11

Compensation Policy and Supply Control

Society in the United States has conducted a dichotomous search for satisfactory policy to allow progress but to guarantee that the full cost of technical advance does not fall on agriculture. The various public policies since 1930 represent attempts by society, with nonpassive encouragement from agriculture, to compensate the farm industry for projected losses stemming from sharp technical and supply advance in face of inelastic demand. The creation of institutions and policy mechanisms which allow and encourage progress, redress serious losses to particular groups resulting therefrom and prevent scorn in magnitude of outlay and method of use of public funds is the crucial farm issue of the 1960's. Further developmental policy and investment in agriculture will be desired if, and as, the nation meets its international challenges and obvious responsibilities. Yet how can farmers reap an equitable share of the reward from their contribution to progress?

Our purpose in this chapter is, starting as given with the premise that society does wish to provide compensation and invests on large scale to accomplish the end, to examine some of the economic alternatives and implications of these. Not all of the policies discussed are basically of compensation nature. Some relate to price and income stability and market power. However, we discuss them in this chapter so that the various elements of the policy subset can be seen in better perspective relative to each other. (Other comparisons of policy means are included in Chapter 14 and subsequent chapters.)

COMPENSATION METHODS

The major funds transferred from general society to agriculture as price supports, nonrecourse loans, per acre payments, practice payments and other forms can be interpreted as (1) compensation for reduced income resulting from society's investment in increasing supply under inelastic demand (2) equity payments to draw real per capita income of agriculture, with its historic lag, nearer the level of the nonfarm sector or (3) a method whereby a competitive industry acquires gain comparable to that obtained through market power possessed by less competitive groups. The first is the deeper philosophic reason and the one more compatible with the methods employed and the distribution of transfer funds over the last several decades. Transfers based on equity and low income alone would be retrogressive to level of income, with a much greater proportion going to the poverty sector of agriculture. The operational goal in use of the larger funds evidently has been compensation, to assure that the distribution of gains and losses growing out of technical advance and supply increase in agriculture do, in fact, increase aggregate welfare. The direct gains are distributed widely, in abundance and low real price of food to all consumers. The direct losses result to farmers as output increases under inelastic demand, revenue necessarily declining to the industry.

Within the farm industry, there are gains for those operators favorably situated in respect to technical advance, either in buying feed and related resources at lower price or with own yields increasing in greater proportion than for the industry or than in decline of price. But with industry revenue declining, farmers who experience loss in revenue are faced with welfare decline. If the transfers from 1930 to 1960 were not for compensation purposes, then an entirely different structure of programs should have been used.

Income to resources in agriculture could have been pushed nearer the levels specified by the conventional marginal conditions of economic equilibrium, by moving resources out of agriculture to increase their return through (1) increasing their marginal physical product, (2) decreasing output and increasing price, both leading to an increase in marginal value productivity, and (3) decreasing the return of resources in other industries in the manner of a general equilibrium model. This movement has, of course, taken place but the slack has never been "taken up" because the rate of technical advance has freed more labor as rapidly as some has left farming. Had society selected to use the conventional equilibrium model as its goal, rather than compensation to guarantee that the direct distribution of gains and losses assured aggregate gain, it would have better invested the transfer funds in payments to cover moving, housing, relocation and income costs to a greater number of persons who could have migrated but did not, and also in guaranteeing economic growth of magnitude to absorb a greater number of migrants.

Hence, with interpretation of past transfer funds as compensation for the purposes outlined above, it is appropriate that the method of these payments be analyzed. Given compensation of particular magnitude as an instrumental goal, what is the most efficient means of affecting it? We turn to analysis of alternative compensation means, given a particular set of funds to be transferred. We can compare the means in terms of (1) the equity in the compensation method as against the distribution of gains and losses, (2) the least-cost method of putting compensation of particular magnitude into the hands of farm people, or the method which will transform given appropriations by the public into maximum compensation for agriculture and (3) the extent to which the method interferes least with the allocation of resources and leaves maximum specification to the open market and preference of consumers.

Equity in Method of Compensation

Funds transferred to agriculture for purposes of (1) accomplishing compensation and (2) eliminating the problems of low income and poverty are for quite different purposes. They require somewhat different programs in terms of general structure and entirely different ones in terms of the distribution of transfer payments. Accordingly, the two programs should be kept separate, except as they come together in other realms at the level of education and investment in improved nonfarm opportunities for those who can best improve welfare by occupational migration. Transfer payments to accomplish compensations should be ordered in magnitude of loss to each individual. With inability of interpersonal utility comparisons, the only manageable magnitude to reflect loss is income. Therefore, the individual who has experienced greatest income loss, through growing output and inelastic demand, should receive the greatest compensation. Generally this will be the person with the greatest income. And also generally, though not entirely, the person with the greatest income is the one with the greatest output and resources. On this basis, then, payments for compensation purposes should not have ceiling or upper restraint, but should be distributed in approximation of predicted loss. But at the same time, funds appropriated for these purposes should not be allowed to seep out to persons who have had no loss from the developmental variables of relevance, such as nonfarmers purchasing land to claim compensation, beginning farmers who have been detached from previous losses and sectors surrounding agriculture who have suffered no price or income decline on the services and resources which they provide to the farm industry. In division of compensation between tenant or landlord, payments should be in proportion to incidence of loss. In general, this division should be in proportion to income, but if payment includes an element to cover capital loss, it should go to the owner of the resource, rather than to be divided in any manner.

Here the recommendation of no restraint on magnitude of payment is based on supposition of transfer for compensation basis. Structuring of payments for meeting equity or poverty goals would be on an entirely different basis. The recommendation of compensation in proportion to loss is based on the tenets of welfare economics supposing (1) that change causing both gains and losses cannot guarantee aggregate welfare increase unless compensation is used to redress sacrifice and (2) measurement of utility of income, or its comparison among individuals, is impossible and no basis exists for saying that marginal utility of a dollar is greater for one than for another individual.

DIRECT PAYMENTS IN COMPENSATION

The least-cost method for society to place a given amount of compensation from treasury outlay in the hands of farmers is undoubtedly direct payments. Aside from small administrative costs, a quantity less than for any other type of compensation program, nearly all of the money appropriated for compensation purposes can be put in the hands of farmers. The method allows maximum returns to farmers from a given allocation of funds by the public, or allows a given transfer of funds to agriculture at minimum treasury cost. (But it is not guaranteed as the method which minimizes treasury costs in transfer of a given amount of income to farmers.) Unlike price supports above market levels with required storage, none of the funds from direct payments need be siphoned off into commodity storage and similar sectors. Neither does investment need to be made in a large staff to administer and police the program, as in the case of input or output quotas. Finally, under certain conditions to be outlined later, direct payments can give more complete freedom to the market in allocating resources of agriculture among commodities in line with consumer preference.

Under certain structure of transfers, direct payments can even aid the pricing mechanism in adjusting the resource mix of agriculture so that excess resources leave the industry and move into sectors where they have greater long-run opportunity. Direct payments can have greater flexibility than other compensation methods in providing this mix of (1) minimum cost of a given public compensation outlay and (2) maximum effect for the market.

The compensation method used from 1930 to 1960, based on support prices and loans, caused these imbalances: First, the magnitude of farm output was greater than necessary or desired by consumers. The programs caused, in the conventional economic sense, too many resources to be used for food. Second, they encouraged the wrong mix of farm product, with too many being allocated in the direction of grains and cotton. Third, they caused some resources to be diverted to fertilizer production, storage facilities and other inputs and capital investment to produce more surplus and to store it, when the nation had little or no direct use for the increment of product so represented.

Direct payments could allow supply and demand to interact giving levels of prices which would clear the market without continuous accumulation of surpluses. With markets cleared and average annual output held back to consumption levels, excess resources and treasury costs would not need to go into the nonfarm inputs which otherwise are used to produce surpluses, and to store them after they are produced. But not all direct payment methods will accomplish this collection of instrumental goals. To do so, the payment must be a lump-sum quantity, devoid of relation to units of output or inputs used in future periods. (But lump-sum payment can still be based on past or historic base without affecting future output.) Once direct payments become scheduled to inputs or outputs, they promise to draw or hold an "overage" of resources in agriculture and of products onto the market. The effect is similar to that of support prices which jut above market prices. As price declines because supply shifts more rapidly to the right than demand, a compensation or subsidy scheme which represents an addition to per unit price of the market will cause output to "over-shoot" demand, causing both an intensified depression of market price and a larger quantity of subsidy or compensation payments than flat or lump-sum payments. Under direct payments attached to each unit of output, public outlay will be greater than for price supports through government purchase and storage of commodities. With direct payments this excessive quantity can still clear the markets, but under support prices and government storage, it goes into stocks with surplus buildup.

Other means of compensation (or more correctly, price and income restoration or maintenance) exist which require smaller treasury outlays while throwing more of the burden on consumer expenditures through the market. The latter are much less "visible" than direct payments since the income transfer is made entirely or partly through the market.

Let us illustrate the difference in lump-sum compensation and per unit compensation, both provided as direct payments. To do so adequately, we should start from the firm's production function and trace technological change through the cost and supply functions in the manner of Chapters 3 and 4. However, to provide the reader with less manipulation at this point we start at industry supply and demand with an "overly simple" annual model, remembering, of course, that outcome would be modified slightly if we considered changes in factor prices and production coefficients and the magnitude of compensation so specified—although the qualitative outcome would still be the same. Hence, we suppose the original industry demand and supply functions in (11.1) and (11.2). Then in the new situation, demand increases to (11.3) and through technical change and given factor prices, supply changes to (11.4).

$$Q_d = a - 2P \tag{11.1}$$

$$Q_s = .79a + .1P \tag{11.2}$$

$$Q_d' = 1.1a - 2.2P \tag{11.3}$$

$$Q_s' = .948a + .12P \tag{11.4}$$

The equilibrium quantities for these two situations are indicated in Table 11.1. Total revenue declines from $.08a^2$ to $.0626a^2$ due to a price elasticity less than unity and a rate of increase in supply which exceeds that of demand.

TABLE 11.1

EQUILIBRIUM QUANTITIES UNDER ORIGINAL AND NEW SUPPLY AND DEMAND SITUATIONS. MAGNITUDES DETERMINED IN FREE MARKET

Quantity	Original	New
Equilibrium price	$.1a$	$.0655a$
Equilibrium output	$.8a$	$.9559a$
Total revenue	$.08a^2$	$.0626a^2$
Price elasticity (demand)	.25	.15

Now, to simplify calculations as compared to analysis through cost and net return changes, first suppose compensation is made for this loss in revenue. On a flat or lump-sum basis it would total $.08a^2 - .063a^2 = .017a^2$. This amount would be divided among farmers according to their individual losses in revenue, perhaps roughly in proportion to their share of output before the change. In effect, a lump-sum payment would be the same as giving the farmer a base on which he would be paid compensation, with no payment on output exceeding the base.

But instead of such lump-sum compensation, now suppose that direct payments are specified to provide the difference between the old ($.1a$) and new ($.0655a$) price levels—a type of "parity pricing" procedure. Hence, farmers are, in effect, guaranteed a price of $.1a$ on all they produce. Under the new technology and supply function (11.4), they will produce $.948a + .12(.1a) = .960a$ output, an amount exceeding the market equilibrium quantity of $.9559a$. But consumers will absorb this quantity, as indicated by (11.3), only at a price of $.5a - .455(.96a) = .0632a$. Total revenue in the market under this per unit price guarantee is $(.960a)(.0632a) = .0607a^2$. As compared to original revenue, market revenue now declines by $.08a^2 - .061a^2 = .019a^2$, more than the revenue reduction when markets were cleared without a price guarantee.

If compensation is paid as difference between original ($.1a$) and subsidy-inspired ($.0632a$) market price, the difference to be made up in direct subsidy payment is $.0368a$ per unit, the total subsidy amounting to $(.960a)(.0368a) = .036a^2$, an amount more than twice the amount ($.017a^2$) when subsidy is under a lump-sum system of direct payment. Under flat or lump-sum payment and a market price of $.0655a$, consumers would pay a higher proportion of the supply price. This is as it should be where the pricing system is used as over-all allocative mechanism, and other means as public schools and progressive taxation are used to bring equity in income distribution over consumers in general (supplemented by other means to meet particular public purposes, to redress injustices in distribution of gains and losses and place economic groups on comparable market power footing).

In the case of per unit payments, the consumer would pay a smaller proportion of the supply price and the public treasury would have to bear a larger subsidy burden, with some mal-allocation of resources occurring relative to market-expressed wishes of consumers. In both cases, however, the market would be cleared without buildup in stocks as under support prices and public storage.

Our example has been with "full restitution" of price or revenue loss. Where it is only at "some portion of parity" or price, the results would be of the same relative differences, being only smaller in magnitude. The conclusion is clear in any case: If compensation is made, direct payments can be a lower-cost method, in terms of treasury outlay, than price supports, production control and storage, such as used in the 1930's and 1950's. However, price support through supply control to avoid surpluses and storage requires an even smaller treasury cost of compensation, the incidence of compensation being thrown mainly to the consumer through the market. A lump-sum payment, unrelated to marginal costs or revenues through per unit additions to price or outlays, is the most efficient method of direct compensation, in total costs and in freedom of market to allocate resources. The market freedom applies not only to domestic consumers but also allows a better gearing of output to foreign demand, with farm commodity being less priced out of the international market as under nonrecourse loans and public storage.

Direct payments, but on a unit basis, were used in the United States to encourage production of hogs, milk and other commodities under price ceilings during World War II, for wool production during and after the Korean War, for sugar under quotas, and by Canada for certain livestock products in recent years. In general it can be said that experience conforms to theory. Direct payments per unit of output serve positively to increase production whether this be desired as during war in the U.S. or whether it be a method of income compensation as in Canada in the postwar period.

Payment per unit, to avoid output expansion effects, would have to be limited to some historic quantity such as the amount produced in a previous period, or as a quota representing the new equilibrium quantity. Direct payment in pure lump-sum fashion, estimated to cover income loss and paid without regard for production (or paid only on a prescribed output base), would be better consistent with the compensation principle and have minimum effect on resource allocation. Difficulty arises, of course, in estimating its quantity per farm, per unit basis perhaps being the more nearly politically acceptable method. Direct payments of this general lump-sum nature were somewhat represented by the "parity payments" of the early 1930's and the conservation reserve income transfer starting in 1956, but both of these were directed also to production control.

Values and Compensation Method

Direct payments leave greater power to the market—in erasing surplus stocks, in bringing forth a more appropriate mix of farm products with less historic proportioning, and in farm output level—than support price-storage which allows attainment of the same compensation level. To the extent that resources so awarded remain in the industry, they still invite some "overage" of factors in the industry, but their product can be swept away by market-free prices. Elements of direct payment could be added, however, which would not retard but would catalyze migration of labor and capital.

For example, the individual given the same right to lump-sum payment if he stayed or left agriculture would not weigh the compensation in his marginal calculation of transfer to other industry. With or without the lump-sum payment, if made on "once and for all" basis, marginal gain or change in income would be roughly the same in shift between industries. The lump-sum might provide him with funds for transfer, if he could not otherwise collect enough. But even if direct "once and for all" compensation tended to cause them to remain, farm families could be given their choice: a given amount if they remained in agriculture, but this plus a bonus if they migrate. Paretoan optimum conditions would be favored, no person moving unless doing so increased his welfare. Those who suffer disutility from accepting subsidy payment, direct or indirect, could also have Pareto optimum: they need not exercise the right to it, whether they remain on farms or leave.

Our quantitative example was with annual payment, the discussion immediately above with "once and for all" single payment. Either could be used. Difficulty with "once and for all" payment is in establishing its quantity. Theoretically, a series of annual lump-sum payments has the present value, L, in (11.5) where A_i is income deficit in the ith year to be compensated and r is the appropriate discount rate, the compensation to extend for n years.

$$L = \sum_{i=1}^{n} A_i(1 + r)^{-i} \tag{11.5}$$

The difficulty with annual compensation payment is in establishing how long the payments "ought" to run. The "once and for all" lump-sum payment would be preferable to the annual lump-sum payment in encouraging resources to leave agriculture, but the annual attachment is no stronger in holding resources to agriculture than equal compensation under price support and surplus storage.

Perhaps a question of values attaches to compensation method. Is it true that the U.S. farmer believes a subsidy or compensation to be just or desirable only if it comes through the market place? The equivalent of subsidy or price level goal is attained by other economic sectors through various mechanisms of the market which do not show up directly as tax payments and as transfers among groups. Protective tariffs, marketing orders for fruits and vegetables, monopoly production and pricing, and even farm support prices cause transfers to take place under the label of market quantities and in a manner not directly apparent to consumers and taxpayers. The transfers to producer groups favored by these institutions could take place by allowing prices to drop to their free competition market level, with taxation and subsidy to replace them.

(Such a transfer of income from consumers to producers of electrical equipment would have saved the stiff fines and jail sentences imposed against firms of the latter in 1961 for monopoly conspiracy.)

Some of the heavy public discussion of direct payments implies them to be restrained by value orientations, although the method has long been used for airline mail services. Further research is needed on this value problem, or its interdependence with political stance among groups conflicting along a contract curve, and on possible reluctance of farm producers to have subsidies directly labeled in cash quantity (versus having them less apparent through the market). It is not impossible that Brewster's work ethic creed in values, "one fails to deserve esteem . . . if easy ways . . . (are) selected in employment of choice,"[1] does have relevance. There appear to be instances where farmers favor direct payments, and others where they favor market-oriented income transfers.[2]

SUPPORT PRICES AND NONRECOURSE LOANS

Support prices based on parity or historic price levels, loans without recourse to make them effective and public ownership and storage of surpluses have been the main policy means since 1930, with the direct instrumental goal being that of higher prices. As a means to compensate farmers for unfavorable distribution of gains and losses stemming from technical advance, the price-support/loans/storage road requires a greater outlay for a given level of compensation than do direct payments, or allows lower farmer compensation from a given level of treasury outlay. This is true because a large portion of funds under the former goes into administration, supervision and in investment for commodity storage. Too, where it is not accompanied by supply control, part of it becomes embodied in the greater output it encourages, with an important portion of this being drained out of agriculture into the nonfarm input industries which provide the resources for the over-extension of output. This complex of means may provide certain "windfall gains," however.

The mammoth accumulation of stocks in the 1950's provided both visible evidence—in magnitude of both treasury dollars and grain storage bins—that "something had to be done." The only variable with "give" related to foreign disposal of commodities. This use of surplus stocks was not costly to the public—they owned them anyway. Accord-

[1] John Brewster, *Value Judgments and the Problem of Excess Capacity in Agriculture,* USDA Farm Econ. Res. Div. Mimeo., May, 1960.

[2] For example, see L. Soth, *Direct Government Payments to Farmers. Policy for Commercial Agriculture; Its Relation to Economic Growth and Stability,* Joint Economic Committee, Washington, D.C., 1957. Some other studies also indicate specific groups of producers who have favored direct payments: D. E. Hathaway and L. W. Witt, "Agricultural Policy: Whose Evaluation?" *Jour. Farm Econ.,* Vol. 36. A discussion of some direct payment alternatives also are discussed in G. E. Brandow, *Direct Payments Without Production Controls,* Economic Policies for Agriculture in the 1960's, Implications of Four Selected Alternatives, Joint Economic Committee, Washington, D.C., 1960.

ingly, greater flow of food went to nations with hunger, such as Southeast Asia and the Middle East. This might not have been so had the public had to appropriate funds for this purpose, in addition to those appropriated for farm programs and foreign aid. Still, elements of indirect "windfall loss" clung to this same line, in the sense that foreign policy goals were sometimes submerged to that of dumping surpluses.[3] (Also, see discussion in Chapter 17.)

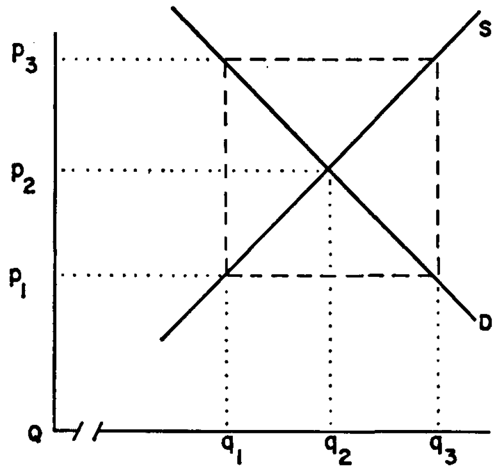

Fig. 11.1. Commodity Cycle Basis in Support Price and Storage.

Stability Mechanism for Aggregate Agriculture

Price supports and storage work best for commodity cycles such as those of hogs and crops which fluctuate in the cobweb manner of Ezekiel.[4] They also apply for somewhat similar phenomena: fluctuations in production due to the stochastic nature of weather variables. In respect to the commodity cycle, there is the case of supply elasticity greater than demand elasticity in respect to price, with exploding effect on magnitude of quantities, and also of supply elasticity less than demand elasticity, with dampening effect and convergence towards stable output and price.[5]

In practice, exogenous variables interact with those endogenous to the cycling mechanism, never allowing production and price to swing to positive and negative numbers of infinite magnitude, or to stabilize at a slumbering equilibrium. With knowledge of limitations in fact, we illustrate

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[3] *Cf.* H. N. Carroll, *The House of Representatives and Foreign Affairs*, University of Pittsburgh Press, Pittsburgh, 1958, pp. 34–63.

[4] M. Ezekiel, "The Cobweb Theorem," *Jour. Polit. Econ.*, Vol. 47.

[5] G. W. Dean and Earl O. Heady, *Changes in Supply Elasticities and Supply Functions in Hog Production*, Iowa Agr. Exp. Sta. Bul. 471; this illustrates tendency of fluctuations to grow for hogs, with demand elasticity decreasing and supply elasticity increasing, but not under given supply and demand functions as in our example.

the adapted role of storage and support price in a case where complete convergence and complete explosion are not in sight. We start with "kickoff" price and output at levels of p_3 and q_1 respectively in Figure 11.1. Naive expectation models and "distributed lag" response, as used by most farm producers of cycle commodities or the latter would not exist, lead to output of q_3 and decline of price to p_1 in the following period.[6] Under demand with price elasticity less than unity, and elasticity declining greatly with quantity over the demand function, extreme fluctuation repeated over and over will lead to smaller revenue than if output and price were stable. But this need not be true under exploding or dampening cycles, or even with uniform cycles and change in supply and demand functions. Even under particular circumstances where demand elasticity is not too low relative to supply elasticity, fluctuation can bring greater revenue than stability.[7]

But supposing elasticities and lagged response are of a nature to cause fluctuations which reduce average revenue over time, in comparison to stable output, and that losses among producers who sacrifice from cycles outweigh gains among those who benefit, the aim of support price would be this: Support price would be set at level p_2 and when output is q_3, the storage authority would subsidize (boost) prices to the extent of p_1p_2, taking quantity q_2q_3 off the market under commodity storage activity. This one step, in our simple static example, would stabilize price at p_2 and output at q_2. But suppose exogenous forces cause "breakout of the system" and output of q_1 and price of p_3. The storage authority wouldn't allow this to happen to price, however, with the cycle resuming force. Quantity q_1q_2 would be moved from storage to the market, with price remaining at p_2 level and further cycling averted.

Neither weather nor economic variables distribute themselves in the symmetrical manner discussed above, either in 2's or 100's of time-series observations. But the logic has been illustrated even if the task of implementation is more difficult. Where the variables of concern are stochastic

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[6] See Earl O. Heady, *Economics of Agricultural Production and Resource Use*, Prentice-Hall, New York, 1952. See Chaps. 15 and 17 for indication of models used by farmers and their consequences.

[7] If we start with the demand and supply functions in (11.1) and (11.2) respectively, for example, and suppose a "kick off" price of $.2a$ and output of $.6a$, the total revenue is $.12a^2$. Under the static "next year's price equals this year's price" expectation model, output will increase to $.81a$ in the second period and price will decline to $.095a$. The total revenue for the latter combination is only $.077a^2$. The average revenue for the two periods is $.099a^2$. If production and price were stable at the equilibrium levels of $.8a$ and $.1a$ revenue would average $.08a^2$ per year—an amount smaller than the average of the above two periods under fluctuations.

For four periods, revenue under year-by-year lagged response to price is $.893a^2$; whereas it averages $.8a^2$ for stable production and prices. But after years 3 and 4, the cycle converges on equilibrium, output and price averaging essentially $.8a$ and $.1a$ respectively in periods 3 through 6 (prices in periods 3 and 4 are $.10025a$ and $.09999a$ respectively while outputs are $.7995a$ and $.8a$). Even though this situation exists, some basis in costs (of production and processing) from fluctuating prevails as an argument for lessening instability. See Heady, *op. cit.*, pp. 524–34.

in relation to weather, averages and rules can be approximated to prevent mammoth swings in prices under yield variations. This was accomplished in the 1950's with support prices. However, stocks carried accumulated into giant magnitudes, instead of at size for "averaging." The tendency of support prices aimed at stability to get politically intermeshed with compensation payments when supply growth exceeds demand growth is the great weakness of the system. Perhaps at some time in history, the two elements of policy can be separated in the market and the public decision process. The time is yet to be seen, however, for any U.S. procedure of price support or forward pricing.

Storage and support mechanisms apply most readily to durable commodities as grain and cotton, less to meat, eggs, dairy products and other perishables. More costly and ample storage is required for the latter, but they have possibilities greater than exercised in past decades. For perishable commodities where weather is not the root of evil, more education and outlook for price expectations and planning, to bring understanding of cobweb phenomena and improved planning process to more farmers, could help stabilize the cycle and lessen investment required for storage of stabilizing stocks. For durable commodities, the restraint is less the ability to accomplish the storage task, and more that of separating the stabilization and compensation facets in political determination. Gustafson has provided us with some rules, in terms of the social welfare function, for gauging the size of stocks to be carried in evening inter-year grain supplies to meet weather fluctuations.[8]

Carryover stocks required are of two types: those of a "pipeline" nature which flow through the system in maintenance of continuity in processing, distribution, feeding and retailing, and those to give stability over fluctuations in yield and acreage of inputs. Stocks for these two purposes can cover some range, with opportunity for the market mechanism to do a moderate amount of "evening out" in supplies and prices. If absolute stabilization of quantity flowing to the market, and effect on price, were attained, carryover would have to be immense—large enough, and carried long enough, to cover "once in 50" deficits of the magnitude during droughts of the 1930's. The marginal cost of carrying such large amounts for such long periods is too great, if compared with the discounted marginal gains of the same. It has been estimated that "pipeline" stocks of corn, for example, need to be about 150 to 200 million bushels, and total or "normal" stocks for both purposes need to be about 15 percent of normal domestic consumption and exports. Hence, the "normal" carryover for feed corn would have been slightly over 500 million bushels, and all feed grain about 20 million tons, over the 1950's. Actual carryovers were more than twice, and on the verge of attaining three times, this amount.

Gustafson's precise rules for feed grains take into account the probability distribution of yields, the social value or welfare function and the costs

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[8] R. L. Gustafson, "Implications of Recent Research on Optimal Storage Rules," *Jour. Farm Econ.*, Vol. 40.

of storage. They specify the rules for optimal storage policy, namely, that which maximizes the sum of discounted expected social gains over an n-year period where gain in each year is total social value minus storage cost of the carryover. He specifies two rules applying to two specified sets of conditions. Rule 1 supposes storage costs of 10 cents per bushel, a 5 percent interest or discount rate and an elasticity of "quantity used with respect to marginal social value" of $-.5$. Rule 2 is based on storage costs of 4 cents, a 5 percent discount rate and an elasticity of $-.3$.

The "computed rules" or specified quantities to be carried over, indicated as carryover per acre of feed grains, are detailed in Table 11.2 for each situation. These rules, however, provide for even lower carryovers than specified above. The previous figures were those which gave a "reasonable" averaging out of absolute surplus or deficits to stabilize prices, without account of discounted social margins or particular distributions of "weather runs." Storage policy to provide reasonable stability to farm prices would provide quantities of somewhat different magnitudes than those to maximize total social welfare, and would allow considerably different magnitude of price fluctuations. In general, stocks would be larger and price fluctuations smaller than those indicated by Gustafson's figures. His figures also, partly since they are aimed more at maximizing the social welfare functions and less at farm price stability, would allow stocks to drop lower in a poor year following run of average years and carryover to be larger in a high yield year following average years.

TABLE 11.2

QUANTITIES PER ACRE TO CARRYOVER AT SPECIFIED AVERAGE PER ACRE YIELDS OR SUPPLIES WITH INTEREST RATE OF 4.5 PERCENT

Bu. Per Acre	Rule 1	Rule 2	Bu. Per Acre	Rule 1	Rule 2
29......	0	0	38......	4.44	7.01
29......	0	.07	40......	5.89	8.66
30......	0	.77	42......	7.38	10.34
31......	0	1.50	44......	8.89	12.08
32......	.55	2.25	46......	10.45	13.83
34......	1.74	3.80	48......	12.02	15.61
36......	3.05	5.40	50......	13.63	17.42

Gustafson's upper limit carryover under rule 1, exceeded with probability of only .1 in weather expectation, would require 420 million bushels of corn equivalent plus 150 to 200 million bushels of pipeline stocks. This quantity, much above his quantity specified as average carryover with probability of .73, would be more realistic for purposes of price stability (but might be too high for maximization of discounted social welfare). For purposes of price stability, a range of 500 to 700 million bushels of corn equivalent for pipeline and stability purpose appears desirable, considering costs of storage, at rates of utilization for feed grains in the 1950's and as an average over years. For feed grains, carryover would be allowed to drop to the approximate level of pipeline stocks in years of smallest output and to withdraw all surplus when output exceeds annual use by 500 million bushels of corn equivalent, trend taken into account. Similar relative quantities needed for wheat and are much less than recent periods when stocks attained levels equal to or greater than annual production.

The large carryovers in grains developed, of course, because storage policy was used mainly as means of compensation, thus submerging its character as a stability mechanism. Numerous people looked upon these large stocks and their treasury carrying costs as the fundamental problem of the food industry. But this was untrue. They were indeed a heavy social problem, but served only as material evidence of the more fundamental problem, namely, supply capacity of agriculture which had grown to rapidly exceed rate of demand growth. Liquidation of surplus stocks, with policy elements of the kind in force during the 1930's to the 1960's, would not have solved the problem of large output based on short-run factor supplies of low elasticity. Neither did the stocks depress market prices in important degree—they were immobilized from the market. Mainly they represented a social dilemma: public costs growing to large magnitudes without solution of the capacity problem which gave rise to them. Accumulation of the stocks killed the pain stemming from excess capacity, but it did not eliminate the cause of the pain.

Man is not omnipotent and weather is not accommodating in prediction, as also is true for purely economic variables. Therefore, man will never predict and stabilize exactly on the target as in Figure 11.1, or as prescribed by storage rules. This is true particularly for aspects of fluctuation growing out of economic change which interact with other variables. But a scheme of forward prices, with the logical purposes outlined in Figure 11.1, would do so more than the imperfections which accompany a pure competition market where producers are at the mercy of weather and other variables.

Politics are rather the more important prediction (or, perhaps it is lack of knowledge of farmers, who do not understand difference in program purposes) which keeps a purely stabilization policy from being adopted. Forward pricing was recommended even before the great depression.[9] It has been given considerable refinement in concept and purpose in later decades.[10] It was used for hogs, wheat and other commodities for reducing uncertainty and encouraging greater output in World War II. Forward prices provide footing for developmental policy in countries such as India. For the goal of stability and greater certainty in planning, attempt would be made to predict and announce forward prices at equi-

[9] See Business Men's Commission on Agriculture, *The Conditions of Agriculture and Measures for its Improvement*, Washington, D.C., 1927.

[10] *Cf.* T. W. Schultz, *Redirecting Farm Policy*, Macmillan, New York, 1943, Chap. 5; and D. G. Johnson, *Forward Prices for Agriculture*, University of Chicago Press, Chicago, 1947.

librium levels before the time of decision and resource commitment by farmers. Supplemented by storage to even supplies, attempt would be made to keep prices effective for planning purpose, the projections modified with new information and not taken as inflexible historic restraints on consumer preferences, technical development and factor prices. Proponents of forward pricing would also use them for countercyclical purpose over business cycles, jutting them above equilibrium levels in depression to help stabilize income.[11] However, the main offense for business depression is at the national front, and not on the contracting farm flank.

Stability for the Individual

Stable commodity flows into the market and prices floating at peaceful stability levels would not eliminate fluctuations attending weather which fall on individual farmers. Even in years of average output and prices, some producers have yield failure and cannot claim a portion of aggregate placidity. Public crop insurance is a policy means to attain the goal of income stability for such random variables. It has been attempted for three decades in the U.S., without widespread use or success in terms of actuarial standards. It is provided, of course on a commercial basis for insurable contingencies such as those of hail and related phenomena. But for all-risk insurance, covering major variables such as weather, it doesn't appeal to private firms. Taking even fairly large producing areas, the relevant observations do not square too closely with the type phenomena needed for insurability, namely, a large sample, independence of observations and lack of control and prediction by the owner.[12] Too, all-risk insurance has not spread to crops of regions where the distribution of weather outcomes or observations provides a "sample in time" whereby the individual farmer can effectively establish probabilities and "carry his own insurance." This possibility is at a minimum for the beginning operator who sometimes is "wiped out" as soon as he starts.

Insurance lacks attraction where it is based on past history and does not sufficiently account for yield trends due to technical development. Farmers who progress in yield with technology will not insure; those who do not progress tend to insure, causing losses in actuarial accumulations where their yields vary more than the average. Insurance does not have great attraction where great variability of some regions causes "actuarial costs" to be at levels discouraging farmers of the area, particularly where indemnities are based on averages and do not account for variation among farms. Finally, where premiums in high risk areas are kept low, being supplanted by higher premium rates in regions of lower relative variance in yields, farmers in the less risky areas are little inclined to participate. All-purpose crop insurance, where weather is of proper characteristics, could be made to work. This is true only on a basis of a large

[11] Schultz, *ibid.*

[12] For further discussion of these and other points, see Heady, *op. cit.*, Chap. 17.

enough sample in respect to time and space and if it were used purely for stability purpose—entirely devoid of elements to transfer income among individuals and regions.

Instability of agricultural production and prices of the kind discussed in this section are not the major foundations of U.S. farm problems; the distribution of gains and losses under economic development and chronic poverty are. To eliminate the latter two would accomplish little in respect to the instability problem, or vice versa. Hence, we turn back to support prices and storage as a means related to goals of compensation.

Support Prices, Loans and Compensation

Support prices, loans and commodity storage have been used in the U.S. largely for income transfers or compensation. While they have stabilized prices of certain storable products, with the public adding an infinitely elastic demand at support levels exceeding market clearance, they have not had stability in the above manner as the basic goal. This complex of policy elements is luxurious in its costs as a means of accomplishing compensation, particularly where it is not accompanied with supply control and leads to large-scale accumulation of stocks. Under technical change and factor prices encouraging supply to shift more rapidly than demand, storage and prices supported at levels of previous periods will cause output to exceed consumer demand and market clearing levels. This is *a priori* obvious in theory; it is *ex poste* obvious in all experience, the size of treasury costs and storage accumulations in the 1950's being sufficient evidence for any doubters.

Looking back to equations (4.1) through (4.20) and to Table 4.1, it is obvious that technical change increasing marginal productivity of factors is expected to lead to an "overage" of output, if price support mechanism is used to retain the previous factor/product price ratio. Similarly, given the production function and a decline in real factor price as for fertilizer from 1940 to 1960, commodity price held at a level to maintain a previous factor/product price ratio also will add to "overage" in output. The effect is illustrated in Figure 11.2. Starting with original demand and supply functions, D_1 and S_1, supply changes to S_2 and demand to D_2, the rate for supply being greater than for demand. Hence, short-run equilibrium price declines from op_3 level to op_2 and output increases from oq_1 to oq_3. Under inelastic demand, the total revenue op_2oq_3 is less than op_3oq_1. If historic price is used as the support level, price at level op_3 is guaranteed under the new supply conditions. But at this price level, short-run equilibrium output is oq_4, rather than oq_3. If loans without recourse are available to farmers at level op_3, demand will allow only quantity oq_2 to clear the market. Hence, a quantity equal to q_2q_4 will move annually into storage, with continuous buildup of stocks. If compensation were provided only to cover loss in revenue, it would be set at magnitude $op_3 \cdot oq_1 - op_2 \cdot oq_3$. If it were to cover price depression on all produced at new equilibrium quantity, the general attempt of past

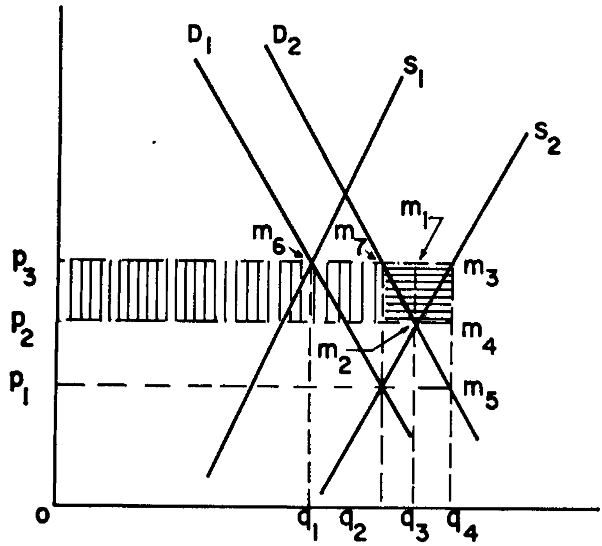

Fig. 11.2. Support Price and Commodity Storage in Compensation.

price supports, it would amount to $p_2p_3m_1m_2$. But without supply control where farmers produce oq_4 at op_3 price, compensation becomes the larger amount $p_1p_3m_3m_5$ where we suppose that prices are supported at the previous or op_3 level, or make up the difference between op_1 and op_3. The actual public outlay in withdrawing stocks from the market to maintain a market price of op_3 then becomes $q_2m_7m_3q_4$.

To this must be added annual storage costs of carrying q_2q_4 quantity. If storage per unit is m, total appropriations or treasury outlay for the year must be $q_2m_7m_3q_4+mq_2q_4$. In the second year, with the same amount added to stocks (leaving weather and yield variations aside at this point), the treasury outlay becomes $q_2m_7m_3q_4+2mq_2q_4$, to allow appropriations for stock acquisition and storage costs for two years of accumulation. The annual outlay in n years thus becomes $q_2m_7m_3q_4+nmq_2q_4$ and the total outlay is the summation of these annual amounts. The storage activity thus promises eventually to become a major cost. The compensation method could be much lessened if the surplus were burned rather than stored (forgetting now about any salvage value of the surplus). With q_2q_4 quantity burned, market quantity would be held back to oq_2, taken off the market at op_3 price, and with the costs of storage saved.[13]

[13] Burning or destroying surplus stocks of commodities such as wheat is considered to be inconsistent with a value held by many people. This value found its greatest expression in the outcry against "killing little pigs" in the 1930's. But this twinge of conscience, held for destroying wheat and feed grain stocks, does not prevail for plowing under lettuce and destroying fruit annually under market order control of supply.

The costs of price supports and storage can now be compared with direct payments. If direct payments were on a "per unit of output" basis guaranteeing the previous price of op_3, output also would be expected to increase to oq_4 level. Hence the total of direct payments would amount to $p_1p_3m_3m_5$, the same compensation amount expected for support prices which are attained through surplus storage price guarantee of op_3. However, for storage, it is only necessary for the public to lay out $q_2m_7m_3q_4$ directly for acquisition of stocks rather than to lay out $p_1p_3m_3q_4$. (Of course storage costs must be added to this.) The smaller amount is required in surplus acquisition since, by cutting the free-market quantity back to oq_2, the consumer helps bear the burden of keeping price at op_3 level. Under support prices and storage, the consumer is expected to bear a larger part of farmer compensation, the treasury and taxpayer (considering some difference in pattern of taxes and consumption) bearing a smaller part. Under direct payments, with price pegged at op_3 level in both cases, the consumer sector gains in real costs of food (more food available at lower prices) while the treasury and taxpayer bears the greater burden of compensation.

If, however, direct payments are placed on a lump-sum basis, and are not tied to magnitude of output, the total treasury outlay required is only $op_3m_6q_1 - op_2m_2q_3$ (as compared to $p_1p_3m_3m_5$ where direct payments are based on a per unit basis to provide the previous price level) where the goal is simply that of providing producers with revenue at the previous level. For lump-sum compensation in this manner, the treasury or taxpayer bears the full burden. The method will cost the treasury less than price supports and storage, where the latter (1) involves storage over a long period of high storage costs and (2) there is no close "salvage value" in use of stocks. Price supports and storage can cost less than lump-sum compensation if stocks need not be carried long and have demand in outside markets with sale at only slight reduction of price below p_3.[14]

For one comparison let us return to the supply and demand equations in (11.1) through (11.4). Under lump-sum compensation to guarantee the same revenue after change in supply and demand, the required public outlay is $.017a^2$. (See previous discussion.) Now suppose that price support and storage are used to maintain the original price level of $.1a$ in Table 11.1. Since farmers are expected to produce $.960a$ at this price level, a quantity of $960a - .8a = .160a$ must be taken from the market and stored to guarantee $.1a$ price. The public outlay to do so is $(.160a)(.1a) = .016a^2$. This amount for public acquisition of stocks is less than the $.017a^2$ required for lump-sum payment. The public acquisition will cost more than lump-sum compensation if storage costs and sales loss exceed this difference of $.001a^2$, but less if storage and sales costs are below $.001a^2$.

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[14] One aspect of resource imbalance, in a conventional sense, also should be mentioned. With lump-sum direct payments and oq_3 output, aggregate allocation of resources would be more consistent with technology, factor supply conditions and consumer preference than price support-burning or storage-price support resulting in $oq.$ output in Figure 11.2.

SUPPLY CONTROL

If the public desires compensation transfer for agriculture geared to an intermediate goal of a previous or other price level, and wishes to minimize the treasury costs, the most efficient method is supply control. In Figure 11.2, if output is restrained to oq_2, price level of op_3 is retained. No product moves into storage and the only costs involved are administrative. This compares with treasury costs of: $p_1p_3m_3m_5$ if compensation is on a per unit direct payment basis to guarantee op_3 price level, $q_2m_7m_3q_4$ plus storage costs if compensation is through support price and storage and $op_3m_6q_1 - op_2m_2q_3$ if compensation is through lump-sum payment to guarantee previous total revenue.

We have been discussing treasury costs only. Obviously some one pays the higher price in both cases: in supply control, the higher food cost is distributed over food consumers, roughly in proportion to expenditures on food; in direct payments, the subsidy is distributed over taxpayers, roughly in proportion to tax payments. In the former, supply control, cost tends to be retrogressive relative to consumer living level; in the latter, it is more progressive to consumer income. Without supply control, equilibrium consumer outlay for product is $op_2 \cdot oq_3$, with supply control and old price it is $op_3 \cdot oq_2$. The consumer pays the difference. Under direct payment by lump-sum method, the difference between $op_3 \cdot oq_1$ and $op_2 \cdot oq_3$ is paid by the taxpayer. Given a society goal of compensation and "peg" to the old price level, which is best? The answer depends on the criterion for evaluation. If the objective is to obscure the difference through the market, as is done by other firms and industries which manage prices and output, if value orientation says that transfer has to be through market mechanism and if there is no negative value orientation to controls, supply management would be selected. If transfer need not be covered up by market mechanism, if producers greatly value freedom of decisions and of planting and have no objection to direct subsidy, if it is believed that cost should be borne progressively with income of taxpayers rather than progressively with food expenditures by consumers, and if preference is for a system allowing resource allocation best paralleling competitive markets, direct payment of "lump-sum" nature would be selected.

Method of Supply Control

Methods of supply control can be many, ranging from tight restraint on inputs to tight restraints on output, or modest approaches to either. In a welfare economics and values context, the major division in control programs is between compulsory and voluntary programs. Freedom of decision can be considered a commodity competing with level of income: Some farmers have lower income under the aggregate freedom which accompanies greater output and lower prices in the market. But other farmers have greater income under aggregate freedom, their ability to out-compete the masses causing the two "commodities" to be technical complements.

The fact that these two distinct groups persist gives rise to much conflict over farm policy. To one group, more supply control—less freedom—means greater income. To the other group, more freedom—less supply control—means greater income. Hence, to move to either more or less freedom is equivalent to a move along the contract curve in Figure 8.1. Economics has no gauge to indicate that more freedom to one group and less income to the other group, or more income to one and less freedom to the other, guarantees aggregate welfare gain. However, supply control programs can still be organized in a manner allowing movement to Pareto optima, without forcing a value judgement or necessity for utility measurement, as long as an "outside group" (taxpayers or consumers) provides method and funds of compensation and wishes to effect it. Here the rule is: make certain that no one is made "worse off," while some are made "better off." Voluntary supply control is specified over compulsory supply control under this rule. The condition specified can be attained by viewing production control in the general framework of supply: Individuals are able to sell their opportunity to produce the commodity, supposing that they can retain or market this opportunity depending on the choice which provides greatest gain to them. Those who so select to sell their opportunity to produce do not have a choice imposed on them, as also is true of those who do not choose to participate and give up no freedom.

This route to compensation and supply control cannot give rise to battle over trespass on freedom or utility level. The system is efficient also in the sense that it considers closeness of alternatives or marginal substitution rates, and also draws out those resources of lowest productivity in farming. It also provides for attaining a positive level of output reduction at lowest cost, by taking first those who offer it at lowest price. But on a purely voluntary or "negative supply" basis, it must relate to resources. If a farmer sells his "right to produce commodity only," as attached to his person, and moves out while another takes over his land and capital, supply restraint is not attained. But in the concept of supply, any magnitude of output reduction desired—any degree of restraint on output through input reduction—can be attained depending on the level of price paid for this "product."

While U.S. farm policy has had output restraint as a major element since 1930, the effort has always been so feeble and half-hearted that it has never been of noticeable effect—not even in keeping up with the rate of supply advance from technical change. The two programs of American society, of investing in research and education to increase output and in supply control to reduce output, appear to present an interesting conflict in goals. However, as is pointed out in Chapter 16, they actually can serve as consistent means of promoting economic development while giving farmers equitable opportunity to share in the growth to which they contribute.

Previous attempts to reduce output have been on both a voluntary and compulsory basis. Marketing quotas on wheat, acreage allotments on tobacco and similar restraints voted on other crops were examples of compulsory restraints in the 1950's. Acreage allotments over a wider range of crops in the 1930's represented an earlier attempt. Marketing associations have sometimes been able to work out successful output restraints for particular commodities; as have dairy farmers in selected areas under federal milk marketing orders. Voluntary participation in the "supply concept" was represented by the soil bank initiated in 1956, with bid by farmers for the rate at which they would withdraw part or all of their land from production. The massive public effort has been output control resting on land input. Programs of the past have variously been those requiring rigid acreage quotas applied to all farms (as in wheat and tobacco), those encouraging fractional withdrawal of acreage from production by all or millions of farms over the entire nation, those allowing withdrawal of whole farms over the entire nation and those allowing whole or partial farm withdrawal in concentrated regions.

The main "input and output control" attempted since 1930 has been to shift part of the land from basic crops on millions of farms. Land could be shifted from "basic or commercial" crops of the region to those not so classified. Cornbelt farmers could withdraw land from corn and plant it to soybeans or grain sorghums. Plains farmers could shift from wheat to feed grains. Cotton farmers could shift to feed and other crops. Programs of this type have no real basis for being called control programs. They had some little effect in reducing surpluses of wheat and cotton relative to absence of a control program. However, they also diverted part of the surplus from these crops to an even greater surplus of feed grain.

Under this type of program, we find the following results between 1945–49 without control and 1954–58 with controls allowing shift among crops: Wheat acreage in the Northern Plains dropped by 10 million acres between the two periods and feed grain acreage increased by 2 million acres. A decline of 25 percent in cotton and wheat in the Southern Plains was accompanied by a 12 percent increase in acreage of feed grains. For the United States, wheat acreage decreased by around 20 million acres and cotton decreased by nearly 5 million acres. However, total feed grain acreage increased by around 10 million acres, even though corn decreased by 10 million acres and a considerable amount of land shifted to urban and forestry uses.

These control programs only caused a greater "swell" in the surpluses of feed grains, while relieving slightly the pressure, but not the surplus, of wheat and cotton. Even in the Cornbelt, diversion of land from corn to grain sorghums and soybeans partly or entirely nullified the reduction in corn acreage. Studies show that for typical rations, 1 pound of soybean oilmeal has a marginal rate of substitution of 2.7 pounds of corn in a hog ration, 2.5 pounds in a broiler ration and 2.3 pounds in a turkey ration.[15] Feeding trials show that a pound of grain sorghums substitutes for approximately .9 pound of corn. With substitution rates of this

[15] Iowa Agr. Exp. Sta. Bulletins 409, 442, 443 and 444. Also see Earl O. Heady and John L. Dillon, *Agricultural Production Functions*, Iowa State University Press, Ames, 1961.

magnitude, control programs which shift acreage on many farms from one feed grain to another, and actually increase feed grain acreage in some regions, have no logical basis for being called control programs.

Even programs which allow diversion of land from grains or row crops to forages, with the latter used for livestock as allowed in early decades of attempted supply control, do not necessarily promise reduction in livestock output. An important question in the feed grain economy is whether land diversion schemes reduce livestock output, rather than whether they simply reduce feed grain quantities. The very great majority of feed grains is utilized through livestock and the price of feed grains in the market, aside from price supports that peg them at other levels, is derived directly from the price and income, and indirectly from the quantity produced and the relative demand for livestock. We can illustrate the conditions under which programs to shift land from grains to forages will or will not reduce livestock output, a crucial quantity in the feed grain-livestock economy.

For a region such as the Cornbelt, an aggregate production possibility curve or relationship such as AB in Figure 11.3 exists. Basically, it represents, given the state of technology, all the possible combinations of grain and forage which can be produced from the supplies of the various soils in the region. To the right, this curve slopes upward, indicating that as more forage is produced from a greater proportion of land in forage and a smaller proportion in grain, more grain also will be produced. Over this range of outputs (rotations or land use) forage and grain are complementary. It has been shown from experiments that, in the absence of

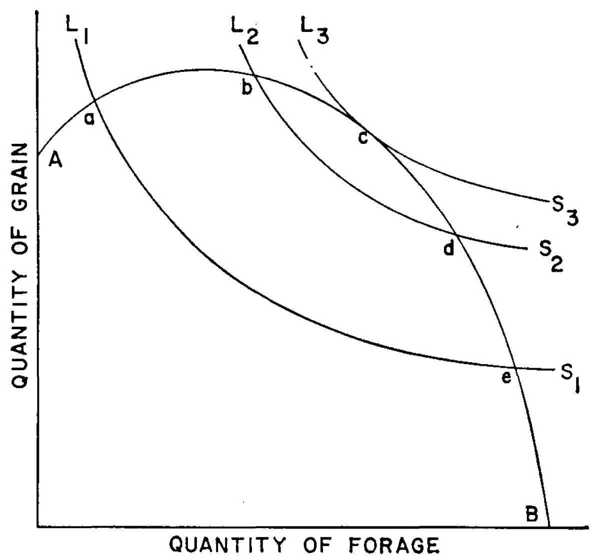

Fig. 11.3. Feed-Livestock Production Potential Under Land Shifts.

certain types and levels of fertilization, Cornbelt rotations which include some forages will produce more grain than if the entire land area is planted to corn or grains.[16] The percentage increase in yield per acre more than offsets the percentage reduction of grain acreage in the rotation.

But at some point in land use and cropping patterns, the relationship becomes competitive: A larger acreage and greater production of forage comes at the expense of grain output because per acre increases in grain yields (due to improved soil fertility, etc.) fail to offset the percentage reduction in grain acreage. A control program which causes an acreage shift from corn to forages, starting from a point on the upward sloping portion of the curve, would actually cause feed grain output itself to increase over a period of years—and thus would allow a greater output of grain and livestock from the same land area.

Sufficient data are not available to measure our current and past status in respect to these conditions. But it is entirely possible that the farms which mainly participate in voluntary control programs of the kind under discussion fall within this complementary range. Surveys indicate that rented, cash-grain farms are mainly attracted to these types of control programs. Rented farms with frequent tenant changes and imperfect sharing systems are the ones where continuous corn rotations are emphasized. Hence, land diversion programs which provide them with economic incentive for planting some forage can bring about an increased grain production (i.e. a movement up the positive sloped portion of the curve AB) from fewer acres over the rotation cycle.

However, presence of a complementary range is not required for livestock output to increase under grain acreage reduction. Even if grain output is decreased with greater forage output (the opportunity curve is negatively sloped only), a curtailment in livestock output is not guaranteed. A given amount of livestock can be produced with an infinite number of feed combinations. Thus for any particular level of livestock output, production contours or isoquants such as L_1S_1, L_2S_2 and L_3S_3 exist. Each of these represents a different quantity of livestock output and the various combinations of grain and forage which will produce this output. Thus the smallest livestock output level, indicated by curve L_1S_1, could be produced with the many combinations of grain and forage which could be "read off" the curve. The same is true for the larger livestock outputs indicated L_2S_2 and L_3S_3.

Suppose now that the land use pattern existing is one which gives the output combination of grain and forage indicated at point a on the production possibility curve AB. If these outputs are used for livestock feed, the level of livestock output indicated by L_1S_1 can be attained. Now, if a land diversion program is put into effect which increases both grain and forage to the level at point b, this same combination of feed will

[16] Quantitative indication of these relationships and production possibilities is included in Earl O. Heady and Harald R. Jensen, *Economics of Crop Rotations and Land Use*, Iowa Agr. Exp. Sta. Bul. 383.

allow the greater output indicated by livestock output curve L_2S_2. Current knowledge of substitution rates in crop production and livestock feeding would suggest that this outcome is physically possible and very likely, starting from the land use base on which our control programs have been projected. But even if the initial starting point were *b* on curve *AB*, in respect to grain and forage output, a land diversion program which changes the feed combination to the smaller grain output and the larger forage output indicated at point *c* would allow livestock output to increase from the level indicated by L_2S_2 to the level of L_3S_3. The curve L_3S_3 denotes, under the assumption of crop production possibilities and feed substitution implicit, the highest livestock output possible from the given land areas. The two curves are tangent, indicating that the marginal rate of substitution in crop production is equal to the marginal rate of substitution in livestock feeding.

Of course, if the land diversion were severe or large enough, livestock output could be reduced. Starting from point *a*, the combination of feed outputs would have to be shifted to the extent of point *e* before livestock production would be reduced. Starting from point *b*, the combination would have to be shifted to point *d*. The magnitudes of acreage change under programs of the past have not been great enough to attain combinations of the latter type, and studies suggest that they may have been within a range allowing a greater output of livestock, and probably a greater output of feed grains. In any case, the quantities suggested by Figure 11.3 need to be known in much greater detail than held true in implementation of previous production control programs if a program is to be structured to actually reduce grain and livestock output. To be sure that a grain acreage control program can reduce livestock output, the two sets of marginal substitution rates mentioned above need to be known. There is no basis to indicate that this knowledge has been available or used in programs of the past.[17]

In a later chapter, we wish to return to the "supply function aspects" of reducing inputs and outputs. Regional adjustment of agriculture, as suggested in Chapter 7, is ahead for American farming. It does, however, need to be structured to consider human resources other than those of agriculture in regions where important shift needs to take place in the product mix and in the input of labor and capital resources. Control programs in the "supply function" context of voluntary participation and Pareto optima can be used for these purposes. This complex has supply response operating or motivating through positive award and opportunity of people. Supply response, in withdrawing land and shifting product mix, functions similarly in an open market where returns are driven down and people give up farming for other pursuits. In the latter case, however, Pareto optimum need not be reflected because of the income reduction involved and the motivation is based rather on negative opportunity for people.

[17] For added notes relative to the effect of acreage control on distortion of production possibility curves, see Heady, *op. cit.*, Chap. 8.

Our discussion above has been in terms of input control. We now turn to output controls as in marketing quotas. Marketing quotas represent a compensation method, if we prefer to call it that, wherein the higher level of income, above that which would otherwise prevail, is distributed at a cost among consumers rather than over taxpayers. It is a method which requires small treasury outlay, as compared to surplus acquisition and storage or voluntary production control where participation is brought about by payments to effect withdrawal of land or other resources.

If price level op_3 in Figure 11.2 were the instrumental goal, under short-run supply and demand conditions giving op_2 price and oq_3 output, the objective of marketing quota would be to restrict output to oq_2, giving op_3 price. The gain in income would come through the market with no treasury costs except for administration and policing—the latter perhaps large for products such as feed and livestock. The system could be Pareto-better for consumers in the sense of giving them as much or more food per capita at equal or lower real price over time and also allowing technical advance so that fewer resources are required in agriculture and more of nonfarm products can be produced. In the Pareto-better sense for agriculture in aggregate, it could also give more of two things: more income than otherwise and allowance for freed resources under technical change to move to other industries and provide farm families with more of nonfarm products. But a question of distribution of gains and losses does arise within agriculture, in a manner differing from the "supply concept" of production restraint where only those who choose participate, those preferring freedom remaining outside the program. In the case of marketing quotas, all farmers would participate under compulsion, even though some value freedom over income. Thus the Pareto condition that "all are left as well or better off" would be negated for those with a high value on freedom.

Marketing quotas, as a means of income protection where farm production capacity exceeds demand potential, have been proposed for major aggregates of products. They are used by farmer selection in the case of milk, under milk marketing orders, as a means of restraining output to levels allowing attainment of particular price and income objectives. They also are used quite widely for nuts, fruits and vegetables, under marketing agreements and orders provided in state and federal legislation.

To illustrate how marketing quotas can simultaneously promote economic progress and allow benefit to consumer and producers, we resort to simple algebraic illustrations, employing a particular equation form (but with the same conclusions applying for other forms under the elasticity coefficients which surround agriculture). We suppose a single aggregate product and concern ourselves with the industry and not with firms. The analysis is short run in the sense of certain resource fixities and production restraints. Production decisions and income generation take place in a series of short runs directed towards the orthodox long run of economics, but highly linked and uniquely in existence. To simplify the analysis and ease the task of "following," we use numerical elasticities quantities, rounded in the neighborhood of some for agriculture in the short run of the 1950's.

The demand function is (11.6) where Q_d is quantity, P is commodity price and c is a constant.[18]

$$Q_d = cP^{-.4} \tag{11.6}$$

$$Q_p = \pi X^{.8} \tag{11.7}$$

$$X = \pi^{-1.25} Q_p^{1.25} \tag{11.8}$$

The industry production function is (11.7) where Q_p is output, π is a constant reflecting a short run of particular technology and resources specialized to agriculture and X is short-run variable resource. (See discussion of equations 1.1 to 1.5 for method.) From (11.7) we derive the resource requirements equation in (11.8), indicating the magnitude of factor needed to produce a particular output. Supposing that agriculture responds roughly to price stimuli, we derive the industry marginal cost function where P_x is the price per unit of X. Following, we derive the supply function in (11.9) where P is the price of product.

$$Q_s = .4096 \pi^5 P_x^{-4} P^4 \tag{11.9}$$

$$P_1 = 2.41^{.227} c^{.227} \pi^{-1.1365} P_x^{.909} \tag{11.10}$$

Equating demand (11.6) and supply (11.9) functions, we define the equilibrium price in (11.10). Substituting equilibrium price (11.10) into the demand function (11.6) provides the equilibrium quantity, Q_1, in (11.11) defined in terms of the original production coefficients and state of demand.

$$Q_1 = 2.41^{-.091} c^{.919} \pi^{.455} p_x^{-.364} \tag{11.11}$$

$$X_1 = 2.414^{-.114} c^{1.149} \pi^{-.682} p_x^{-.455} \tag{11.12}$$

Substituting Q_1 for Q_p into the factor requirements equation (11.8), we specify total inputs, X_1, in (11.12). The magnitudes Q_1 and X_1 refer to a given short-run state of demand and production technology.

A new short run arises, one step away from the first but related to it

[18] This constant c in (11.6) has the value below where N is population, I is per capita income, P_0 is price index for nonfood commodities (actually a series of such P_i would be desirable) and T is time to allow changes

$$c = rN^{b_1} I^{b_2} P_0^{b_3} T^{b_4}$$

in preferences not related to population, income, and similar variables. For the time being, however, we consider these variables to be fixed and define a particular short run in respect to food demand. We might consider the π in (11.6) to have the value below where the Z_i, except one being varied, are fixed in different magnitudes in the short run, with some at positive levels to represent a particular state of technology.

$$\pi = sZ_1^{\beta_1} Z_2^{\beta_2} \cdots Z_m^{\beta_m}$$

since certain resources remain fixed. We suppose the new production function to be that in (11.7) multiplied by Γ where $\Gamma > 1.0$. Also demand increases in this second short run through multiplication of (11.6) by λ where $\lambda > 1.0$. These continuous types of short-run change characterize agriculture. Resources with low mobility and reservation prices remain in the industry over a succession of interrelated short-run periods even though their return is less than comparable resources in other sectors.

Suppose marketing quotas are to be established allowing attainment of a prescribed price level and growth of income of farmers as they contribute to economic progress. Many levels of price would do so, but momentarily we select the equilibrium price in the previous period, namely P_1 as defined in (11.10). Substituting this price into the new demand equation, (11.6) multiplied by λ, the annual output, Q_2, allowed by the price target of (11.10) becomes that in (11.13).

$$Q_2 = \lambda Q_1 \tag{11.13}$$

$$X = \Gamma^{-1.25}\pi^{-1.25}Q^{1.25} \tag{11.14}$$

$$X_2 = \lambda^{1.25}\Gamma^{-1.25}X_1 \tag{11.15}$$

This level of output is used for our example as the aggregate quota for the product. Under the conditions set forth previously, it is the total production quota which, under the new demand, will give the price level of (11.10), even though technology has changed to that represented by the production function in (11.7) increased by Γ proportion. For the particular algebraic conditions, output or quota level is the old equilibrium output increased by λ proportion.[19] Given this annual quota level and the new resource requirements equation in (11.14), with the latter reflecting technological change between the two periods, the resource input under quotas is X_2 in (11.15). This input quantity will produce the quota in (11.13) but maintain the price level in (11.10). Hence, inputs and costs will decrease if technical improvement is sufficiently large relative to demand growth.

If Γ is larger than λ, inputs and costs will decline: consumer's food needs are met with fewer resources, and farm income can increase because of both increased total revenue (more product sold at the same price) and decline in total costs. Obviously, incentive to increase the magnitude of Γ relative to λ exists and economic growth is encouraged just as if quotas did not exist. But even where Γ and λ are equal, farm income can increase as demand quantity grows to (11.13). The actual standard of comparison for income gain from the quota system should not be that of output in (11.13) and input in (11.15), against those in

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[19] The relation of Q_2 to Q_1 grows out of the fact that Q_2 has the value in (a).

$$\text{(a)}\quad Q_2 = 2.41^{-.091}\lambda\pi^{.455}c^{.919}P_x^{-.364}$$

The relation of X_2 in (11.15) to X_1 exists because of (b)

$$\text{(b)}\quad X_2 = 2.41^{-.114}\lambda^{1.25}\Gamma^{-1.25}\pi^{-.682}c^{1.149}p_x^{-.455}$$

(11.11) and (11.12), with price geared at P_1 in (11.10). Instead it should be against the quantities which would arise under market-free equilibrium of price, output and input. These quantities of the free market are indicated later in (11.19) and give, under certain magnitudes discussed subsequently, a smaller profit than Q_2 output, X_2 input and price at P_1 level in (11.10).

Industry incentive in improving technology and promoting general progress could be greater than previously, since each improvement increases profit, whereas under market-free conditions and low price elasticity the aggregate effect of innovation is a short-run decrease in revenue and net income. With demand growing as indicated and price held at the level in (11.10), the amount of resources required in the absence of technical change would be (11.16), an amount always greater than (11.15) where technical improvement takes place.[20]

$$X_3 = \lambda^{1.25}X_1 \tag{11.16}$$

$$\Delta X = (1 - \Gamma^{-1.25})\lambda^{1.25}X_1 \tag{11.17}$$

Thus a contribution which farmers could make to general economic progress by improving technology, under the restraint that price be maintained at the previous equilibrium level, has been defined. This gain to society, ΔX, is the resource savings represented in (11.17). The savings of $1-\Gamma^{-1.25}$ proportion of resources, under technical improvement as compared to its lack, is attained in meeting the demand quantity of (11.13).[21] This proportion of resources is "freed," against no technical change, for other products: to allow society a greater total mix of goods and services, or for more of other products at lower prices. But farmers also have positive gain from this contribution to technical improvement and general economic progress. Four industry net profit equations can be defined which allow expression of this gain:

$$N_1 = P_1Q_1 - P_xX_1 \tag{11.18a}$$

$$N_2 = P_1Q_2 - P_xX_2 = \lambda P_1Q_1 - \lambda^{1.25}\Gamma^{-1.25}P_xX_1 \tag{11.18b}$$

$$N_3 = P_1Q_2 - P_xX_3 = \lambda P_1Q_1 - \lambda^{1.25}P_xX_1 \tag{11.18c}$$

$$N_4 = \overline{PQ} - P_x\overline{X} = \lambda^{1.146}\Gamma^{-.217}P_1Q_1 - \lambda^{1.149}\Gamma^{-.682}P_xX_1 \tag{11.18d}$$

These include (11.18a) which is industry profit before change in demand or technology; (11.18b), profit with change in demand and technology but price retained at the original equilibrium level; (11.18c), profit with

[20] The magnitude in (11.16) supposes the new demand as a basis of indicating resource savings and one Pareto-type of gain to consumers where technological change does take place as against that where it does not. Under the price elasticity conditions of the farm industry, greater aggregate income from demand increase would come with no technical advance.

[21] Our comparison is in meeting the demand quantity in (11.13), where we suppose growth in consumption with population and income, first where we do not have technical change as in (11.16) compared with the case where we do in (11.15).

change in demand, no change in technology and price retained at the original equilibrium level; and (11.18d), with change in demand and technology and with price allowed to move to a new equilibrium or market-free level consistent with the new demand and supply functions. (In the first three equations, commodity price is at the P_1 level, but in the fourth equation it is at the level of the new equilibrium of the market under change in technology and demand.)

Now comparing (11.18b) and (11.18c), with society gaining $1-\Gamma^{-1.25}$ proportion of saving in resources under the former as compared to the latter, farmers have this net gain: Gross income is the same but costs are less by $1-\Gamma^{-1.25}$ proportion in (11.18b). Hence, society in "freed resources," and farmers in cost savings, gain by equal proportions to obtain a given output level, as technical change takes place and quotas hold price to the original level. We have, then, a scheme which allows farmers to contribute to general economic progress but to gain from the process, rather than to be penalized under elasticity conditions of the market. There would be great incentive for farmers to adopt a new technology, saving costs and resources because the quota would restrain output sufficiently to maintain price level and insure profit.

Output can be increased to match population growth and still allow gain in farm income. The price target need not be held at the prior equilibrium level to benefit farmers from contribution they make to economic progress. If the quota were managed properly, output could increase, absolute inputs could decrease, price of food could decline and farm profits could increase under sufficient rate of technical advance. An income goal, rather than a price goal, could be used with the price and quota level set accordingly. This modification would allow a degree of flexibility since consumers could "remix" their food and nonfood commodities, while still guaranteeing an income gain to farmers for their contribution to economic progress.

We have been comparing the gain to consumers under a situation where technical change does or does not take place. Dropping this comparison for the moment, we return to the case where demand and supply are (11.6) and (11.7) respectively. Before technical change, we have the equilibrium price, output and input of (11.10), (11.11) and (11.12). After technical change and demand increase and price held at (11.10) level, output and input are (11.13) and (11.15) respectively. Now obviously, if Γ is greater than λ, techniques improve at a rate faster than demand; total inputs will decline although "demand quantity" has increased to (11.13). Consumers have more commodity at lower total input requirements, allowing some resources to be shifted to nonfood commodities. Farmers have more gross revenue from the same price and greater output and increased net revenue for this reason and because cost of inputs also have decreased. The gain, allowing an increment of utility to both consumers in general and farmers, is of Pareto type. The decrease in resource requirements and the increase in farm income represented can cause both groups to "be better off."

In effect, we have moved from point m in Figure 8.1 to a point within the shaded Pareto area. Neither, of course, is in "best off" or optimum position in the sense of movement along a contract curve and gain at the expense of the other. Farmers would be "best off" if they formed a monopoly moving output and input below and price above levels such as those specified in (11.18b).[22] Consumers would be "best off" or in higher utility position (if great degree of monopoly does not interfere with resource allocation in the economy generally and they place no disutility on the relative income position of farmers) under a market-free equilibrium for the changes in technology and demand such as that represented in (11.18d), which has the corresponding prices, output and input in (11.19).

$$\bar{P} = \lambda^{.227}\Gamma^{-1.137}P_1 \tag{11.19a}$$

$$\bar{Q} = \lambda^{.919}\Gamma^{.455}Q_1 \tag{11.19b}$$

$$\bar{X} = \lambda^{1.149}\Gamma^{-.682}X_1 \tag{11.19c}$$

As we see from these quantities and from (11.18d), revenue and net profit will decline if Γ (technical change) is large relative to λ (demand change). The value of Γ must not be greater than approximately $\lambda^{1.7}$ if revenue is to remain at a level as high as in (11.18a) before technical change. If Γ grows more rapidly than this where prices are market free, consumers will gain in more food at lower prices but producers will sacrifice in income. Price will decline below the level of (11.10) if Γ is greater than $\lambda^{.2}$ But obviously, quotas could be arranged which let price drop below (11.10), with consequent gain to consumers, but retain net income gain to producers in the sense that supply is held in check (so that in effect Γ is less than $\lambda^{1.7}$).

But just as consumers would be best off if prices and output were turned loose in the market, they would similarly be best off if prices in the steel, petroleum, electrical equipment and other industries were flexible and market free, rather than managed, and if there were more firms and greater competition in these industries. Under inability of interpersonal utility comparison, we cannot specify an increase in total utility in either of the two cases: where farmers are made best off by forming a monopoly, but at a cost to consumers in level of price and pattern of resource allocation; and where consumers are made best off by market-free prices and output, but at a cost to farmers in income. Increased aggregate welfare can be guaranteed, however, where both groups are made better off. Both can be made better off, consumers

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[22] The market price, quantity, and input magnitudes corresponding to (11.18b) are (11.10), and (11.13) and (11.14) respectively. The market price quantity and input magnitudes for (11.18c) are respectively (11.10), (11.13) and (11.16) where technical improvement is not supposed for (11.16). The price output and input quantities corresponding to (11.18a) are those in (11.10), (11.11) and (11.12).

through resources "saved" to be used elsewhere (or even in reduction of food price) and farmers through more revenue and lower costs, for the conditions outlined above.

Marketing quotas to accomplish income gain as above for farmers, but still allowing economic progress for consumers, would involve no treasury costs except for administration and policing—as in marketing orders applied variously over the nation in milk and as applied particularly to fruits and vegetables in California and Florida. They would parallel or be similar to the "self-administered" price and output programs used in major nonfarm industries, claimed to help profits and safeguard against the vagaries of "over competition." Progress does take place under marketing orders and "self-administered" plans of major nonfarm industries, as mentioned in several previous chapters. But large treasury cost is not involved, as in producing surpluses and storing them for agriculture. The consumer, rather than the taxpayer, contributes the difference in major nonfarm industries where prices are not market free.

Allocation by Regions and Persons and Distribution of Gains

Marketing quotas for inputs or outputs can be set on a historic basis with attachment to land, as they have been for tobacco, wheat, cotton and other crops. In this case, surplus profits, or returns to factors above their supply price considering their particular attachment to agriculture, become capitalized into land values. The historic apportionment is "inefficient" in the sense that it restrains technical advance on farms and regions where it comes to have special advantage (but is no more "inefficient" than in the quota systems which emerge under oligopoly, "follow the leader" and market-sharing arrangements of other industries).

Quotas also can be attached to the person or business apart from its resources, as is often done under marketing orders for fruits and vegetables. They can be attached to a particular resource, such as cows in the milk marketing orders of California where the quota takes on value in sale of cows. It is not necessary, however, for them to be maintained on an historic basis. They can be made negotiable, as can be true of any kind of allotment system even if resting on resources, with sale in the market.[23] Accordingly, more efficient farmers or regions can purchase them from the less efficient, allowing production to become concentrated at the point of greatest comparative advantage. Similarly as technical change breaks out more rapidly in particular regions, these regions can purchase quotas from other regions.

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[23] See W. W. Cochrane, "An Appraisal of Recent Agricultural Programs in the United States," *Jour. Farm Econ.*, Vol. 39, for an early discussion of negotiable aspects. For other aspects of quotas see R. L. Clodius, "Opportunities and Limitations in Improving Bargaining Power of Farmers," Center for Agricultural and Economic Adjustment, *Problems and Policies of Commercial Agriculture*, Iowa State University Press, Ames, 1959; H. W. Halvorsen, "Direct Management of Market Supplies " *Economic Policies for Agriculture. Implications of Four Selected Alternatives* Joint Economic Committee, Washington, D.C., 1960.

In a manner, this scheme, when applied to either output or input quotas, has an advantage in helping some farmers move out of agriculture. Selling their quota value, perhaps in discounted magnitude approaching (11.5), they have a lump-sum quantity to finance the shift to other products or to move out of agriculture. As a method purely for compensation purposes, marketing quotas (or input allotments) with negotiable characteristics do not negate the market mechanism in allocating resources: They allow more efficient farmers and regions to specialize in commodities, encourage improved technology and reduced resource requirements for a given output, allow fund acquisition and movement from agriculture by those who select to acquire their compensation in lump-sum fashion and migrate rather than remain in farming. Prices and the market would still have as much power over these adjustments, and others. But aggregate output of farm products would be restrained below short-run level prevailing under market-free prices.

The problem of determining quota restraints for either inputs or outputs, depending on the type of supply control, is difficult. Without some precedent, it involves pure power politics, perhaps with "semi-equilibrium" and nonequity sharing as explained for equations (9.9) through (9.13). This likelihood typically leads to a historic start. Negotiable quotas for inputs or output allows eventual departure from this pattern, however. But even though the initial allocation problem is difficult and political, sometimes because it represents conflict along the contract curve in Figure 8.1, it seems to be attainable in many instances—even if not always on an historic basis. It has been worked out with degree of placidity allowing "control of marketings" under fruit and vegetable marketing orders, in major milk markets and in informal, "self-administered" market-sharing arrangements of selected nonfarm industries.

Evidently "rules of the game" can be established to allow distribution of some gain to all members of a producing group. Still, conflict and inability to bargain except along a contract curve may be one basis of major conflict in application of effective compulsory marketing quotas or input restraints to commodities such as hogs, wheat and feed grains. Those who oppose quotas may obtain a much larger share of market revenue through lack of controls; those who favor them may gain a larger share by controls allocating a portion of input or output restraints to each producer. It may be this more than the freedom issue which causes conflict in selected cases of quotas. Few rumblings of lack of freedom are forthcoming from those highly commercialized farmers who produce under quota allocation by marketing orders of fruits and vegetables in California or in the major milksheds over the nation. Neither do all large oil firms decry lack of freedom under the various quota systems which they employ. Negotiability of quotas or input allotments removes, of course, freedom restraint in the sense of limits to production: acquisition of quotas through the market allows any farm or region to up its output.

Transfer of Quotas and Allotments

If the only ingredient of agricultural production were a wave of the wand of Demeter, Goddess of Agriculture, complete freedom to produce would be accorded anyone in her favor. But this is not the nature of agriculture, and freedom to produce in unrestrained manner is lacking for many persons who would be farmers, as well as many who are. Right to produce exists only when farmers purchase it, through obtaining land under title of ownership or under monetary contract for its leasing. Too, capital in its agricultural forms must be purchased to use with it.

After these titles, rights, contracts and prices are attained and paid, farmers have unrestrained right to produce in the quantity desired. Having a basic input or output restraint in quota, but being able to enlarge it by purchase, they would be operating under a somewhat similar regime of freedom. In both cases they must pay a price to obtain the right and flexibilities of quantities arising from their decisions. Quotas do not place restraint on freedom of production, but only require a price for unrestrained production and greater sharing of market revenue where they are negotiable. This is true for the quotas going with cows in the Los Angeles milkshed or with land in Carolina tobacco areas. In the absence of any quotas, farmers are free to produce any quantity they wish or can from a given collection of resources and a particular technological state. Under absolute quotas, they are free to use as few resources as they wish or as is possible, given the quota and the technological possibilities. Both are freedoms: one in the case of maximizing against upper restraints in resources and inputs, the other in minimizing against upper restraint in output.

Negotiable output quotas or input allotments provide a setting not unlike the "self help" or organizational procedures employed by nonfarm industries where price competition does not prevail exactly and market-free prices do not reign. It is obvious in industries such as steel, petroleum, automobiles and others that "homogeneous short-run" price comes to prevail and competition is not typically over price. Price is established and competition is in share of the market, or in new products and technology. Firms can buy part of this market quota, the total consumer demand at the established price, through greater advertising, public relations and various promotions and investments. They can sell shares of the market by investing less in these activities. But the fact stands that the process is one of acquiring market share at a cost, where aggregate quantity and market price are more or less given, and is not unlike the sale or purchase of negotiable quotas and allotments.

While much conflict over quotas stems from competing economic interests of various groups within and surrounding agriculture, it also must be true that some resistance is value oriented. Most university professors have "built-in values" causing them to vigorously denounce any force restraining "freedom to produce." Farmers are not always dissimilar, even though the product is quite different.

Quotas Under Market Orders

Marketing quotas are not foreign to the American farm scene. They have had widespread use over particular commodities and locations. Too, negotiable features have prevailed for some time, tied usually to such resources as cows and land. Marketing quotas best apply and have had widest use for commodities where the market is concentrated to a particular point with opportunity to control the product which flows into it, or where the adapted production area is small with facility in organization and control agreement by producers.[24] It works least well where both the markets and producers are large and are dispersed widely over the nation.

Marketing agreements and orders had their forerunner in cooperative marketing associations of the 1920's. These groups, depending on voluntary organization and control, found that without enabling legislation, they were unable to attain the desired controls in quantity and quality. Producers who participated held up the price umbrella for those who did not participate. Evidently, legislation and an extent of governmental participation were necessary for success of marketing orders to control quantity and quality.

Federal and state legislation has provided this extent of government participation for commodities covered. Federal legislation was first provided in the Agricultural Adjustment Act of 1933. It was extended under the Agricultural Marketing Act of 1937, with the volume and price connotation as follows: " . . . through exercise of powers conferred upon the Secretary of Agriculture . . . to establish and maintain such orderly marketing conditions for agricultural commodities in interstate commerce as will establish, as prices to farmers, parity prices. . . . "

Federal legislation provides for "orders with marketing agreement" and "orders without marketing agreement." Marketing orders are not forced forever on a group of producers, nor are they allowed to select just their desired course of action and no other. They can vote orders out, just as they can vote to initiate them. A *marketing agreement* is a voluntary arrangement between an authorized government agency and individual producers and handlers of a commodity in a particular area, with terms of the agreement binding only on those who sign it. In contrast, a *marketing order* is uniformly applicable to all producers and handlers of the product once it has been voted in by the above rules. Marketing orders have come to dominate marketing agreements, although the latter set the historical precedent. A federal marketing order, the mechanism for volume control, can be initiated only when handlers with 50 percent of the volume handled and two-thirds of the producers in the specified area

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[24] For detailed description of market orders and agreements, their extent and particular implications, see S. Hoos, "Economic Implications of California Agricultural Marketing Programs," *Jour. Farm Econ.*, Vol. 38; *Contribution of Marketing Agreements and Orders. Policy for Commercial Agriculture, Its Relation to Economic Growth and Stability,* Joint Economic Report, Washington, D.C., 1957.

approve. In terms of population, milk price control thus extends to a major portion of the nation. Its pricing is dominated by public regulation highly similar to that of public utilities in general.

In addition to federal legislation, nearly two dozen states have marketing programs with somewhat similar purpose. California had initiated such legislation as early as 1933 and has moved forward on the broadest front in terms of farm commodities and number of producers included under marketing agreements designed to have impact on quantity, quality, price and other provisions affecting the supply of the demand for, and the orderly marketing of, food commodities.[25] One reflection of this legislation and its purpose is included in the following statement by the director of the California Department of Agriculture:

One might think that this remarkable increase in farm productivity would enable farmers to become extremely prosperous. However, that is not the way it has worked out. The net farm income has decreased by 30 percent since 1951, while urban consumers have benefited by getting more food of a better quality, at a cheaper price. . . . These figures are reflected in a comparison of the years 1929 and 1958 for quantities of food which could be bought with one hour's wages. . . .

	1929	*1958*
Loaves of bread	6.4	11
Pounds of steak	1.2	2
Pints of milk (delivered)	7.8	16.8
Pounds of butter	1	2.9
Pounds of bacon	1.3	2.7
Dozens of eggs	1.1	3.5
Pounds of potatoes	17.7	33.8
Dozens of oranges	1.3	2.8

Even if the individual farmer could make exact production and marketing plans and carry them out, he would not be able to make a significant impact on the supply or demand of the market in which he sells. Because of the infinitesimal proportion of the total supply of a commodity produced by any one farmer, he can not, by himself, bring about a higher selling price by cutting back his production, for this would not cut back the total supply by any measurable amount. Moreover, his output usually becomes a small and unidentifiable part of the supply marketed under the brand name of some other person. For these reasons, the individual farmer, unless he takes joint action of the kinds I will mention later, has little or no opportunity to influence the demand for his product. . . . California farmers recognize these problems and have adopted methods of working together to improve their marketing positions. One kind of group action by farmers is the use of the cooperative association as a bargaining agent in selling their farm products. . . . There are several such associations in California which have attained a very important position in the determination of prices and other terms of sale by negotiations on behalf of their members. . . . Special legislation and the services of governmental agencies have also been utilized. Under the authorization of the California Marketing Act, agricultural producers are taking joint action on marketing problems by adopting marketing order programs. . . . Such programs may be designed to control the volume or quality of the product marketed, to provide for advertising and trade stimulation, to control unfair trade practices, and to

[25] For detailed explanation of California legislation and market order arrangements see: *California Agricultural Marketing Programs*, Calif. Dept. of Agr. Bul., Vol. 45; *The California Marketing Act of 1937*, Extracts from the Agricultural Code of California, Revised to September, 1959; and Sunkist Growers Inc., *A California Adventure in Agricultural Cooperation*, FCS Circular 27.

provide for research. . . . At the present time, there are 34 California marketing programs, several of which have been in operation for more than 20 years. . . . In conclusion, I feel that the farmer cannot prosper and our independently operated type of agriculture cannot be maintained unless there is brought into existence a condition of planned supply.[26]

Evidently, marketing agreements and controls work adequately and to the income advantage of producers where they are used. This fact may cause producers such as those producing milk in the East and fruit and vegetable producers in the West to have little interest and some scorn for the types of supply control and surplus storage programs used since 1930 for grains and cotton.

With a marketing order, an industry or group of producers provides means for regulating and affecting the marketing of a commodity. Under quantity control, quotas can be allocated to producers—as they are in fact. Certainly the basic purpose of marketing orders is to regulate quantity moving into market channels and price to producers, although provision also is included for quality regulation, advertising and promotion, research and similar activities. Federal marketing orders have orientation to quantity and quality control for the specified products, but state orders more generally include the other features and not all state programs allow quantity control. For example, California legislation covers more than two dozen commodities but with volume or quantity control only on such commodities as early apples, asparagus, lemon products, dry-pack lettuce, lima beans, cling peaches, fresh fall and winter pears and Delta white potatoes. Marketing orders generally differ between milk and other commodities, with direct price setting for milk, accompanied by supply restraints in quantity and/or quality regulations. The price effects are brought about indirectly through supply restraints or quotas for other commodities. Quantity restraint is reflected back to producers in quotas of commodities which they are allowed to market, with acreage adjusted accordingly or a portion of the crop destroyed if output exceeds marketing quota of producers. Hence, plowing under of lettuce and destroying peaches is a common occurrence for California producers. While the stated objectives of marketing orders and agreements are various, the real intent is to control supply, expand demand and improve returns to farm producers.

CONTROL, MARKET POWER AND PARETO OPTIMA

Supply control under marketing orders can be looked upon partly as a general compensation scheme as outlined previously, with Pareto-better conditions allowed in retention of some gains of progress by producers but with relative resource savings from new technology and lower real prices for food passed on to consumers. As much as anything perhaps, they are means of placing market or bargaining power in the hands of producers who otherwise, as "pure competitors," operate under the in-

[26] Charles Paul, Director, California Department of Agriculture, Speech to Clovis, Calif., District Chamber of Commerce, March 23, 1961, "California's Stake in Agriculture."

come instability characteristic of a pure competition market where *ex ante* expectations and plans lead to mass *ex poste* "overages" in upward and downward swings of output.

In addition to bargaining power with some control on market volume and price, marketing orders have been effective in lessening instability stemming from extreme seasonality of production. Not only has greater price stability been attained within the year, but also that growing out of price wars and fluctuation through the commodity cycle has been lessened. There is no indication that marketing orders have been used to create pricing conditions characteristic of pure monopolies for the selected commodities to which they have been applied. This extreme is impossible for individual categories of food commodities. There are too many substitutes for a particular vegetable, fruit or nut crop, just as there are numerous substitutes for industrial commodities produced under oligopoly and near-monopoly conditions where extreme price level encourages substitution of other materials and services. Not only does one food commodity have substitute in other products, but also substitute exists in the same commodity produced at other locations. The effects of long-run price competition in major production allocations cannot be reduced effectively by marketing orders, although they can bring an important degree of short-run stability to particular farm sectors. If one group of producers is "too successful" in attaining price goals through marketing orders, it is almost certain to be faced with competition (1) from producers in other regions and (2) from other commodities which compete in consumption. Since marketing orders best apply for perishable commodities moving directly to consumption or processing, produced by farmers with a homogeneity of interest located in a small area, they have much less promise for commodities such as wheat, feed grains, cattle and hogs. In the realm of feed grains, which serve as both inputs and outputs, the task of policing marketing quotas would be complex and costly if, in fact, it can be done.

Conflict in Restraint

Some detail has been added in this section on marketing agreements and orders to emphasize their existence on a fairly widespread magnitude, and as indication that there is great variance as to the expressed kind and degree of decision freedom desired by American farm producers. In addition to output and quotas of the type represented by marketing orders, there are also those represented by input quotas which producers of wheat, tobacco and cotton have voted upon themselves.

Imposition of these supply controls on themselves by farmers and commodity groups under the voting mechanism, while other farmers and organizations vigorously protest output and input restraints, have various implications, one being that a conflict of interest exists along a contract line such as that of Figure 8.1. And this is very likely true for commodities which have wide spatial adaptation and changing comparative advantage by region. In these cases, quotas distribute gains to some and potential or relative losses to others, without opportunity for trades. Attainment of the loci of tangency of indifference curves as in Figure 8.1 means that all cannot be lifted simultaneously to preferred positions. Quotas can be favorable to farmers with few resources and no volume expansion possibilities, and unfavorable to those with capital for extension of supply. (Some opportunity in expansion is still allowed under numerous marketing orders and under all quota or allotment systems wherein sale and purchase of resources or output restraints is possible. As explained in Chapter 14, other output quota systems may distribute the gains of control more in the direction of large producers.)

Conflict along the loci of tangency also occurs for commodities such as feed grains: While some farmers are sellers of feed as a commodity, others are purchasers of it as a resource. Also, milk producers in feed deficit areas of the East can gain from milk marketing orders which support and control price and volume of this commodity, but "have their freedom trespassed" where similar restraints are applied to feed grains. Finally, feed grains are grown widely, as general substitutes for other crops which may come under quantity or volume controls. They thus become the "general commodity of trade or compensation" (a method of "side payment") among regional groups which, in effect, give up some of one commodity to gain more of another. Hence, each regional group which gives up acreage of cotton, wheat or vegetable and other commodities moving directly to consumers wishes to have more acreage of feed grain, as in giving up some of X to obtain more of Z in Figure 8.1. Feed grains thus become the outside commodity (along with price support and direct subsidy) used to compensate the group where it otherwise would be made "worse off" in restricting acreage and output of its particular commodity. But this procedure, with feed grain as the trading commodity or method of "side payment," does not give recognition to all groups in position of being reflected gains and losses under such trades.

Besides direct economic conflicts of the type outlined above, differences in values per se might help explain the extreme conflict over supply control and freedom reflected by farm groups: Value differences do not themselves require an "either or" choice. The two sets of indifference curves in Figure 8.1 can have entirely different slopes, but still allow exchange and increase in welfare for both individuals or groups. But this is a case of continuous functions with divisible quantities for substitution and rearrangement. The real value conflict arises less under these circumstances, but more under cases where resources are not involved, the opportunity is discrete and only "one or the other" state can exist. The "belief or not" in a particular God is such a case. Does the supply restraint-freedom conflict for U.S. agriculture reflect discrete and ideological difference of the latter type? Or, is it more nearly the economic interest conflict outline previously?

To the extent that individual values alone are involved in quota restraints on supply, procedures may still be possible which allow Pareto optima in the sense of "making no one worse off" because of the weight he attaches to his own "freedom to produce." Quotas could be established for those who prefer more income even at loss of some freedom. They would then receive the market price for their sales, plus a direct payment from the public. Those who select more freedom would not be given a quota and they would receive return equal only to the market price for the commodity. But the equity of the procedure might still be questioned: Quotas would have to be continuously restrained for the first group to offset growth in supply by the second group, if the system served to "hold up the price umbrella."

Pareto-Better Mixes in Farm Policy

The historical extent of input and output restraint used in U.S. farm policy may well be oriented to Pareto optima. Under democratically selected mechanisms, those preferring less freedom and more income or stability have been able to select output restraints. Hence supply restraints exist for products such as tobacco, milk, cling peaches and dry-pack lettuce. Other farmers who prefer freedom over income maintenance have been allowed to select more of the former and less of the latter (and some have gotten more of both because of their advantage in capital and managerial possessions). Then, it is entirely possible that the maze of farm policy of 1930–60, with its great variance in control and flexibility of production as selected by producers, was highly consistent with welfare maximization or improvement over the distinct groups which make up the total of the U.S. farm community. Variance in policy over commodities and locations, rather than homogeneity, likely characterizes Pareto optima and welfare maximization. In this sense the heterogeneous and apparent piecemeal pattern of policy of 1930–60 was not necessarily incongruous, except in those instances where it did not attain income or freedom objectives for those producers selecting a particular policy element.

FOCUS OF COMPETITION AND LONG-RUN SOLUTIONS

Input or output restraints to stabilize markets and effectuate compensation probably are favored over direct payments by some producers because they are less apparent and invite less public scorn and resistance, just as is true for nonfarm firms and industries which use managed prices to attain stability and insurance of resource return. Publicly regulated prices in the case of milk marketing orders which control volume, through quotas for vegetables and fruits, and acreage allotments for tobacco, cotton and wheat are all devices which help prevent the extreme fluctuations in price and income which normally attend industries based on many producers who must make decisions under imperfect knowledge.

However, quotas and allotments which are attached to marketable resources, or which are themselves marketable, do not eliminate competition, regardless of cry to this effect. Competition still exists; only the focus of its implementation shifts. Under market-free prices, competition impinges on both commodity and resource. Under commodity supply control, the focus falls on the resources and the allotment restraints. This fact is implied in statements by those who claim that input or output quotas eliminate competition but immediately state that they are ineffective anyway because they become capitalized into resource values. The fact that they do become capitalized indicates existence of competition.

Long-Run Solutions

Capitalization of gains from price and quantity control into resource values provides the precise reason why supply control and price support do not provide a permanent solution to the lag of farm income below nonfarm income. The historic and world-wide characteristics of this lag, illustrated in Chapter 3, rest on variables and coefficients which will never be overcome by compensation policies and programs using extra-market means to boost resource returns.

Income gain can be attained in the short run but it cannot be retained in the long run (aside from direct payment compensation attached in lump-sum fashion to the individual) for the simple reason that it becomes capitalized into nonhuman resources. With policy which maintains higher price and income, a given quantity of capital then simply buys fewer resources, giving no greater total income to the resource bundle than if the program did not exist, factor prices were lower and given funds purchased more resources. For this reason, supply control and price support programs provide compensation only for the moment. They do not erase the variables causing the historic lag of farm income.

Marketing quotas of negotiable character, spread globally and permanently over all commodities, would have similar effect: compensation for the immediate generation with resource prices eventually increasing, rate of return declining and original disparity returned. This "return of the wicked" will remain as long as the basic cause of the income disparity is the low short-run factor supply elasticity and other conditions explained previously.

Farmers, of course, live and plan in the short run. They wish programs which bring income comparability at the moment, with less concern for the structural explanation of the disparity. To the extent that their income position is worsened from rapid advance in supply over a series of interrelated short runs, this interest is consistent with need to create conditions which spread gains and losses of economic growth in a manner to guarantee aggregate welfare advance. Programs are needed to attain these conditions, to the extent that conflict in economic interests and values of farm groups and political interaction allows them. But at the same time, programs and aids are needed which help overcome the structural imbalances giving rise to this historic depression of farm income relative to nonfarm income. Compensation methods are possible which do so while still allowing mechanisms for greater stability of price and supply of agriculture. The two problems, (1) compensation to offset rapid short-run rush of supply beyond demand, with its nonsymmetrical distribution of gains and losses among producers and consumers and (2) historic lag of income because of low factor supply elasticity, are not the same. Compensation will not solve the latter, and increased factor supply elasticity is not a substitute for compensation in the former.

ALTERNATIVES IN POLICY

We have discussed alternative approaches in the realm of compensation policy, in the context of distribution of gains and losses to better guarantee aggregate welfare increase and in the manner of a goal which society evidently has attempted to accomplish. Our concern was mostly with the compensation goal, supposing desire of society to attain it, and less intensively with the stability problem.

There are, of course, additional alternatives in policy. One is reliance solely on the open market and the structure of pure competition, with their particular scatter of sacrifices and gains from technical advance and general progress in agriculture. Still society has rejected this, as a pure approach, through its investment in public schools, roads, police force and even production of new agricultural technology. It has done so in regulation of food and drugs, in attempt to control the business cycle and in provision of unemployment compensation and social security.

In agriculture, as in other sectors, the great strengths of the price and market mechanisms need retention and strengthening, supplemented by public policy where (1) national goals are not best attained by complete reliance on the market and (2) the distribution of gains and losses through the pricing mechanism are deemed by society to be unequitable and incompatible with guarantee of aggregate gain. Of course the free market mechanism could serve to squeeze surplus resources out of agriculture, given sufficient time and widespread bankruptcy of farmers. But there are methods whereby the pricing mechanism can be supplemented to better salvage the dignity and capital values of individuals.

Miscellaneous Policy Means

We wish to speak at length in later chapters of policy means to accomplish the complex of intermediate goals cited above. Here, however, it is apropos to list some worthy of consideration in purpose and objective, if not entirely in efficiency and acceptability.

There is not complete precedent in the past wherein society has provided full compensation to redress individual loss, especially that arising from technical and economic progress. Accordingly, there is a question of whether it should now do so in complete scale for agriculture. Yet a minimum and reasonable scale of compensation seems in order and is only consistent with the large public outlays of the past to accomplish this goal. Efficient compensation policy would emphasize positive opportunity.

Policy consistent with both economic advance and retention of some fruits of progress for agriculture would include the following elements, to be discussed in detail later: an improved flow of economic knowledge and understanding to farm people; compensation and loans to cover capital losses and transfer from agriculture; retraining and greater job guidance services to overcome inflexibilities of older persons; aid in purchase of housing and relocation; unemployment compensation during the period of transfer and other measures to overcome the fear and uncertainty of transfer.

Pure Compensation

Given compensation as a pure and single goal of policy, with little resistance to method, simple means could be used to accomplish this end. One precedent exists in current Social Security Administration machinery.[27] If we could make an approximate inventory of persons who should not or never will leave agriculture, and if society firmly believes that compensation is due agriculture because of the burden of economic growth falling on the industry, the age at which social security payments begin might be lowered from 65 to the appropriate level. This system would not tie the interproduct use of resources in agriculture to consumption and technical patterns of the past. Given the conditions that the persons concerned are those who should not or would not leave agriculture, the system would not freeze resources in agriculture.

Even if some "errors" were made in designation of individuals, or even if anticipations led some surplus labor to remain in agriculture, the misuse of resources would be less than under price policies where farmers must remain in the industry to receive parity subsidies. With the age for social security payments lowered to a particular level, it need not be left permanently at this level. It would be moved up progressively to reach 65, the level for the rest of the population. In other words, the rest of the farm labor force would be warned that the same arrangement would not apply to it when it reaches the lower age, but that if its income is low, advantage should be taken of special education or mobility subsidies with movement to other employment. This policy would be clear-cut in its composition and "cut off." It is, however, less likely in general acceptance than others which can be advocated.

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[27] These notions and others dealing with compensation to redress gain and loss distribution to guarantee increase in aggregate welfare appeared previously by the author in the article: "Adaptation of Extension Education and Auxiliary Aids to the Basic Economic Problem of Agriculture," *Jour. Farm Econ.*, Vol. 39.