Production and income effects of agricultural subsidies in the corn belt, 1933-1942

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PRODUCTION AND INCOME EFFECTS OF AGRICULTURAL SUBSIDIES

IN THE CORN BELT, 1933-1942

by

Oswald Harvey Brownlee

A Thesis Submitted to the Graduate Faculty for the Degree of

DOCTOR OF PHILOSOPHY

Major Subject: Agricultural Economics

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1945
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I. INTRODUCTION

Agriculture, as a broad sector of our national economy, has been for many years a recipient of governmental aids designed to stimulate certain kinds of income and production effects as well as to encourage the development of rural education, transportation, communication, and other factors supposedly contributing to rural and national welfare. Among the most important forms of governmental subsidies to agriculture (in terms of the total expenditure involved) has been the direct supplementation of farm income through the various farm programs inaugurated by the New Deal. However, agricultural subsidies have also take such forms as land grants, aid to rural education, the development of rural highways, rural electrification, rural free delivery of mail, reduced interest rates, the provision of managerial assistance to some farmers, provision of fertilizer at less than current costs, etc.

A few scattered analyses of some of the effects of governmental activities upon such factors as the level of education of rural people, the speed of land settlement, the extent of highway development, etc., have been made. However, the broader implications of using governmental funds to supplement agricultural incomes, and particularly the effects which these programs have upon the distribution of income as well as the allocation of resources, have been little more than staked out for exploration.
to the formulation of important policy is made in Chapter VII. Appendix to Chapter IV. The committee is presented in Chapter IV and upon the developments of the problem. Some information bearing on the general development presented in Chapter III. The study may suggest areas for future research. In the face of the limitations in productivity answers to a number of

Corn Belt

income affected of some of the resources of which they have affected the productive resources of the nation. Important information that is introduced relates to the production and use of new and not many of them can be tested with adequate data. It is necessary that not all of the modes be subjected in this study.

Although corn belt and tropical can do little more than accept the applications developed are not. Nevertheless, the committee the primary data on which the plans could not be evaluated because of the limitations of personal and transportation effects of wartime subsidies to agriculture. The plans were made for operation by personal interviews of persons employed. The committee, it is not a matter of expectation, although this study attempts to anticipate some of these problems.
II. REVIEW OF LITERATURE*

Research on the production and income effects of agricultural subsidies is almost entirely yet to be done. Large scale subsidization of an already highly developed agriculture began primarily with the advent of the New Deal. Sufficient time has not yet elapsed for there to be widespread analysis of the effects of agricultural policy during the past decade. Analysis of non-agricultural subsidies has not been developed to a great extent in economics literature. Perhaps the lack of studies on the effects of subsidies is due to the difficulty of obtaining empirical information plus the fact that the theoretical aspects are largely applications of theories already developed. Only one treatise on the subject of subsidies has come to the writer's attention, and this is primarily historical in nature.¹

In spite of the lack of treatises devoted solely to subsidies, there have been numerous references made to the effects of subsidization in economics literature. Some of the critics of mercantilism devoted considerable discussion to the effects of export bounties upon the allocation of resources within the national economy and to the effects which such


bounties had upon prices paid by consumers. However, this early bounty theory is almost entirely confined to the controversy on international trade, a development that one might expect in view of the almost exclusive use during the period of bounties to foster particular exports. The propounders of mercantilism seemed primarily interested in expounding the benefits of protectionism and in demonstrating that bounties on exports would improve the favorable balance of payments. They were quite aware, however, that export bounties had the effect of shifting resources into the production of the subsidized commodity.

Ricardo devoted an entire chapter (Chapter XXIII) of his Principles of Political Economy to "Bounties on Production". In this chapter he noted that such bounties obviously have the effect of shifting resources into producing the commodity on which the bounty is paid if the funds from which the bounty is paid are collected from sources other than taxes upon the subsidized enterprise.

Smith notes bounties on production as having been "very rarely granted. The prejudices established by the commercial system have taught us to believe that wealth arises more immediately from exportation than from production." One of the more important production bounties of Smith's day was the tonnage bounty to the white herring fishery. In order to

---

1 Considerable space is devoted to bounties in Adam Smith, The Wealth of Nations, and in David Ricardo, Principles of Political Economy and Taxation. John Haughton and Henry Home are among the early opposition to the corn bounty (See Jacob Viner, Studies in the Theory of International Trade, pp. 69-72).

encourage the industry, bounties were granted to vessels engaged in
fishing for white herring. Smith observed that,

The bounty to the white herring fishery is a tonnage bounty
and is proportional to the burden of the ship, not to her
diligence and success in the fishery; and it has, I am
afraid, been too common for vessels to fit out for the
sole purpose of catching, not the fish, but the bounty.¹

Cournot in 1938 gave one of the first deductive analyses of the
effects of taxes and bounties upon national income.² He considered a
bounty as a negative tax and applied the same analysis to both taxes and
bounties.³ Cournot demonstrated that a bounty to a monopoly might
result in a greater gain to consumers than the loss to the treasury.
However, Cournot's welfare analysis was very crude, for the theory of
marginal utility had not yet been developed. Welfare theories devoid
of interpersonal comparisons of utility were not developed until nearly

Marshall formulated his theory of the effects of taxes and bounties

¹Adam Smith, ibid, page 486.
²Augustin Cournot, Recherches sur les principes mathématiques de la
théorie des riches (1838), translated by Nathaniel T. Bacon,
New York: The Macmillan Co. (1927), Chapter VI and Chapters X-XII.
³Cournot, ibid., page 69. "To use an algebraic expression they
(bounties) are a negative tax, so that the same analytical formulas
are applicable to taxation and bounties. But bounties differ from
taxes in being reckoned on the gross product; it has never been
proposed to grant a bounty on the net product, so that it is only
for the sake of system that we mention bounties at all here in
connection with taxation on income or net product."
in terms of the comparability of taxes and bounties to changes in the
prices of products or of productive agents.\(^1\) He considers the cases
of industries of constant, increasing and decreasing costs, and analyzes
the effects of a tax and of a bounty upon consumers' surplus. According
to Marshall, bounties on the production of commodities produced under
conditions of constant costs or increasing costs will cost the state more
than the amount of surplus satisfaction gained by consumers, while
bounties on the production of commodities produced under conditions of
decreasing costs may add more to consumers' surplus than they subtract
from the treasury.\(^2\)

---

467-475 and 413-439. See also his Industry and Trade, pp. 204-205.

\(^2\) Marshall's analysis of taxes and bounties is a familiar one to nearly
all economists. A graphic representation similar to that of Marshall's
is presented in Figures 1, 2 and 3. \(DD'\) is the demand curve for the
product and \(SS'\) is the supply curve prior to the granting of the
bounty. \(SS\) is the rate of the bounty granted to the industry, shifting
the supply curve to the position \(SS'\). The bounty is on a per unit
of output basis, i.e. it amounts to \(SS\) per unit of output produced.

\(SS\) is the gain in consumers' surplus under conditions of constant
costs (Fig. 1), but \(SS\) is the cost to the treasury. Consequently,
it was considered unwise to grant a bounty to an industry of constant
costs under normal conditions, since \(SS > SS\).

Under conditions of increasing costs (Fig. 2), \(PP'\) is the gain in
consumers' surplus while \(mp'an\) is the cost to the treasury, \(mp'an >
PP'\) so that it was considered unwise to grant a bounty to an industry
of increasing costs under normal conditions.

Where the supply curve is falling as output is increased (see Fig. 3)
\(PP'\) is the increase in consumers' surplus resulting from the grant-
ing of a bounty \(SS\), and \(mp'an\) is the cost to the treasury. Whether
the gain in consumers' surplus is greater or less than the cost of the
Out of this analysis grew Marshall's suggestion for permanent bounties on industries subject to decreasing costs, the funds for such subsidization to be collected from the taxation of commodities produced under conditions of increasing costs. Marshall's analysis assumes the measurability of utility. He did not consider the conclusions following from his analysis as a valid basis for a governmental program of counties and taxes. To him it merely demonstrated what remains to be done

... by a careful collection of the statistics of demand and supply, and a scientific interpretation of their results, in order to discover what are the limits of the work that society can with advantage do towards turning the economic actions of individuals into channels in which they will add the most to the sum total of happiness.¹

Perhaps the most important contributor to analysis of the effects of subsidies, both from the standpoint of resource allocation and welfare of given individual consumers, is Professor Pigou.² Not only has he set forth some of the economic criteria for evaluating subsidies, but he has also pointed out many of the political and sociological problems involved in their administration.

(Footnote continued)

bounty depends upon whether \( P_{mk1} \) is greater or less than \( b_{na} \). It is obvious that the more the supply curve approaches the horizontal, the smaller becomes \( P_{mk1} \) until it vanishes when conditions of constant costs are reached.

The usefulness of the concept of consumers' surplus, for purposes of economic analysis, is questionable. Consequently, Marshall's analysis may be relatively useless.

¹ Marshall, op. cit., page 475.

² A.C. Pigou, The Economics of Welfare, (Fourth Edition); Industrial Fluctuations, pp. 314-ff; and The Theory of Unemployment.
In addition to his comments on the Marshallian analysis of taxes and bounties as means of increasing the "national dividend", Pigou investigates subsidies to wage earners as means of alleviating unemployment in situations where wage rates are established at a level which he considers too high to enable full employment; and he analyzes subsidies as means of making transfers of income from the rich to the poor. Pigou points out that if wage rates are established (usually by union action) at a level too high to enable the employment of all laborers at the established wage, subsidies to employers to enable the payment of the going wage to all laborers may increase the welfare of both the laborers and non-wage earners. Laborers who were employed without the bounty are no better off than previously (non-wage earners are taxed to pay the subsidy as well as to collect funds for unemployment benefits); laborers formerly unemployed are better off than before (if the wage earned is in excess of unemployment benefits); and non-wage earners are obviously better off if the amount of the bounty is less than the amount of the contribution which they otherwise would have had to make to unemployed laborers. To put it more accurately, non-wage earners are better off if the value of the extra product obtained from the additional workers employed plus the saving in unemployment compensation is greater than the amount of the bounty.1

---

10.

The conclusions following from his analysis, in Pigou's estimation, do not comprise a valid case for the use of subsidies to alleviate unemployment. The political and sociological problems arising from the administration of such subsidies have no easy solutions. Larger subsidies would probably be paid to industries with low wage-rates and a high proportion of unemployment than in other industries.

As the demand for the products of any industry fell off and distress became more pronounced, higher subsidies, both absolutely and relatively to those ruling in other industries, would always be called for. Such pleas would often be acceded to. As a consequence, too many people would be set to and kept at work in some industries and too few in others. Extraordinary strength and competence on the part of the Government would be needed to prevent a policy of wage subsidies from acting in this way. If these were not forthcoming the resulting social loss might well be large. There is also a second serious danger. If the government were in a position to control the wage demands of the workpeople as well as the amount of the subsidies, and if it were absolutely impervious to political pressure, the adoption of the above policy would not lead to any change in the rate of wages demanded. In practice, however, once the policy was adopted and, as a result of it, unemployment reduced to a low level, there would be a strong temptation to workpeople to demand higher wage-rates, while employers, hoping to recoup themselves from an increased subsidy, might not resist these demands very strenuously. In this way both wage-rates and the rates of subsidy would be subject to continuous upward pressure. This tendency, which would exist even in a static community, would be accentuated in the actual world; for in times of boom, wages would tend, as now, to go up; and, when subsequently, depression came, there would be a powerful demand, very likely on the part of employers and workpeople acting together, for an addition to the subsidy to prevent them from falling again. The annual revenue required to provide the subsidy would thus tend to grow larger and larger continually. The burden imposed on non-wage-earners would be raised above the benefit accorded them, and the gap would grow always wider. The supply of services rendered by them in work and saving would be discouraged; and in the end both the national dividend and the real absolute share of it enjoyed by the workpeople would be diminished.
II.

The broad result then is this. If wage earners insist on maintaining a real rate of wages above the economic level in the sense defined above, and if no mitigating action is undertaken by the State, an abnormal volume of unemployment, with all the material and moral waste that this implies, is the inevitable concomitant. In principle it appears that this evil is susceptible of large alleviation, of a kind not involving injury to society at large, by a system of wage subsidies. But in practice it is probable that the applications of such a system would be bungled, and that a community which relied upon it would lose more than it gained.\(^1\)

Some consideration is given by Figou to subsidies as a technique for reducing ignorance and encouraging mobility of labor through reducing costs of movement.

A cheapening of knowledge and movement to individuals, brought about by a transference of a part of the cost of these things to the State, is quite a different thing and works quite differently from a cheapening brought about by a real fall in cost. The two sorts of cheapening have the same tendency to promote—apart from the exceptional cases noted above—increased equality among the values of marginal net products at different points. But, when the cheapening is due to transference, the resultant increase of equality is an increase beyond what, relatively to existing conditions, is most advantageous. **Prima facie** this sort of cheapening, though it will generally make the values of marginal net products more equal, is likely to injure the national dividend.

To obviate misunderstanding two modifying considerations should be added. First, the presumption just established against the grant of a bounty to the industry of promoting mobility is merely a special case of the general presumption against the grant of a bounty to any industry. It may, therefore, be overthrown if there is a special reason to believe that, in the

---

1 Figou, ibid. pp. 703-704.
absence of a bounty, investment in the industry in question would not be carried so far as is desirable. Secondly, when the State takes over the work of providing either information or the means of movement, and elects for any reason to sell the results of its efforts either for nothing or below cost price, we have, in general, to do, not merely with the grant of a bounty on these things, but at the same time with a real cheapening due to the introduction of large-scale methods. Even, therefore, though the bounty element in the new arrangement were proved to be injurious, it might still happen that that arrangement as a whole was beneficial.¹

Stimulation of particular lines of investment by means of subsidies, a consideration which has a direct application in the problems of education, labor mobility and soil conservation in agriculture, is discussed by Pigou. He says:

When it is said that obstacles to ideal distribution are pulled down at public expense, it is meant that information or the means of movement are supplied more cheaply to workpeople, not because the real costs have been reduced, but because a part of these costs has been transferred to the shoulders of the tax-payers. This form of cheapening and that discussed in the preceding section do not react in the same way upon the national dividend. For this kind of cheapening implies that a greater quantity of resources is invested in the work of securing knowledge and effecting movement than would normally be devoted to that work. It implies, in fact, that a particular form of investment is being stimulated by means of a bounty; and there is a presumption that bounties hurt the dividend. As was shown, however, in Chapters IX and XI of Part II, this presumption, in respect of any particular industry, may be overthrown, if there are definite grounds for believing that, in the absence of a bounty, investment in that industry would not be carried far enough to bring the value of the marginal social net product of resources employed in it down to the general level. The industry of promoting the mobility of workpeople, partly because it yields a product

¹Pigou, ibid, pp. 147-48.
difficult to sell satisfactorily for fees, is one about which there are definite grounds for believing this. Consequently, up to a point, it is probable that the expenditure of public money in promoting mobility would improve the national dividend. It is necessary, however, for the state to watch this expenditure carefully; for, if it is carried too far, the cost at the margin will exceed the gain.\footnote{1}

In his comments on transfers from the rich to the poor by means of bounties on things purchased by the poor,\footnote{2} Pigou makes some conjectures as to the effects of such bounties upon the supply curve of labor and consequently upon the national dividend. He concludes that the individual’s willingness to work may be reduced if the bounties are granted upon goods the demand for which is relatively inelastic, but that the willingness to work may be increased if the bounties are granted upon goods, the demand for which is elastic. Since bounties on things purchased by the poor appear less as charity than do direct transfers of income by means of the dole, such bounties may be less damaging to the "morele" of the workers than would a dole.

Royal Meeker’s \textit{History of Shipping Subsidies}, an obscure work published in 1905,\footnote{3} describes and attempts to analyze the various subsidies granted to shipping during the 19th century in the United States and in foreign countries. The Marshallian analysis is reviewed and an attempt is made

\footnotesize
\begin{itemize}
\item \footnote{1}{Pigou, \textit{ibid.}, pp. 510-11.}
\item \footnote{2}{Pigou, \textit{ibid.}, pp. 757-61.}
\end{itemize}
to apply it to shipping and ship building. Popular economic arguments for subsidy are reviewed and criticized, and some of the political arguments for shipping subsidies are discussed and analyzed.

There are also numerous briefer comments on shipping subsidies.¹ MoVey has pointed out that subsidies to shipping, if made conditional upon specific types of construction, might be of value in assembling a merchant marine which could be somewhat more easily converted into war vessels than the kind which would probably be developed if shipbuilders designed ships solely for their suitability for peace time purposes.

Shipping subsidies have also been made conditional upon such factors as the nationality of the crew and the board of directors, the speed, tonnage, conditions of sale, place of construction, cargo carried, training of the men, days in use per year, etc.

Some of the more recent contributions to subsidy analysis have focused upon particular aspects of subsidization, pointing out that certain individual and state practices and policies provide indirect subsidies to certain groups, and indicating the effects upon resource allocation and income distribution.²

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Nicholas Kaldor has developed Pigou’s suggestions for wage subsidies as means of overcoming unemployment. Kaldor has pointed out that wage subsidies may be more effective than wage decreases in increasing employment. Although isolated money wage reductions and wage subsidy tend to be equivalent, general money wage reductions may cause a marked reduction in the price level of consumers’ goods, thereby making significant reductions in real wages impossible. Subsidies to wages, however, may increase the total purchasing power in the hands of consumers and may increase somewhat the price level of consumers’ goods. Kaldor’s analysis of the cost of such subsidies to the state and to the taxpayers is similar to that of Pigou.

(Footnote continued)


Black indicates that some of the effects of allowing farmers alternative bases of income tax assessment are (1) to induce capital into land and into agricultural production to an extent greater than would be the case if the tax were computed as it is for other taxpayers, (2) to encourage the rich to enter farming, (3) to increase the production of farm products, (4) to result in higher wages to agricultural labor, (5) to worsen the position of small farmers (they do not benefit if they pay no tax, yet they face increased competition in renting land, hiring labor and selling crops). The subsidy tends to operate on a wider front than would a direct subsidy, i.e. it expands all production, not just the production of a single commodity (as, for example, would a subsidy on wheat).


The recent use of subsidies as means of maintaining price ceilings has brought forth some analyses of subsidies and price control. Mikesell and Galbreath\textsuperscript{1} briefly review British and Canadian experience with subsidies and price control and indicate the need for subsidies as a part of U.S. wartime economic policy. These authors consider increased import prices, unabsorbable squeezes, increases in agricultural prices and increased transportation costs as evidences of the need for subsidization or increased retail prices. They also attempt an economic justification of subsidies in a price controlled economy, pointing out that subsidies effect a socially favorable distribution of income and that they may be less inflationary than price increases.

Harris\textsuperscript{2} has presented an analysis of some kinds of subsidies as applied in a war economy striving toward the objective of preventing inflation but at the same time obtaining adequate production of war materials. He has pointed out that given production effects may be obtained with a smaller transfer of income by using subsidies rather than changes in relative prices to direct production. This is likely to be true where the conditions for price discrimination are present but political opposition to such discrimination in pricing makes its practice unacceptable.


Analysis of AAA subsidy has been primarily concerned with the income effects of these payments. The production effects have not been ignored, but they have been considered extremely difficult to determine. Schultz has indicated the extent to which government payments have added to farm income and has pointed out the tendency to "pyramid" payments on the farms with highest incomes. He has also suggested some questions which should be answered in any analysis of the effects of AAA on farm production and income.\(^1\) Schultz has pointed out that analysis of the effects of AAA must consider the extent to which the farm is a unit of consumption as well as a unit of production. He also sets forth some suggested criteria whereby supplementary income might be allotted to farmers.

Smith and Roberts have indicated the relationship of benefit payments to farm population and have suggested means for reallocating these payments so that their distribution would conform more to the distribution of farm

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\(^1\) T.W. Schultz, "Economic Effects of Agricultural Programs", American Economic Review, 30:(February Supplement), 127-154. 1941. Some of the questions posed by Schultz are: (1) the purpose of the payments, i.e. the extent to which "they are rewards necessary to induce farmers to make specific adjustments such as reducing the acres of given crops and adopting soil conservation practices" and the extent to which they are mere supplementary income; (2) criteria for allotting supplementary income; (3) the effects of the payments upon "(a) the mobility of resources, (b) rent and price of farm land, (c) the returns to the farmer for his labor and management, (d) the risk and uncertainty involved in farming, and (e) the attainment of ends which are considered necessary when incomes are supplemented by public action." (pp. 147-148).
population. Export subsidies and their effects upon agricultural prices and production have also been analysed to some extent.

Virtually all of the analyses of "specific" subsidies (those paid on the basis of per unit of output of a given commodity) have considered such subsidies primarily as an addition to the revenue of the producer or as a deduction from his costs equal to the subsidy (the Marshallian treatment).

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Three propositions are submitted "as essential elements in a national policy for agriculture".

"(1) The distribution of all federal benefit payments to the states should be in proportion to the sizes of their farm populations."

"(2) These federal contributions should not be paid directly to the farm operator but should be channelized into the support of essential services now financed by local taxation."

"(3) The principle of equalization should be adopted on a federal scale so that areas benefiting from rural-urban migration would contribute a portion of their share in the provision of such services as modern schools and public health facilities."

The basis for these propositions making farm population the focal point of agricultural policy is the assumption of the necessity for maintaining or increasing our population, and the further assumption that farmers are the principal suppliers of population.

The differences between the effects upon income uncertainty of subsidies and returns via the price system have not been explored. Nor have the psychological and sociological factors been given much more than mere mention in most analyses. The possibilities of employing discriminatory subsidies (payment of various rates of subsidy on various units of output of a given producer or similar discrimination in rates of payment between various producers) has been mentioned but not adequately explored.

The failure to consider the effects of subsidy upon price uncertainty and to adequately treat the psychological and sociological implications of subsidization concurrently with economic analysis is not wholly unexplainable. The development of tools suitable for handling problems of risk and uncertainty has been stimulated largely within the last three decades. And economics during the past two decades has only begun to consider solving problems not adapted to solution with the tools of perfect competition.


2 Knight's Risk, Uncertainty and Profit is probably the first extensive specialized treatment of the problem of risk and uncertainty.
III. THE THEORY OF SUBSIDIES

In this chapter we propose to analyze deductively the production and income effects of subsidies. The production and income effects are closely interrelated. Anticipated income from various alternative lines of production guides the allocation of resources and hence the production pattern. In turn, the production pattern—to the extent that it influences the prices of productive agents and the distribution of their ownership—influences the magnitudes of individual incomes. The income and production problems, however, are usually separated in order to simplify the analysis.

A deductive analysis of the production effects of subsidies is merely a special application of the theory of the firm. We will treat the production effects of subsidies primarily in terms of the way in which changes in anticipated returns from production, costs of productive agents and production techniques might be expected to influence firms' decisions as to what to produce, how much to produce, and what productive agents and production techniques to utilize. It is not proposed to present any additions to the theory of the firm or to state in detail this theory. All that will be attempted is a brief sketch of the general outlines of the theory of the firm so that analysis of the effects of subsidies may be fitted into the framework of this outline.
A. The Theory of the Firm\(^1\)

The firm may be defined as the business and planning unit in production.\(^2\)

Within its framework decisions are made relative to the kinds and volumes of outputs, the kinds and volumes of inputs and the methods of production.


2For a more adequate discussion of the nature and functions of the firm, refer to A.G. Hart, op. cit., pp. 2-4.
The first theorem of the firm under perfect competition

1. 1. The output of the firm

The output of the firm is to be maximized to maximize net
and the marginal production function are not changing over time, which is
assuming that the prices of output, the prices of production factors,

The firm's net profit will be maximized if the

This function is the technical rate of transformation of factors of production

The firm buys production factors and sells products. The production

and the product of production factors and the prices of production factors are all

perfect.

The expected behavior of the firm—i.e., it is attempting to maximize net

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price of a product is increased relative to the prices of other products, the firm will produce greater relative amounts of this product. Inverse effects will follow from price changes opposite from those mentioned. The price mechanism, by assumption, is thus a means for shifting resources from one line of production to another.

1 Expressed symbolically, the theory of production is as follows:

\[ y_1, y_2, \ldots, y_m \text{ are productive agents} \]
\[ x_1, x_2, \ldots, x_m \text{ are products} \]

The transformation function is expressed:

\[(1) \ f (y_1, y_2, \ldots, y_m, x_1, x_2, \ldots, x_m) = 0 \]

If a quantity of a product or a factor is altered, there is also a corresponding alteration in inputs of other factors or outputs of other products.

One can solve for the relationship between the output of a product and the inputs of factors, yielding the production function:

\[(2) \ x_i = \partial^A (y_1, y_2, \ldots, y_m, x_1, x_2, \ldots, x_{i-1}, x_{i+1}, \ldots, x_m) \]

The marginal rate of transformation will be:

\[(3) \ \frac{\partial y_i}{\partial x_1} \]

This may be expressed as a ratio between factors, between products or between a factor and a product.

The partial derivative of the product with respect to any factor is the marginal productivity:

\[(4) \ \frac{\partial x_1}{\partial y_1} \]

Factors may be considered as negative products, in which case one may work only with the transformation function:

\[(5) \ f (x_1, x_2, \ldots, x_m, x_{m-1}, x_{m+2}, \ldots, x_n) = 0 \text{ or} \]
\[ f (x_1, x_2, \ldots, x_n) = 0 \]
(Footnote continued)

It is assumed that the marginal rates of transformation are all negative, i.e., the substitution ratios are less than unity; Hence:

\[ \frac{\partial x_s}{\partial x_r} < 0 \]

Thus, if \( x_s \) and \( x_r \) are both products, \( x_s \) can be increased only by decreasing \( x_r \); if \( x_s \) and \( x_r \) are both factors, \( x_s \) can be decreased only by increasing \( x_r \); and if \( x_s \) is a product and \( x_r \) is a factor, an increase in \( x_r \) leads to an increase in \( x_s \), i.e., the marginal productivity is positive. These conditions need hold only within the "effective region" (that part of the production function of economic significance).

Under perfect competition, the profit function is:

\[ V = \sum_{j=1}^{n} x_j p_j \]

This is to be maximized subject to the constraint of the transformation function. Thus, we maximize:

\( V = \lambda f \), where \( \lambda \) is a Lagrange multiplier.

For each product and factor we will have the relation:

\( V_j = \lambda f_j = 0 \) (j = 1, 2, ..., n), if net profit is at a maximum.

\( V_j = \lambda f_j \)

and

\[ P_j = \lambda (f_j) \]

Hence,

\( V_j = p_j \)

and

\[ \frac{p_s}{p_r} = \frac{f_s}{f_r} \] and \[ p_s = -\frac{\partial x_r}{\partial x_s} \]
Thus where profit is a maximum, subject to the constraint of the production function, marginal expenditure \( V_j \), if \( x_j \) is a factor, is equal to the price of the factor, marginal revenue \( V_j \), if \( x_j \) is a product, is equal to the price of the product, and inputs of factors are carried to the point where marginal productivities are equal to marginal rates of transformation times price.

The conditions above are the first order conditions. The second order (stability) conditions are not set forth here.

If the assumption of perfect competition is dropped, then \( V_j = p_j \). We have instead:

\[
V_j = \frac{\partial}{\partial x_j} \left( \sum_{j=1}^{n} p_j x_j \right) = p_j \left( 1 + \sum_{j=1}^{n} \frac{\partial p_j}{\partial x_j} \cdot \frac{x_j}{p_j} \right)
\]

\[
= p_j \left( 1 + \frac{1}{p_j x_j} \cdot \sum_{j=1}^{n} p_j x_j \cdot \frac{\partial p_j}{p_j x_j} \right) \text{ where } \frac{\partial p_j}{p_j x_j} \text{ is the cross elasticity of price with respect to quantity.}
\]

The general first order conditions then become:

\[
V_j = p_j \alpha_j, \text{ where } \alpha_j = 1 + \frac{1}{p_j x_j} \cdot \sum_{j=1}^{n} p_j x_j \cdot \frac{\partial p_j}{p_j x_j}
\]

\( \alpha_j \) is the monopoly coefficient and is zero under perfect competition, and

\[
\frac{\partial\alpha_j}{\partial x_j} = \frac{\partial}{\partial x_j} \left( \sum_{j=1}^{n} p_j x_j \right) = -\frac{\partial x_j}{\partial x_j}
\]

The case of fixed production coefficients has been considered by a number of writers and will not be discussed here except in connection with capital rationing. For discussions of the theory of production under fixed as well as variable production coefficients see N. Georgessen-Kroegen, "Fixed Coefficients of Production and the Marginal Productivity Theory," Review of Economic Studies, 3:40-49, 1937; Abba P. Lerner, The Economics of Control, New York: The Macmillan Co., 1944, Chapters 10, 15, 16 and 17; and George Stigler, Production and Distribution.
2. The theory of the firm under non-static conditions

The theory of production under non-static conditions differs from the theory under static conditions in that inputs and outputs are dated and the prices of products, the prices of productive agents and the transformation functions are all changing through time. Consequently, the entrepreneur must make decisions based on expected rather than realized values. And in the mind of the entrepreneur, the probability that any expected value will be realized may vary from zero to unity. Analysis of the firm's behavior in such circumstances is obviously more complex than in the static model.

Hicks\(^1\) has handled the time factor by considering inputs of a given productive agent at different points in time as different productive agents and outputs of a given product at different dates as different products. He has assumed that the transformation function is known and that the anticipations of the entrepreneur are single-valued (future prices are assumed to be anticipated with certainty, or only the most probable value of the distribution is taken into consideration). In this situation, solutions to the problems of resource allocation, the production pattern

(Footnote concluded).


\(^1\)J.R. Hicks, Value and Capital.
and the response to alterations in anticipations are reached in somewhat
the same fashion as they were in the static case.\footnote{1}

Tintner\footnote{2} has considered the problem under conditions where the trans-
formation functions are not completely known and where anticipations are
not single-valued, i.e. the entrepreneur has in mind only an \textit{a priori}
probability of different forms of the production function, the distribution
of expected product prices and the distribution of expected prices for
productive agents. Various features of the distributions may be combined
to form what Tintner has called "uncertainty preference functionals", and
the analysis may then be handled in a manner similar to that employed by
Hicks.\footnote{3}

Non-static analysis thus introduces anticipations and uncertainty,
interjecting the element of subjective evaluation (on the part of the entre-

\footnote{1}{We merely substitute expected prices for prices and continue as in the
static model. There is a further relationship between anticipations and
such stimuli as existing prices or changes in prices which must also be
established before we can determine the relationship between price
changes and alterations in the production pattern.}

\footnote{2}{See Gerhard Tintner, "The Theory of Production under Non-static Conditions",
\textit{Journal of Political Economy}, 50:645-667. 1942.}

\footnote{3}{This treatment is expressed symbolically by Tintner in "A Contribution to
the Nonstatic Theory of Production", in \textit{Studies in Mathematical Economics}
and Econometrics, edited by Lange, et. al., Chicago: The University of
Chicago Press. (1941), pp. 92-109.}

The firm produces at various points in time, decisions being made in
response to anticipations. We may substitute for the prices in the
static model, the uncertainty preference functionals. We will have,
however, not one but several transformation functions.
entrepreneur) into responses of the firm to such stimuli as changes in relative prices. Under non-static conditions the behavior of the firm in response to given stimuli may be quite divergent from that in the static model, depending upon the nature of the anticipations. However, the directions of responses to a given stimulus—a change in relative prices, for example—are probably the same in most non-static situations as they are under static conditions, although the magnitudes of the responses may differ widely.¹

B. The Production Effects of Subsidies

1. Definition of subsidy

The term subsidy as applied in this analysis will be used to refer to a payment made by the government to an individual or firm, conditional upon the performance of certain actions and usually supplementary to prices.²


²A subsidy has been defined by Joseph S. Davis in terms of its supposed contribution to the public interest. "Strictly speaking, a subsidy is a direct payment made by the government to a private individual, group, or corporation, to encourage the recipient to carry on or develop a line of operations that is considered to be in the public interest and to require such a subsidy." See Joseph S. Davis, "The Export Debenture Plan for Aid to Agriculture", Quarterly Journal of Economics, 43:250-277. 1929.

The definition of subsidy given by Otto Nathan in the section on "Subsidies" in the Encyclopedia of the Social Sciences is "confined to financial or other aid given, without equivalent recompense, by govern-
This payment may be in money or in kind.

The conditions upon which the subsidy may be granted, however, may vary considerably between different subsidy programs and may be so loose as to enable broad groups of economic units to receive grants without altering significantly their production or consumption patterns from what these patterns would be in the absence of subsidy. Consequently, we shall distinguish between various types of subsidies according to the conditions under which they are granted.

By a specific subsidy on outputs we are referring to a payment per unit of output of a particular commodity or group of commodities. This payment is made to producers and may be non-discriminatory, i.e. it may be

(Footnote continued)

ments, government agencies or government-owned corporations to promote or preserve private enterprise in industry, trade, commerce, and agriculture. Subsidies always involve an actual outlay in cash or in kind (usually land) by governments or government agencies, or assistance, benefits, or promises which might lead to government expenditure. They thus affect a shift in the national income, since in the last analysis the government must use for special purposes and for the benefit of a small part of the community funds which have been derived from general taxation. Since subsidies are always calculated to increase the profitability of the enterprise beyond its extent in an entirely unaided free market, they change the competitive position of different parties in either the domestic or the foreign market."

Nathan's definition of subsidies explicitly excludes tariffs, since they involve no expenditure of government funds. It also excludes financial help to educational institutions and supplementary income to certain groups of consumers, since these are not intended to help individual businesses or to increase their profit. Davis' definition implicitly excludes grants to consumers as being subsidies.
the same for all units of production of the subsidized commodity or commodities; or it may be discriminatory, i.e. rates of payment may vary between producers and between particular outputs of a given producer. We shall refer to this distinction between discriminatory and non-discriminatory subsidies at later points in the analysis.

A specific subsidy on inputs is similar to a specific subsidy on outputs except that payments to producers are made per unit of input of a particular productive agent or group of productive agents used. This type of subsidy may also be discriminatory or non-discriminatory.

One may also consider certain types of payments designed to alter the transformation function (the production practices) of given producers as practice payments or transformation subsidies. These are conditional upon the use of certain kinds of production practices.

Payments to particular economic units and designed to supplement the incomes of these units may be only vaguely conditional upon the patterns of outputs and inputs or upon the production practices utilized. The conditions, however, cannot be such that every economic unit can receive a subsidy. Payments conditional upon the economic unit being a part of a particular industry, but not conditional upon amounts of outputs or inputs will be referred to as unconditional subsidies. This category is admittedly a very nebulous one. At least a part of AAA payments appear to have been of this variety, however.
2. The production effects of specific subsidies on outputs

The production effects of such subsidies are generally considered to be analogous to those induced by a change in relative prices. Assuming that the payment is an addition to returns received in the market, the immediate reaction of the firm to such a subsidy is likely to be very similar to the firm's reaction to an increase in the price of the product. A subsidy on the production of a particular commodity will usually encourage producers of that commodity to try to expand their output. Its receipt will, at least in the short run, enable firms to bid more effectively for the resources used in producing the subsidized commodity. The longer-run effect, however, may not be equivalent to that induced by a shift in demand for the product, unless the subsidizing agency withholds from the market all of the increment in output encouraged by the payment of the subsidy.

An increase in the demand for a product obviously refers to a situation where buyers will be willing to purchase a given amount of product at a higher price than they would have been willing to pay prior to the shift. A subsidy on outputs, aside from monetary effects which it may have, does not shift demand. Although immediate returns from the disposal of a given output are increased as a result of the subsidy, it is conceivable that after sufficient time has elapsed for the effects of the subsidy to be completely realized total revenue attributed to the production of the commodity might

---

1The assumption which obviously underlies this statement is that the supply curves of enterprise are not backward sloping throughout the "effective range".
be unchanged, increased or decreased depending upon the elasticity of
demand for the product, the response of producers to the subsidy, and the
way in which the subsidizing agency disposes of the increment in production.

As a first approximation, let us make the following assumptions:

(1) There is free entry of firms into the production of the sub-
sidized commodity, and resources can be shifted from one line
of production to another;

(2) producers expect no shift in the demand schedules for the
subsidized product;

(3) the subsidy is expected to be continued for a period of time
sufficient in length to warrant producers shifting resources
into production of the subsidized commodity.

The short-run effect is very likely to be an increase in the output of
the subsidized commodity, producers of this product being able to induce
resources away from the producers of other products. Assume that producers
are unlikely to take into consideration the effects which their increases
in the output of the product will have upon the price of the product, i.e.
they are unlikely to distinguish between the demand curve facing the
individual firm and the demand curve facing the industry, or are unlikely
to distinguish between an increase in returns due to a subsidy and an
increase due to a shift in demand. A producer's long-run total expected
returns are likely to be in excess of his long-run total realized returns.

---

1 This type of reaction is related to the nature of expectations. Such
relations may be obtained in "sequence analysis"—when we have a
relationship between realized values at different points in time. In
intertemporal analysis this would be the case where existing prices are
(Footnote continued)

expected to hold indefinitely into the future. The most simple case is the so-called "Cobweb Theorem" (Refer to Mordecai Ezekiel, "The Cobweb Theorem", Quarterly Journal of Economics, 52:235-80. 1938.

(1) $D_t = aP_t - c$, where $D_t$ is the demand at time $t$ and $P_t$ is the price at time $t$. $a$ and $c$ are constants, $a$ being the slope of the demand curve.

(2) $S_t = bP_t - d$, where $\theta$ is the time lag, and $b$ is the slope of the supply curve.
In equilibrium $D_t = S_t$.

We can assume the intersection of the two curves at the origin, so that $c$ and $d$ are 0.

A function $P(t)$ can then be determined which satisfies the relation $D_t = S_t$.

(3) $aP_t = bP_t - c$, or

$P_t = \frac{b}{a} P_t - c$.  

$P_t + \theta = \frac{b}{a} P_t = \left(\frac{b}{a}\right)^2 P_t - c$.  

$P_t + 2\theta = \frac{b}{a} P_t + \theta = \left(\frac{b}{a}\right)^3 P_t - c$.  

$P_t + (n+1)\theta = \frac{b}{a} P_t + (n+1)\theta = \left(\frac{b}{a}\right)^{n+1} P_t - c$.

If $a$ and $b$ have the same sign, and $b > a$, then

$$\lim_{n \to \infty} P_{t+n\theta} = \infty$$

If $a$ and $b$ have the same sign, and $b < a$, then

$$\lim_{n \to \infty} P_{t+n\theta} = 0$$

If $a$ and $b$ have opposite signs, and $b = a$, then $P_{t+n\theta}$ oscillates with a constant amplitude.

If $a$ and $b$ have opposite signs, and $b > a$, then $P_{t+n\theta}$ oscillates with an increasing amplitude.

If $a$ and $b$ have opposite signs, and $b < a$, then $P_{t+n\theta}$ oscillates with a decreasing amplitude.
Such a divergence between realizations and anticipations could hardly be expected to continue indefinitely. The extent of the long-run expansion in the output of the subsidized product will thus depend not only upon the size of the subsidy, but also upon the elasticity of the demand for the product (the stability of the new level of returns per unit of output) and the extent to which costs of production are increased as output is expanded—the nature of the industry's supply functions for productive agents. The more elastic the demand for the product and the more elastic the supply functions for productive agents, the greater the long-run response in output which a subsidy of a given amount will induce.¹

¹This relationship expressed symbolically is as follows:

1) \( V = R(x) - C(x) \), where \( V \) is the firm's profit, \( R(x) \) is the total revenue function and \( C(x) \) is the cost function for the firm's output, \( x \).

2) \( R(x) = x(p_x + S_x) \), where \( p_x \) is the price of the product per unit of output and \( S_x \) is the amount of subsidy per unit of output.

\( V \) is at a maximum where:

\[
\frac{dV}{dx} = R'(x) - C'(x) = 0
\]

(3a) \( p_x + S_x = C'(x) \)

Under conditions of perfect competition, \( p_x \) will depend not only upon the firm's output, \( x \), but upon the aggregate output of all firms, \( X \). Hence:

(4) \( p_x = f(x) = X \cdot \eta \cdot \frac{dp_x}{dx} \), where \( \eta \) is the elasticity of demand for the product.

Thus we have:

(5) \[
\frac{dV}{dx} = X \cdot \eta \cdot \frac{dp_x}{dx} + S_x - C'(x) = 0
\]

\( C'(X) \) is not a constant, but is an increasing function of \( X \) if the
If the subsidy is applied during periods of unemployment, the effect upon output (independently of the monetary effect) is likely to be greater than if the subsidy was applied during a period of full employment. The supply functions for productive agents are likely to be much more elastic in periods of unemployment than in periods of full employment. In fact, the terms full employment and unemployment are frequently utilized to describe extremes in the supply functions - full employment being the condition when the supply for the economy as a whole is completely inelastic and unemployment the condition when the supply is completely elastic.¹

The production effects of a specific subsidy on output are thus likely to be quite similar to those induced by a change in relative prices. Differences between the effects which price increases and subsidies will

(Footnote continued)

industry uses a large enough part of the total supply of the productive agents used in producing X so that the prices of these agents are altered as the quantity utilized by the industry changes.

The larger \( n \) and the more nearly \( C'(x) = k \), the greater the expansion in the long-run output of \( x \) which will result from any subsidy, \( S_x \).

¹Alternatively, assuming that the supply curve for a particular productive agent was that in Figure 4, unemployment might be said to occur when the level of employment was less than \( OE_1 \), full employment might be employment at levels between \( OE_1 \) and \( OE_2 \), and inflation might be the level \( OE_2 \). This analysis obviously applies to the economy as a whole rather than to a particular industry.
Fig. 4
have upon production are likely to be derived primarily from differences in monetary effects\(^1\) or differences in the types of expectations induced by the two types of stimuli. Monetary effects, however, may be entirely unrelated to whether the change is induced by changes in relative prices or by the payment of subsidy. For example, if the subsidy is financed from the proceeds of taxation and there is no change in the quantity of money or in liquidity preferences, the overall monetary effect may be the same as that stimulated

\(1\)By monetary effects we have reference to the changes in the demand for money as a result of particular changes in the economic system. \(M\) is the quantity of money and \(L\) is the willingness to hold cash balances. \(L\) may be defined, in Professor Boulding's terminology, as the "preferred liquidity ratio". For an individual, this is the proportion of his total assets which he wishes to hold in the form of money. For a closed economic system, this is the ratio of the quantity of money to the total value of capital. (Refer to K.E. Boulding, "A Liquidity Preference Theory of Market Prices", *Economics* (New Series) 11:55-63. 1944.) An increase in \(L\) is then the equivalent of a fall in prices, if the total quantity of money and the total stock of goods are unchanged.

We may classify various monetary effects after Lange (See Oskar Lange, *Price Flexibility and Unemployment*, Bloomington, Ind.; The Principia Press, Inc. 1944) as follows:

If the monetary effect is **negative**, then:

\[
\frac{dM}{dL} \cdot \frac{L}{M} > 1, \text{ i.e. the quantity of circulating media expands and contracts proportionately more than the demand for cash balances.}
\]

If the monetary effect is **positive**, then:

\[
\frac{dM}{dL} \cdot \frac{L}{M} < 1.
\]

If the monetary effect is **neutral**, then:

\[
\frac{dM}{dL} \cdot \frac{L}{M} = 1.
\]

Only when the monetary effect is positive will a fall in the money price of a commodity result in a reduction in its real price.
by a shift in the demand schedule for a particular product with no change in the total quantity of money or in liquidity preferences.

The case of payment of a subsidy on specific outputs in a situation where there are unemployed resources deserves further consideration. If units of the resources used in producing the subsidized commodity are unemployed, the payment of a specific subsidy on its production may lead to an expansion in its output without a reduction in the outputs of other commodities. All units of the resources needed to expand the output of the subsidized product may be drawn from the ranks of the unemployed. In fact it is quite conceivable that not only would the output of the subsidized product be increased, but the production of other commodities might also be expanded. This sort of reaction might occur if the monetary effect and the effect upon expectations were favorable to expansion throughout the economy. Such might be the case if the subsidy were financed in a manner which would lead to a net expansion in the circulating media. If the monetary effect were neither neutral nor negative it is likely that there would be a net increase in prices and the expectation that this new level would at least be maintained or perhaps increased. Such an effect might also be prompted by a shift in the demand for a product so that its price was increased—if at the same time there also was a shift in liquidity preferences so as to maintain all other prices or to increase them. However, such an autonomous price change is less likely to occur than is a similar change induced by subsidies on outputs.
a. Effects of discrimination in subsidy rates. Specific discriminatory subsidies on outputs are likely to have production effects similar to those of non-discriminatory subsidies. Their monetary effect, however, will probably be less pronounced, since a smaller transfer of income per unit of output of the subsidized product is involved. If increases in the prices of products are utilized to secure additional outputs of these products, such increased prices usually must be paid on all output—that which would have been produced had there been no price change as well as that produced as a result of the price change. This need not be true if there are available means for dividing the market so that the increased price need be paid only on "additional" output. But for the most part, such division is not practiced, for it means not only differentiating between outputs of various producers (those already in production before the price change and those entering the industry in response to the expected price increase), but also differentiating between various outputs of a given producer (those units of output which would have been produced under the old schedule of prices and those units of output produced in response to the expected price increase).  

1In Figure 5, SS' is the supply curve for a product, X1. The output of X1 is assumed to be a function of the price of X1, P1. If P1 is increased from Op11 to Op12, the aggregate gross income of producers is increased by 0 x12 s12 P12 - 0 x11 s11 P11 or by P12 s12 x12 s11 x11 s11 P11. If the increased price is paid only on additional output, aggregate gross income is increased by x11 x12 s12 t or P11 s11 t P12 less than if there no price discrimination.
Fig. 5
Subsidies, however, can often be directed to particular producers or at particular additions to output. They may be made conditional upon an expansion in output and need be paid only on that part of output which is in addition to that which would have been produced in the absence of a subsidy. The differentiation in rates of payment on various units of output of a given producer may be carried a step further. Where producers think that their marginal costs are increasing as output is expanded, rates of payment for additional outputs may be differentiated, such rates increasing with increases in output.

Whether such differentiation could be administered depends upon the extent to which "additional" output can be determined and the extent to which farmers are guided by changes in marginal revenue. The administering agency might be able to designate output in some historical base period as "normal" output and pay a subsidy on all units in excess of the amount produced in the base period. Or the agency might attempt to compute "normal" output on the basis of existing technological rates of transformation, prices of products and prices of productive agents and make payments for all output in excess of the computed "normal". This latter method, of course, is an ideal which can only be approximated. It is essentially what historical base allotments attempt to approximate.

Whether agricultural producers respond to changes in the marginal revenues from the production of particular commodities determines, to a large extent, the degree to which discriminatory pricing or subsidies (if such could be administered) would be effective in bringing about certain
production responses. Variations in a given farmer's output of a given commodity obviously depends not only upon the changes in the price of that particular commodity, but also upon the changes in the prices of other commodities which could be produced with the farmer's resources, the prices of productive agents and the level of the farmer's income. Income may enter into the production response via its effect upon the reservation prices of productive agents furnished by the farm operator. For example, as the farm operator's income increases, expansion in the production of a particular commodity in response to an increase in the commodity's price may be slowed, particularly if additional exertion on the part of the operator is required.  

This simply means that production responses to small incremental increases in expected income are reduced as income itself increases. Consequently, equalization of marginal costs and marginal revenues may be less effective as the principal guiding changes in the firm's production when its income is at a high level than when its income is at a lower level.

b. Effect upon uncertainty. A difference between the production effects of subsidies on specific outputs and expected increases in product prices may also result from differences between the two types of stimuli in their effects upon uncertainty. This might enter into reactions via the expectations of the entrepreneur. Subsidy payments, if announced in advance of the planning of production for a particular time period, may be anticipated with greater certainty than would be higher expected product

---

prices. Consequently, a given expenditure administered by the government in the form of subsidies may bring forth a greater addition to production than an equivalent amount expended in the form of higher product prices.

Subsidies thus administered have the same sort of effects in reducing uncertainty as would forward prices. (The support prices for agricultural products now being utilized by the federal government are a forward pricing technique).

This conclusion regarding the relative effects of subsidies and expected price changes is based upon the assumption that producers prefer a probability distribution of expected product prices with a given most probable price and a given dispersion to one which has the same most probable price (expected with the same probability) but a greater dispersion. This hypothesis may be represented graphically as follows:

The curves $r_1, r_2, \ldots, r_n$ in Figure 6 represent combinations of most probable expected prices and dispersion of the distribution (both being subjective), any point on a curve $r_1$ being equally desirable to the seller, but points on curve $r_2$ being preferable to those on $r_1$. OT represents the effective price of a most probable value OS with a range OM, and TS represents the risk premium, the effective price being defined as the price with probability one equivalent in the mind of the seller to the most probable expected price given the dispersion of the probability distribution.\(^1\)

\(^1\)This particular graphic presentation has been suggested by Professor Oskar Lange. It is similar to that employed by Tintner, but takes into consideration only two features of the probability distribution. If the
actor is a buyer the indifference curves will be inverted as in Figure 7.

It is assumed that the buyer will similarly prefer a probability distribution of expected factor (or product) prices with a given most probable price and a given dispersion to one which has the same most probable price (anticipated with the same probability) but a greater dispersion. However, he will be indifferent to some most probable expected price with a given dispersion and some lower most probable expected price with a greater dispersion.

OF represents the effective price, TS the risk premium.

Professor Knight questions this approach, since he assumes many individuals do not have an aversion to risk. Pigou explains risk aversion in terms of diminishing marginal utility, i.e., expected utility decreases as the dispersion increases (see Pigou, Economics of Welfare, Appendix I). If we drop the assumption of measurability of utility we have to deduce the presence of risk aversion on empirical grounds.

Professor Hart, although acknowledging the prevalence of risk aversion, criticizes the above treatment on the grounds that one cannot translate uncertain prices into "certainty-equivalents" (a term suggested by G.L.S. Shackle) for there are no such behavior comparisons in reality, i.e., you cannot treat behavior under uncertainty as equivalent to some behavior under certainty. The existence of future markets may refute Hart's argument.

In the analysis we assume a closed economic system and variable production effects of specific subjects on income.

The production effects of specific subjects on income to obtain a known production effect, if one assumes the monetary effect will be smaller, a smaller transfer of income will be required in order, however, that monetary effects of specific subjects, however, have production effects similar to those of non-cooperating subjects. Hence, the monetary effects of a certain commodity, their production effects per unit of income, will be smaller. A smaller reduction in specific subjects' income from a subject who receives a price increase will result in a smaller reduction in specific subjects' income from a subject who receives a price decrease.

Therefore, the monetary effects and the effects upon expectations of costs (price changes and specific subjects' expectations of costs and expectations of costs) are similar in their production effects to the two kinds of specific subjects, whereas such subjects are not.

The overall conclusion which one may draw from this is that in general, such subjects are.
in its effect upon production, to a reduction in the price of the productive agent upon which the subsidy is being paid. A reduction in the price of one productive agent relative to the prices of other productive agents encourages firms to try to expand the outputs of products produced with the aid of this factor and to reorganize the factor combination, employing relatively larger amounts of the productive agent the price of which has been lowered.¹ Thus, if it is generally anticipated that the subsidy will be continued for a period of time sufficient in length to warrant adjustment, firms will plan for an expansion in the output of those commodities in the production of which this factor can be employed.

The payment of a subsidy of a given amount per unit of specified inputs does not alter the demand functions for the products produced with these factors, assuming that the monetary effect is negligible. Nor does it alter the transformation functions. Hence, it does not change the relative productivity schedules of the various productive agents. The extent of changes in the outputs of products which can be produced with the subsidized agents and the degree to which factor combinations will be altered thus obviously will depend entirely upon the nature of the supply functions for the various productive agents.

If the supply function for a subsidized factor is perfectly inelastic, no change in the pattern of inputs can take place. The subsidy will be reflected in higher prices for the subsidized agent. Such will be the

¹The effects of a reduction in the relative price of a factor may be divided into substitution effects and expansion effects. See Oskar Lange, op. cit., pp. 3-4.
situation in a closed economy if there is full employment of the subsidized factor. The monetary effects may alter the general price level, but not the relative prices of productive agents other than those upon which the subsidy is paid.

At the other extreme, if the supply function for the subsidized factor is perfectly elastic - a situation which might occur if there is unemployment - an expansion in the inputs of the subsidized factor and a reorganization of the factor combination would be an expected result. Additional inputs of the subsidized factor would tend to increase the productivities of the other factors used in combination with the one being subsidized. If the supply schedules of these other agents are less than perfectly elastic, an increase in their prices will also follow.

If the supply function for the subsidized agent is neither perfectly inelastic nor perfectly elastic - the most probable situation - an expansion in inputs of the subsidized factor, a reorganization of the factor combination and somewhat higher prices for other productive agents (assuming that their supply functions are less than perfectly elastic) is to be expected.

a. Monetary effects. The monetary effect and the influence of the subsidy upon producers' expectations is of importance particularly when there is unemployment. As has been demonstrated by Mr. Keynes and more adequately by Professor Lange, a price reduction may not increase employment, if there is a proportionate fall (or the expectation of such a decline) in all other prices equal to or greater than the decrease in the factor price. Money prices for the productive agent would be reduced, but its
real price would not be lowered. Such a situation may occur if the monetary effect is negative — an effect quite comparable with that derived given the existing banking structure in the U.S. If the subsidy is financed by a net expansion in the quantity of circulating media, or in any manner such as to transfer money from individuals with low propensities to consume to those with high propensities to consume, an adverse monetary effect is unlikely — assuming no marked change in liquidity preferences. Hence, a net expansion in output is very probable. A subsidy on inputs is very likely to be more effective in increasing employment than is a price decrease, because of the more favorable monetary effect.

b. Effects in reducing resistance or impediments to obtaining capital. Subsidies on inputs may also provide a greater stimulus to expansion in production (per unit of transfer of income) than would a price decrease, in situations where there is resistance to the use of credit even though the funds might otherwise be available and profitable use might be made of them. There are also situations where capital-rationing prevails, i.e. where funds cannot be borrowed up to the point where their expected marginal productivity (minus a risk premium) is equal to their expected marginal costs. If subsidies on inputs are administered at the time the inputs are purchased, less use of borrowed funds would be necessary.

There is evidence that there is both capital rationing and a reluctance to use borrowed funds for agricultural production. This is not universally true of farmers, for many of them have "over-borrowed". Credit has often been over extended. And where such resistance has prevailed it has been
partially the outgrowth of uncertainty of expected returns being realized. A subsidy on output or forward pricing would also reduce this uncertainty. But there is also a sort of traditional resistance to borrowing funds if sufficient income may be "earned" without the use of credit. Part of this resistance is a prejudice against indebtedness as such. But part of it may be the result of a desire on the part of the farm operator to maintain a subjectively determined minimum liquidity position. He may adopt some planning procedure which maintains a minimum cash balance (or potential cash balance, e.g. credit rating with the local bank) which in turn will enable him to meet all normal expected cash transactions, to meet some estimated amount of unforeseen contingencies, and to make some unexpectedly "good buys". Or he may also desire to maintain some minimum percentage of equity in the enterprise, thus enabling in effect a sort of potential liquid reserve for future operations. As funds are borrowed in order to expand the enterprise the requirements for cash for normal transactions and unforeseen contingencies are increased. Similarly the proportion of the operator's equity in the enterprise may be decreased thus making more probable the loss of the operator's equity if product prices decrease. (It is assumed that the lender has prior claim on the assets, i.e. that a first mortgage or lien is given by the borrower.) Even though product prices may increase he may not expand output because of the resultant

1 These are also Keynes' motives for holding cash. See J. M. Keynes, The General Theory of Employment, Interest and Money, New York: Harcourt, Brace and Co., 1936.

impairment of his minimum liquidity position or his equity. But a subsidy administered as a deduction from costs will enable him to expand his output without increasing his cash expenditure. ¹

Barriers to obtaining use of additional funds even though such funds might be employed also exist. The phenomenon of capital rationing—the conditions existing "when the amount of financing a firm obtains is limited otherwise than by considerations of profitability in the light of buying-markets, selling-markets and the rate of interest charged"—is fairly widespread. Subsidies on inputs would also tend to reduce this impact, if the subsidies were paid at the time of purchase of the inputs.

c. Effects of discrimination in subsidy rates. Discriminatory subsidies will have effects similar to non-discriminatory subsidies. Here again, however, the monetary effect may be of less significance, since a smaller transfer of income would be involved.

d. Summary

(1) Specific subsidies on inputs are unlikely to alter the production pattern, if there is full employment of resources. If the subsidy is paid to only a part of the users of the subsidized inputs a change in the production pattern would be expected, however.

¹This reluctance to borrow has been characterized by some economists as "self-imposed" capital rationing. The existence of "self-imposed" rationing appears illogical, since rationing implies the imposition of the restrictions by an outside force.

(2) If there is unemployment, such subsidies will tend to expand output of products produced with the aid of subsidised productive agents.

(3) This expansion may be brought about without reductions in the output of other commodities. In fact, the monetary effects may result in an expansion of all outputs. Unless the monetary effect of price reductions is positive, such reductions may not bring about expansions in employment and output. A positive monetary effect is more likely to follow if inputs are subsidised than if input-prices are reduced.

(4) Where there exists a resistance to borrowing or where there is capital rationing, the impact of these phenomena may be reduced by specific subsidies on inputs.

4. The production effects of practice payments

The claim that practice payments (subsidies conditional upon the employment of particular transformation functions) will be of significance in increasing production rests on the assumptions (1) that there exist production practices superior to those being employed by some firms, (2) that such practices are not being universally utilized because of lack of knowledge or the entrenchment of customary production methods, and (3) that the educational process can be speeded, or the resistances--whatever they may be--to the use of the superior methods can be broken down
by monetary inducements tied directly to particular production practices. Uncertainty of expected product prices, factor prices or transformation rates being realized may also be of importance in accounting for the failure to use the most "efficient" production practices. In this case the situation might be remedied by removing the uncertainty.

In situations where the inefficiency is due to ignorance or custom, changes in relative factor or product prices may have little effect upon the use of given transformation functions. Such changes will influence only the factor or product combination. A subsidy made conditional upon the use of specific production practices, however, may increase the ratio of outputs to inputs.\(^1\) A net expansion in production, even though there is full employment, may thus be the result.

Here, again, if there is unemployment, there may be a further expansion as a result of the monetary effect—if the subsidy results in a net expansion in the quantity of money by an amount greater than the increased demand for cash balances or if income is transferred from individuals with high liquidity preferences to individuals with low liquidity preferences.

\(^1\)The assumption which is made here is that innovations, adoptions of which would be encouraged by practice payments, are what Lange has called "output increasing" either because they are "factor using" or because they reduce technological uncertainty. (See Carl Lange, "A Note on Innovations", Review of Economic Statistics, 25:13-25, 1943.) Such an assumption is realistic for situations where many of the conditions of perfect competition are met. It is in such situations that practice payments would "make sense" as a part of economic policy.
5. The production effects of general subsidies or grants of income not conditional upon the production pattern

Some of the subsidies to agriculture, while conditional upon certain broad types of input and output patterns, have been primarily means of supplementing farm income. About the only conditions which had to be met in order to receive payment was that the firm was engaged in farming. Benefit payments to farmers under AAA fall largely in this category. Consequently, it is of interest to analyze the various effects which these "unconditional" subsidies might have upon production.

Since such subsidies are only vaguely conditional upon given production patterns, there should be little similarity between their production effects and the production responses to price changes. Such subsidies affect production only indirectly through their monetary effects and their effects upon income—both its absolute magnitude and its variation over time.

a. Effect upon reservation prices of productive agents. As was indicated previously, income may enter into the production function via its effect upon the reservation prices of productive agents furnished by the entrepreneur (the labor of the farm operator and his family is an example). It is believed that, as expected income increases, these reservation prices tend to increase. Consequently, if no upward alteration in the firm's output is necessary in order to obtain this expected increase in income, the output of the firm would be expected to fall due to an increase in the reservation prices of the productive agents.  

1Expressed symbolically, this relationship is as follows:
(Footnote continued)

(1) \( Y = f (x_1, x_2, \ldots, x_n) \), where \( Y \) is the physical output and
\( x_1, x_2, \ldots, x_n \) are inputs of various productive agents.

It is assumed that \( \frac{\partial Y}{\partial x_i} > 0 \).

(2) \( \Pi = y_{p_{y}} - \sum_{i=1}^{n} x_i \ p_i \), where \( \Pi \) is the net profit, \( p_{y} \) is the product
price and \( p_i \) is the price of any factor, \( x_i \).

(3) \( \frac{\partial \Pi}{\partial x_i} = (\frac{\partial y_{p_{y}}}{\partial x_i}) \ p_{y} - p_i = 0 \), where \( \Pi \) is at a maximum,

or

\( \frac{\partial y_{p_{y}}}{\partial x_i} \ p_{y} = p_i \), where \( x_i \) is a maximum.

An increase in \( p_i \) leads to a reduction in \( x_i \) and consequently in \( Y \),
other conditions remaining unchanged.

(4) It is assumed that \( p_i = \phi (I) \), where \( I \) is the entrepreneur's total
income, and \( x_i \) is owned by the entrepreneur and has a reservation price.

(5) \( I = \Pi + S \), where \( S \) is supplementary income.

It is also assumed that \( \frac{dp_i}{dI} > 0 \), if \( x_i \) is a factor furnished by the
entrepreneur and has a reservation price.

Hence:

(6) \( \frac{\partial Y}{\partial I} < 0 \).

If the increase in \( I \) is due to an increase in \( S \), the production effect
is negative.

If the increase in \( I \) is due to an increase in \( \Pi \) resulting from an
increase in \( p_{y} \), the net production effect may be positive, zero, or
negative depending upon whether \( \frac{\partial Y}{\partial I} > \frac{\partial Y}{\partial p_{y}} \).
A further production effect may follow from the way in which the relationship of marginal costs and marginal returns varies as a guide to production as income varies. It may be that the marginal principle is of less significance as a guide to resource allocation within the firm when income is at a high level than when income is at a low level. This may decrease production if the allocation of a given resource is such that it consistently brings marginal returns greater than marginal costs.  

b. Effect in offsetting capital rationing. To the extent that such subsidies add to the entrepreneur's income, they may be expected to have, other conditions remaining unchanged, a negative production effect. However, as income increases, other conditions are also altered. This is particularly true in a situation where there is capital rationing.

An increase in income in a situation where capital rationing prevails may enable the entrepreneur to improve the factor combination and thus add to total production. This may further increase the income of the operator and obviously improves the combination of resources for the economy as a whole. Increased income offsets capital rationing in two ways:  

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1 The supply curve for "enterprise" may be backward sloping throughout part of its range.

2 There is probably no reason to assume, however, that marginal returns for all productive agents are consistently greater than marginal costs. A more realistic assumption may be a distribution in which marginal returns are both above and below marginal costs.

3 The effect of capital rationing upon the firm may also be expressed symbolically. Using the same symbols as in the footnote on page 54, this relationship is as follows:
(Footnote continued)

(1) \( Y = f(x_1, x_2, \ldots, x_n) \)

(2) \( \Pi = YP_y - \sum_{i=1}^{n} x_i P_i \)

If capital rationing exercises a constraint upon inputs of all of the factors of production, then:

(3) \( \sum_{i=1}^{n} x_i P_i = K \), where \( K \) is the limit to the total expenditure upon inputs.

The profit function then becomes:

(4) \( V = \Pi - \lambda \left( \sum_{i=1}^{n} x_i P_i \right) \) where \( \lambda \) is a Lagrange multiplier.

(5) \( \frac{\partial V}{\partial x_i} = P_y \frac{\partial f}{\partial x_i} - P_i - \lambda P_i = 0 \) where \( V \) is at a maximum

\[ \frac{P_y}{P_i} \cdot \frac{\partial f}{\partial x_i} - 1 - \lambda = 0 \]

\[ \frac{P_y}{P_i} \cdot \frac{\partial f}{\partial x_i} = 1 + \lambda \]

\[ P_y \frac{\partial f}{\partial x_i} = P_i (1 + \lambda) \]

\( \lambda = 0 \), when there is no capital rationing. When there is capital rationing \( \lambda \) is equivalent to the rate of interest which firms would be willing to pay in order to get a small additional quantity of \( x_i \). \( \lambda \) is thus a sort of marginal profitability of capital. (See Oskar Lange, "The Place of Interest in the Theory of Production", Review of Economic Studies, 3:159-192, 1937.)
(1) It diminishes the need for additional borrowings in order to obtain additional inputs, and (2) it decreases the lender's risk in advancing funds to a given borrower, thus making it possible for a borrower to obtain a greater amount of funds with a given equity in an enterprise as security. The latter effect is of significance, however, only if the lender views the expected total income of the prospective borrower as well as his equity in an enterprise as an index of the probability of repayment or recovery of funds.

(Footnote concluded)

If capital rationing exercises a constraint only upon one factor, \( x_n \), then \( \pi = 0 \) for all factors except \( x_n \), or:

\[
\begin{align*}
4a) \quad V & = \Pi = \sum_{i=1}^{n-1} x_i p_i + \lambda x_n p_n \\
6a) \quad \frac{\partial V}{\partial x_1} & = p_y \frac{\partial f}{\partial x_1} - p_1 = 0 \\
& \quad p_y \frac{\partial f}{\partial x_1} = p_1 \\
\end{align*}
\]

and

\[
\begin{align*}
6) \quad \frac{\partial V}{\partial x_n} & = p_y \frac{\partial f}{\partial x_n} - p_n - \lambda p_n = 0 \\
& \quad \frac{p_y}{p_n} \cdot \frac{\partial f}{\partial x_n} = 1 + \lambda \\
& \quad p_y \frac{\partial f}{\partial x_n} = p_n (1 + \lambda) \\
\end{align*}
\]

Capital rationing thus may mean that the application of productive agents in production is carried to a point where their marginal productivity is greater than their price per unit.
c. Monetary effect. A production effect, in addition to that arising out of the impacts upon the reservation prices of productive agents and the offsetting influence to capital rationing, may arise as a result of the monetary effect of such subsidies. If there is full employment there will be no increase in total output, but a change in the general level of prices may result. If there is unemployment, an expansion in employment and output may result if the subsidy is financed by issue of money (or some kinds of borrowing) so that there is a net addition to the quantity of money greater in amount than the increase in people's willingness to hold given cash balances at any given level of prices.

d. Summary. Unconditional subsidies thus may tend to have counteracting production effects—a negative one arising out of the increases in reservation prices of productive agents furnished by the entrepreneur and a positive one due to the reduction in the impact of capital rationing. There is likely to be a further positive impact, if there is unemployment, growing out of the monetary effect.

It should be noted in analyzing not only these unconditional subsidies, but any income changes and their consequent indirect production effects, that the farm is both a production and a consumption unit—a firm and a household. Consequently, income which accrues to the firm may be entirely shifted to the household and will not alter the production pattern. It will

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1 Other kinds of business units—small retail establishments, for example—are also combined firms and households.
production pattern, if there is full employment of resources and if the
output and the production pattern
are not expected to change when and after
the

Also, it may result in a somewhat improved allocation of resources even if there
are changes in the relative prices of resources. They suggest that the
output and the production pattern in about

It may also be well to briefly summarize these effects at this point:

although the existence of the various effects upon production

6. Representation of production effects of subsidies

Income upon production

and the output of production

The long-run production

the government consumes seem appropriate. The long-run production

This may be somewhat unexpected when examining

After all, the pattern of consumption of resources

At least when it is expected that the effect of

the income upon production

and the output of production

The long-run production

the government consumes seem appropriate. The long-run production

This may be somewhat unexpected when examining

After all, the pattern of consumption of resources

At least when it is expected that the effect of
subsidy is paid to all users of the resources. If there is unemployment, they may increase employment and total output. To the extent that such subsidies tend to offset capital rationing or the reluctance to borrow, they may improve the allocation of resources, even though there is full employment.

Practice payments are of significance in changing either the production pattern or total output only if there exist practices superior to those being employed by some firms and if the resistances to their use can be offset by some form of compensation.

Unconditional subsidies deter production to the extent that they increase the reservation prices of productive agents furnished by the entrepreneur. However, they tend to improve resource allocation if they offset capital rationing. They may also have a significant monetary effect which may increase total output, if there is unemployment.

C. The Income Effects of Subsidies

In an economy where individual incomes are derived entirely from the sale of productive agents, the size of an individual's income depends upon the amount of resources which he owns and is able to sell and the prices which these resources bring on the market. Incomes in our economy are not determined strictly by these considerations, for there are various techniques employed to modify this norm of distribution. However, as a first approximation to the determination of the income effects of various kinds of subsidies, we shall analyze the effects which these subsidies have upon resource prices and upon the pattern of resource ownership. The
latter phase of this problem—-that of the pattern of ownership—is obviously a dynamic one. It must be viewed within particular time periods and must also consider the way in which income is used by its various recipients. Furthermore, income effects are partially dependent upon production effects. The income problem and the production problem cannot be entirely separated.

1. The impacts upon the relative prices of productive agents

The effects which various kinds of subsidies will have upon the prices of productive agents depends upon such factors as (1) the kind of subsidy, (2) the supply functions for the various kinds of resources, and (3) the effects upon the production pattern and upon the total income to be distributed.

a. Specific subsidies on outputs. As was indicated previously, this type of subsidy is essentially equivalent in its impact upon the production pattern to an increase in the price of the subsidized product. Similarly, it will have effects upon the prices of productive agents quite comparable to those induced by an increase in the price of the subsidized product. The effect upon prices of resources thus depends upon the supply functions of these resources and upon the changes in marginal productivities.

If a subsidy is paid on a particular commodity, immediate returns from the sale of a given output of the subsidized product are increased. If there is free entry into the production of the commodity and a more
\[ 0 = \mathbf{d} - \frac{\mathbf{t}_e \mathbf{d}}{\mathbf{j} \mathbf{e}} \quad \mathbf{d} = \frac{\mathbf{t}_x \mathbf{e}}{\Lambda \mathbf{e}} \quad (3) \]

\[ \lambda \text{ is at a maximum where} \]

*the price is greater than the price of the product and the product function will be*

\[ \mathbf{t}_x \equiv \mathbf{t}_x \mathbf{d} \text{ where } \mathbf{d} \text{ represents output of the product} \]

\[ (\mathbf{t}_x \equiv \mathbf{t}_x \mathbf{d}) \mathbf{d} = \Lambda \quad (1) \]

*If the product function is*

In output is the profit and the income in the price of a

*with the elasticity of demand for the product*

\[ \mathbf{d} \text{ is the price of the product} \]

\[ \mathbf{x} \equiv \mathbf{x} \mathbf{d} \text{ is the price of the product} \]

\[ \mathbf{x} \equiv \mathbf{x} \mathbf{d} \text{ represents output of the product} \]

\[ \mathbf{x} \equiv \mathbf{x} \mathbf{d} \text{ represents output of the product} \]

*The elasticity of demand for the product and the elasticity of demand for the product are greater than the elasticity of demand for the product and the elasticity of demand for the product are greater than the elasticity of demand for the product and the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are greater than the elasticity of demand for the product are gre
productive agent is likely to be larger (given the product demand function) in periods of full employment than in periods of unemployment. If there is unemployment, the demand schedule cannot be treated as given, for it may shift as employment increases.

b. Specific subsidies on inputs. This type of subsidy prompts responses in production similar to those encouraged by reductions in the prices of productive agents (ignoring the monetary effects). If there is full employment of the subsidized resource, no change in the demand functions or the transformation functions, the marginal productivities of the various factors will remain unchanged by the addition of the subsidy. There will not be a shift in the factor combination or in the production pattern. However, the prices of subsidized resources will be increased by the full amount of the subsidy.

(Footnote continued)

(total inputs of the factors are varied.

Hence:

(4a) \[ p_y = y \cdot \eta \cdot \frac{dp_y}{dy} \], where \( \eta \) is the elasticity of demand for the product, and

(4b) \[ p_i = x_i \cdot \xi \cdot \frac{dp_i}{dx_i} \], where \( \xi \) is the elasticity of the supply function for \( x_i \).

If a subsidy of \( S_y \) is paid per unit of output, then we have:

(5) \[ \frac{\partial y}{\partial x_i} = \Delta y + y \cdot \xi \cdot \frac{dp_y}{dy} \cdot \frac{\partial y}{\partial x_i} = x_i \cdot \xi \cdot \frac{dp_i}{dx_i} \]
If there is unemployment of resources, and it is anticipated that the subsidy will be continued for a period of time long enough to warrant adjustments, there will be a tendency to expand the input of the subsidized resource and the outputs of commodities which can be produced with this resource.¹ There will be an immediate tendency to substitute the subsidized agent for other productive agents, the extent of this substitution depending also upon the relative elasticities of the supply functions for the various productive agents. However, unless there is an adverse monetary effect, the ultimate result may be an expansion in the employment of all productive agents, since their marginal productivities may be increased as a result of additional employment of the subsidized productive agent. Here, again, the ultimate effects upon prices and employment depend upon the nature of the demand functions, the supply functions and the monetary effect. (This latter effect may express itself via shifts in the demand functions.) The more elastic the supply function for the subsidized productive agent, the greater the expansion in its employment and the smaller the increase in its price. Prices of other productive agents may be decreased or their employment decreased (or both) if there is substitution of the subsidized factor for other factors. However, if there is a favorable monetary effect, both prices and employment

¹If there is an expectation that the subsidy will not be continued for a period of time long enough to warrant adjustments, the subsidy may be entirely captured by the entrepreneur, no adjustments in outputs or inputs being made.
of these agents may be increased.\(^1\)

\(^1\) For purposes of analysis the effect of the subsidy may be divided in a manner somewhat analogous to Hicks' distinction between income and substitution effects in consumption (See J.R. Hicks, Value and Capital). In production we have a substitution effect and a monetary effect, however.

Employing the same symbols as in footnote on page 65, we have:

\[(1) \frac{\partial V_r}{\partial x_r} = p_y \frac{\partial f}{\partial x_r} - p_r = 0\]

\[(2) \frac{\partial V}{\partial x_s} = p_y \frac{\partial f}{\partial x_s} - p_s = 0\]

Hence:

\[(3) \frac{\partial f}{\partial x_r} = \frac{p_r}{p_s}\]

If a subsidy of \(S\) is paid on each unit of \(x_r\), then:

\[(4) \frac{\partial f}{\partial x_r} = \frac{p_r - S}{p_s}\]

The price ratios of the productive agents are independent of the price of the product. If the supply functions of both \(x_s\) and \(x_r\) are infinitely elastic, the relative returns of the subsidised factor (\(x_r\)) will be increased by the full amount of the subsidy.

The levels of employment, however, are not independent of \(p_y\). If there is a sufficient increase in \(p_y\), the level of employment of \(x_s\) may be increased as a result of the subsidization of \(x_r\), even though \(p_s\) and \(\frac{\partial f}{\partial x_s}\) were unchanged. If the new price of \(p_y\) \(\left( p_{y1} \right) \) were

\[\frac{p_s}{p_r-s_r} (p_{yo})\]

where \(p_{yo}\) is the old price of \(p_y\), then there would be no reduction in the employment of \(x_s\).
In the notation of the various production equations, so far as the firm

productions are concerned, the same may be considered analogous to changes

increase by the same proportion. If, however, the changes are

given, levels of inputs (the unthrottled, unthrottled production processes) in a

steady manner without the slope in the inputs, the relative production function is

If a result of production per unit of each factor constant

change so as to hold employment of each factor constant.

and consequently at the factor combination, the factor combination

will be most frequently in reference to relative marginal productivities

functions for the various production equations, free of technical change in

since that production of products are estimated and upon the nature of the supply

the curves upon factor prices depend upon the extent to which realizable

the process.

and where the relative prices of production equations appear to increase, the total output from a given aggregate of resources is in

aggregate output is increased. It is clear that the transformation function is the

transformation function so that the rates of

important to the general the above described methods of production--

These dependences are desired to reduce the

69
is concerned, and the factor combination will be altered accordingly.
The more elastic the supply function for a given factor whose marginal
productivity is unchanged, the greater the reduction in its employment
and the smaller the reduction in its price (assuming that the supply
function itself does not shift).

The immediate effects of the income from practice payments may, as a
first approximation, be ignored. They probably accrue largely to the
entrepreneur, for they are offsets to uncertainty, lack of information,
and the other impediments to adoption of the improved technique. Once
the technique is adopted, these payments may be withdrawn.

d. Unconditional subsidies. Since this kind of subsidy has been
declared as one whose receipt is conditional only upon the firm's being a
part of a given industry, determination of the effect of such subsidies
upon resource prices is rendered rather difficult. Such payments are not
designed to alter either marginal productivities or the supply functions
for the various productive agents. However, as was pointed out in the
previous section, they may have certain production effects and their effect
upon the income of the firm may also lead to alterations in factor prices.

The production effects of such subsidies partially offset each other.
There may be a negative production effect arising from the impact of such
subsidies upon the reservation prices of productive agents furnished by
the operator. There may be a positive production effect arising as a
result of the monetary effect (which exerts itself via shifts in the demand
curves for products) and as a result of the reduction in the impact of
capital rationing.
The negative production effect may thus be expressed in an increase in the prices of such productive agents as management and the labor of the operator of the firm. If not offset by monetary effects, there will be a reduction in the employment of these factors. The positive production effect resulting from increased income with which additional inputs of productive agents may be profitably purchased and utilized, leads to an increase in the marginal productivities of those productive agents which are not influenced by capital rationing. The result of this upon the prices of these factors of production depends upon the nature of the supply functions for these productive agents and upon the extent to which marginal productivities are altered.

e. Recapitulation of effects upon prices of productive agents. Few answers to such questions as "will land values increase if corn production is subsidized?" have been yielded by the previous analysis. To answer such questions one must know the nature of the demand functions, the nature of the transformation functions, the effects of subsidies upon the expectations of producers and owners of productive agents, the nature of the supply functions for the various productive agents, etc. To say that such information is not readily available is a rank understatement. We have only very sketchy data for any of these factors. Some applications based on certain assumptions derived from existing information will be made in the final chapter. However, some preliminary applications seem in order at this point.
The effects of subsidies of any kind upon the prices of factors of production depend upon the resultant changes in the demand for these factors (their marginal productivities) and upon their supply functions. Subsidies on particular products alter the marginal productivities of productive agents used in producing these products. The effect of such subsidies upon the prices of productive agents depends upon the elasticities of the demand curves for subsidized commodities (and the shifts in demand induced by the monetary effects) and upon the nature of the supply functions for the productive agents used in turning out these products. Subsidies on inputs alter relative factor prices, so far as the firm is concerned, and indirectly, as a result of alterations in the factor combination (if there is unemployment) alter the marginal productivities. The most significant effect upon marginal productivities is likely to come via the monetary effect, however. Practice payments alter relative marginal productivities. And unconditional subsidies may alter both marginal productivities and the supply functions.

The more elastic the supply function for any productive agent, the less the change in price and the greater the change in employment—unless the supply function also shifts. It seems very probable that for most of the productive agents employed in agriculture, the supply functions are elastic. But they are also, in a sense, discontinuous—e.g. the labor and management furnished by the farm operator and his family are sold in rather large indivisible units. The marginal costs of an additional hour of work, when the labor is sold in such units as the work-year or the work-month,
may be zero. (It may also be a month's or a year's wages, too, however.) The potential significance of this feature is that if the prices of the factors whose supply functions are elastic change very little in response to the increased productivity of these factors and if factor supplies are not (within certain limits) responsive to price, the incomes to owners of these productive agents remain unchanged. Thus, subsidies on outputs may alter relatively little the incomes of owners of such productive agents as labor and management. Subsidies on inputs, however, may increase the prices of these inputs (particularly if there is full employment or if their supply curves shift upward) and will consequently increase the incomes of owners of these factors of production. Practice payments, like subsidies on outputs, may have rather unimportant effects upon the prices of some factors of production, particularly those whose supply curves are elastic and do not shift.

Thus, if the administering agency wishes to increase, by subsidization, the prices of particular productive agents, it can direct most readily the income to particular factors by paying subsidies on inputs, rather than by subsidies on products.

2. The impacts upon the distribution of incomes

The changes in the relative prices of various productive agents which might be expected to follow from various kinds of subsidies, given various technological conditions, were described in the previous section. The ways in which changes in the prices of productive agents will alter the
between the various composition characteristics of the resources held by the retainer and the retainer's own characteristics. These characteristics are very significant for the composition of the resource, and they are important for the composition of the resource because they can be considered as a significant homogeneous element. All the resources by the same proportion are homogeneous in the sense of determining how they are used. Any change in the principle of the production function results in a change in the proportion of the resources held by the retainer. The factor of the resources held by the retainer is the same as the relative composition of the resources held by the retainer.

Assume that the relative composition of the resources held by the retainer is known.

The effects of this kind of subject are often used in this section. The common name of the resources of resources that we have called "unconstrained substitution" stands for the purpose that the resources under various assumptions patterns of resource compositions take place under various assumptions. The pattern of the resources of resources cannot be assumed unless one knows the pattern of the resources of resources.
that every individual will hold title to only one kind of productive agent. The owner-operator of a large farm owns not only more resources than does a sharecropper, but the relative composition of the productive agents owned by the large owner-operator differs considerably from the composition of the agents owned by the sharecropper. Nevertheless, there are numerous individuals whose aggregates of resources are made up largely of a single factor—the landlord, the skilled laborer or the doctor, for example.

The conclusions which follow from these simple assumptions are obvious. If the first assumption holds so that producers own approximately the same relative amounts of resources (a likely situation among the producers of corn in north central Iowa, wheat in Kansas or among producers of any agricultural commodity in a relatively homogeneous area), and if a subsidy on outputs is to be utilized to increase the incomes of a particular group of producers of a given commodity, producers owning the most resources will find their incomes increased by greater absolute amounts than those producers owning relatively smaller amounts of resources. If we assume both variations in the amounts and compositions of resources owned, the impact of increased product prices will depend not only upon the amount of resources from which the individual receives income, but also upon the nature of the supply functions of the various productive agents. Individuals selling resources the supplies of which are relatively elastic will find their incomes increased relatively less than will individuals selling resources whose supplies are relatively inelastic. For example, a landowner may be expected to gain more than a farm laborer from a subsidy
on corn, not only because the landowner's resources are greater but because the total supply of land is relatively less elastic than that of farm labor.

Thus, although subsidizing a particular kind of output may increase the average income of producers of the subsidized commodity, such a subsidy is likely to also increase the dispersion of the income distribution for these producers. Subsidizing particular inputs may bring about a reduction in the variance of the income distribution only if low income receivers own predominately resources not owned by high income receivers—or if discrimination in the subsidization of particular inputs is feasible.

a. Changes in income distribution over time. To attempt a complete analysis of how the structure of today's income and the changes which have occurred since yesterday will be reflected in tomorrow's flows of income is beyond the scope of this study. The factors influencing the accumulation or decumulation of individuals' resources are not easy to isolate. Many of them are institutional factors. All of them are changing over time. For example, deliberate intervention by society to alter the distribution of income by income taxation and to alter the pattern of resource ownership by such means as inheritance, gift, death and estate taxes, tends to modify cumulative effects. However, unless the marginal rates of such taxes are 100 per cent or more, the cumulative effects—though smaller—are still present.¹

¹The marginal tax rate will be less than 100 per cent if the increment in tax is less than the increment in income.
In an economy such as that of the United States all current production is not consumed. Part of it is "saved" for subsequent consumption or for use in producing goods in the future. The distribution of future income depends not only upon the current pattern of ownership, but also upon the pattern of savings, since part of the new capital (in an enterprise economy) is owned by private individuals.

Empirical studies indicate that as an individual's income is increased, the proportion which is currently consumed decreases, i.e., the proportion which is currently saved increases. Among low income groups, an ex-

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1 See, for example, Horst Wedershausen, "Differences in Family Savings Between Cities of Different Size and Location, Whites and Negroses", Review of Economic Statistics, 22:122-135, 1940. Family Expenditures in the U.S., Statistical Tables and Appendixes, National Resources Planning Board, June, 1941, table 1, page 1. The relationship between income and saving for 1935-36 as cited in the above publication is as follows:

<table>
<thead>
<tr>
<th>Income level (per family)</th>
<th>Avg. income $</th>
<th>Savings $</th>
<th>Savings as a % of income</th>
<th>ΔS/ΔY</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-500</td>
<td>312</td>
<td>-162</td>
<td>-51.9</td>
<td>0.22</td>
</tr>
<tr>
<td>500-750</td>
<td>627</td>
<td>-92</td>
<td>-14.6</td>
<td>0.14</td>
</tr>
<tr>
<td>750-1,000</td>
<td>874</td>
<td>-59</td>
<td>- 6.6</td>
<td>0.11</td>
</tr>
<tr>
<td>1,000-1,250</td>
<td>1,120</td>
<td>-31</td>
<td>- 2.8</td>
<td>0.18</td>
</tr>
<tr>
<td>1,250-1,500</td>
<td>1,364</td>
<td>14</td>
<td>1.0</td>
<td>0.17</td>
</tr>
<tr>
<td>1,500-1,750</td>
<td>1,612</td>
<td>56</td>
<td>3.5</td>
<td>0.17</td>
</tr>
<tr>
<td>1,750-2,000</td>
<td>1,829</td>
<td>92</td>
<td>5.0</td>
<td>0.23</td>
</tr>
<tr>
<td>2,000-2,500</td>
<td>2,231</td>
<td>182</td>
<td>9.2</td>
<td>0.27</td>
</tr>
<tr>
<td>2,500-3,000</td>
<td>2,715</td>
<td>315</td>
<td>11.6</td>
<td>0.32</td>
</tr>
<tr>
<td>3,000-4,000</td>
<td>3,594</td>
<td>529</td>
<td>15.6</td>
<td>0.35</td>
</tr>
<tr>
<td>4,000-5,000</td>
<td>4,391</td>
<td>904</td>
<td>20.6</td>
<td>0.45</td>
</tr>
<tr>
<td>5,000-10,000</td>
<td>6,874</td>
<td>2,028</td>
<td>29.5</td>
<td>0.53</td>
</tr>
<tr>
<td>10,000-15,000</td>
<td>11,353</td>
<td>4,115</td>
<td>33.9</td>
<td>0.53</td>
</tr>
<tr>
<td>15,000-20,000</td>
<td>17,331</td>
<td>6,915</td>
<td>39.9</td>
<td>0.42</td>
</tr>
<tr>
<td>20,000 &amp; above</td>
<td>41,871</td>
<td>21,229</td>
<td>50.7</td>
<td>0.58</td>
</tr>
</tbody>
</table>
pansion in income may lead only to increased consumption, although a
decrease in capital decumulation may also result. Among individuals
with large incomes, much of an increase in income may be saved, thus adding
to their income-earning potential (the amount of resources which they own).

Thus, if at a given time each individual's income was increased by a
given absolute amount, the pattern of resource ownership would be modified
to direct more of "tomorrow's" income to those individuals who already own
the most resources and hence have the largest incomes "today". This
cumulative effect is intensified when the additions to income are distrib-
uted proportionately to the amounts of resources owned—the tendency
when specific subsidies on outputs are utilized to improve the incomes of
producers of a specific product or group of products.

Modification of the income distribution to reduce its dispersion
could be accomplished by (1) reducing the dispersion of the distribution
of resource ownership (shifting resources from the upper income brackets
to the lower income brackets), (2) by discrimination in the pricing of
productive services so that higher prices are paid for a given service
rendered by a low income receiver's resource than for the same service
rendered by a high income receiver's resource, or (3) by supplementing
the incomes of individuals independently of the amount of resources they own.
It is questionable whether the first means could be accomplished by
anything short of revolution. Existing techniques may only shift the
deal with the implications of the approach taken in this section will be discussed further in the next section and in the subsequent portion of the paper. The support of the hypothesis, if it is permissible the most desirable alternative is income received and not income received. The second means is administratively superior, and is not politically acceptable. The passage of one broken estate to the owners of other large holdings.
IV. THE EMPIRICAL EVIDENCE

As was indicated at the beginning of this study, sufficient data have not been assembled to enable testing most of the hypotheses which were set forth in the previous section. However, in addition to presenting and analyzing some of the available data, we might also indicate some of the kinds of information which would be required to test the realism of the models which have been constructed. These suggestions are not intended to be exhaustive. They are merely set forth as broadly indicative of some of the kinds of information needed and some of the techniques which might be employed to obtain necessary data.

In the absence of "controlled" experimental data, the social scientist must frequently resort to analysis of "uncontrolled" historical observations. One method of analysis is that of comparing the actual course of events with the pattern which might have been realized had certain factors been of a different nature than they were. For example, the effects which various stimuli exert upon a "dependent" variable may be estimated by such statistical techniques as multiple regression. The hypothetical situation is established on the basis of these estimates. Comparisons between two events subject to the same factors—except for one—may provide a basis for estimating the effects of the factor not common to both events. Other somewhat more crude (in the sense that a greater element of personal judgment is involved) techniques may also be employed.
It is perhaps worth noting that the research methodologies of the social scientist and the biologist, chemist or physicist are essentially similar. All follow the procedure of constructing hypotheses and proceeding to test their reality. The differences in procedures arise primarily from differences in the kinds of data which may be obtained.

In determining the effects which various kinds of subsidies have had (or might be expected to have) upon the agricultural production and income patterns, the analyst has to make estimates of these patterns as they would have been in the absence of such subsidies. Estimates of alterations in the production pattern resulting from subsidies on outputs would need, as basic data, determinations of the relationship between expected returns (the mean, variance and perhaps other moments of the distribution) from various crops and livestock and planned outputs of such products. This would involve analysis of such factors as the data which farmers utilize in formulating their production plans and the extent to which such plans are actually put into effect and are realized. One also would need to know when the plans were made, when they were put into effect and the modifications that might take place between conception and realization. Such data are needed not only for analysis of the problems dealt with in this study. They are also needed for intelligent formulation of agricultural price and production policies. One cannot accurately estimate the effects of various proposed price and production policies without knowledge of farmers' reactions to these various stimuli.
Such needed information might be obtained by analysis of the firm itself—by intensively studying the reactions of a relatively small group of farmers to the changing structure of selling prices and costs. It may be that the process of plan-making can be accurately described only by this method. Some additions to our knowledge of the reactions of aggregates of farmers might be obtained by noting the relationship between changes in the aggregate outputs of various commodities (or the aggregate inputs of various productive agents) and changes in relative prices. Both types of studies have been conducted. The information which can be gained from the second type is limited not only by the limitations imposed upon macro-economic analysis in general, but also by the lack of the "right kinds" of data. The first type of study—if properly designed—would probably yield information which would be most useful in testing some of the models constructed in the previous section. It should be pointed out, however, that studying a particular sector of the economy in isolation may neglect important interactions between sectors.

Empirical investigations of income effects necessitate, first of all, a picture of income patterns (distributions) at various points in time. Secondly, these patterns need to be related to the patterns of resource ownership and the prices of resources. Obtaining the distribution of income at a particular time presents no insurmountable difficulties. However, determination of the pattern of resource ownership would be extremely difficult, particularly since such resources as managerial ability are
virtually impossible to capitalize. Empirically determining the income effects of subsidies on particular outputs or upon inputs of specified resources is therefore, a difficult problem, if one wishes to know more than the effects upon the economy as a whole.

The effects which the monetary imports of subsidies have had upon individual incomes are even more difficult to determine. If the changes in incomes of particular firms are to be analyzed, the product patterns for the firms and the pattern of resource ownership must be known. But, in addition, the changes in relative prices brought about by monetary effects would also require analysis.

First approximations of the incomes effects of grants of income can be made by assuming that the patterns of product prices, resource prices and the quantities of inputs and outputs are unchanged. Over a relatively short period of time this assumption is probably not too unrealistic. The income of the recipient can be thus assumed to be increased by the amount of the grant.

The empirical evidence presented here deals with some of the effects which AAA has had upon production in the Corn Belt, and with the relationship between income and AAA benefit payments for a random sample of farmers in Iowa in 1939. The Agricultural Adjustment Administration attempted to influence farm production and farm income by means other than subsidies. However, benefit payments comprise the bulk of AAA expenditures and, together with corn loans, were the principal incentive employed to secure the adjustments considered desirable by the administration. Crop production control was related almost exclusively to benefit payments. Such
features as marketing quotas (which were not invoked for corn) were independent of these subsidies, however.

A. The Nature of the AAA in the Corn Belt

The three most important features of AAA, as they have attempted to alter production and income in the Corn Belt, have been (1) corn loans and storage, (2) crop production control and (3) benefit payments.

1. Corn loans and storage

Corn loans and storage were designed primarily to provide farmers with higher prices for corn by (1) altering the time distribution of the release of corn into its various uses, particularly its use as feed, and (2) establishing loan rates in excess of prices which would have prevailed had farmers followed the same pattern of filling and emptying the "corn granary" as was followed by the lending agency. The loan program was inaugurated in 1933, loans being made by the Commodity Credit Corporation. The largest volumes of corn were sealed from the 1933 crop and in the

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four crop years, 1938-41. Corn loan rates, particularly prior to 1942, were somewhat above current market prices. Furthermore, since there was sufficient corn placed under seal to reduce by as much as 10 per cent the total supply available in some years, the corn loans and storages program undoubtedly tended to buoy the market price at a level higher than would have prevailed in the absence of such a program.

An element of subsidy was involved in corn loans and storages. The Commodity Credit Corporation suffered some losses, although the general rise in prices growing out of the war probably resulted in smaller losses than

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1 Commodity Credit Corporation loans on corn are summarized in the annual reports of the president of the corporation. The 1943 annual report gives the following data (p. 15 of the Report of the President of the Commodity Credit Corporation):

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantities pledged (thousands of bu.)</th>
<th>Amount loaned (thousands of $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1933 loans</td>
<td>267,762</td>
<td>121,276</td>
</tr>
<tr>
<td>1934</td>
<td>20,075</td>
<td>11,042</td>
</tr>
<tr>
<td>1935</td>
<td>30,966</td>
<td>13,934</td>
</tr>
<tr>
<td>1936</td>
<td>158</td>
<td>67</td>
</tr>
<tr>
<td>1937</td>
<td>(in fall of 1937)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>47,117</td>
<td>22,871</td>
</tr>
<tr>
<td></td>
<td>(in fall of 1938)</td>
<td>14,600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7,980</td>
</tr>
<tr>
<td>1938 loans</td>
<td>229,839</td>
<td>130,882</td>
</tr>
<tr>
<td>1939</td>
<td>301,729</td>
<td>171,756</td>
</tr>
<tr>
<td>1940</td>
<td>103,256</td>
<td>62,917</td>
</tr>
<tr>
<td>1941</td>
<td>110,991</td>
<td>81,001</td>
</tr>
<tr>
<td>1942</td>
<td>56,450</td>
<td>43,643</td>
</tr>
<tr>
<td>Total</td>
<td>1,182,343</td>
<td>667,389</td>
</tr>
</tbody>
</table>
Annual Reports of the Commerce Credit Corporation

I. See also...

From an address by J.P. Huntington, President, Commerce Credit Corporation.

Any about 2 cents per bushel.

1923-41. If only enough corn is produced for the period

estimated losses of the year 1941 as finished at the amount of estimated

were had been surprisingly high, however. If one considers all

estimated losses at 25 million dollars.

I billion bushels of corn, had last 25 million dollars on corn standing and

for corn, prior to March 31, 1941, the C.C. had made some on comparo...

deemed upon the relative size of the corn crop and upon participation

basis there was in 1941 year were

of corn, with respect to the 1941 basis per bushel of corn standing at about 70 cents per

From 1922 through 1941, corn were made on nearly 1.2 billion bushels

having been reduced to corn products.

exceeding by more than the hands of the Government and as this

exceeding in excess of the losses incurred by the C.C. can be considered as

of the amount as a result of the normal operations of the C.C., which has been

deemed upon the difference between the losses which would have been recovered

the upper

considered on the lower limit to the actual amount of subsidy. The upper

these losses might be
An element of subsidy might be considered to also have been provided by the payments to farmers for storing corn. Storage allowances, until July 24, 1940, were 7 cents per bushel. This allowance after July 24, 1940, was reduced to 5 cents per bushel. Although the CCC probably would have had to pay charges of this magnitude if the corn had been stored in commercial elevators, most farmers would probably have been willing to undertake the storage with lower allowances—perhaps as low as 4 cents per bushel.

2. **Crop acreage control**

This feature of AAA seems to have had two objectives—(1) conservation of the nation's agricultural resources, and (2) regulation of the production of crops in such a way as to increase and stabilize farm incomes. To some extent these objectives were consistent. Measures taken to restrict certain crop acreages also aided in encouraging other steps which would either slow down the rate of soil depletion or actually result in a definite building up of the soil. Crop production control in the corn belt consisted primarily of limiting the acreages of corn which could be grown by individual farmers. Acreages of such crops as oats and soybeans harvested for grain were also restricted, but primary emphasis was on corn. Limitations were administered in the form of acreage allotments, such allocations being set forth in contracts voluntarily established between the federal government and individual farm operators.

Acreage control for corn was established both to aid in soil con-
reservation and in increasing farm income through regulation of the
production of livestock, particularly hogs. Corn had been the major
feed for hogs and for the fattening of beef cattle. By limiting the
production of corn, similar limitations on hog production might be expected.
It was assumed that the demand curves for hogs and beef cattle were
inelastic within the "effective range"\(^1\) and that reductions in quantities
sold would thus result in increased total revenue from the sale of the
commodity.

5. Benefit payments

Payments made by AAA were of two types—(1) those paid to encourage
participation in the acreage control program and (2) those paid to en-
courage the use of specific soil building practices. Payments for com-
pliance with the established allocations of crop acreages consisted of
parity payments and non-practice conservation payments. The former were
based not on current or expected prices or yields, but upon the relation-
ship between prices received and parity prices in the year previous to
that in which the payments were made. For the United States as a whole
practice payments comprised about one-fifth of total AAA payments.

Compliance payments were thus the principal element in the "bait"
offered to farmers to induce their participation in crop acreage control.
The size of the payment per acre was determined by the estimated loss of

\(^1\) Unless a demand curve is asymptotic to the price axis, it cannot be
inelastic over its entire range.
income entailed in reducing corn acreage. Consequently, payments were highest for the most productive land. These payments have had a sort of negative effect upon the decisions of farmers—they induce a farmer not to do something.

Practice payments have been confined exclusively to cropping practices. They were designed to serve two functions: (1) to encourage expansion in the production of certain soil-building crops, and (2) to induce farmers to adopt certain practices which would check soil erosion and deterioration and build up soil fertility. To these practice payments must go much of the credit for any increased productivity of the soil which has occurred during the past decade. Much of the shift to higher quality and higher yielding hays can be attributed to the encouragement given to liming and the seeding of legumes. Winter cover crops, green manure crops, and other similar practices were also instrumental in increasing the productivity of the soil or in reducing the rate of soil depletion.

B. The Production Effects of AAA Payments

As can be noted from the previous description of the nature of AAA in the corn belt, the principal features—corn loans and storage, crop acreage control and benefit payments (including both compliance and practice payments)—have been all closely related. Corn loans have included subsidies on specific outputs (corn), practice payments have been subsidies for following specific production practices, and compliance payments have been subsidies for following a particular pattern of inputs
of land in the production of corn. The conditions which had to be met in order to receive compliance payments were, however, rather loose. Crop acreage control probably has exerted the major influence on production. But crop acreage control could not have been secured without compliance payments and in some cases without corn loans.

Insofar as production is concerned, the integration of the various features of AAA makes it difficult, if not impossible to impute to each feature a definite production effect. For example, the relatively higher returns from corn would have been expected to encourage expansion in the output of corn. However, such expansion was prohibited by acreage control. Consequently, one can only estimate the pattern of production that would have prevailed in the absence of AAA and compare it with the production pattern which has been realized. The differences can be attributed only to AAA in general—not to specific parts of the program.

This obviously means that many of the models established in the preceding chapter cannot be tested. We cannot ascertain the monetary effects, for example. The procedure which has been followed in estimating the effects is one of attributing to the AAA payments as a whole, the deviations between the realized production pattern and the estimate of the pattern which would have prevailed in the absence of AAA.
1. The effect of crop control upon feed and livestock production in the Corn Belt

As has been indicated in previous analyses, crop acreage control has been a form of rationing of inputs (acreages) of land to be used by the firm in producing various crops. In the corn belt, crop acreage control has consisted chiefly of rationing the acreage of the key feed crop—corn, and has been accomplished by allocating to each farm a maximum corn acreage. In addition to the corn acreage allotment, a "soil-depleting" base or maximum acreage of all concentrate feed crops has also been established for each farm. The rationing of corn acreage has not been mandatory for any farmer. The farm operator has had a choice of conforming with the acreage allotments and receiving the compliance payments together with the privilege of securing a loan on his corn, or not conforming with the allotments and thus not receiving the payments and the other privileges. Each farmer might be expected to make some estimates of relative returns from these alternative courses of action and to follow that which he expected to yield the greater returns.

Assuming, however, that a farmer has made the decision to comply with AAA allotments, he may then reorganize his production plan, substituting other outputs for corn, other inputs for land, or both. On the input side

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fertilizer, labor or more intensive use of farm machinery might be expected to be substitutes for land. Among the products, other crops on which there were no limitations might be substituted for corn.

Unless there were expected changes in relative input prices, the production function or in the prices of corn, or there was perfect substitution between land and some other productive agent, the absolute quantities of inputs used in producing corn would all be smaller in a situation where corn acreage was rationed than in a situation where it was not. The limiting of corn acreage might have had a tendency to stimulate expectations of higher corn prices and thus have led farmers to make some substitutions of other productive agents for land.

Similarly, unless there were changes in the relative prices of other products which could be produced from the productive agents (including land) rendered potentially idle by the limitation on corn acreage, or there were reductions in the prices of these productive agents, there would be no change in the output of other substitute products. The supply prices for land and some other factors formerly used in corn production may have been reduced as a result of these limitations on corn production, however, so that expansion in other outputs without any changes in their prices would have been consistent with maximizing the profit from the enterprise.

a. The effect on total feed production. By making comparisons between the amounts of feeds produced in a given period during which there were imposed limitations on corn acreages, and the amounts which would have been produced had there been no such limitations, the extent to which
substitutions were made can be estimated. This is the procedure which was followed by Schultz and Brownlee. Their estimates indicate that crop acreage restrictions were ineffective in reducing the total amount of feed produced in the eleven states analyzed (see Table 1).  

Table 1. Production of Corn, Other Feed Concentrates, and Feed Roughages in Eleven Midwest States

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>1,826.4 : 40.8 : 1,811.2 : 41.3 : 1,852.5 : 42.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other feed concentrates</td>
<td>1,161.5 : 26.0 : 1,129.6 : 25.7 : 1,116.1 : 25.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roughages</td>
<td>1,486.3 : 33.2 : 1,446.3 : 33.0 : 1,354.8 : 31.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4,474.2 : 100.0 : 4,387.1 : 100.0 : 4,323.4 : 100.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*From Schultz and Brownlee, *ibid.* Table 1, page 679.*

The study conducted by Schultz and Brownlee has many limitations, some of which have already been mentioned. Their estimates of the production effects of AAA depend entirely upon judgments as to what would have happened had there been no AAA. The bases for such judgments are not wholly explicit, i.e., although "they have been modified by the collective judgments of a number of workers in agricultural economics," the judgments of another

1. Schultz and Brownlee, *ibid.*
group might have produced somewhat different estimates. A comparison of changes in feed production in areas relatively unaffected by AAA with changes in feed production in areas where AAA has been a relatively potent influence might modify somewhat the estimates made in the study mentioned. However, in spite of its limitations, the study is the most complete one available and is consequently the most reliable basis for estimates.

A study conducted by Wilcox indicates that for comparable farms, the total quantity of feed units produced by a farmer cooperating with AAA was essentially equivalent to that produced by a non-cooperator. Both studies indicate that, although the total quantity of feed produced was not altered significantly, the composition of feed production has been altered to include a slightly larger proportion of roughage feeds and a slightly smaller proportion of grains.

b. Substitution of roughage for grains in livestock rations. One phase of a determination of the effects of crop acreage control on livestock production is an examination of the physical substitution ratios between feed concentrates and feed roughages in livestock rations. Even though total feed production remained unchanged as a result of crop control, alterations in the composition of the ration might alter the pattern of livestock production. Schultz and Brownlee have estimated that for the 3 years, 1939-40, 33 per cent of the total feed units produced was feed roughages in the eleven midwest states analyzed, while if there had been

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1 See Walter W. Wilcox, "The Non-Participator, Does He Wreck AAA Production Control?", Iowa Farm Economist, 6:(June 1941)14.
no AAA, slightly more than 31 per cent of the total feed supplied would have been roughage feeds.¹

For animals such as hogs and poultry, the range within which roughages can be substituted for feed grains without reducing the rate of conversion of feed into food is probably very narrow. The range is wider for beef cattle, sheep and dairy cattle and may be rather wide when one takes into consideration the entire farm enterprise. Corn and other concentrate feeds can be shifted from roughage-consuming animals to concentrate-consuming animals, and additional roughage fed to the roughage-consuming animals.

Few studies have been made which deal with the extent to which feed roughages and feed grains can be substituted for each other under farm feeding conditions. The investigation described in this analysis is only a test for perfect substitution. From it one cannot determine the manner in which the ratios of substitution vary as the proportions of grain and roughages are altered.

Records of the amounts of various kinds of feed fed and the volumes of butterfat produced on each of 31 farms in Northeast Iowa during 1942 provided data for the analysis of the substitution between feed grains and roughages in dairy production. The 31 farms were those classified as dairy farms in the Northeast Iowa Farm Business Association.² Records

¹Schultz and Brownlee, op. cit., page 679. A feed unit is defined as the feed-energy equivalent of a bushel of corn and thus assumes perfect substitutability of one feed for another. Such an assumption is realistic over a rather narrow range of the production function for some kinds of livestock and over a fairly wide range for other kinds.

²The classification of farms is based primarily upon the ratios of animal units of various kinds to the land area of the farm.
of the amounts of the various kinds of feed fed and the pounds of weight added to beef cattle in 1941 on 50 farms classified as beef-feeding farms in the Central Iowa Farm Business Association provided data for the analysis of substitution in beef feeding. Neither group of farms is representative of typical Iowa conditions. The observations are also averages for the farms, there being no records of the feed consumption of individual animals.1

Feeds were classified as feed grains or feed roughages, the quantities of each feed being converted into the common denominator of feed units (bushels of corn equivalent). Conversion rates are based on the relative amounts of total digestible nutrients in the feeds.

If the substitution of a pound of total digestible nutrients provided from grains for a pound of total digestible nutrients provided from roughages is less than perfect (within the range of variation of these ratios for the farms analyzed), variations in the proportion of total feed comprised by feed grains should result in variations in the ratios of outputs to inputs, other factors remaining unchanged. This hypothesis was tested by means of multiple regression of output per feed unit upon average amount of feed fed per animal, average total amount of product produced, and percentage of total feed supplied from feed grains. Previous studies have shown that the level of productivity of dairy cows and the total amount of feed fed to a given cow also affect the ratios of outputs

1These data are from unpublished records of the Agricultural Experiment Station, Iowa State College, Ames, Iowa.
to inputs in dairy production,\(^1\) and that the weight added to a beef animal in the feeding process affects the efficiency of the gain.\(^2\) Consequently, if the partial regression between output per feed unit and percentage of feed supplied in the form of feed grains is zero, the substitution between feed grains and feed roughages is perfect, within the range of variation of the data on which the analysis is based.

It was assumed that the "independent" variables enter into the regression in a linear fashion within the range of variation of these factors in this particular analysis. This assumption would be unrealistic if the percentage of grain fed and the amounts of feed fed per animal varied over wide ranges.

1) Dairy feeding - About 94 per cent of the total variance in the returns of butterfat per feed unit fed was associated with the factors analyzed. However, the regression of butterfat produced per feed unit upon percentage of grain fed was not statistically significant. Neither the regression coefficient nor the partial coefficient between percentage of grain in the ration and output per feed unit indicated that the proportion of grain fed was of significance in the efficiency with which the dairy herds analyzed converted feed into butterfat. Thus, we would conclude that there was perfect substitution between feed grains and feed.

\(^1\)See, for example, Einar Jensen, et. al., Input-Output Relationships in Milk Production, U.S.D.A. Technical Bulletin No. 315, May 1942, and O.H. Brownlee, "Putting Dairying on a War Footing (Revised edition), Wartime Farm and Food Policy, Pamphlet No. 5, 1944, appendix tables 1, 2 and 7.

\(^2\) Refer to O.H. Brownlee, ibid.
roughages at the levels at which these farmers were conducting their feeding operations. This does not mean, however, that there is perfect substitution between feed grains and feed roughages in all dairy rations. An average of about 26 per cent of the total feed units fed to these herds was feed grains, and two-thirds of the farmers fed between 22.5 and 34.5 per cent grain. Within this rather narrow range, the substitution might be expected to be perfect.

The multiple regression coefficients and correlation coefficients are given in Table 2.

One factor of importance in the efficiency with which feed is converted into animal product - that of care of the herd - could not be analyzed. A more complete analysis should attempt to take this factor into consideration. Further study of the substitution between feed grains and feed roughages in dairy feeding should also be conducted under conditions where there is a wider variation in the percentage of total feed made up of feed grains. Some physical optimum proportion of grain to roughage - a percentage at which the amount of product produced per unit of feed is at a maximum - probably exists for each level of feeding. It may be that this optimum, for the level of feeding considered, is somewhere within the range covered by these data.

(2) Beef feeding. Since the relationship between the efficiency of gains in beef feeding and the percentages of grain in the ration was not statistically significant, one might also conclude that the substitution between feed grains and roughages in the rations of the beef feeders whose records were analyzed was perfect. However, the variability
Table 2.

<table>
<thead>
<tr>
<th>Pounds of butter</th>
<th>Average pounds of fat produced per day</th>
<th>Butterfat produced</th>
<th>Units fed</th>
<th>Grain fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>X₁</td>
<td>X₂</td>
<td>X₃</td>
<td>X₄</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arithmetic means</th>
<th>2.026</th>
<th>275.42</th>
<th>138.00</th>
<th>27.79</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard deviations</td>
<td>0.4314</td>
<td>73.2416</td>
<td>34.2383</td>
<td>6.5187</td>
</tr>
<tr>
<td>Multiple correlation coefficient (R₁₂₃₄)³</td>
<td>0.968387*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of determination (R₁²3₄)²</td>
<td>0.937774</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regression coefficients</td>
<td>(constant)</td>
<td>(b₁₂₃₄)</td>
<td>(b₁₃₂₄)</td>
<td>(b₁₄₂₃)</td>
</tr>
<tr>
<td>1.9035</td>
<td>0.0070*</td>
<td>-0.0120*</td>
<td>-0.0051</td>
<td></td>
</tr>
<tr>
<td>Fiducial limits of regression coefficients⁴</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper limit</td>
<td>0.0094</td>
<td>-0.0071</td>
<td>0.0181</td>
<td></td>
</tr>
<tr>
<td>Lower limit</td>
<td>0.0046</td>
<td>-0.0169</td>
<td>-0.0283</td>
<td></td>
</tr>
<tr>
<td>Partial correlation coefficients</td>
<td>(12.34)</td>
<td>(13.24)</td>
<td>(14.23)</td>
<td></td>
</tr>
<tr>
<td>0.964023</td>
<td>0.949859</td>
<td>0.263611</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Level of significance, 1 per cent.

³Corrected value.

⁴Fiducial limits are at 5 per cent level.
Table 3.

<table>
<thead>
<tr>
<th>Pounds of gain</th>
<th>Average total</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>per 10 feed</td>
<td>feed units fed</td>
<td>pounds of grain</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Arithmetic means</td>
<td>50.66</td>
<td>62.62</td>
</tr>
<tr>
<td>Standard deviations</td>
<td>17.0594</td>
<td>27.3320</td>
</tr>
<tr>
<td>Multiple correlation coefficient ( R_{1,234}^2 ) &amp; 0.916449* &amp; &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of determination ( R_{1,234}^2 ) &amp; 0.839879 &amp; &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regression coefficients</td>
<td>(constant)</td>
<td>( b_{1234} )</td>
</tr>
<tr>
<td>48.6664</td>
<td>-0.7944*</td>
<td>0.1600*</td>
</tr>
<tr>
<td>Fiducial limits of regression coefficients b</td>
<td>&amp; &amp;</td>
<td>&amp;</td>
</tr>
<tr>
<td>Upper limit</td>
<td>-0.6837</td>
<td>0.1844</td>
</tr>
<tr>
<td>Lower limit</td>
<td>-0.9051</td>
<td>0.1356</td>
</tr>
<tr>
<td>Partial correlation coefficients</td>
<td>( 12.34)</td>
<td>( 13.24)</td>
</tr>
<tr>
<td>0.905276</td>
<td>0.889348</td>
<td>0.103160</td>
</tr>
</tbody>
</table>

*Level of significance, 1 per cent.

a Corrected value.

b Fiducial limits are at 5 per cent level.
in the percentages of grain fed was also relatively small. These 50 feeders fed an average of 68.6 per cent grain, two-thirds of them feeding between 56 and 61 per cent grain.

It will be noted that the regression of feeding efficiency upon pounds of gain is positive. This is probably due to the fact that the largest gains were made by animals put in the feed lot at the lightest weights. If the data were available, one should include the initial weight as well as the amount of gain in the regression analysis.

The results of this investigation check rather closely with controlled feeding experiments which indicate that feed roughages can be substituted for feed grains till beef animals are on about 50 per cent full feed without reducing the gains per pound of total digestible nutrients. However, many of these controlled feeding experiments suffer the same incompleteness as does this analysis - the substitution has not been carried far enough.

One cannot definitely say, on the basis of this analysis, that altering the composition of total feed production by as little as that induced by AAA would not alter the total amount or the composition of livestock production in the corn belt. The estimated change in the composition of feed production is for the total feed produced in the area. On some farms, AAA has perhaps stimulated a higher percentage of grain production. On others proportionately more roughages have been produced. Nevertheless, the changes in either the composition or the total amount of livestock produced resulting from changes in the composition of total feed production
need not have been important - if feed could have been shifted from farm to farm. In the corn belt, considerable feed grains and some roughages are not consumed on the farms where they are grown.

2. **Summary of production effects of AAA in the corn belt**

Two aspects of the production effects of AAA in the corn belt were discussed in the previous analysis - (1) the changes in total feed production and (2) the extent to which changes in the composition of the feed supply might alter the ratios of outputs of livestock products to inputs of feed. Other analyses have indicated that crop control had little effect upon the total quantity of feed produced in the corn belt. The investigation described in this analysis indicates that, within the range of the ratios of grains to roughages found in the rations analyzed, there was perfect substitution of feed roughages for feed grains in feeding dairy and beef cattle. Thus, it is quite conceivable that AAA had little effect upon livestock production in the corn belt.

Assigning to various aspects of AAA (and particularly to the various subsidies utilized by AAA) the changes which did take place, is rather difficult. For example, compliance payments were the active force inducing participation in crop control. However, one cannot attribute the effects of AAA exclusively to these payments. The maintenance of corn acreage at a lower level than would otherwise have prevailed was due indirectly to benefit payments, although the expectation that crop control would be effective may have induced some (non-participating) farmers to
grow more corn than they would have grown in the absence of AAA. The expectation of effective crop control together with the higher prices for corn stimulated by corn loans may have encouraged a larger corn acreage in the non-commercial areas than would otherwise have been the case.

Compliance payments were essentially subsidies conditional upon not performing certain actions - not harvesting more than the allotted acreage of corn and soil-depleting crops. The substitution of other alternative crops might reasonably be expected from such a procedure. A part of the increase in roughage output in some areas of the corn belt can be attributed to this feature of AAA. However, practice payments were made conditional upon the planting of certain crops and the following of certain cropping practices. These payments contributed to altering the production pattern in the same direction as did compliance payments.

The practice payments were a combination of subsidies for the following of specific production practices and subsidies on specific inputs -- particularly lime and legume seed. Since the supplies of both of these productive agents could be increased, an expansion in the outputs of the products produced with these factors was to be expected.

The soil conservation aspects of AAA also arise from both the negative (crop acreage control) and the positive (practice payments) features of AAA. An alternative, other than the production of crops on which there were no restrictions, open to the AAA cooperator was investment in soil resources (or less rapid disinvestment). Pursuance of this alternative might also be expected as a result of crop control. In
addition, the direct payments for practices contributing to soil conservation also stimulated investment in soil resources.

To the extent that AAA payments actually added to farm income (independently of their income effects via the production effects), and that this additional income enabled some farmers to "hang on", the stream of outputs over time has probably been at a higher level than it otherwise would have been, particularly in the areas where drouth was most acute. Although farm operators in these areas disinvested rather rapidly (sold their breeding stock, failed to keep their equipment in good repair, etc.), this process of disinvestment would probably have been more rapid in the absence of such supplemental income.

C. The Income Effects

As has been indicated in the previous discussion, AAA payments can be divided into two general classes: (1) **compliance payments** - the compensation offered to farmers to induce them to enter into contracts with the federal government to restrict their acreages of specified crops, and (2) **practice payments** - compensation for following the cropping practices set up as conditions for receiving practice payments. Following such practices as the planting of legumes and liming of the soil were part of the conditions which had to be met before the farmer was eligible for practice payments.
1. The effect upon aggregate farm income

In the previous analysis it was pointed out that the aggregate production effects of AAA in the corn belt have been small. Total feed production was estimated to have been modified relatively little by AAA, and the composition of the feed produced has been little different from estimates of the nature of feed production in the absence of AAA. Furthermore, the changes in feed composition—the ratios of feed grains to feed roughages—have not been sufficient to force alterations in the ratios of livestock outputs to feed inputs. This means, in turn, that the pattern of livestock production has probably been about the same as it would have been in the absence of AAA. Consequently, gross income from the production of livestock—the bulk of farm income in the corn belt—probably has been affected very little as a result of AAA. The immediate income effects (the effect upon the incomes of the aggregate of farmers during the period analyzed) arising directly from production effects probably have been small.

The investment in soil resources induced by AAA may, however, have altered aggregate future farm incomes in the corn belt. The extent to which the pattern of incomes over time was changed as a result of investment or disinvestment in farm resources cannot be accurately estimated with the data available to us and will not be analyzed here.

The conclusion that corn belt farm incomes have not been altered by the production effects of AAA, i.e. as a result of any changes in
outputs or inputs, does not mean that product prices or factor prices were not altered indirectly by the monetary impact. The demand schedules for corn belt agricultural products may have been shifted as a result of the monetary injection provided by AAA. Approximately 5 billion dollars - or about 6 per cent of total cash farm income for the United States - was expended in the form of compliance and practice payments under AAA to all participating farmers during the 10 years 1933-42.

Although the effect which this expenditure had upon the demands for each of the various agricultural products cannot be accurately estimated from the data available, it is very likely that expenditures of these funds increased the demands for agricultural products as a group. How much larger the gross income from the sale of livestock and livestock products was, as a consequence of this expenditure, can only be guessed. Estimates of the multiplier vary from about 2 to slightly above 4 for the United States.1 Assuming a multiplier of 4, an income elasticity of unity for agricultural products and thus no change in the percentage (approximately 10 per cent) of total national income going to agriculture, a net monetary injection of $5 billion would result in an indirect increase of about $2 billion in agricultural incomes. This is beyond doubt the upper limit. A more realistic estimate of the increased income would be

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less than one billion dollars, since both the multiplier and the income elasticity appear to have been lower than the figures used above.

Assuming an income elasticity of 0.5 for corn belt products, a multiplier of 3, and 40 per cent of total agricultural income going to corn belt farmers, the $5 billion injection would result in an indirect increase of approximately $300 million in corn belt farm incomes during the period 1933-42.¹

Although these are rough estimates, they do not need to be refined, for it would not have been necessary to employ this particular technique—injecting money at the farm level—in order to have influenced by monetary action the level of expenditure for the economy as a whole. In fact, injecting this money at other points in the economy might have encouraged greater expansion in expenditure and indirectly in farm income.²

¹Income elasticities derived from the data on food expenditures by income groups presented in Family Expenditures in the United States, National Resources Planning Board, June, 1941, indicate that for many agricultural commodities these elasticities are less than 0.5. Livestock products—ice cream, fluid cream, milk, butter, cheese, eggs, and meats, for example—have higher income elasticities than most other agricultural products, but few income elasticities for livestock products were in excess of 0.5.

The estimates are for changes in consumption for the economy as a whole and have been computed from the data cited above. They are based on the assumption that if a consuming unit's per capita expenditure is increased from \( x_1 \) to \( x_2 \), the per capita consumption pattern of the unit will approximate that of similar units whose expenditures were previously \( x_2 \).

²Stone's studies indicate a greater marginal propensity to consume for non-farm families in the U.S., in 1929 than for farm families.
Ignoring the monetary effects and their consequent impact upon farm income, the effect of AAA payments upon the incomes of farmers would be to increase farm income by the amount of the gross payments minus the increased costs incurred in complying with the acreage allotments and in following the practices designated by AAA. The additional costs incurred are also difficult to estimate and vary considerably between farms. Many farmers were able to comply with the acreage allotments and produce as much livestock as they would otherwise have produced without incurring any additional costs. It seems very likely that many farmers in southern Iowa have had this experience. Other farm operators probably found it somewhat more costly to grow as much feed per acre from other crops as from corn. Farmers in the cash grain area of Iowa have probably had this experience. For the corn belt as a whole, however, costs of complying with AAA restrictions appear to have been almost negligible.

Payments for following specific practices were set at levels which were expected to approximately cover the costs of following these practices. Although additional farm production might be expected to have been stimulated by such practices as liming and seeding legumes, data are not available to enable making an accurate estimate of the extent of the change due to this factor alone. In this study the production effects of AAA have been lumped together without any attempt to evaluate the influence of each feature of the program.

Assuming that the net addition to farm income in the corn belt resulting directly from AAA payments (exclusive of monetary effects) has been
approximately equal to the expenditure for compliance with acreage restrictions, about 1.5 billion dollars was added to corn belt farm income by AAA in the ten years 1933-42.

Adding to this direct increase in farm income the indirect monetary effects and the parity payments, AAA payments have increased farm income in the corn belt during the decade 1933-42 about 2 billion dollars.

2. The effect upon the distribution of incomes among various farm enterprises

As a first approximation in determining the effects of AAA payments upon the distribution of farm incomes, one might note the relationship between the net incomes of farm enterprises and the sizes of the payments received. The data presented here are only for the calendar year 1939 and for a sample making up about 0.3 per cent of the farmers in Iowa. However, these data may be somewhat indicative of the relationship throughout Iowa and the corn belt.

AAA payments, particularly compliance payments, have been allocated proportionately to the size and the productivity of the farm. This method of allocation was assumed by the administration to have been necessary in order to induce a maximum of participation in the acreage control program. Even though the assumption appears to have been erroneous, it was considered that the larger and more productive the farm, the greater the loss in income which might be suffered in complying with the acreage restrictions and hence the greater the compensation necessary to secure participation.
a. Geographic distribution within Iowa. As is shown in Figure 8, the average size of payments per farm in the Iowa sample for 1939 was largest in the north central and central parts of the state and smallest in the southeastern portion of the state. Although we do not have complete data on average farm incomes by counties, it appears very likely that the various counties ranked in about the same order relative to average net income per farm as they ranked on the score of benefit payments per farm.

b. Relationship between net farm income and benefit payments per farm in Iowa, 1939. The data presented here are based on a random sample of farmers in Iowa for the calendar year 1939. The data were collected by means of personal interviews with the farmers at the end of the calendar year. Both net farm income and government payments per farm are probably underestimated, the error being greater for net farm income. These errors are due primarily to the failure of the operator to recall all of the income or perhaps in some cases to conscious understatement. ¹

As is indicated in Table 4 those farmers in the sample whose net farm incomes were highest also tended to receive the largest benefit payments. There is a similar correlation between farm size (in acres) and the amount of government payments per farm (See Table 5).

¹See Raymond J. Jessen, Statistical Investigation of a Sample Survey for Obtaining Farm Facts, Research Bulletin 304, Iowa Agricultural Experiment Station, Ames, Iowa, June 1942.
1939

Compiled from unpublished data of the U.S. Dept. of Agriculture.
Table 4. Relationship of Benefit Payments to Net Income of Selected Iowa Farmers Participating in AAA, 1939a

<table>
<thead>
<tr>
<th>Net income group</th>
<th>Number</th>
<th>Average of acres</th>
<th>Average income</th>
<th>Average benefit payments</th>
<th>Average benefits of payments made of per farm</th>
<th>Average net income</th>
<th>Average per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 0-299</td>
<td>58</td>
<td>115</td>
<td>$ 159</td>
<td>$ 159</td>
<td>100.0</td>
<td>$ 1.38</td>
<td></td>
</tr>
<tr>
<td>300-599</td>
<td>72</td>
<td>136</td>
<td>466</td>
<td>223</td>
<td>47.8</td>
<td>1.34</td>
<td></td>
</tr>
<tr>
<td>300-599</td>
<td>81</td>
<td>149</td>
<td>745</td>
<td>246</td>
<td>35.1</td>
<td>1.55</td>
<td></td>
</tr>
<tr>
<td>900-1199</td>
<td>81</td>
<td>189</td>
<td>1,038</td>
<td>254</td>
<td>24.5</td>
<td>1.33</td>
<td></td>
</tr>
<tr>
<td>1200-1499</td>
<td>59</td>
<td>191</td>
<td>1,470</td>
<td>327</td>
<td>22.3</td>
<td>1.71</td>
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<tr>
<td>1500-1799</td>
<td>56</td>
<td>210</td>
<td>1,743</td>
<td>355</td>
<td>20.2</td>
<td>1.88</td>
<td></td>
</tr>
<tr>
<td>1800-2099</td>
<td>42</td>
<td>191</td>
<td>2,027</td>
<td>394</td>
<td>18.9</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>2100-2399</td>
<td>42</td>
<td>210</td>
<td>2,237</td>
<td>434</td>
<td>21.6</td>
<td>2.30</td>
<td></td>
</tr>
<tr>
<td>2400-2999</td>
<td>42</td>
<td>208</td>
<td>2,662</td>
<td>393</td>
<td>14.8</td>
<td>1.89</td>
<td></td>
</tr>
<tr>
<td>3000-3999</td>
<td>55</td>
<td>252</td>
<td>3,002</td>
<td>570</td>
<td>19.0</td>
<td>2.26</td>
<td></td>
</tr>
<tr>
<td>4000 &amp; over</td>
<td>33</td>
<td>272</td>
<td>4,707</td>
<td>689</td>
<td>14.6</td>
<td>2.53</td>
<td></td>
</tr>
<tr>
<td>All farms</td>
<td>619</td>
<td>179</td>
<td>1,587</td>
<td>342</td>
<td>21.5</td>
<td>1.91</td>
<td></td>
</tr>
</tbody>
</table>

aData are from interviews with a random sample of Iowa farmers and were collected by Iowa State College in cooperation with the Bureau of Agricultural Economics and Agricultural Marketing Service, U.S. Dept. of Agriculture.

Both net farm income and benefit payments per farm appear to have been underestimated. The farm incomes of those in the low income classes were in many cases supplemented by earnings from industrial or farm employment. This supplementary income is not included in this compilation.
Table 5. Relationship of Benefit Payments to Farm Acreage of Selected Iowa Farmers Participating in AAA, 1939a

<table>
<thead>
<tr>
<th>Acreage Group</th>
<th>Number</th>
<th>Average Acres</th>
<th>Average Net Benefit</th>
<th>Payments made of</th>
<th>Benefit per Farm</th>
<th>Benefit per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-79</td>
<td>49</td>
<td>47</td>
<td>$600</td>
<td>$85</td>
<td>14.1</td>
<td>$1.80</td>
</tr>
<tr>
<td>80-119</td>
<td>98</td>
<td>92</td>
<td>1,021</td>
<td>211</td>
<td>20.6</td>
<td>2.29</td>
</tr>
<tr>
<td>120-159</td>
<td>129</td>
<td>132</td>
<td>1,241</td>
<td>250</td>
<td>20.1</td>
<td>1.90</td>
</tr>
<tr>
<td>160-239</td>
<td>204</td>
<td>178</td>
<td>1,583</td>
<td>343</td>
<td>21.7</td>
<td>1.92</td>
</tr>
<tr>
<td>240-319</td>
<td>81</td>
<td>266</td>
<td>2,435</td>
<td>511</td>
<td>21.0</td>
<td>1.92</td>
</tr>
<tr>
<td>320 &amp; over</td>
<td>58</td>
<td>426</td>
<td>2,966</td>
<td>745</td>
<td>25.1</td>
<td>1.75</td>
</tr>
<tr>
<td>All farms</td>
<td>619</td>
<td>179</td>
<td>1,587</td>
<td>342</td>
<td>21.5</td>
<td>1.91</td>
</tr>
</tbody>
</table>

aData are from interviews with a random sample of Iowa farmers collected by Iowa State College in cooperation with the Bureau of Agricultural Economics and Agricultural Marketing Service, U.S. Dept. of Agriculture.
If these data are reasonably representative of the corn belt as a whole, benefit payments have increased the incomes of virtually all farmers. But these payments have also tended to increase the dispersion of the distribution of net farm income, adding most to the incomes of those farmers whose incomes were already highest.

3. The effects upon the incomes of resource owners

Thus far our analysis has been concerned only with the impact of AAA payments upon the aggregate of farm income and upon the frequency distribution of the incomes of farms. Where the farm operator is the owner of the resources used on the farm he is operating, he is the recipient of the payments whether they go to the human agent or to any of the other resources. However, where the farm is tenant operated, part of the payments may go to the landlord in the form of increased rents. Or other resource owners may be able to capture part of the increment of income paid to the farm.

As was indicated in the deductive analysis of income effects, one should know the nature of the supply functions of the various resources in order to determine the way in which income paid to the farm is divided among the various resources. Empirical information concerning the effects of AAA payments upon resource prices is almost entirely lacking. However, there is little evidence to indicate that interest rates or the prices of capital goods other than land have been altered as a result of the change in farm income occasioned by AAA. Such a result is to be expected since
agriculture utilizes a relatively small proportion of the total supply of such productive agents. The supply function of these agents, so far as agriculture is concerned, is relatively elastic. The supply function for farm labor (hired labor as well as that of the farm operator and his family) may be discontinuous and is probably very elastic over parts of its range and very inelastic over other parts. The supply function for land is relatively inelastic, so far as the agriculture of any relatively large area is concerned.

The way in which increased returns to the farm enterprise would eventually be divided between the labor, management or land depends largely upon the extent to which the landlords were able to capture the subsidy by increasing rental rates. (The labor-management return on a tenant operated farm is essentially a residual return.) The benefit payments going to the farm were sufficiently attractive to some landlords to induce them to convert their tenant-operated farms into manager-operated units. In other instances, increased rents were reported.

Table 6 shows estimates of average gross cash rent per acre of farm real estate in Iowa, 1933-1942, and indicates that rents rose steadily during the period. However, increased rents were the result not only of government payments, but also of the increased crop yields and farm prices following the drought and depression of the middle thirties.

About all that can be said relative to the distribution of government payments among resource owners, given the paucity of data, is that (1) the supply functions of virtually all of the productive agents except land
were probably sufficiently elastic to have prevented any marked increase in the prices of these agents, (2) although land rents increased, government payments were not the sole factor accounting for this increase. The farm operator probably captured the bulk of the payments.

Table 6. Estimated Gross Cash Rent per Acre of Farm Real Estate in Iowa, 1933-1942

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross cash rent per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1933</td>
<td>$4.46</td>
</tr>
<tr>
<td>1934</td>
<td>4.99</td>
</tr>
<tr>
<td>1935</td>
<td>5.21</td>
</tr>
<tr>
<td>1936</td>
<td>5.70</td>
</tr>
<tr>
<td>1937</td>
<td>5.71</td>
</tr>
<tr>
<td>1938</td>
<td>5.86</td>
</tr>
<tr>
<td>1939</td>
<td>5.86</td>
</tr>
<tr>
<td>1940</td>
<td>5.99</td>
</tr>
<tr>
<td>1941</td>
<td>6.24</td>
</tr>
<tr>
<td>1942</td>
<td>6.79</td>
</tr>
</tbody>
</table>

aData are from The Farm Real Estate Situation, 1942-1943, Circular No. 690, U.S.D.A., Oct. 1943, Table 9, page 20.
A. A General Principles of Agricultural Policy

Agricultural policies within a nation be developed

That the agriculture department of the government has not been associated sufficiently with policy

Moreover, the agricultural sector has not been considered sufficient, and the policies associated with it. The agricultural sector is not fully understood. And the utilization of the potential of current or expected problems in need of the measures to be taken in the formulation of agricultural policy.

A. APPLICATIONS TO THE FORMULATION OF AGRICULTURAL POLICY

1.5
determine what these objectives have been, and to set forth, in the light of overall social policy, what the objectives of agricultural policy should be. Determination of what these objectives should be can be arrived at by evaluating the consistency of the aims of agricultural policy with the aims of overall social policy. Social policy, however, is an area in which there is not general agreement as to appropriate aims. Strictly objective appraisal is extremely difficult, if not impossible, to achieve.

Agricultural policy in the past, particularly since 1920, has been aimed primarily at improving the income position of agriculture -- absolutely as well as relative to non-agriculture income. Governmental activities employed to help attain this objective may be classified into five general types: (1) those designed to increase the amounts of resources owned by farmers (e.g. tenant purchase programs), 1 (2) those calculated to reduce the prices of resources purchased by farmers (e.g. reduced interest rates, electric power rates, fertilizer prices, taxes, etc.), (3) those established to increase the rates of transformation of resources into products (e.g. the dissemination of information relative to improved farm practices and the subsidization of research in agricultural technology), (4) those designed to increase the relative returns from the sale of agricultural products (e.g. tariffs, production control, commodity loans and storages, reduced marketing costs), and (5) direct supplementation of agricultural income outside of regular marketing channels.

1Increasing the amounts of resources owned by farmers need not imply increasing or even holding constant the total amount of resources utilized in agricultural production.
Some of these activities might have been inconsistent with the avowed objective. For example, improvements in farm technology need not result in increased farm income, even though such improvements permit increasing the income of the economy as a whole. However, before appraising the techniques one should at least examine the objective in terms of its consistency with overall social policy.

1. Compatibility with overall social policy

The objectives of social policy, as has been indicated previously, are to a large extent personal or social judgments. Acceptable objectives in Russian social policy differ considerably from objectives acceptable to the bulk of the citizens of the United States. A slate of objectives of social policy prepared by the editors of The Nation would differ from a slate prepared by the editors of The Saturday Evening Post. In spite of these differences, there is fairly general agreement in the United States that social policy should include among its objectives (1) allocation of resources in line with consumer preferences, (2) freedom of the individual to dispose of his resources in the way he wishes—given the pattern of prices for these resources, (3) maintenance of conditions

1Refer to Earl O. Heady, "Changes in Income Distribution in Agriculture with Special Reference to Technological Progress", Journal of Farm Economics, 26:435-447, 1944.

favorable to economic progress, and (4) "equity" in the distribution of income. The principles enumerated in the Atlantic Charter might also be considered as acceptable goals of social policy.

If pursued independently, some of these objectives may be inconsistent. For example, "equity" in the distribution of income and maintenance of conditions favorable to economic progress may be incompatible. In fact, "equity" in the distribution of income has left the door open for a number of activities which may have interfered with reasonable attainment of the other objectives. If the objective of allocation of resources in line with consumer preferences is to be achieved, and if the size of the economic "pie" is to be maximized, it may not be possible to alter to a very great extent the distribution of incomes so that it does not correspond closely to the pattern of "rewards" dictated via the pattern of relative resource prices—particularly for those resources which cannot be separated from the person. In practice, it is a combination of overall social aims—none being achieved to the fullest extent—which social policy attempts to maximize.

Assuming, for a moment, that increasing agricultural incomes is consistent with the aim of "equity" in the distribution of incomes, how consistent is this aim of agricultural policy with the other objectives of social policy?

The extent to which income distribution can be modified without seriously reducing the total production of the economy is an empirical question which is, as yet, unanswered.
Expected rates of return from engaging in particular lines of production influence the production pattern. Relatively low rates of return in agriculture (or in any other line of enterprise) is a means—in fact one of the most impersonal and perhaps most effective means—of encouraging the owners of resources to shift these productive agents out of areas of production where they contribute least and into lines of production where they can render a greater contribution. Such a movement of resources thus contributes both to allocation of productive agents in line with consumer preferences and to economic progress.

The per capita consumption of most agricultural products is relatively stable over time. Food and some items of clothing are near the top of the "list of priorities" in the proposed expenditure patterns of nearly all families. As family incomes increase, expenditure for non-agricultural items expands much more rapidly than that for agricultural products (assuming no changes in relative prices). As the per capita national product is increased as a result of such factors as technological improvements, the proportion going to agriculture should decrease—given such objectives as allocation of resources in line with consumer preferences and a favorable climate for economic progress.

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Part of the "agricultural problem", so far as agricultural policy is concerned, is to facilitate the movement of resources out of agriculture, or at least to prevent inflows when the resources that would flow in could yield a greater contribution in some other line of production. And one of the ways of impeding what appears to be a desirable movement of resources would be to adopt policies which would provide too high relative incomes from agricultural production.

It has been claimed that relative income opportunities are indicated by the pattern of relative prices and that the price mechanism has not proven effective in encouraging resources to move out of agriculture. For example, it is pointed out that during the early thirties when agricultural prices were lower in comparison with industrial prices and wage rates than they had been in most of the previous decade, there was a slowing of the movement of population out of agriculture. In fact, in some of these "depression" years the net movement of population was into agriculture, while in the previous decade there had been considerable movement of population out of agriculture.

The answer to this contention is that relative prices do not provide an adequate index of relative income opportunities when a resource owner cannot dispose of resources at these prices. If an individual cannot find employment at any wage, the wage rate to him is zero, not the rate being paid to employed workers. The flexibility of agricultural prices, the stickiness of industrial prices and wage rates, and the rather high direct correlation between the level of employment and the general level
of agricultural prices are all factors which help to explain the higher movement of population out of agriculture when agricultural prices are relatively high than when agricultural prices are relatively low.

Thus, increasing incomes in agriculture (relative to non-agricultural incomes) and tying the receipt of such incomes to agricultural production or to the use of the resources in agriculture may interfere with the most desirable division of resources between agriculture and the rest of the economy. And since a part of the agricultural problem has been an excess of labor resources employed in agriculture, even during the twenties, agricultural policies tying increased resource incomes to employment of these resources in agriculture could hardly be expected to improve the situation. Some relative increase in agricultural income undoubtedly could be achieved without impeding the movement of resources out of agriculture. In fact, such income increases might facilitate a more desirable division of resources. But resource movement cannot be encouraged if the receipt of such income is tied to agricultural pursuits as such. The extent to which this objective of agricultural policy—increasing agricultural incomes—interferes with the most desirable division of resources thus depends partially upon the conditions which must be met by the recipient in order to receive the income.

Separation of the distribution of incomes from the allocation of resources has been urged by many economists. As related to agricultural policy, see T.W. Schultz, Redirecting Farm Policy, New York, the Macmillan Co., 1943, and "Economic Effects of Agricultural Programs", American Economic Review, 20: (Feb., 1941) 127-154. Refer also to D. Gale Johnson, "Contribution of Price Policy to the Income and Resource Problems in Agriculture", Journal of Farm Economics, 26:631-84. 1944.
In addition to the potential incompatibilities between the aim of increasing agricultural income and some of the objectives of overall social policy, there is no assurance that increased agricultural incomes would mean greater "equity" in the distribution of incomes. The general concept of "equity" appears to be independent of the source of the income, and refers primarily to relative sizes of incomes. Low incomes prevail in non-agricultural as well as agricultural pursuits, although southern agriculture appears to support a rather large proportion of low income receivers. It is not low agricultural incomes, but low incomes in general that is considered "inequitable". Consequently, if measures are taken to raise low agricultural incomes, they would have fewer unfavorable impacts upon the rest of the economy if they were a part of a program to increase all low incomes. The means which have been utilized to increase agricultural incomes have been largely those which tie income to the volume of the recipient's agricultural output. Such measures exert little influence toward achieving more equitable incomes for those receiving their income outside of agriculture and may actually increase the dispersion of incomes within agriculture.

Here, again, incompatibilities result primarily from not considering the interrelationships between agricultural policy and overall social policy. Measures treating agricultural income in the same manner as other incomes are treated would avoid this kind of conflict.

Another aspect of the "agricultural problem", when viewed from the standpoint of social welfare, is that of increasing the efficiency of
We shall assume in the forthcoming discussion that in the event of further treatment in the subsequent discussion what aspects of the structure of our society in the context of all this income, it must be considered within the framework of our society that a part of overall societal position of a certain category of production into a product should not be part of the pattern of production of resources into product, and (2) the product of a resource, being between resources employed in the transformation of resources into product should have to more and more important elements within the pattern of production that more and more the product of consumer preferences. Both of these phases are compatible with our society as a whole. The national context to it in our society is the pattern of our production with the possible exception of that of consumer preferences within the possible exception of consumer preferences within the pattern of production with the possible exception of our society as a whole.
B. Applications to Achieving a Desirable Balance in the Allocation of Resources Between Agricultural and Non-Agricultural Production

The net product from the given resources in an economy where resources can be moved without cost is at a maximum when marginal returns imputed to any unit of any productive agent in any given productive enterprise are exactly equivalent to the returns which would be imputed to this agent if it were employed in any other productive enterprise. When costs of transferring resources are also considered, the net product is at a maximum when marginal productivities minus costs of transfer are equalized.

Although direct comparisons of marginal returns to given productive agents are exceedingly difficult to formulate, available empirical information seems to indicate that marginal money returns (and in many cases, marginal money returns plus such items as housing, food, etc. furnished from the farm) to the labor on many farms are lower than marginal returns in some other lines of production in which the labor might be employed. Yet this apparent discrepancy has not been sufficient to move enough labor out of agriculture and into other lines of employment (or from one agricultural producing unit to another) to equate these returns.

Before this condition can be adequately appraised, a further comment on the nature of the "social product" and the conditions for its achieving a maximum should be made. Considerations other than expected
relative monetary returns obviously influence decisions as to where an individual is to sell his labor (or any other type of resource). Many types of agriculture provide, as a minimum, subsistence to the operator. The variety of tasks and decisions connected with farming may offer to the farm operator a challenge which could not be provided in such other lines of endeavor as may be open to him. These non-monetary factors are of importance in determining how resources should be allocated in order to maximize the social product (which includes not only "real" but "psychic" values). If there is complete knowledge of all employment opportunities and resource owners can move their resources, the net social product may be considered to be at a maximum when there is no further movement of resources from one line of production to another, given relative resource prices (as imputed from product prices) and technical rates of transformation.

The two conditions assumed in order for the social product to be maximized, i.e. there is no incentive to move resources--(1) complete knowledge of the market and (2) ability to move the resources--are very infrequently met in reality. Expectations of relative returns may be in error. If returns outside of agriculture were consistently under-estimated relative to returns within agriculture, the ratios of resources in agriculture to resources in non-agricultural enterprises would be larger than that which would maximize the net social product. Furthermore, even though expectations were correctly formulated, some resource owners may not be able to accomplish the transfer of their resources to other lines
of activity. Most investments in land, for example, can be "moved" only over a long period of time.

 Provision of more adequate labor exchanges to provide both laborers and employers with information as to the available demands and supplies of labor would aid in more correctly formulating expectations. Government operation of such exchanges is within the generally accepted framework of the function of government. Payments to resource owners to enable them to transfer their resources, particularly labor, to more remunerative lines of employment has been suggested as a means of bringing about a "better" division of labor resources between agriculture and the rest of the economy. Such payments would combine provision of additional incentive to move and of means for effecting the transfer, if they were made conditional upon movement of the resource. However, failure to move from less remunerative to more remunerative lines of employment is frequently due to lack of liquid funds. In such cases only loans would be needed. The difficulties in obtaining funds may be largely the result of capital rationing. Potential borrowers often lack the security necessary to obtain funds from lending agencies, since such agencies frequently utilize, as an index of repayment potentialities, the security offered rather than the expected income opportunities of the investment.

\[1\text{Such payments should not be compensation for "real" costs of transfer. For example, if wages in industry } A \text{ exceed wages in industry } B \text{ by } W, \text{ per year, but imputed annual training costs necessary to fit a } B \text{ worker to operate in } A \text{ are } W \text{ or more, no payment should be made. If training costs are less than } W, \text{ the payment should not exceed the difference between } W \text{ and training costs.}\]
The contribution which subsidies can render to improving the division of resources between agriculture and the rest of the economy is thus rather limited. Incentives to move resources can be best established via the price mechanism. Expectations of relative income opportunities can be made more accurate by improving the dissemination of information regarding relative resource prices. Loans, as well as subsidies, to resource owners may enable them to move resources from less remunerative to more remunerative lines of employment.

C. Applications to Encouraging the Utilization of Improved Technology

The price mechanism appears to be the most impersonal and one of the most effective techniques for directing production. This applies to any economy in which consumers' choices can be reflected directly in the market by means of relative prices which consumers are willing to pay for various goods and services. Although price uncertainty (or in more general terms, uncertainty of expected returns from the disposal of products) may impede somewhat the direction of production in an economy such as that which characterized the United States in the decade 1920-30, this should not be grounds for discarding the price mechanism or for reducing the area of its framework. Alterations in the pricing technique may enable shifting part of price uncertainty away from the individual firm and to a specialized uncertainty-bearing agency. Forward pricing is a technique which has been suggested as a means for accomplish-
ing such a shift. Whether the potential political losses involved in forward pricing counter-balance its potential economic gains is still to be answered.\footnote{See C.H. Brownlee, "Some Considerations on Forward Prices", \textit{Journal of Farm Economics}, 25:495-504. 1943; and Abba P. Lerner, \textit{The Economics of Control}, New York:The Macmillan Co. 1944.} Nevertheless, with the possible exception of a war economy, changes in the pattern of relative prices rather than subsidies on outputs are probably the best means for inducing particular production patterns.

As we have indicated previously, however, price changes are likely to be ineffective in inducing farmers to alter their production methods. It is conceivable that an increase in income may give the farm operator more "freedom" (subjectively) to try techniques which are new to him. However, the problem of attaining more widespread adoption of improved techniques is essentially one of education. It is in the area of inducing such changes that subsidies may be able to play an important role, as a supplement to education or as an independent technique—a sort of "we'll-pay-you-to-try-this" procedure.

The type of subsidy best adapted to induce getting more product from a given amount of resources appears to be some form of practice payment or transformation subsidy. To date such payments have, in agriculture, been administered largely by AAA and have been confined almost exclusively to cropping practices. Payments have been made for following such practices as liming, seeding legumes, cover crops and
green manure. Some of these practices were encouraged not so much to expand output as to induce reductions in the acreages of feed concentrates. Some AAA practice payments may also be criticized because they were made for utilizing practices already being used by most farmers.

Expansion of practice payments on crops and extension of this principle to livestock production might prove an effective means for encouraging more rapid adoption of improved techniques for converting agricultural resources into products. In crop production, farmers might be induced to inoculate legume seed, plant the most productive crop varieties or employ the most efficient cultivation practices by means of small payments conditional upon the utilization of these practices. Or improved seed varieties might be furnished to farmers at reduced prices through government purchase and resale.

In livestock production, such practices as vaccination of hogs and poultry, improved feeding methods, and the raising of hogs and poultry on clean ground might also be encouraged by means of payments to farmers conditional upon employing these practices. More efficient conversion of feed into food is of particular significance since about 70 per cent of the total crop acreage in the United States is devoted to producing feed crops.

Much of the administrative machinery which would be required in order to administer such payments is already in operation. County AAA committees check practices currently employed by farmers where payments are made for such practices. Employment of additional technicians to
demonstrate practices and to check their utilization by farmers might be desirable if the scope of practice payments was expanded. Since payments probably would have to be made to all farmers utilizing and approved practice, a role for abandoning payments would also be desirable. For example, if it were found that after one year of payments for a particular approved practice, 30 per cent of the farmers who could use this practice would utilize it in the next year without payment, employment of this practice might no longer be subsidized. Since the problem of encouraging farmers to use the most efficient conversion techniques is primarily an educational problem, payments on any particular practice may not need to be continued for more than one or two production periods. Once such practices are utilized by the bulk of farmers and are found to be more "efficient" than old practices, continued utilization of the improved techniques is virtually assured.

The only "real" costs involved in inducing the utilization of improved production techniques are represented by the alternative goods or services which otherwise could have been produced by the men and materials utilized by the administrative organization. The apparent money costs are merely transfers of purchasing power. These financial aspects may, however, be of importance in determining the political acceptability of the proposed procedure.

D. Applications to Income Supplementation

If the objective of "equity" in the distribution of incomes, regardless of the way in which "equity" is defined, is to interfere least with
the attainment of resource allocation in line with consumer preferences, techniques designed to redistribute income should be such that they divorce as much as is possible income distribution from resource allocation.\(^1\) Complete separation of the two problems is, of course, impossible. However, given the types of income distribution considered most desirable, there are some techniques which will achieve this distribution with less "distortion" of the production pattern than would result if other techniques were used. Even if it were possible to use the relative price pattern to achieve the desired income distribution, the result would probably be an extremely distorted production pattern. Redistribution via taxes and subsidies may, in the short run, alter little the relative allocation of resources from what this allocation would be in the absence of such redistribution.

The extent to which the size of the "pie", in the long run, will be reduced by measures designed to alter the relative sizes of the pieces from what they would be if determined solely by the pattern of resource prices as imputed from "contributions" to the social product, is still an unanswered question.\(^2\) The answer to this query is of major signif-


\(^2\)It is quite conceivable that income taxes, if not "confiscatory" (a very subjective term), may have little effect upon the short-run allocation of resources or upon the supplies of productive agents. Since the taxes apply equally to incomes of given sizes, resource allocation should be unaffected, except insofar as high incomes are concentrated in particular lines of enterprise. Existing supplies
icance in determining social policy. It may be that not only would
redistribution of income reduce the size of the "pie", but the reduction
may be so drastic that the larger share of the smaller pie going to a
particular group will be smaller than the piece prior to redistribution.

This need not concern us immediately, however. Our problem is
especially part of the question, "given the relative income distribution,
how can the size of the pie be maximized?"

Some further preliminary comments on what kind of redistribution
there should be, i.e., the criteria for determining who should get more
and who should get less of the pie, are appropriate. Redivision should
be primarily, if not exclusively, along income lines. Low incomes
should be supplemented at the expense of high incomes. Low incomes
are not peculiar to agriculture, nor are the "undesirable" social,
economic and political consequences of low incomes confined to agriculture.

(Footnote continued)

of resources are also unlikely to change, the short-run supply of
"enterprise" being a potential exception.

Such taxes as inheritance taxes are likely to exert relatively little
influence upon supplies of resources or upon their allocation. High
income taxes, however, may reduce markedly the supply of enterprise.
And price ratios might have to be widened considerably to induce
resources to move from one line of production to another.

1The assumption which is made here is that the total income to be
distributed among the various potential recipients is large enough
to permit supplementation of low income groups sufficient to bring
their total income from all sources to a level high enough to provide
a "decent" standard of living. The realism of this assumption
depends upon the definition of "decent" as well as upon the ratio
of total national income to total potential recipients.
Consequently, if it is considered desirable to supplement low incomes, all such incomes should be supplemented—not just those in agriculture. The techniques for redistribution, however, might vary between various groups of individuals so long as such techniques did not discriminate between individuals with equivalent incomes to be supplemented.

Since changes in relative prices of products cannot accomplish desirable alterations in the pattern of income distribution without rather drastic modifications in the pattern of resource ownership, some form of subsidization of low-income groups is probably necessary. However, the desired redistribution cannot be accomplished by subsidies on outputs, since the income effects of such subsidies are essentially equivalent to the income effects induced by changes in relative product prices. Practice payments are also unlikely to have a decided effect upon the distribution of incomes, even though inferior practices may be used more widely by those with low incomes than by those in the high income brackets. Practice payments are likely to have little effect toward increasing the incomes of laborers. If there was a high correlation between the kinds of resources owned and relative sizes of incomes, subsidies on particular inputs might be reasonably effective in bringing about "desirable" changes in the distribution of incomes. Low incomes are most prevalent among resource owners who have only the services of unskilled labor to sell. Subsidization of inputs of this productive agent might provide a means for raising the income level of a relatively large number of individuals.
Law, however, the objections of so-called "reasonable expenditure"

for a reason of course, should be the same as could be produced to any purpose that the object could be used for. The question of the collection of goods and services

more than they should be supposed to be unimportant, since the same argument should be used even by those who would be affected by the same action when each individual consumer is free to allocate his income.

be encompassed here, however.

Some of the objections must be understood in this light. Some of the objections must be understood in this light. Some of the objections must be understood in this light. Some of the objections must be understood in this light.
themselves. If public attitudes favor such forms of expenditure, a part of the supplemental income might be provided as a form of investment in human resources. In the interest of improving health and increasing working efficiency, food, medical care, and perhaps additional recreational and educational facilities could be provided to individuals as a kind of supplemental income.

E. Summary

Among the conclusions which one can draw from an analysis of the use of subsidies in implementing agricultural policy are these:

1. To direct the allocation of resources within agriculture, alterations in the relative price pattern rather than subsidies on particular outputs are likely to prove most effective. The pattern of relative prices enables translation of consumers' demands into incentives to move resources with a minimum of political intervention.

2. Practice payments may yield relatively large returns per unit of expenditure in inducing farmers to follow the most productive practices in the growing of crops and the care of livestock. These payments have the effect of speeding the educational process. Such payments are unlikely to exert a very great influence upon the distribution of incomes, however.

3. In the supplementation of agricultural incomes, if such is considered desirable, two important factors must be kept in mind:
a. Low incomes and their consequent undesirable economic and social effects are not confined to agriculture. Consequently, from the standpoint of "equity", income supplementation in agriculture should be a part of a broad program of raising low incomes throughout the economy.

b. To supplement low agricultural incomes without a similar program for the non-agricultural sector may not have adverse allocative effects within agriculture, but may hinder attainment of a desirable allocation of resources between agriculture and the rest of the economy.
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