean Percent Change Between Years	Commodity	Mean Percent Change Between Years
Hogs (no. farrowed)	9.8	Soybeans	22.6
Beef cattle (no. on farms)	3.6	Flax	39.4
Beef cattle (no. fed)	9.6	Wheat	14.0
Dairy production	1.7	Feed grains	15.1
Turkeys (no. produced)	10.3	Cotton	17.8
Chickens (no. produced)	4.9	Potatoes	10.5
Eggs (no. produced)	3.5	Tobacco	13.6
Corn	16.2	Oranges	8.9
Total farm inputs used	.5	Total farm output	4.0

planned change, although aggregate adjustment also obscures offsetting changes or substitutions among resources.

The income problem stemming from short-run fluctuations in farm output can be illustrated by means of a simple algebraic example where, for simplicity, we do not bother to include the effects of cross elasticities. Suppose again a demand function as in equation (2.1) where the price elasticity is of magnitude $-e$, a quantity smaller than 1.0. Also suppose that mean industry output is Q_m. By equating this supply, Q_m, with the demand in (2.1), the indicated equilibrium price for this output is (3.1) and gross revenue is (3.2) where we make the substitution $e^{-1}=r$ and r is greater than 1.0. However, if in individual years output or production takes on the value b_iQ_m, the equilibrium price in the ith year then is

$$P_m = c^r Q_m^{-r} \tag{3.1}$$

$$G_m = c^r Q_m^{1-r} \tag{3.2}$$

$$P_i = b_i^{-r} c^r Q_m^{-r} = b_i^{-r} P_m \tag{3.3}$$

$$G_i = b_i^{-r} P_m \cdot f_i Q_m = b_i^{1-r} G_m \tag{3.4}$$

(3.3) and gross revenue is (3.4) where equation (3.3) has been multiplied by output, b_iQ_m. Now with price elasticity of demand, e, less than unity, and with b_i greater than 1.0, G_i will be smaller than G_m. In other words, revenue in a year of a large crop will be smaller than that in a year of an average crop. This is true since G_m in (3.4) is multiplied by a quantity, $1/b_i$, smaller than 1 raised to a power which increases as elasticity decreases. Hence, if b_i is 1.2 and e is .5, revenue in (3.4) is only .83 proportion of that in (3.2), a decline in revenue due to an increase in output. If, however, b_i is less than 1.0, indicating a decline in output due to weather or similar variables, G_i will exceed G_m by the ratio b_i raised to the power $1-r$. Hence, with $b_i=.8$ and $e=.5$, G_i exceeds G_m by the ratio 1.25, an increase in revenue due to a smaller crop. This change in mag-

nitude of revenue with large or small outputs would hold true for demand functions of other algebraic forms where elasticity is not held constant, given the low price elasticities for major farm commodities. Also, revenue from fluctuations can be less than that from constant production.[2] For, even if we consider cross elasticities and add the substitution effect, total revenue still decreases with greater output of major farm products.

At low price elasticities, revenue from an agricultural commodity fluctuates more than production, as weather and farmer planning procedures cause output to swing in contrary directions between years or production cycles.[3] Too, the relative magnitude of fluctuations in income, without countervailing force in farmer decision procedures or public mechanisms, stand to increase with time, as price elasticities decline due to further rise in per capita income and greater constancy in food intake. Hence, while output fluctuations are due to peculiarities of the agricultural production and decision making processes (aside from magnitude of consumer demand and per capita income growth) the relative magnitudes of the fluctuations in income are a function of economic growth and the demand environment. Under expected conditions outlined above, growth in magnitude of fluctuation with economic growth and decline in demand elasticity, average revenue will be depressed even more due to fluctuations in output. (See discussion in previous footnote.)

If the mean of income increments in years of small crops was greater than the mean decrement in years of large crops, fluctuating output would return more to agriculture than constant output, as an average over time. But with the opposite holding true, short-run output fluctuations will cause mean income over time to be less than under stable production. For example, with a constant price elasticity of .4, an increase of 10 percent in output will decrease price by 25 percent and decrease revenue by 17.5 percent; a decrease of 10 percent in output will increase price by 25 percent and increase revenue by 12.5 percent. In this case, average revenue from periods of increase and decrease in output by 10

[2] As a simple example using another algebraic form, suppose the demand function in (a) which, from equation with annual supply Q_m and solving for P, gives the equilibrium

$$\text{(a) } Q_d = K - aP \qquad \text{(b) } P = a^{-1}(K - Q_m)$$

price in (b). Using the arithmetic quantities $K=7$, $a=.2$ and $Q_m=5$; the equilibrium price is \$10, the price elasticity is $-.4$ and total revenue is \$50. If production is b_iQ_m in a first year with $b_i=.8$, elasticity is $-.75$ and total revenue is \$60. If then $b_i=1.2$ in a second year, equal absolute "deficits" and surpluses in the two years, elasticity drops to $-.17$ and revenue to \$30. Under production at Q_m level each year, revenue averages \$50 per annum. But if a series of three years gives production of Q_m, $.8Q_m$ and $1.3Q_m$, per annum revenue averages only \$46.67.

[3] In our numerical example above, using a particular algebraic form, output ranges only between $.8Q_m$ and $1.2Q_m$ but gross revenue ranges between .83 G_m and $1.25G_m$. If the elasticity coefficient used were .2 instead of .5, output fluctuating between $.8Q_m$ and $1.2Q_m$, revenue would fluctuate between $.41G_m$ and $1.56G_m$. In the example of our previous footnote, output fluctuates only from 4 to 6, but revenue fluctuates from 30 to 60.

percent each will be smaller than if output were constant at the mean of periods. In the case above, gross revenue will be 2.5 percent less with fluctuations in output equal to plus or minus 10 percent, as compared to constant output among years. (Net revenue will be even smaller due to fixed costs within and between years.) It appears for major commodities that the decrements exceed the increments, in their effect on revenue and due alone to output fluctuations, for recent crops and periods without government price supports and storage.[4]

The income problem pointed out above does not rest on variables which call for modification of agricultural structure. It is true, of course, that the uncertainty and income instability created by the phenomenon cause farmers to use planning strategies which lower the efficiency of resource use.[5] The latter could be greatly lessened with elimination of the source of output variation, but the change in structure of agriculture would be modest. Modification is needed, instead, in market institutions to dampen annual fluctuations in quantities marketed and prices. Public storage policy to withhold the excess of bumper crops until years of small crops is needed to meet output fluctuations based on weather. Mechanisms for forward pricing and an altered environment for formulating price expectations, and education on decision procedures or strategies to accompany it, are needed for commodities with production cycles conforming to the cobweb pattern. We shall return to these and related policy propositions in a later chapter.

Equity in Distribution of Gains and Losses

But why should policy concern itself with fluctuations of the type mentioned above? Farm records and other data are available to prove that while farmers in aggregate may have less revenue under cobweb production response and commodity cycles, managers who are "on their toes" can actually gain from this instability. They, given knowledge of the cobweb structure, can increase their output in years of mass reduction and vice versa. Gain by some and loss by others does not, however, guarantee positive-sum utility outcomes for the aggregate community of farmers. Perhaps it could be true that a dollar of loss to a beginning farmer with low income involves less sacrifice in utility than the benefit to an experienced manager from a dollar of gain, but there is no interpersonal measurement available to prove it. Many would doubt it under these circumstances. Thus a problem of equity in the distribution of gains and losses from economic change and instability does arise. As in struc-

[4] We know too little here since demand estimates, like the example above, have most often been estimated in terms of average of arc elasticity. Hence, we still know little quantitatively about the magnitude by which elasticity increases or decreases as quantity decreases or increases respectively. As Table 3.1 indicates, the major short-term fluctuation is in output, and not in inputs. Hence, farmers do not compensate, in years of increased output and reduced revenue, by reducing costs. For this reason, fluctuation in net revenue is even greater than fluctuation in gross revenue.

[5] For example, see the discussion in Chapter 17 of Heady, *op. cit.*

tural problems of agriculture under economic growth, it is appropriate to examine policies which may better guarantee the positive-sum welfare outcomes or Pareto optima outlined in later chapters. These problems of equity in the distribution of gains and costs of change are almost everywhere the foundation in agricultural policy.

FUNCTIONING OF AGRICULTURE UNDER ECONOMIC GROWTH

The above section dealt with an aggregate problem of a commodity, and one of some importance to a major part of the industry where self-administered or public management of supply and price is absent. But it is a problem of a much shorter period than the one showing through the sketch of recent economic trends in Chapter 2. We now turn to the much more basic and long-run source of problems in relative income and factor rewards in agriculture. The phenomena to be examined is that of economic growth and agriculture's contributions to, and burdens from, it.

The Hens and the Egg

The interrelationship between agricultural development and national economic progress poses the problem of the hen and the egg. Which contributes mainly to the other? This question is still an extremely important one for some countries. What priority in allocation of public and private investment capital should be made for agricultural development as compared to industrial sectors? There is no standard answer to this question, even in nations where the public sector predominates and planning is largely by the state. The optimum current allocation of increments in development capital differs between India where food scarcity is a problem and Russia where food scarcity is near elimination; just as it does between Russia with less development and the United States with greater development and food surplus. It also differs between the U.S. economy of a century ago and that of the decades ahead. The question itself is now much less crucial and appropriate in the United States.

Before World War I, the U.S. agricultural sector employed a significant portion of the nation's labor force and total resources. Development of agriculture to save resources and free them for other sectors could contribute to the nonfarm sector, in magnitudes comparable to the gain of agriculture from economic development in other sectors. Development of agriculture still contributes to national development, but dependence of the national economic growth on agricultural development is now greatly diminished. This is true because the agricultural sector is a small and declining portion of the national economy and uses only a small fraction of nation's employed resources. While the hen couldn't exist without the egg, it has now hatched and can grow and produce its own surplus; the one egg of the product allocated to regeneration of the cycle being largely an insignificant diversion.

Growth Initiation in Agriculture

Starting from the other end in isolated and primitive societies, the story was quite different. General economic development depended unilaterally on agricultural development. Man's first task was to feed, shelter and reproduce himself. With no surplus product beyond that needed for these consumption activities, growth aside from primary subsistence could not be kindled. Only as development progressed to a point where labor produced a product in surplus of subsistence requirements could growth be initiated in another sector; or could another sector even exist. Development of agriculture effectively provided the capital allowing the initiation and growth of other sectors. As part of this process, it also produced food beyond subsistence of agricultural families, in order that population grew and a portion of food growth could be so utilized.

Initially, development in the primary sector went entirely to support population growth remaining in the sector, rather than for providing capital for initiation and growth of other sectors. Given the extreme postulated by Malthus, growth of other sectors could never have been initiated. But either through abstinence or primary development, growth of other sectors was initiated and the occupational trek from farm to town began. Initially, and for many centuries, growth of the nonfarm sector came about not by a direct diversion of labor and other resources from agriculture, but from simultaneous growth in labor and capital resources used in both sectors, with agriculture producing a surplus of labor and capital for diversion to development of the nonfarm sector. Problems in relative incomes and income distribution were nonexistent, even had there been statistics to allow their comparison, in periods when growth in agriculture not only paralleled that of other sectors but also agriculture dominated the total economy. Most persons born in agriculture remained in the sector and occupational transfer, and lagging income of agriculture was not an important issue.

This setting holds true and continues as long as the pace of development is slow, with growth in national income equal to, or meagerly in excess of, population growth. Populations then are kept so poor that their most urgent marginal want is still food and the central assignment of new members, representing additions to the labor force, is to produce their own food with only slight surplus. Frequently, this is the only choice open to them, since supply of employment opportunity in the nonfarm sector is too greatly restrained by slow growth rate. As long as the major effort of resources must go into food, growth in other sectors, starting from a small portion of the total economy, spreads thinly over the total. Growth in nonagricultural sectors has no appreciable effect on per capita incomes of the total population and, hence, on the pattern of demand.

Even after agriculture has developed to an extent allowing initiation of and progress in growth of nonfood sectors, the pace is slow and

centuries-consuming. But even at minute initial pace in this growth process, the passage of sufficient time eventually brings capital and income to crucial levels. National product then allows important gain in per capita income and causes the pattern of demand to shift greatly, with the major part of consumer expenditures no longer allocated to food. Also at this point, allocation of the stream of population growth between the two sectors changes in relative proportions. This process is not, of course, as distinct as change in the seasons. It is so gradual that it is scarcely identified as it takes place, until it reaches a point where it is a "common place knowledge" of agriculturists that farming is a declining portion of national income—even though the turning point occurred far in the past.

AGRICULTURE IN ECONOMIC DEVELOPMENT

Agriculture has played an important role in economic growth for most nations up to and as they moved into the take-off stage towards maturity in development. This contribution often was less importantly that which might be indicated as "directly and biologically fundamental and obvious," and more that which was *indirect and less apparent.* In the primitive stage, of course, productivity of labor had to be increased to a point where some was freed from husbandry for other sectoral occupations. Workers could be released from food production to plant the first seeds of general economic progress only with development of agriculture. Too, food industry had to grow so that population, industry and commerce as well as agriculture could increase. But even in early stages, and later in nineteenth century America, the gain was as much the other way around. The rapid growth of population, supported particularly by commerce, industry and foreign trade, provided a market for the product of agriculture. It wasn't necessary that population exogenous to agriculture increase, but since it did, the role was as much that of social growth creating a market for farm products as that of farmers feeding city consumers so that they could keep alive.

Agriculture of nations in the future will never realize expansion in markets, from total growth in population and society, as rapidly as it did in the seventeenth and eighteenth century frontier regions of the world. Never will the U.S. agricultural sector have the same relative opportunity for capital gain, from general economic growth and activity quite apart from farming, as it did in the nineteenth century with land clearing and rising land prices. Contrast twentieth century India and nineteenth century North America. Economic growth in India cannot give comparable capital gains to Indian cultivators, which in turn can be used for improvement of farming. The only comparable periods, and then temporarily, of large capital gains to American agriculture from forces entirely outside the industry, were in two world wars of this century.

Social and economic growth obviously contributed much to agriculture in the United States during the 1800's. But agriculture also con-

tributed to economic growth in a manner apart from the typically emphasized biological role of food. This contribution was of character realized in early growth stages for all nations. Agriculture provided an important amount of capital for general progress. Starting from an economy which is dominantly agricultural, the surplus and capital formation largely must be drawn from this industry. Employment in farming represented 72 percent of the U.S. work force in 1820. It was still 65 percent in 1850 and had only fallen to 50 percent in 1880.

In early regimes of landed nobles and serfs, or landlords and croppers, the surplus of income was practically all in the hands of the landowner. It was he, and not the serf or cropper with subsistence level of income, who could be taxed to provide funds for social investments. Still, in the development of nations such as the United States and Canada with owner-operators dominating, surplus or capital was drawn directly out of agriculture by property taxes. It gave rise to a type of social overhead capital represented by public schools, roads and other facilities of extreme importance to growth in the longer perspective. In a manner, agricultural resources contributed greatly to the development of railroads in the United States. Extension of this transportation was promoted through land grants, attractive as payment in kind largely because of the growing market for farm products.

Yet the most important syphon of surplus income from U.S. agriculture was by another source. It came about as population growth or labor supply in agriculture exceeded labor demand by the industry and net outmigration occurred. One source of capital transfer was in people per se. The agricultural sector invested capital in children, beyond its own labor demands. Capital so represented moved to the city with the laborer and nonfarm industries was not required to allocate a portion of income and capital to this portion of their labor force. But another source of capital transfer was also important. The inheritance customs prevailing in early times as well as now caused a distribution of capital gain and accumulation among all members of farm families, with a portion of the capital gain and income surplus eventually moving to the city with farm children who so migrated. This process still continues, but it is of much less relative importance than in early times.

Only in recent decades have numerous state economies passed this stage where a major portion of social capital was forthcoming from agriculture, and the intergeneration transfer of capital to city sectors became of minor importance. Agriculture has been the dominant sector of state economies within the last 50 years for most states west of the Mississippi River. Schools, roads and court houses were built mainly during the period prior to World War I in Iowa, Kansas, Oregon, Oklahoma and similar states with the exchange of products from original soil nutrients.

We have already mentioned another type of gain which accrues to general society from progress in agriculture. It occurs with technological progress and a relative increase in the commodity supply function, ac-

companied by a relative decrease in the factor demand function in agriculture. While the decline has been relative in the demand for the capital, it has been absolute for labor. The nonfarm labor force has been augmented by reduction in number of farm workers as well as by net outmigration from the continuous supply of youth entering the labor force. Through internal development, agriculture has freed resources to be used elsewhere in the economy, but not without some income lag due to the low mobility and supply elasticity of farm labor. Under these conditions, farmers simply accumulate less surplus income and capital to be transferred to nonfarm sectors. But by the same token, and because they need not make so large an outlay for food, food consumers can have greater surplus over income, allowing capital accumulation accordingly. A century hence, few will care whether capital for development arose more because food was abundant and consumers had greater savings, or because food was somewhat less abundant and farmers had greater surplus of income over consumption. In either case, the state of demand will lead to its eventual investment more in other sectors than in agriculture.

The question is more one of the present. Who should bear the sacrifice and who should realize the gains of this income and capital for development? In terms of numbers, one might now say that it is more essential that food consumers be given the opportunity; they outnumber food producers 11 to one. Yet there are no propositions in intergeneration or intrageneration welfare economics to prove that community utility over time is so maximized. Again, then, we are confronted with the foundation of agricultural policy problems; namely, equity in distribution of gains and losses, or of distribution which guarantees positive-sum outcomes in utility and welfare aggregated across all major economic sectors.

Agricultural Development for Social Capital

The demand setting to the turn of the current century was ideal for agricultural development policy, the variety of policy emphasized by the United States for the farm industry. It was ideal not only in the sense that the setting of demand elasticity allowed development of agriculture to bring greater revenue, but also in a Pareto-better sense. The Pareto-better condition, explained in detail later, was a product attainable by development of agriculture because two groups could be made better off: farm producers in greater revenue from farm products and consumers with lower real price of food and, effectively, more resources for economic growth. With direct focus on welfare of the agricultural industry, which was largely the whole of American society in terms of population, the demand for agricultural products allowed growth of the farm industry which outpaced the supply of labor arising in agriculture. Farming was expanding rapidly and drew upon supplies of labor outside the agricultural industry, particularly foreign emigrants and persons from settled farming regions. Income elasticities of demand were favorable and even, in the developing foreign market, price elasticity of demand

for U.S. farm products blessed rapid shift in the supply function over much of the nineteenth century.

These conditions also were ideal for general society and progress. American society needed to build up its overhead capital, beyond that supplied by foreign investments and nonfarm sectors. It needed investments which provided "quick turnover." Public investments or aid in railroads, schools and general utilities of time required a much longer period for high payoff. Agriculture represented an opportunity for a much quicker payoff. Agriculture of the time rested mostly on land and labor, resources abundant in supply (land from within and labor from emigration), and but little on capital. By putting public land in the hands of cultivators who developed them commercially, a surplus of income over consumption was developed in a short period. Labor used to develop the land did not always drain on the capital of agriculture for rearing, because much of this cost or capital was provided by European countries. Labor came from these economies as "capital ready to go to work" in agriculture.[6] This surplus, in a relatively short time, provided a most important single source in capital formation leading to the rapid take-off in economic growth. Given the realized expansion in foreign markets during the 1800's and the availability of unsettled space around it, U.S. society could have found few other investments, leading to a quicker payoff and generation of further capital, so productive as investment in the Louisiana Purchase and its distribution to farmers and foresters.

A great deal said above also applies to the public decision which later led to social investment in research and knowledge communication for agriculture at a later time. While the gestation period in capital formation, or in capital input relative to its payoff, was a little longer, starting from the point of employing public scientists and building research facilities, it still was an investment which could give a large and relatively quick payoff. Once uncovered, improved seed varieties, improved husbandry, fertilization and better ration mixes require a short transformation period, as compared to canals, roads and alternative public investments which generate income only over a longer period of time. Hence, public policy to further aid development of agriculture, through socialized research facilities, was an appropriate decision in behalf of economic development. When initiated a century ago, demand conditions favored this as a quick payoff method for capital formation leading to economic development. Capital formation, as surplus of in-

[6] Each new region of agriculture fed on older settled regions similarly. Capital investment representing labor turned to the new regions came from families in the older regions of the United States, as well as from abroad, and had been accumulated in the rearing of persons over long investment period with no or little return. Most of the return on this human investment commenced immediately when the labor was used in the new region. In a similar vein, the total American economy realized quick return on investment made in human resources originating in European countries, and did not have to use part of its own product for these purposes.

come over consumption so derived, was drawn off partly by property taxes and the transfer of farm children to cities. However, a major payoff, in terms of resources released from food production, has come since 1920 from public research. This was a demand period in which the source of capital was less that of greater farm income, and hence surplus for eventual transfer to cities, and more that of abundant food at low cost and with fewer resources required to produce it. Undoubtedly the two major developmental policies, public pricing and distribution of land resources and public investment in research were viewed primarily as means of bolstering farm income. But, even if unwittingly, American society had made a profitable decision in investing in agricultural development as a means of promoting national economic growth. The setting was appropriate with a large proportion of the nation's resources in agriculture—a condition which is no longer true.

Other Market Feedbacks in Development

Agriculture and industry have simultaneously facilitated growth of each other. This has been true almost over the whole of the U.S. history. If the simultaneity was ever at a minimum, it is now when agriculture is small relative to the national economy. The nation was never truly faced with a Malthusian regime wherein increase in food supply was antecedent to increase in food demand (i.e., a population at subsistence equilibrium level with increase allowed only by greater food output). Dependence of increased food demand on existence of food supply has nearly held true in India and similar countries of population pressure and tardy food supply. But in the United States, growth in food demand almost always preceded greater food supply. Population increased nearly four times in the half century following 1800. It nearly tripled between 1850 and 1900. Consider the effects of an increase in demand at 8 percent per year, the rate of increase in population between 1800 and 1850; or of 4 percent per year as between 1850 and 1900. Population and income growth provided large opportunity for growth in food supply up to 1920. Whereas population increased by about 25 percent per decade between 1870 and 1920, it increased by only 15, 16, 7, 14 and 12 percent respectively in the five decades following. The population increase of 2.5 percent per year over the period 1870–1920 was greater than a 2.3 percent annual increase in agricultural production over the period 1920–1960, but the per annum population increase of 2.1 percent in the latter period was not.

We have explained the process by which capital generated in agriculture was diverted to investment in other sectors. But which was causal: the growth of American society which provided an expanding market for the product of agriculture, or the production of surplus labor and capital in agriculture which could help fill the growing resource of demand of industry? With agriculture as the broad foundation of early American society, its development provided the mass domestic market for initiation of industry. The farm demand for producers goods and

durable consumption commodities, as small as it was in terms of current standards, helped to prime the pump for an infant industrial complex.

Still, if we view market interrelationships in another light, developing nonfarm industry provided a landing place (or a dumping ground) for some of the surplus labor which began to arise in agriculture shortly after the Civil War. While this was a developmental blessing to industry, it also was a windfall to agriculture. Had this surplus, of labor supply over labor demand in agriculture, had less outside employment opportunity and been turned back into farming, agricultural welfare would have been greatly depressed. With a greater labor supply, commodity supply would have pressed more on demand and lowered price. Labor returns would have been lower for this reason, and also because given income would have been divided among more persons. Competition for farming opportunity would have bid up the price of land, and resulted in more and smaller farms with higher unit costs. Thus, while each contributed to development of the other, it is not possible to say that net development of the U.S. economy in the nineteenth and early twentieth centuries depended on a one-way relationship between agriculture and industry sectors. Still if we use Rostow's point of take-off, in rapid economic development, with emphasis on industrialization, as about 1843–1860, agriculture was somewhat singularly important in providing preconditions for takeoff.[7] Given the stage of development, agricultural or natural resources and products were a chief source of the social capital accumulated up to that time. It also was important in contributing a source for capital import after the take-off point. Agriculture would have produced a surplus, to serve as capital and eventual transfer to the national economy, had it only been a domestic industry. However, this process and source of capital formation was greatly aided through the international aspects of U.S. agriculture. During the nineteenth century, agriculture contributed 80 percent of the value of U.S. exports. Exports represented a fifth of the value of the nation's farm production between 1850 and 1900.

The period in which agricultural and nonfarm economic development were so highly compatible and of relative equal contribution to each other no longer exists in manner of the period prior to 1925. Heading towards 1975, the farm sector is small relative to the total, and in capital and labor which can be generated in the industry for eventual transfer for development elsewhere. Expansion of the farm sector supply no longer meets a market of large demand elasticities for food. Expansion of the nonfarm sector does not bring with it, proportionately, as much increase in demand for food as it did in decades bygone.

It is important that this changed role and outcome of agriculture in economic development be understood. To an important extent, much recent policy and philosophy for U.S. agriculture has presupposed the developmental environment of the earlier economic regime. Policies

[7] W. W. Rostow, *The Stages of Economic Growth*, Cambridge University Press, New York, 1960, pp. 6–7.

since 1930 have had orientation towards overcoming short-term emergencies, as if the nation and agriculture were still attempting to erase the effects of the last major depression, rather than coming abreast of the stage of economic development and the functioning of institutions which is now fact. Many other nations, more tardy in both agricultural development and economic growth, still face a setting paralleling that of nineteenth-century America. They have problems of pushing food supply ahead with growing population and food demand, and of increasing productivity of agriculture in a manner to allow its commercialization and a greater transferable surplus for national economic growth. But typically, too, industrialization to absorb more of the farm population is needed in these economies.

Although the means is not entirely clear, further development of American agriculture may find its place as an aid in general economic progress of these much less developed nations. Agricultural progress may be relatively more important for these purposes than for promotion of domestic economic growth over the 1960's and 1970's. With capacity to produce our food in surplus for a decade, greater farm productivity has meaning for the domestic population largely in 1975 and 1990.

For purely internal developmental goal of the moment, an effective harnessing of current surplus resources and commodities of agriculture is more pressing than investment to increase current supply. Yet it would be unfortunate if our planning horizon was warped so closely to the present. Vision and an extended planning horizon led to investment in the Louisiana Purchase, the creation of the public school system, initial public participation in research for agriculture and others with large payoff over the last century and a half. Development is desired no less now than in the past. However, the role of agricultural progress in national economic development now is different, at least in relative contribution and in distribution of gain and cost over the contemporary farm generation.

Relative Allocation of Resources

In the 150 years from 1810 to 1960, the U.S. farm labor force dropped from over 75 percent to less than 10 percent of the nation's total labor force. Relative reallocation of this nature and magnitude does not at first, or necessarily ever, come with a sudden absolute shift of resources from agriculture and other primary industries to secondary and tertiary industries. In early stages of the relative reallocation, primary sectors grow in total quantities of resources used, but not at a rate as fast as sectors characterized by higher income elasticities of demand. A greater proportion of a nation's addition to labor force and capital supply simply is drawn into the more rapidly expanding industries.

Three conditions of inter-industry allocative patterns under economic growth can be postulated: In the *first*, wants for any product are far under the satiation level, and income elasticities of demand are equal

for all commodities. With equal growth in supplies and productivity of resources, the relative allocation of resources would remain unchanged among industries. Resource employment in each sector would grow by the same proportion. Each sector would retain the historic proportion in national product and resource shares. Each sector could, in fact, absorb exactly the capital accumulation and population growth within it, supposing comparable intersector rates of saving and birth. If labor resources were like those of capital, without personal preference or utility attaching to different occupations, intersector exchange would be needed only in commodities and not in factors. Economic growth could be just as rapid under edicts preventing capital or labor arising in one sector from transferring to another, as where freedom of markets and resource flows are allowed and occur. The biological and psychological nature of consumers prevents this constancy of sector shares over time and under economic growth. It is not, however, unlike the model implicitly assumed in early U.S. educational policy, with education for farm youth largely oriented to their reentry into agriculture, or unlike the recently held thesis that all farm youth should have opportunity in farming.

Under the *second condition*, one encompassing most nations over the world, growth takes place in all major sectors, but at unequal rates. Preferences of consumers approach a satiation limit and marginal utility declines for particular goods. New consumer commodities are developed and income elasticities of demand take on varying magnitudes. With income elasticities greater than zero but having differential magnitudes for all sectors, a relative change in resource allocation necessarily takes place even if all sectors grow in magnitude of product and total resources employed. Resources are drawn, from capital accumulation and population increase, in sectors with lowest income elasticities to those with highest elasticities, although some additions to capital and labor remain in the former. Relative shares of particular sectors then change, in respect to both income and resources employed. If the transfers came from the *additions to capital stock and labor force* within sectors where demand for product grows less rapidly than supply of resources, the costs and difficulties of transfer could be small under certain conditions. The conditions required are, of course, rapid reflection of consumer desire (1) from commodities through resources, and (2) over spatial and industry boundaries, with consequent price effects to draw resources to them. Resources also must be highly mobile, without particular attachment or low reservation price for the sector of origin. With transfer coming from growth-generated additions to resource supplies, resources previously specialized to the particular sector could remain so, and with some growth rate, realize returns comparable to those of sectors expanding at greater relative rate even while the sector is absorbing more resources. Comparable factor returns could still prevail even if the sector of declining relative share has rates of capital

accumulation, birth, and technological improvement greater than those of sectors increasing in relative share because of changing consumer expenditure patterns and high income elasticities under income growth; providing, of course, that markets are sufficiently alert in intersectoral reflection of demand and prices for factors and major shifts come from resources added to total supplies. This general condition, of absolute growth of agriculture and farm labor force but in decline of relative share, held true for U.S. agriculture up to 1915. (Also see Figures 16.1 and 16.2.)

Under the *third condition* of development, rates of growth vary greatly among sectors, because of either near-complete satiation of certain consumer wants or because substitute commodities are developed. Some sectors have rates of capital accumulation, technical progress and birth which exceed growth in demand for their product. These sectors then must decline in shares of income and resources. In these sectors, it also is necessary for some resources already employed, as well as those added to the supply, to transfer.

This has been the condition confronting American agriculture in respect to labor since 1920. While capital input has not been reduced, a part of savings and capital accumulation have been transferred to other industries, as an integral contribution to aggregate economic growth. Capital use has increased, but not in proportion to net family savings of agriculture over time. Transfer of both labor and capital surplus has been consistent with national economic growth and changing consumer preferences, and with maintaining incomes and resource returns in agriculture at more favorable levels. Had U.S. agriculture reemployed all of its additions to the labor force and saving, the industry would now be composed of a vast number of small-scale subsistent farms. Without transfer of labor from agriculture for over a century, a major source of labor force for industry, labor returns in agriculture would now be meagerly low while those in other sectors would be even greater. The same conditions also hold true in respect to capital. Evidently the industry employs sufficient capital to keep returns in aggregate at a level low relative to other industries. (See Chapter 5.) Had it absorbed entirely the surplus of income over consumption from the outset, given the current state of technology and low price elasticity of demand, capital return would now be approaching zero.

Condition one above unloads no burden on agriculture. Condition two would not do so under the degree of factor market communication and perfection mentioned earlier. But given any degree of imperfection and lack of communication, resources must pile up in the industry and earnings must decline relative to other sectors. The extent of decline depends on the degree by which the rate of increase in supply through capital accumulation or savings and birth rate within the industry exceeds the rate of growth in demand. Relative decline in factor earnings would be of important magnitude under condition two, but are of even

greater extent under condition three. U.S. agriculture went through a long stage of condition two, an intermediate stage of economic development, with earnings in agriculture lagging those of other sectors. In recent decades, it has been under the more advanced stage of economic development, condition three. While the ratio of farm to nonfarm earnings has not declined continuously, difference in income among sectors has become of more critical public concern because communication science and statistical knowledge have improved so greatly. Farm people now know more about the lag of their income behind that of other sectors.

The United States is not the only country with growth rates sufficient to cause these differentials. These facets of growth are well illustrated with global figures. Practically all nations of the world now are developing under conditions two and three, although the exact stage of each differs greatly. Russian agriculture used 13 percent more man days of labor in 1950 than in 1929, although evidently reducing input by about 1 percent per year in the 1950's.[8] United States agriculture had a declining labor force in each of these periods. Many countries have had an increase in total agricultural employment since 1930, but the rate of increase has been less than for other sectors. Consequently, the surplus of births in agriculture has required a transfer of labor to other sectors. In nearly all countries approaching the U.S. level of economic growth and per capita income, agricultural employment has declined since 1940. Relative decline in agriculture, as in the recent history of practically all countries, can come alone from (1) national economic growth and (2) differential demand in elasticities of different sectors. It need not be a function of factor prices and resource substitution rates. But absolute decline in input of a resource, total output of the industry still increasing, must arise not only because of the differential rates of demand expansion which attach to economic growth but also because of relative changes in factor prices and substitution rates.

We can thus postulate a fourth pure condition or model wherein: population is constant, food is a commodity taken in limitational or fixed amount per person (demand elasticities are zero), knowledge of the production function is complete, factor prices remain in fixed ratio to each other and the current birth rate in agriculture just allows replacement of the farm population. Under these conditions, technology and resource mix in agriculture would remain constant, although agriculture's proportionate share in national employment would decline. But suppose that economic growth also causes differential changes in factor prices, with capital declining in relative price under excess of income over consumption and labor increasing in relative price as it is demanded more for service and tertiary industries. Under these conditions, the absolute, as well as relative, magnitude of labor share in agriculture will decline with

[8] A. Kahan, "Changes in Labor Inputs in Soviet Agriculture," *Jour. Pol. Econ.*, Vol. 57, p. 452.

economic development. Given a level of demand for food and complete knowledge of alternative technology, an isoquant of the nature in Figure 3.1 effectively exists for each country.[9] For the particular level of agricultural output, a least-cost technology, representing different mixes of labor and capital, exists under prevailing prices for capital and labor in all countries. For those at low stages of development, capital is high in price relative to labor. Technologies adapted are those which use large amounts of labor and little capital, as at points *a* and *b* in Figure 3.1.

Under the time path of economic development capital supply increases relative to labor and price of the former declines relative to price of the latter. Hence, the iso-outlay or budget lines decrease in slope. They are tangent lower on the isoquant in Figure 3.1, indicating resource mixes richer in capital and leaner in labor and calling for a large degree of mechanization, as at *d* and *e*. In optimum adjustment to factor prices, retention of larger labor supplies is specified at low stages of economic development. But with growth and relative change in labor and capital supplies and prices, diminished absolute input of labor becomes optimum. Thus, even if food demand and technical knowledge did not change, we would expect the capital-labor mix to change with economic development and decrease in price of capital relative to labor.

United States agriculture now falls somewhat in this category, with slight increases in capital to replace labor but with new technology still increasing the output/input ratio and dampening capital requirements while speeding the decline in labor requirements. In terms of relative shares of labor in agriculture, the general path described for Figure 3.1 will be reflected in other nations as economic progress reaches take-off stage or continues.

In summary, then, decline of income share by agriculture is a function of economic growth, as reflected in consumer preferences and differential income elasticities for various products. Decline of labor share is a function of this same phenomenon, and also of the relative change in factor supplies and prices under economic growth. The return to labor in agriculture would keep abreast of that in other sectors under conditions where the rate of population increase, rate of productivity increase and the income elasticities of demand for the products of all sectors are equal.

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[9] Here we consider capital funds to be the resource input measured on the horizontal axis. The form of this capital is allowed to change as its magnitude is increased. Over the "whole" of a nation's agriculture, an isoquant of this type is likely to be continuous. But for an individual farm, it would better be represented by linear segments. More accurately, of course, we should include all factors (labor, tractors of different sizes, bullocks and other capital items being different resources) in our system and equate the quantities

$$\frac{\delta Y}{\delta X_i} = \frac{P_i}{P_y} \quad \text{and} \quad \frac{\delta X_i}{\delta X_j} = \frac{P_j}{P_i}$$

in reference to the production function in (7.13), specifying land, labor, machinery of various kinds, and other inputs simultaneously.

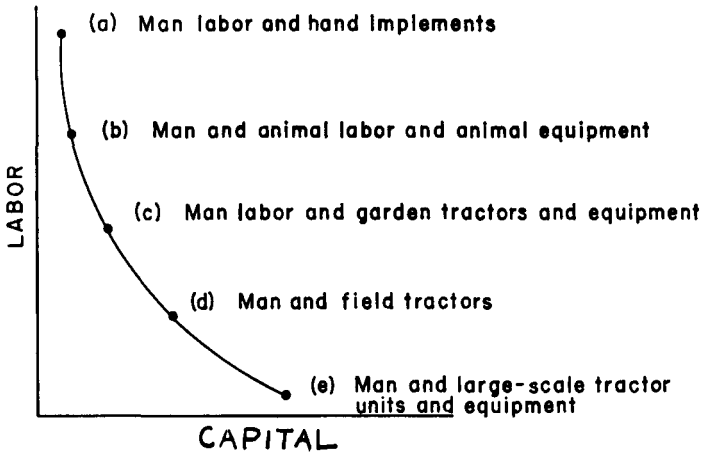


Fig. 3.1. Nature of Product Isoquants in Relation to Technology and Labor and Capital Inputs Under Economic Growth and Changing Factor Price Relatives.

However, with lower income elasticities, rates of population and productivity increase being the same, the demand for labor in agriculture will decline relative to nonagricultural sectors. Similarly, growth rate in agricultural labor productivity which exceeds that of other sectors, and a sharp rise in the marginal rate of substitution of capital for labor from new technology or rapid advance in the price of labor relative to capital, also will cause the relative demand for agricultural labor to decline if the supply of labor to agriculture is sufficiently elastic. Given the extreme case of an infinitely elastic supply function for labor in agriculture, returns to this resource would remain at a par with labor earnings in other industries, with differential due alone to living costs and occupational preference. But with low elasticity of supply of labor to agriculture, due to various mobility deterrents such as transportation costs and lack of knowledge, return to labor in agriculture will fall relative to that of other sectors.

Three Stages in Labor Demand and Supply

The United States has gone through three distinct stages in respect to development and demand and supply of labor in agriculture. In the first stage, total employment in agriculture increased faster than growth of labor force from farms. Labor was drawn into agriculture from outside the industry. In the second stage, total employment grew but at a slower rate than growth of labor force from families on farms. In the third stage, absolute decline in labor employment occurred. (See Figure 16.2.) In the history of agriculture in all countries, the first two stages have

generally been experienced. The third has been experienced by a number, but still is a developmental goal of others.

Farm use of labor in the United States as a percent of national employment, has declined almost continuously since the birth of the nation. In much of the early period, however, growth of employment in agriculture was much greater than growth of the labor force in agriculture. Under these developmental conditions, and a supply of labor to agriculture which is highly elastic, labor earnings in agriculture should (for labor of given skill) parallel those industries which compete in employment. The elasticity of labor supply for the two sectors, farm and nonfarm, was likely about equal in periods of great migration to the United States. Growth in employment by U.S. agriculture fell behind the internal rate of increase in labor force around 1875, and net outmigration of labor began. As mentioned above, labor returns could equal those of other sectors under these conditions, with a sufficiently high elasticity of labor supply to agriculture. However, as is indicated later, this level of labor supply elasticity has never been the case. Under developmental conditions calling for net outmigration of labor from agriculture, returns are depressed in extent depending on supply elasticity of labor. Supposing alternative employment to be available, an obvious avenue for boosting labor returns is that of increasing its supply elasticity, an alternative discussed in later chapters.

While the United States passed from (1) a stage of growth in farm employment exceeding growth of the farm labor force within agriculture to (2) one requiring net outmigration around 1875, it passed from this stage to (3) one causing the absolute employment in agriculture to decline, around 1920. Hence, magnitude of labor supply elasticity to match outmigration requirements in the previous stage would have been too low in the second stage. Undoubtedly, the supply elasticity of labor to agriculture has increased since the period prior to 1875, and especially in recent decades. Yet the increase has not been great enough to draw labor earnings to the level of the nonfarm sector. An important question, then, is: does the complex of labor supply and food demand elasticities tend to worsen or improve the position of relative earnings in agriculture over time?

SHARES IN NATIONAL INCOME

We now review characteristics of national economic development as it relates to declining share of income to agriculture. The decline in share of agriculture in national income is universal, once minute degree of development occurs to allow some release of labor from pure pursuit of subsistence. The data used for examination of this phenomenon are those of Kuznets and refer to his A-sectors. While it includes agriculture, fisheries and forestry, we use the term agriculture since it dominates the

sector. We present data for three periods or years, centering respectively on 1880, 1915, and 1950, from his estimates.[10]

Decline in proportion of income from agriculture has been especially great since 1950 in most countries. In the United States, net income from agriculture has fallen below 5 percent of national income in recent years. The proportion of agriculture in national economies will decline further with continued economic growth. Depression of agricultural earnings and return to farm labor would not occur under this relative change in sector shares if absolute growth of agriculture and in demand for food exceeded or was equal to growth in labor supply of agriculture; technology were constant and demand for labor in agriculture remained in constant proportion to output; or, without this condition, the supply of labor to agriculture were highly elastic. But generally one of these conditions is violated for all countries listed. In the United States, all are violated. We must, then examine how these conditions affect the returns to labor in agriculture relative to other industries. We wish, too, to determine whether economic progress has generally worsened the position of agriculture with time, supposing the relative decline in demand for labor to be great relative to growth in labor supply from farm families or, to decline in supply elasticity of agricultural labor. Or, conversely, we may try to determine, from the scanty data available, whether supply elasticity might have been increased sufficiently to offset other forces, thus causing improvement of relative earnings in agriculture.

Relative Share of Labor Employment in Agriculture

One basis for inference about supply elasticity for labor to agriculture is in relative share of the labor force in agriculture. With low supply elasticity, labor backs up in agriculture, causing share of the labor force to exceed share of income. Table 3.3 indicates the decline in percent of labor force in agriculture for countries which have experienced rather continuous economic growth since 1870. It also indicates the magnitude of labor force recently in agriculture for a number of countries with lower states of economic development, some only now reaching the "take off" stage. The percentage share of national labor force in agriculture has de-

[10] Various differences in data may cause some lack of comparability between time periods or countries for Tables 3.1 through 3.5. Differences likely arise because of: Classification of national labor force; inclusion or not of women and family workers in agriculture; change in composition of farm consumption between home-raised and purchased items; part-time employment of farmers; price of food at farm and non-farm sources; change in composition of labor force in different sectors; the period and method of national income accounting; etc. Some of these, as part-time farming and dependence more on purchased goods, cause the ratio for agriculture to appear either less or more favorable than long-term trends would indicate. But even with these difficulties in measurement and computation, it is certain that the income of agriculture does lag, and has for long periods, that of the aggregate nonfarm sector. This point is generally consistent with the interpretations of G. Bellerby (Agriculture and Industry: Relative Income. Macmillan. London, 1956), and E. Ojala (Agriculture and Economic Progress. Oxford University Press. London, 1952).

clined for countries experiencing growth of important magnitude. The rate of decline conforms roughly to the rate at which national economic growth has taken place. Or, stated in another way, the proportion of the labor force currently in agriculture corresponds approximately, but inversely, with the magnitude of income or consumer welfare per capita in the various countries.[11]

Comparison of Tables 3.2 and 3.3 suggest that supply elasticity of labor to agriculture has not been high enough to allow a decline in relative labor force of magnitude equal to the decline in relative income share. While the data of the two tables are not for identical periods and times, they indicate in all cases a greater decline in income share than in labor share. Under these conditions, and except in the case where labor productivity in agriculture outpaces that of nonagriculture, we should expect the difference to result in lower labor earnings in the agricultural sector. Again we do not have the refined data we wish, including marginal

TABLE 3.2

RELATIVE SHARE OF AGRICULTURE IN NATIONAL INCOME FOR SELECTED COUNTRIES

Country	Early Period	Middle Period	Recent Period
Denmark	45	21	19
France	49	35	23
Germany	24	18	11
Netherlands	49	16	13
Norway	—	24	14
Sweden	40	25	13
U.K.	10	8	6
Italy	56	43	26
Hungary	49	49	—
Japan	54	34	24
Canada	43	26	14
United States	16	15	7
Australia	37	24	13

Source: S. Kuznets, *Quantitative Aspects of the Economic Growth of Nations*, II. Industrial Distribution of National Product and Labor Force (Economic Development and Cultural Change. Supplement to Vol. V, No. 4).

productivities of labor and returns of the resources imputed separately from those of capital. However, figures available are sufficient indication of long-term trends in ratios. For this analysis, we compare income in agriculture per worker with the comparable figure for nonagriculture as measured by Kuznets (with the A-sector being that explained above). Figures are presented in Table 3.4 for major countries of the world. The differences in real income are somewhat smaller than those suggested for money income since farmers consume more home-produced food at lower price and may have other slight advantages in living costs. How-

[11] For example, compare these figures with those of income in standardized units as indicated in Colin Clark, *Conditions of Economic Growth*, Macmillan Co., New York, 1957.

TABLE 3.3

LABOR FORCE IN AGRICULTURE (A-SECTOR) AS PERCENTAGE OF NATIONAL TOTAL FOR SPECIFIED COUNTRIES AND DATES

Country	1870	1900	1930	1950†
Algeria	—	—	—	81 ('48)
Australia	37	25	22	15 ('47)
Belgian Congo	—	—	—	85 ('52)
Belgium	25*	17	14	11 ('47)
Brazil	—	—	—	61
Canada	50	43	31	21
Denmark	51	41	30	23
Egypt	—	—	—	60
Finland	79†	72	57	47 ('40)
France	75	46	36	32
Germany	42*	35	17	13
Hungary	—	59	54	—
India	—	—	—	71
Ireland	41	44	48	31
Italy	62	59	47	41 ('54)
Japan	83	70	50	48
Mexico	—	70	70	58
Morocco	—	—	—	67 ('52)
Netherlands	—	—	21	19 ('47)
Norway	59	47	41	29
Pakistan	—	—	—	77 ('48)
Paraguay	—	—	—	55
Philippines	—	—	—	71 ('48)
Spain	—	67	53	49
Sweden	68	55	39	20
Switzerland	—	27	19	13
Turkey	—	—	—	86
United Kingdom	15	9	6	5
United States	50	37	22	12‡
USSR	—	—	58	45 ('53)

Source: Kuznets, *ibid.*
* Refers to 1880.
† Figure in parentheses indicates year other than 1950.
‡ Based on Colin Clark, *Conditions of Economic Progress*, Macmillan Co., New York, 1957, pp. 248–50.

ever, even with adjustment for these differences, an important difference in real income would still exist in most of the countries.[12]

The data of Table 3.4 indicate that decline in or lower relative income is not unique to U.S. agriculture. Income per worker in agriculture lagged that of income per worker in other sectors over the entire globe. The only exceptions to this statement for 1950 were countries such as the United Kingdom and Israel which were trying to develop agriculture for purposes of national defense or large scale immigration. Also, for the particular time indicated, income was relatively highest for countries where

[12] The figures used are "gross," in the sense that they represent all income of the two sectors divided by the number of workers (but represent income to all factors generally for all persons employed in the two aggregate sectors as explained elsewhere). Using more nearly "net return to labor," Bellerby, *ibid.*, shows the same general lag of farm income behind nonfarm income in his incentive income ratios.

TABLE 3.4

RATIO OF INCOME OF AGRICULTURE (A-SECTOR) PER WORKER TO INCOME OF NONAGRICULTURE FOR SELECTED COUNTRIES

(Labor Force of 1950)

Country*	Ratio A/non-A	Country*	Ratio A/non-A
Australia ('39)	.99	Israel	1.02
Austria ('51)	.40	Italy ('54)	.51
Belgian Congo ('52)	.09	Japan	.34
Belgium ('47)	.63	Mexico	.16
Bolivia	.48	Netherlands	.61
Brazil	.34	New Zealand ('51)	.88
Bulgaria ('34)	.18	Norway	.50
Canada ('51)	.63	Pakistan ('51)	.47
Ceylon ('46)	1.07	Paraguay	.74
Chile ('52)	.46	Philippines ('48)	.28
Denmark	.77	Portugal	.43
Ecuador	.68	Puerto Rico	.41
Egypt ('47)	.36	Sweden	.58
El Salvador	.66	Thailand ('47)	.21
Finland	.42	Turkey	.16
France ('46)	.36	U.K. ('51)	1.08
Germany	.44	United States	.56
Hungary ('41)	.56	USSR ('39)	.26
India ('51)	.42	Yugoslavia ('53)	.20
Ireland ('41)	.73		

Source: Kuznets, *ibid.*

* Figure in parentheses indicates year other than 1950. Figures are not entirely same as in Table 3.3 because of difference in year of measurement.

agriculture served to important extent as an export industry or in growing national market. Aside from these demand regimes, no definite international pattern exists; the ratio being high or low depending on status and rate of economic growth. Communication of employment knowledge, creation of nonfarm employment opportunities, education and labor mobility for agriculture is highest in countries with greatest economic growth. However, in these same countries, the rate of growth of agricultural productivity and the approach of per capita food to saturation level also are greatest, causing the demand for labor in agriculture to be dampened more severely and the demand for food to grow more slowly. Clearly, the income problem of agriculture is not a local problem; it is a world problem, and in relative magnitude, it is an economic growth problem. Only where societies are purely subsistence, or are in special developmental stage do we find a farm income per worker equal to or exceeding that of the nonfarm sector.

Ratio of Income in Agriculture and Other Sectors

But is this a problem only of modern day? Does the relative income problem of agriculture occur only in the last stages of development? Does it worsen with degree of economic development? To attempt answers for

these questions, we again turn to data from Kuznets, the best currently available for these purposes. For our purposes and goals the data have, just as those in Table 3.4, these limitations: They are based on product per worker in the various industries. This product is due, of course, to capital as well as labor and an industry or country which used capital intensively would show a larger ratio of product or income per worker than one using a large proportion of labor to capital. However, the product of both labor and capital for such broad aggregates as agriculture and nonagriculture do provide the income of persons and families in these industries, the owners of both the labor and capital. Hence, income per worker or family corresponds roughly to the product per worker when based on these data, although the productivity imputed to a laborer need not.

Again, the data show no formal pattern. They do not increase or decline or decline consistently over time, even with depression periods excluded. If there is any tendency in these and other data, it is for the ratio to increase with time. Perhaps the best we can say is that the relative position of agriculture has not lessened in respect to time and economic growth. Or, comparing the relative depression of income in agriculture per worker with that of nonagriculture, it appears that agriculture generally has gained relatively as much from economic progress as the nonagricultural sector of countries experiencing economic growth. Certainly, farm families have not failed to realize gain from economic growth. Of course, with a growth in income for both sectors, with nonagriculture at a higher initial level, an equal growth rate over time means a greater absolute difference in money units or purchasing power. This fact, plus the greater communication among farm and nonfarm people and the fact that the goals of farm families now more nearly cause them to have the same level of consumption desires as other families, is still reason for concern, even though the relative position of agriculture has not been worsened by economic growth.

The position of U.S. agriculture appears particularly depressing if we view only the 1950's, for example, in Figure 3.2. And it is this and the 1960's which is of concern to current farm operators. The fact that their relative position is no worse in 1961 than that of their ancestor of 80 years ago is no particular comfort in a wealthy nation which has expressed, since 1930, some general objective of eliminating income disparities and their cause. Still, when we examine the data, for long-term perspective as in Table 3.5, there would appear to be definite improvement for U.S. agriculture in the long run.[13] Farm families have not been without some gain from economic growth; although, as mentioned earlier, an improvement in the income ratio of Table 3.6 still allows the absolute differential, in farm and nonfarm incomes, to grow wider as the level

[13] The figures for the more recent years are affected by government programs which transferred income to agriculture. The gain in magnitude of the ratio would have been somewhat less in absence of these public aids.

TABLE 3.5

RATIO OF INCOME OF AGRICULTURE (A-SECTOR) PER WORKER TO INCOME OF NONAGRICULTURE PER WORKER, SELECTED COUNTRIES AND PERIODS*

Country	1870–79	1900–09	1930–39	1950
Australia	—	1.05	.81	—
Canada	.72	.65	.33	.61
Denmark	.79	.58	.48	.79
France	.65	.75	.59	.58
Germany	.39	.43	.38	.41
Italy	.81	.58	.45	.51
Japan	.38	.42	.29	.34
Norway	—	.35	.28	.39
Sweden	.60	.53	.39	.59
United Kingdom	—	.65	.74	1.08
United States	.25	.35	.40	.56
USSR†	—	—	.83	.70

Source: Kuznets, *ibid.*

* Kuznets periods are not the same for each country. Hence, a period or year centering on the dates indicated is used. In the last column, most figures apply to 1950 or a few years in the early 1950's.

† Kahan, *op. cit.* Most recent figure is for 1953, 1955, 1957; earlier figure is for 1937, 1938, and 1940.

of all incomes increases. Being most optimistic, the present trend of Table 3.6, although other data do not show similar certainty of upward trend, would indicate that if we wait out time, the ratio of income in agriculture per worker should move up to that of nonagriculture.[14] The time involved is long, however, if we rest on the rates of improvement in

TABLE 3.6

RATIO OF MONEY INCOME IN AGRICULTURE PER WORKER TO INCOME OF NONAGRICULTURE PER WORKER, UNITED STATES

Year	Ratio
1870	.26
1880	.23
1890	.27
1900	.35
1910	.46
1920	.49
1930	.34
1940	.48
1950	.56
1960	.47

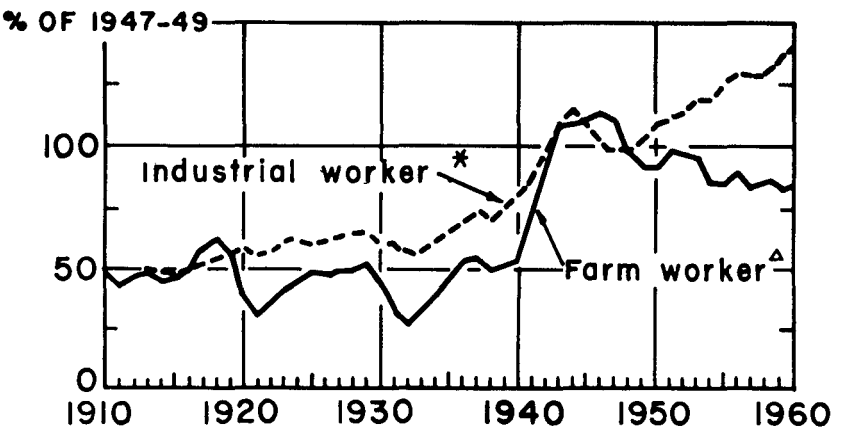
Source: Kuznets, *ibid.*, and agricultural outlook charts for 1960.

[14] Bellerby's (*op. cit.*) comparison of labor earnings for agriculture and industry show no upward trend after 1910, with the ratio average about the same in the late 1940's as in the period 1910–14. Thompson's (*Productivity of the Human Agent in Agriculture, an International Comparison*, Unpublished Ph.D. thesis, University of Chicago, 1951) figures, computed on a somewhat similar basis apparently show an upward trend somewhat paralleling that in Table 3.5. The figures for the United States in Table 3.6 overestimate the differential in terms of real income. For more adequate comparisons in this light, see Chapter 12.

the past, even such as those in Table 3.6. It would take over a century, at the indicated rate of improvement in the last 90 years, for the ratio to equal unity. Even if we adjusted the income figures for differences in purchasing power and capital costs, the time required for the ratio to equal unity at rates of improvement in the past, would still be great. It is desirable, in national growth objectives and welfare of farm families, that the gap be closed in even less than half a century. But, as mentioned before, U.S. policy issues stem not from trends of the last century, nor what they will be over the next century. Today's farmers naturally are concerned over the income drop of the 1950's and whether it will continue for the 1960's. The relative trends in Figure 3.2 provide the setting in which U.S. farm policy of the near future will be made. If we examine only this figure, it appears apparent that the ratio of real income per worker in agriculture has been declining rapidly relative to nonagriculture. If we view only this period, we do not get full interpretation of the long-run growth problems of agriculture. Similarly, if we view only the long run, we fail to interpret the urgency of the U.S. farm problem.

Long-Time Terms of Trade

We have examined a time span for agriculture which is long in terms of the interests of this generation of farmers, whose welfare is largely determined over three decades, or of public administrators who provide legislation to meet existing problems of food surplus or deficit. The span



SOURCE: AGRICULTURE MARKETING SERVICE

* INCOME PER EMPLOYED INDUSTRIAL WORKER ADJUSTED FOR CHANGES IN THE CONSUMER'S PRICE INDEX.

△ NET INCOME PER FARM WORKER ADJUSTED FOR CHANGES IN THE INDEX OF PRICES PAID FOR FAMILY LIVING.

Fig. 3.2. Index of Real Income Per Farm and Industrial Worker, 1910–60.

examined is, of course, short in duration of agricultural and economic development. However, if we wished to better reflect all possible changes in the structure and fortunes of agriculture under economic growth, we would need to go back over a much longer period of time. Then we would not find a single trend expressing the fortune of agriculture in terms of trade or factor returns. The terms of trade and returns to resources would fluctuate absolutely and relatively, depending on the particular stage of economic growth and the nature of factor supply and mobility, for agriculture and other sectors at particular times. In an early society characterized by great population and demand growth from births or immigration, large income elasticities of demand for food, a labor supply internal to agriculture small relative to its growth and low supply elasticity of factors to farming, we would expect terms of trade and resource returns in agriculture to increase greatly. Given large supply elasticity of factors to agriculture, particularly for labor but also for capital, increase in terms of trade and factor rewards would be less, but likely positive. Under these same conditions, except for growth of labor supply in agriculture exceeding growth of labor demand in the industry, terms of trade and factor returns would bear no premium relative to other sectors; but they would not be depressed if factor supply elasticity to agriculture were infinitely elastic. Given extremely low factor supply elasticities, and a backing up of labor in the industry, both quantities would be depressed even under the otherwise favorable circumstances mentioned above. Transition to an economic growth stage with low rate of demand increase and small income elasticities for food need not dampen the fortunes of agriculture if supply elasticity of factors is high. But under conditions of labor supply typical of agriculture, birth rates greater than farm employment opportunities and a low relative mobility of labor, terms of trade must certainly be depressed. They will be depressed even more with technological progress exceeding growth in commodity demand and a strong leftward shift of the farm demand function for labor. The position of agriculture as an export or import industry also can alter the trend. Even with low internal food demand elasticities, terms of trade for agriculture can remain favorable if the industry is oriented to foreign markets and factor supply to agriculture, including knowledge and birth rate, has low elasticity. But increase factor supply elasticity under these conditions and premiums in terms of trade or factor rewards, will diminish.

Looking to the data, we find that long-term fluctuations in terms of trade for agriculture have very well expressed these developmental phases. A trend in relative prices or factor returns hardly exists, as a single regression line of positive or negative slope, for any nation. Apart from business cycle fluctuations, their magnitudes have moved upward or downward depending on the particular circumstances of economic growth and foreign trade. We illustrate this point with the long-run data from Britain, the United States and New Zealand. The data in Figure 3.3 provides expression of terms of trade for agriculture. They are prices of

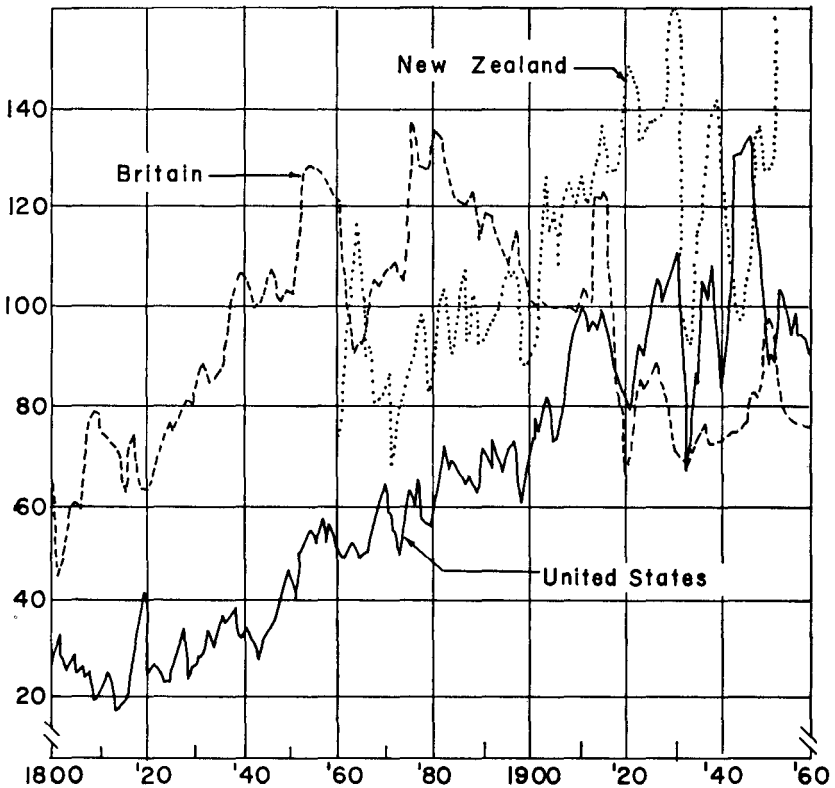


Fig. 3.3. Terms of Trade for Agricultural Commodities, 1800–1956, for Three Countries.

farm products divided by prices of manufactured products.[15] If we view British data only over the last 70 years, terms of trade for agriculture seem to have fallen, although in the 70 years of 1800–1870 they almost certainly were rising. They appear to move fairly regularly upward for the United States up to 1915, then give way to no particular direction, except for upward movement in war periods and downward movement in peace periods. During the period prior to 1915, American consumers grew rapidly in numbers and export markets for U.S. products had high price elasticity; farm products being the most important industrial aggregate in exports and amounting to as much as a fifth of foreign sales

[15] The source of these data are Theodore Morgan, "Long-Run Terms of Trade Between Agriculture and Manufacturing," *Economic and Cultural Development*, Vol. 8, no. 1, pp. 1–23. The series used are B for British and D for U.S. and New Zealand data. The price relatives, comparing only commodities and not factor returns, are not a sufficient indication of the real terms of trade because they do not account for changes in technology and input or cost for unit of output in the various sectors. Also, in recent decades, monetary costs have represented an increased proportion of farm prices.

during the late 1800's. During the period stretching from the Spanish War to 1920 (see Figure 3.4) relative prices rose for agriculture. During this period, growth in output of agriculture did not keep pace with growth in the rest of the U.S. economy. After 1920, however, the capacity of agricultural supply has raced ahead more rapidly. The New Zealand data indicate an upward trend in terms of trade to 1930, a period of rapidly growing exports, but not with similar firm indication thereafter. But it is quite obvious that these data correspond to growth stages discussed above and in Chapter 2. Viewing the U.S. data, we can see why agricultural development policies were especially appropriate in the United States up to 1920, but why they do not have the same relative premium in farm income for later decades.

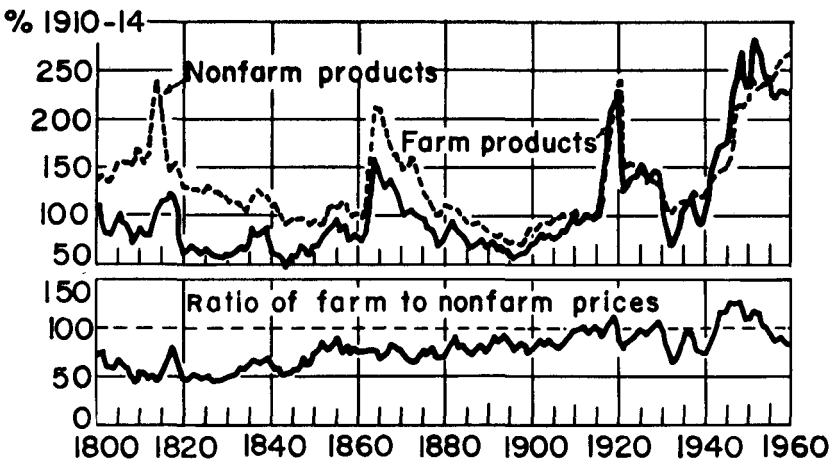


Fig. 3.4. Wholesale Prices of Farm and Nonfarm Products and Their Ratio, U.S., 1910–14 = 100 (Source: USDA).

Income and Transfer Problems

Left to the market in enterprise nations, and to planners in complete socialist countries, the relative income problem of agriculture is long-run and complex in nature. The United States, at the present level of per capita income, represents one extreme in development and the income problems attached to it. Not only is the level of per capita income so great that agriculture cannot grow at the rate of the nonfarm sector, but also the absolute demand for labor is declining. The supply elasticity of labor to agriculture has not been great enough to draw income per worker in agriculture to levels of the nonfarm sector. In most other nations, the same general growth pattern now exists, with income elasticities of demand being much less than unity and causing agriculture to grow at a slower rate than secondary and tertiary sectors. In many of these, the

absolute demand for labor in agriculture has not declined, but additions to the labor force from the farm population exceeds replacements needed in farming. Hence, in these countries also, labor supply elasticity for agriculture has been too low to allow comparability of labor value productivity in farm and nonfarm sectors. The variables causing these differentials are long-run and growth-oriented. They are not likely to be turned back by temporary farm price or conventional compensation policy or increased technological progress in farming.

Productivity changes have, of course, taken place in the general economy as well as in agriculture. The annual rate of (percent) increase in productivity for the U.S. private domestic economy and for agriculture have been estimated as follows:[16]

Period	U.S. Private Domestic Economy	U.S. Agriculture
1889–1957	1.7	.76
1919–1957	2.1	1.16
1940–1957	2.3	1.62

Farm people have gained from productivity increase in the domestic private economy, just as consumers in general have gained from farm technological advance. In fact, as indicated above, the rate of productivity advance in the nonfarm economy is predicted to be greater than in agriculture. As for the U.S. economy in total, the real income of farm workers had a sharp rise after 1940. Economics-wise, as is illustrated in Figure 3.5, the war was an easy adaptation and real incomes were able to rise because of unemployed resources and an upsurge in economic growth rate. While farm real income jumped to a level equal to that of factory workers during the war as indicated in Figures 3.5 and 3.6, it sagged back to its historic comparison in postwar years. The gain in real income of farm workers during the two decades 1910–30 were much less than for factory workers; this being a beginning reflection of the less favored position of an agriculture in economic growth. The postwar upsurge in productivity and economic growth has not by-passed farm people. They now have much higher real incomes than in the prewar period. The income problem is more in relative terms, as explained elsewhere, and in an equitable sharing of agriculture in the productivity gains which it contributes to national economic growth. Loomis and Barton estimate that the real income of farm family workers dropped by 11 percent from 1947 to 1957, at a time when real income of factory workers increased by 22 percent. The real income of all unpaid resources in farming is predicted to have declined by 22 percent over the same period.[17]

[16] Based on S. Fabricant, *Basic Facts on Productivity Change*, Natl. Bur. Econ. Occas. Paper 49; and R. A. Loomis and G. T. Barton, *Productivity of Agriculture; United States, 1870–1958*, USDA Tech. Bul. 1238.

[17] Loomis and Barton, *ibid.*, p. 32.

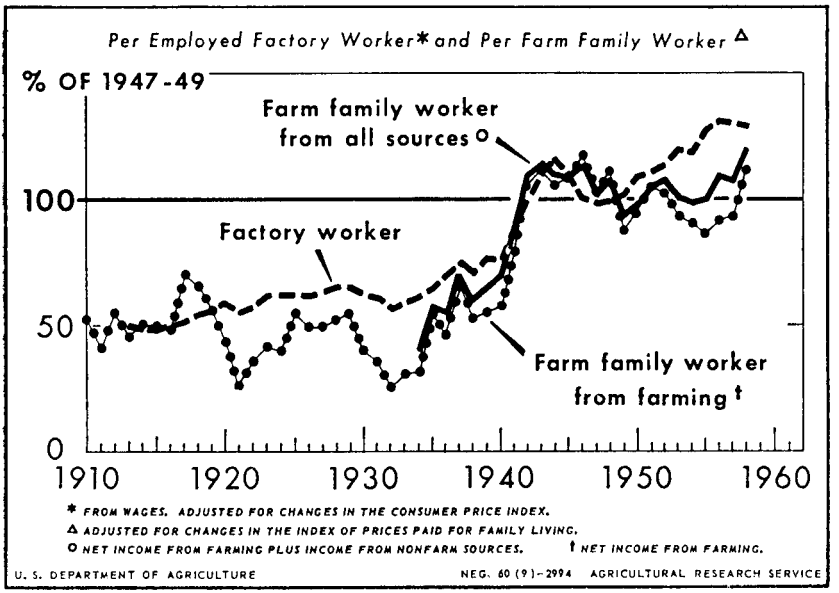


Fig. 3.5. Indexes in Real Income of Farm Family Workers and Factory Workers, U.S., 1910–60.

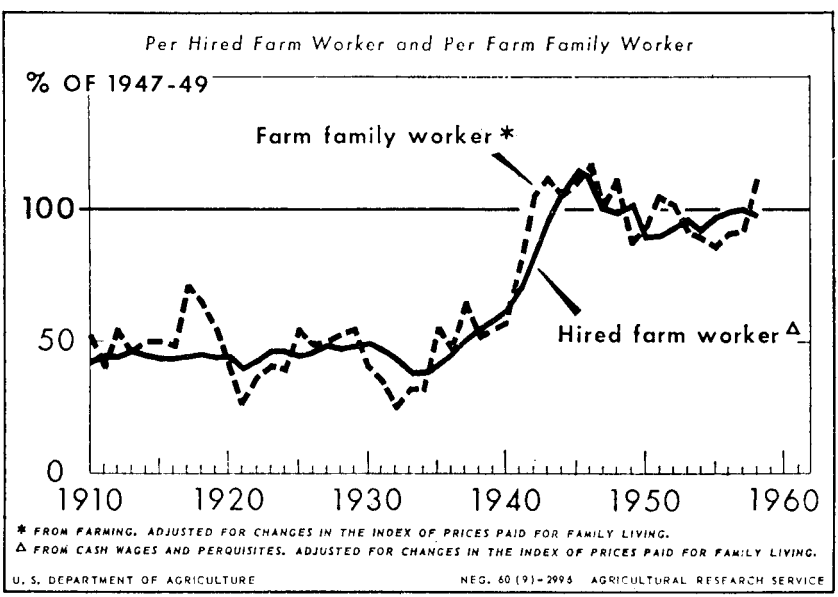


Fig. 3.6. Indexes of Real Income. Farm Family Workers and Hired Farm Workers, 1910–60.

Policies Appropriate to Income Problems

In this chapter we have outlined the two major income problems peculiar to commercial agriculture. One is of short-run nature and rests on high supply elasticities and low demand elasticities (both elasticities in respect to price) for individual products. The other is of long-run nature and rests particularly on low supply elasticity of labor to agriculture and low income elasticities of demand. The first has no important relationship to national economic growth. The second has its roots in this very complex. Both call for public policy, if they are to be solved readily and effectively. They need, however, quite different policies mechanisms and those appropriate for the first are not appropriate for the second, even if they have been so mixed in the United States.