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The interests of the many groups concerned with commodity programs for wheat are highly diverse. Consumers want adequate food supplies at low prices, taxpayers want low government outlays for farm programs, and farmers desire high incomes and freedom from restrictions on production and marketing. Persons representing the U. S. in international affairs prefer adequate wheat supplies to meet welfare needs of nations with inadequate diets, large exports in "dollar" markets to help balance-of-payments difficulties, but low enough output and exports to avoid undue interference with markets of competing but friendly foreign nations.

This study was made to design and analyze selected wheat programs in the United States. Wheat prices, production, gross farm returns, production expenses and net farm returns are presented for the various programs. In addition, increased net farm income per government dollar and overall social cost are included to aid in the evaluation of the programs.

Basic Criteria

Past studies of commodity program alternatives have emphasized the implications in terms of (a) farm incomes, (b) consumer food costs, and (c) total U. S. treasury (taxpayer) costs (1) Additional criteria that might be used for current policy decisions are (a) net social cost (gain) and (b) net farm income per dollar of U. S. treasury cost. Freedom of individual decision making is another important criterion which cannot be quantified but is relevant.

Net Social Gain

At any given wheat quantity, the vertical distance from the quantity axis to the demand curve is one measure of the social benefits of that bushel, the distance to the supply curve is one measure of the social cost. It follows that the difference between these vertical segments, the distance between the demand and supply curves, is one measure of the **net** social gain from producing and consuming the particular bushel of wheat. If we sum the net social gain for each bushel of wheat, the area between the supply and demand curves is traced. Positive additions to social gain are made by moving to the right until supply and demand

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intersect. Since this is the equilibrium output under free markets, it follows that the equilibrium price and quantity established in "free" markets, unrestricted by production controls and price supports, maximize the net social gain.

The validity of this argument depends on rigid assumptions including:[1] (a) the initial distribution of assets must be satisfactory, (b) resources used in production must be transferable to alternative uses with a minimum of cost, time and friction, and (c) decision makers must be informed about returns to resources in alternative uses. If some farmers are poorly endowed with resources at the outset, free markets may not allow them to accumulate a socially acceptable income in a reasonable period (e.g., a lifetime). If labor in an industry characterized by depressed earnings (because of an inelastic demand coupled with demand contraction or supply expansion) transfers slowly to more lucrative employment because of institutional and psychological restraints, labor returns may be depressed over extended periods. Price and output at the intersection of supply and demand in such an industry need not maximize national welfare. Some contend that these assumptions characterize agriculture, therefore, welfare or satisfaction is not necessarily maximized by the output and prices resulting from the intersection of demand and supply with absence of government interference in the market.

The concept of net social gain as defined above must be used with caution, but is one measure of the utility or satisfaction foregone by society due to restricting or overextending output. Also, it may be argued that since the equilibrium price and quantity (at the intersection of supply and demand) represent the largest "pie" of utility available, consumers can compensate producers for depressed returns and still leave consumers with more "pie" than at any other output. Finally, despite low income to producers, the free market equilibrium output may represent an acceptable output and resource return for producers and consumers alike simply because it arose from an impersonal pricing mechanism which society may prize for rewarding factors according to their contribution.

Farm Income Per Taxpayer Dollar

Growing public concern over large treasury outlays for farm programs suggests another measure of program "goodness"—the increased

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[1] Other assumptions are that external economies and diseconomies of scale must be absent or reflected in the demand and supply curves.

Perhaps the most serious limitation arises in the application of the net social concept to wheat programs requiring sizeable government subsidies to wheat producers. The net social gain does not recognize the interpersonal changes in utility stemming from a redistribution of income through transfer payments.

farm income per dollar of government cost. Mandatory control programs, of course, give the greatest increase in net farm income per dollar of government cost. But if farmers rule out mandatory programs because of conflicts with freedom or resource efficiency, then the choice may be between several voluntary programs, each acceptable from a social cost and "freedom" standpoint. If taxpayers are reluctant to provide funds for farm price and income support programs, these circumstances suggest that wheat growers might choose the program giving the greatest increment in net income per unit of government cost, subject to the budget and other restraints imposed by Congress. Unfortunately, programs that make taxpayers' dollars go farthest in raising farm incomes may have high social cost because output is restricted.

Institutional Restraints

More than 90 percent of wheat sales for dollars by the U.S. are with countries participating in the International Wheat Agreement (IWA). To help stabilize the world wheat market, the 46 nations in the 1962 Agreement set certain price limits on sales, which for U.S. hard red winter wheat ranged from a $1.15 minimum to a $1.55 maximum at the farm level. The U.S. also recognizes certain informal wheat agreements with other nations. Even with opportunities to increase commercial export sales while remaining within the guidelines established by the IWA, the U.S. may be reluctant to increase foreign dollar sales because the goodwill engendered by lowering world wheat prices to importers of U.S. wheat is more than offset by the displeasures of Canada, Argentina, Australia and other wheat exporting competitors.

Institutional restraints perhaps make several of the subsequent programs untenable. It may be realistic to assume that national and international "nonmarket" forces would not permit U.S. wheat farmers to set production goals under 1,000 million and over 1,400 million bushels. These same forces probably would take action if the wheat price were to fall below $1.10 per bushel or to rise much above $2.00 per bushel. While these restraints are not always explictly recognized in subsequent analysis, it is acknowledged that they preclude adoption of several programs presented.

Other Criteria

The extent of "red tape," policing, and administrative costs are important in determining the acceptability of programs. It is not possible to quantify the "cost" of these activities accurately under all situations. However, in most instances the description of the program type suggests the degree of "overhead" required. Free markets generally require the least administrative and other overhead costs.

The flexibility in output made possible by a program in times of national stress should not be overlooked as a program criterion. Past experience has demonstrated that excess capacity can be valuable in national emergencies. Programs that reduce stocks and move resources out most rapidly retain the least excess capacity in the agricultural industry for national emergencies.

United States Wheat Demand and Supply at the Farm Level

The following demand and supply equations for U.S. wheat provide the basic data needed later to analyze specific wheat programs. All trend, income and population variables are set at estimated 1967 levels. The general price level is set for 1964 conditions, hence, may need to be revised for future inflationary trends. Constants are combined to give equations only in wheat price and quantity. The equations are intended to reflect a normal year, and do not adequately express demand during war periods, or supply during years of unusual U.S. and world weather conditions as occurred in 1934, 1936 and 1963.

The magnitude of market elasticities suggests that the wheat demand be divided into three categories: (a) food, seed and industry, (b) feed, and (c) export.

Food, Seed and Industry Demand

The quantity of wheat demanded for domestic use in food, seed and industry does not respond markedly to price and has remained quite stable in recent years. Tendencies of a growing population to increase demand have been offset by a negative income elasticity of demand and by changes in tastes. Setting income, trend and other variables at the anticipated 1967 level, and collecting terms, the demand quantity of wheat, C_h, at the farm level in million bushels is a function of the wheat price P in cents per bushel in equation (1).

(1) $C_h = 595 - .25P \qquad 100 < P < 250$

The slope is based on the wheat demand model estimated by Meinken. (2,3)

At a wheat price of $1.20 per bushel, the elasticity of demand in the food, seed and industry market is estimated from equation (1) to be —.05. The demand quantity is 545 million bushels at $2.00 per bushel. At that price, nearly 500 million is allocated to the domestic food wheat market. The remainder is used primarily for seed,[2] since only 100,000 bushels are expected to be utilized by industry.

Feed Demand

The demand for wheat used for feed is highly responsive to price as wheat becomes priced competitively with other grain if the feed grain price is held at a constant level. The following is a different concept of demand, allowing the feed grain price to fall but assuming the non-wheat feed grain quantity fed is fixed at 136 million tons in 1967. Total elasticity of feed grain demand with respect to the feed grain price has been estimated to be —.25. (4) Based on the period to which the estimate applied, with 120 million tons fed and a corn equivalent price of 111 cents per bushel, each one cent increase in price would decrease the quantity fed by nine million bushels of wheat equivalent. Assuming other feed grains and wheat are perfect substitutes in feed use, the demand equation for wheat used as feed are estimated to be (2).

(2a) $C_f = 50 \qquad 130 < P < 250$

(2b) $C_f = 1{,}220 - 9.0P \qquad 100 < P < 130$

C_f, million bushels of wheat fed, is fixed at 50 between the national average wheat price range of \$1.30 and \$2.50 per bushel. At \$1.00 per bushel, 320 million bushels are fed based on the equation. The feed wheat demand elasticity is —7.7 at \$1.20 per bushel, implying a sizeable response to price when other feed grain quantities are fixed at the assumed 136 million tons for 1967 and price is allowed to fall with the wheat price. Equation (2) applies only when the government does not support feed grain prices;[3] but the government can play a role in restricting feed supplies to the 136 million ton level indicated above.

Export Demand

Export demand for wheat is composed of two components: (1) commercial "dollar" demand and (2) autonomous government demand. The latter is basically a nondollar market. The commercial dollar demand is (3), expressing the commercial export demand quantity C_e in million

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[2] Some error is introduced by including seed since its demand and price characteristics do not necessarily follow those of the food industry. This limitation should be kept in mind throughout the analysis.

[3] If the government supported feed prices, including feed wheat, then the demand for wheat would become infinitely elastic at the prescribed support level. The wheat price would not go below the feed grain equivalent price support level.

bushels as a function of U.S. farm level wheat price P in cents per bushel.

(3a) $C_e = 0$ $143 < P < 250$

(3b) $C_e = 4{,}344 - 30.4P$ $100 < P < 143$

Equation (3), presented in more detail in Appendix A, is intermediate-run demand and should not be interpreted as an accurate prediction of immediate repercussions of a lowered wheat price. The "intermediate-run" is defined as approximately three years, and is after initial price responses have stabilized.

Future commercial exports at alternative prices are difficult to predict because: (a) there is no recent experience-period when market forces had enough play to trace out a commercial demand curve, (b) the effective commercial demand for wheat in the developing, dynamic wheat export markets of South America and Asia (after curtailment of government program exports) cannot be judged with accuracy, and (c) there is much uncertainty over policy measures that might be taken by countries in Western Europe for example in response to lowered world prices and increasing commercial supplies. The world wheat market structure is discussed in more detail in Appendix A. Commercial export equation (3) is considered to be an upper limit of commercial demand. Because the estimate is highly tentative, alternative estimates of commercial export demand also are utilized in the following analysis of wheat programs.

The commercial wheat demand equation (3) is to be used subsequently to estimate output and pricing under a "free" market in the absence of government controls or supports. Even with the sharpest trend conceivable toward free markets, some minimum shipments of wheat under P. L. 480 or other government supported programs would be sustained.

Commercial export demand is assumed to be supplemented by a constant autonomous U.S. government demand quantity C_a=100 million bushels at all prices (4). This quantity is intended to meet defense and welfare commitments to foreign nations which have insufficient buying power to constitute an effective commercial or dollar demand. Prior agreements and other considerations are assumed to maintain this demand throughout the price range indicated in (4).

(4) $C_a = 100$ $100 < P < 250$

Commercial Stock Demand

In addition to the above estimates, a demand equation (5) for commercial wheat stocks, C_s, is based on Meinken's data. (2) At P = 120,

(5a) $C_s = 0$ $\quad 200 < P < 250$
(5b) $C_s = 820 - 4.1P$ $\quad 100 < P < 200$

the elasticity computed from (5) is —1.5 and the commercial carryover is 338 million bushels. The demand for stocks tends to buffer the price repercussion of supply variations. Persistently large output would dampen the buffering effects of commercial stocks, and the price determination with the wheat model including (5) would be about the same as omitting the commercial stock equation (5) from the wheat model.[4]

With time to "balance out" carry over and production, the stock equation effect is small, hence, it has little use in the 1967 market structure for which we assume initial effects already are dissipated. Also, Commodity Credit Corporation stock operations have removed much of the traditional function of commercial stock demand. For these reasons in the program analysis, little use is made of the stock equation (5).

Aggregate Wheat Demand (for all purposes, including commercial stocks)

Aggregate demand for wheat is the sum (6) of the components listed above.

(6) $C_A = C_h + C_f + C_e + C_a + C_s$

Four segments of the discontinuous function (7) below constitute the total demand for wheat.

(7a) $C_A = 1{,}485 - 4.35P$ $\quad 200 < P < 250$
(7b) $C_A = 1{,}565 - 4.35P$ $\quad 143 < P < 200$
(7c) $C_A = 5{,}905 - 34.75P$ $\quad 130 < P < 143$
(7d) $C_A = 7{,}079 - 43.75P$ $\quad 100 < P < 130$

Demand equation (7) is appropriate when Commodity Corporation activities are limited and do not compete with commercial stock operations.

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[4] The equilibrium values are found by equating the supply and demand quantities, expressed as functions of price. Inclusion of the stock equation (5) makes long-run demand more elastic but does not change the long-run equilibrium price, production or utilization quantities. Without (5), production equation (14) presented later is equated to demand (9) without stocks. With (5) included, carryover plus production or total supply is equated to total demand (7). In equilibrium, the same carry over constant is added to both sides of the latter equations.

Aggregate Wheat Demand (excluding commercial stocks)

Aggregate demand for wheat, C, in million bushels, is defined as the sum of the following components given earlier.

(8) $C = C_h + C_f + C_e + C_a$

The sum of these equations is a three segment demand function as follows:

(9a) $C = 745 - .25P \qquad 143 < P < 250$

(9b) $C = 5{,}089 - 30.65P \qquad 130 < P < 143$

(9c) $C = 6{,}259 - 39.65P \qquad 100 < P < 130$

Demand equation (9) applies to the "intermediate" run, after initial supply-demand adjustments are made, institutional restraints are maintained about as in the past, commercial stocks are stabilized, and CCC has disposed of its stocks or will use them only as emergency buffer reserves. The equation has little or no predictive power above $2.50 and below $1.00 wheat prices, thus is restricted within this range.

Modifications can easily be made in the demand equation to accommodate alternative assumptions. Setting $C_e + C_a = 650$ and summing with the other equations gives the demand function with **total** wheat exports set at 650 million bushels. Other circumstances may call for the implications of wheat programs isolated from the feed market. The feed equation can be easily removed from the total demand equation (9) or the feed quantity C_f can be fixed at any desired level for this purpose.

Elasticity of Demand

The aggregate elasticity of demand at selected wheat prices from $1.00 to $2.00 per bushel is shown in Table 1. The total elasticity of demand E_T can be computed directly from equation (9) or can be expressed as a weighted average of the component elasticities computed from equations (1) to (4) as in equation (10). The stock equation (5)

$$(10) \quad E_T = \frac{C_h}{C_T} E_h + \frac{C_f}{C_T} E_f + \frac{C_e}{C_T} E_e + \frac{C_a}{C_T} E_a$$

is omitted because the total elasticity here is intended to measure responsiveness to price in an intermediate run of approximately three years. E_h is the food, seed and industry market demand elasticity, E_f is the feed market elasticity, E_e the commercial export market elasticity and E_a the autonomous government demand elasticity. E_a is considered to be zero.

Total wheat demand elasticity is less than .09 (absolute value) be-

Table 1. Total Wheat Demand Elasticity E_T and Its Components E^1.

	Food, Seed, Industry		Commercial Export[2]		Feed		Total
Wheat Price	E_h	$(E_h \frac{C_h}{C_T})$	E_e	$(E_e \frac{C_e}{C_T})$	E_f	$(E_f \frac{C_f}{C_T})$	$E_T = \Sigma E_i \frac{C_i}{C_T}$
2.00	—.09	—.07	0	0	0	0	— .07
1.60	—.07	—.06	0	0	0	0	— .06
1.30	—.06	—.03	—10.08	—3.58	0	0	—3.61
1.20	—.05	—.02	— 7.71	— .72	—5.24	—2.43	—3.17
1.10	—.05	—.01	— 4.3	— .52	—3.34	—1.76	—2.30
1.00	—.04	—.01	— 2.81	— .39	—2.33	—1.33	—1.73

[1] Elasticities derived from equations (1) to (4). Totals may not be exactly additive because of rounding errors.
[2] The commercial export demand estimate has important limitations discussed in the text and Appendix A. Tables 3 and 4 show effects of variation in the export demand equation.

tween a wheat price of \$1.43 and \$2.00 per bushel. Total demand is highly elastic at \$1.30 per bushel, primarily because of the high export demand elasticity. The highly elastic feed demand adds about one point to the total elasticity at \$1.20 per bushel, but total elasticity continues to fall. It remains elastic, however, at \$1.00 per bushel.

Supply of Wheat

Equation (11) expresses the yield of wheat per acre Y as a function of time T and acreage of wheat A (1). With acreage of other crops fixed,

(11) $Y = 9.5 + .34T - .15A$

the yield of wheat decreases as wheat acreage is expanded. Expansion of wheat is assumed to occur mainly in areas such as the Great Plains where marginal land reduces wheat yields. The weighted average wheat production cost (excluding land, taxes and family labor) in 55 wheat regions was computed to be approximately \$15 per acre.[5] (5)

Letting T = 67 for 1967, multiplying (11) by A, and solving for A; million acres of wheat A is expressed in (12) as a function of total wheat production W in million bushels.

(12) $A = 107.6 - (11{,}578 - 6.67W)^{1/2}$

Equation (12) is multiplied by cost per acre (\$15) and the derivative is

[5] The production cost of \$15 per acre includes all machinery, fertilizer, seed, pesticide, hired labor and custom costs.

taken with respect to W to form the marginal cost equation (13). MC is the marginal cost in cents per bushel and W is wheat output in

$$(13) \quad MC = \frac{5{,}002.5}{(11{,}578-6.67W)^{1/2}}$$

million bushels. According to (13), the marginal cost of a bushel of wheat at 1,200 million bushels (approximate current production) is 90 cents and at 1,400 million bushels is $1.19.

Equation (13) does not include the cost of land, family labor, and taxes. We assume that these costs are fixed in the time period considered and have no important influence on wheat supply. In a longer period, land prices and family labor returns would have a role in determining the yield, acreage and location of wheat production.

Equation (13) may be interpreted as a wheat supply function. If the price is greater than marginal cost, the additional profit will encourage farmers to produce more wheat until marginal cost equals price. Equation (14) is the suply function derived by solving for W in equation (13) and is based on the assumption that farmers respond to price changes in a manner to raise their profits. W is quantity supplied in million bushels, and P is wheat price in cents per bushel.

$$(14) \quad W = 1{,}736 - .15\left(\frac{5{,}002.5}{P}\right)^2$$

Graphic Illustration of Demand and Supply Equations

Figure 1 shows the aggregate wheat demand computed from equation (9) and three major components: (a) food, seed and industry, (b) feed, and (c) commercial export demand. Components are from equations (1), (2) and (3). Autonomous export demand, C_a = 100 million bushels, is not shown but is included in the aggregate demand.

Wheat supply computed from equation (14) is curvilinear and intersects total wheat demand at $1.20 per bushel in Figure 1. Farm costs, returns and quantities associated with this equilibrium are discussed in the following section.

Wheat Programs With Low Government Cost

Two major types of wheat programs are analyzed in this section—unrestricted production (free markets) and mandatory controls. (cf.6,7,8,9) We assume that the agency responsible for setting mandatory controls behaves as a monopolist, setting quantity allotments on production or

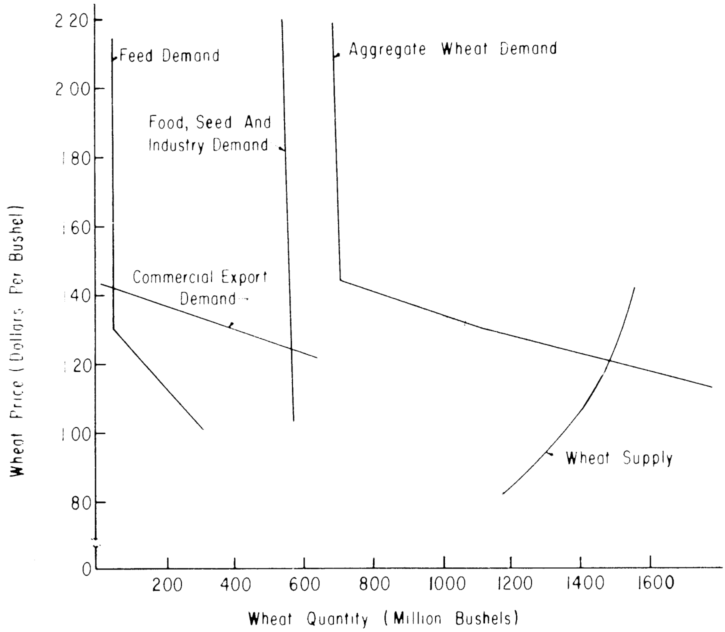

Figure 1. Estimated U. S. aggregate wheat supply, demand and three major demand components for 1967.

marketing to maximize net returns to wheat growers. Government cost of free market and monopoly programs are nominal, thus differences in prices, quantities, costs and returns in the following programs are due to market structure.

Free Markets

The intersection of the supply and demand curves in Figure 1 determine the competitive, free market equilibrium price and quantity. An algebraic solution is attained by specifying a third condition or equation to (9) and (14), i.e., that in equilibrium the supply quantity W and demand quantity C are equal, (C=W), and solving the three equations simultaneously for C, W and P.

The equilibrium price is $1.20 per bushel and the quantity is 1,480 million bushels (Table 2). Slightly over 66 million acres are planted. Gross farm returns are $1,783 million, production costs $996 million and net farm income from wheat $787 million.

The initial impact of removing production restrictions and withdrawing price supports may be quite unlike the above estimates, which apply (a) given a fixed nonwheat acreage (at about the 1964 level) and (b) after initial disturbances smooth out. Farmers might have wheat price expectations of (say) $1.40 per bushel for the first year following removal of allotments, and would plant 72 million acres according to the supply equation (14). The resulting price would be lower than the $1.20 equilibrium, and likely would prompt an acreage cutback to less than the 66 million equilibrium acreage the second year.

However, commercial or "emergency" Commodity Credit Corporation stock accumulations after a year of large production would cushion the impact on prices. But if the large output were repeated, storage facilities might be too full to absorb much excess output and buffer prices.

Table 2. Wheat Industry Pricing and Market Allocation Under (a) Competitive (Unrestricted) and (b) Supply Control (Monopoly) Market Structures.[1]

Item	Unrestricted Production	Supply Control or Monopoly: One-Price[2]	Two-Price[3]	Three-Price[4]
	I	*II*	*III*	*IV*
Food, Seed, Industry				
Price ($/Bu.)	1.20	1.25	2.00	2.00
Quantity (Mil. Bu.)	565	563	545	545
Returns ($ Mil.)	681	704	1090	1090
Feed				
Price ($/Bu.)	1.20	1.25	1.22	1.19
Quantity (Mil. Bu.)	135	94	119	144
Returns ($ Mil.)	163	118	145	172
Export				
Price ($/Bu.)	1.20	1.25	1.22	1.23
Quantity (Mil. Bu.)	780	643	724	699
Returns ($ Mil.)	939	804	885	860
Gross wheat receipts ($ Mil.)	1783	1620	2120	2122
Total production cost ($ Mil.)	996	801	891	891
Net farm returns ($ Mil.)	787[5]	819	1229	1231
Total quantity (Mil. Bu.)	1480	1296	1388	1388
Planted acres (Mil.)	66.3[5]	53.4	59.4	59.4
Yield per planted acre (Bu.)	22.3	24.2	23.4	23.4
Social cost ($ Mil.)[6]	0	26	14	15

[1] Prices, output, costs and returns are at the farm level. Totals may not be exact because of rounding errors.

[2] The equilibrium quantity is determined by equating the marginal revenue computed from the aggregate demand function, with marginal cost (supply). The individual market allocation is found by computing the demand quantity in each market at the price $1.25.

[3] The equilibrium quantity is determined by summing the two marginal revenue curves of (a) the domestic food, seed, and industry market, and (b) the feed and foreign export market, and equating the combined function to marginal cost (supply). The equilibrium marginal revenue is related back to the component demand, with the price and quantity in each major market specified by the equilibrium marginal revenue.

[4] The same procedure as in 3 above, but with three markets.

[5] Some of the wheat production with free markets may simply replace feed grain with little change in net returns on acres where this substitution occurs. If 60 million acres is the *effective* acreage, excluding substitutions, the net return under free markets is $706 million.

[6] Social cost is defined as the net value of consumption foregone by society because of a departure from the free market equilibrium. For the relationship of social cost to utility, see Luther Tweeten and Fred Tyner "Utility Measures from Demand and Supply with Applications" (Mimeo.), Department of Agricultural Economics, Oklahoma State University, 1965.

Also, expectations and plantings would be influenced by long-run program prospects. For example, if farmers expected to return to allotment programs and were afraid of losing allotment history by overplanting, they might plant within allotments even with "temporary" free markets. The result would be lower output and higher prices than indicated above.

Monopoly or Supply Control: (single and multiple pricing)

The income advantage is one reason why some multiple price feature has been the core of numerous wheat programs beginning with McNary-Haugen proposals of the 1920's. Necessary conditions for success of multiple price programs are that: (a) synthetic or other competing domestic products do not substitute readily in the high-price domestic market, and (b) tariffs, quotas or characteristics of the product such as perishability effectively insulate domestic markets from low-price imports of the product itself or substitutes.

Control over wheat supplies by the government or by organized wheat growers could increase income to the wheat industry over the competitive free market level. The analysis of monopolistic pricing and output in the wheat industry is useful to the government in determining optimum restrictions under mandatory controls, or in estimating profitable market allocation of CCC stocks. Wheat producers might be interested in knowing the potential income gains from a cohesive organization of producers. The public might also wish to know the potential social cost of a monopolized wheat industry.

Monopoly power may be interpreted as a substitute for resource adjustments. In place of resource outmovement for gaining parity resource returns under a competitive market structure, monopoly power might be used to secure higher returns through output restrictions.[6]

Table 2 depicts farm prices, farm incomes and market allocations under three types of monopoly organizations. If the same price is charged in all wheat markets, marginal revenue is the derivative of the aggregate wheat demand. This marginal revenue is equated to marginal cost (supply). The wheat quantity that maximizes farmer returns from wheat is 1,296 million bushels, selling at $1.25 per bushel. Gross returns are less than under competitive conditions, but reduced production expenses more than compensate, leaving net farm returns from

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[6] We are not recommending this solution, only examining the possible implications of monopoly power exercised in the wheat industry.

wheat at $819 million under the one-price monopoly solution compared to $787 million under competitive conditions.

Slightly over 53 million acres of wheat yielding 24.2 bushels per planted acre would fill the monopoly market requirement of 1,296 million bushels, hence, production or marketing controls would be necessary. To avoid depressing wheat prices through excess feed production, acreage diverted from wheat below 55 million acres would need to remain idle.

The output restrictions increase net farm income only $32 million over the free market level. If markets can be separated, and quantities in each regulated, opportunities for increasing net farm income are sizeable under two and three-price plans. Under the multiple price system, markets are separated and higher prices are charged where demand is least elastic. A priori, we specify that food, seed, and industry market price is allowed to go no higher than $2.00 per bushel, although the multiple-price solution suggests that net revenue would be increased by raising price (restricting quantities) even further in this market.

Under the two-price plan, the commercial export and feed demands are combined. Autonomous exports C_a are assumed to receive the same price per bushel as commercial exports C_e. This two-price method would be more easily administered than the subsequent three-price plan. The highest possible net farm income from wheat results by charging the $2.00 maximum in the domestic food, seed, and industry market and $1.22 in the feed-commercial export market. The $1.22 feed wheat price and 119 million bushel wheat allocation to feed markets would depress feed grain prices slightly, hence, might meet some resistance from growers of corn and other feed grains that would compete with feed wheat.

Exercising of supply (monopoly) control of the wheat industry by organized wheat growers or the government using a two-price plan would bring net farm returns of $1,229 million, nearly one-half billion higher than the free market competitive equilibrium income.

Wheat demand with the three-price plan is divided into the categories: (1) food, seed, and industry, (2) feed, and (3) exports. Autonomous exports are assumed to bring the same price as commercial exports. Summing marginal revenues in each market, equating the total with marginal cost, and relating back to each market, profits are maximized by allocating 545 million bushels to food, seed, and industry, 144 million bushels to the feed industry and 699 million bushels to commercial and government exports. The equilibrium demand quantity, 1,388 million bushels, is greater than the 1,296 million bushels demanded under the one-price plan, but is somewhat lower than the 1,480 million bushel competitive equilibrium quantity. The three-market allocation brings $2.00 in food, seed, and industry uses, $1.19 in feed uses and $1.23 in export uses, grossing $2,122 million for wheat growers. Costs of $891 million result in a net of $1,231 million. The total quantity and net farm income are comparable under the two and three-price plans.

Net social costs, closely related to the level of outputs, are lowest for the competitive equilibrium output and highest ($26 million) for the one-price monopoly. Although output is similar, net social cost under the two-price plan ($14 million) is slightly less than under the three-price plan ($15 million). These observations suggest that the monopolist solution, where different prices are charged in the major market, potentially gives farmers a higher net income, but also costs society less than does the single price monopoly solution. The competitive equilibrium maximizes the total gain available to society, but many contend that the distribution of the net social gain between wheat producer-profits and consumer-surplus is unsatisfactory. In theory, consumers could more than compensate farmers for the income loss from operating under free markets and could still retain a higher social gain than under monopoly schemes. But in practice, such compensation is difficult to make.

Modified Two-Price Plans

To obtain the results shown in Table 2, market quantities must be controlled. However, approximately the same results as the two-price plan in Table 2 can be obtained without production controls through use of certificates on domestic wheat. If certificates valued at $.80 per bushel were issued on 545 million domestic bushels, the returns with unrestricted production would be increased approximately $434 million at nominal U.S. treasury cost. Output, export, and feed prices would remain unchanged from the free market, since marginal conditions would be sustained. Net farm income would be nearly $436 plus the free market net income $787 million, or a total of $1,223 million. Thus, with use of certificates and avoidance of output controls, net farm income from wheat would exceed the one-price supply control level and nearly reach the two and three-price supply control incomes of Table 2.

A major limitation of the market plans presented in Table 2 is output in excess of "socially acceptable" levels in the feed or export market. To avoid this, the government might use the income incentives of a two-price plan to induce farmers to cut production.

Sources of Increments in Net Farm Income

Increased net farm income above the free market level must come from these four sources: (a) lower production costs, (b) reduced marketing margins, (c) increased consumer outlays, or (d) higher U.S. treasury costs. The analysis in Appendix B of marketing margins for wheat used in breadmaking indicates that margins tend to be constant at alternative wheat prices, and a given increase in the wheat cost is quickly passed to consumers. The analysis provides some evidence that (b) above cannot be expected to be a significant source of increased farm income. The net farm income from the two-price plan III is \$442 million above income from the unrestricted plan I. The sources of this income are: (a) lower production cost—\$105 million, (b) changed marketing margins—zero, (c) increased consumers costs—\$337 million, and (d) U.S. treasury—zero. Later voluntary programs tend to emphasize the U.S. treasury rather than consumers as a source of additional farm income.

Modifications of Export Demand

The implications of the low government cost programs in Table 2 depend, among other things, on commercial export demand equation (3) which is considered to represent the upper limit of export demand elasticity. Table 2 programs are reexamined in Table 3 with a lower export demand to illustrate (a) the sensitivity of economic ramifications to a change in export demand elasticity, and (b) the equilibrium income, price and quantities under a lower (and what some consider to be a more realistic) commercial export demand.

Influence of Reduced Export Demand Elasticity on Programs Involving Low Government Cost

The modified commercial export demand equation is (15), where C_e

(15a) $C_e = 0$ $\qquad 151 < P < 250$

(15b) $C_e = 2{,}292 - 15.2P$ $\qquad 100 < P < 151$

is million bushels of U.S. wheat exports, and P is U.S. wheat price in cents per bushel. Other equations and assumptions in Table 3 are unchanged from the previous analysis. The price elasticity of export demand at $P = 135$ in (15b) is one-half that computed from (3). Also, the marginal response—15.2 of C_e to price is one-half that of equation (3) at all prices.

Commercial plus government exports with unrestricted production and unsupported prices in program I′, Table 3, are reduced from 780 million to 675 million bushels and the wheat price from \$1.20 to

Table 3. Wheat Industry Pricing and Market Allocation Under (a) Competitive and (b) Supply Control Market Structures and a Reduced Export Demand from Table 2.[1]

Item	Unrestricted Production	Supply Control or Monopoly One-Price	Two-Price	Three-Price
	I'	*II'*	*III'*	*IV'*
Food, Seed, Industry				
Price ($/Bu.)	1.13	1.26	2.00	2.00
Quantity (Mil. Bu.)	566	564	545	545
Returns ($ Mil.)	640	708	1,090	1,090
Feed				
Price ($/Bu.)	1.13	1.26	1.19	1.14
Quantity (Mil. Bu.)	203	90	153	196
Returns ($ Mil.)	229	114	182	223
Export				
Price ($/Bu.)	1.13	1.26	1.19	1.21
Quantity (mil. Bu.)	675	484	590	547
Returns ($ Mil.)	763	608	702	662
Gross wheat receipts ($ Mil.)	1,632	1,430	1,974	1,975
Total production cost ($ Mil.)	951	667	795	795
Net farm returns ($ Mil.)	681	763	1,179	1,180
Total quantity (Mil. Bu.)	1,443	1,138	1,288	1,288
Planted acres (Mil.)	63.4	44.5	53.0	53.0
Yield per planted acre (Bu.)	22.8	25.6	24.3	24.0
Social cost ($ Mil.)	0	82	33	35

[1] See footnotes in Table 2. Assumptions underlying Table 3 are the same as those underlying Table 2, except that commercial export demand is changed from equation (3) to equation (15).

$1.13 per bushel by the substitution of demand function (15) for (3). It is interesting to note that this export quantity, 675 million bushels, is exactly equal to the average U.S. wheat exports during the five years preceeding 1964. The implications of I' are consistent with equilibrium where exports plus domestic food, seed and industry demands are fixed at 1,241 million bushels by a perfectly inelastic demand, quotas, or other barriers and the excess production would have to be disposed in the domestic feed market. Either the feed price would fall or the government would have to remove wheat and feed grain from the market to hold the wheat price above the $1.13 unrestricted production equilibrium indicated in Table 3.

Comparing Tables 2 and 3, exports and receipts are down, and social costs are up appreciably in the latter. Net income in program I is reduced just over $100 million by the lower export demand. The reduction in net income is somewhat less than $100 million between Tables 2 and 3 under the three supply control programs.

Effects of Variation in Export Demand With a Fixed Domestic Demand Quantity

To give more generality to previous estimates and further illustrate the effect of variation in export demand on wheat prices and quantity, the food, seed, feed and industry demand quantity is set at 695 million bushels and the export demand is varied around equation (3). The assumed nonexport demand quantity, 695 million bushels, is added to (3b), forming total wheat demand equation (16). C is total wheat demand in million bushels and P is national average wheat price in cents per bushel. Wheat demand in Table 4 is raised or lowered by 200 million bushels and the slope in (16) is reduced to —15.2 and —7.6, ceteris paribus, and the equilibrium computed as shown in Table 4.

(16) C=5,039—30.4P

Equating equation (16) with supply equation (14), the equilibrium price is estimated to be $1.18 or nearly comparable to the result for program I in Table 2. If other things remain equal and the commercial export demand is lowered 200 million bushels, the equilibrium price falls to $1.12 and net farm income falls by $83 million. A 200 million bushel increase in export demand has a similar tendency to raise net farm income in Table 4.

The slope of the export demand equation is lowered in the last two programs of Table 4. The two demand curves with reduced marginal response to price are constructed to give the same demand quantity with wheat priced at $1.35 per bushel. But at lower prices, they predict a smaller demand quantity than equation (16). The result is a considerably lower equilibrium price, quantity and net farm income when the marginal response of quantity to price is reduced in exports markets. The

Table 4. Estimated Effects of Alternative Wheat Export Demands.

	Modification of Equation (16)				
	Slope Constant, Intercept Changed			Slope Reduced	
Item	No Change[1]	—200 Mil. Bu.[2]	+200 Mil. Bu.[3]	—15.2 Mil. Bu.[4]	—22.8 Mil. Bu.[5]
Equilibrium					
Wheat price ($/Bu.)	1.18	1.12	1.23	1.05	.90
Wheat quantity (Mil. Bu.)	1,459	1,436	1,494	1,395	1,275
Planted acres (Mil.)	64.6	62.9	67.4	59.9	52.2
Gross returns ($ Mil.)	1,719	1,608	1,841	1,465	1,148
Production expenses ($ Mil.)	969	944	1,011	898	783
Net farm returns ($ Mil.)	750	664	830	567	365
Demand Quantity (Mil. Bu.) at fixed wheat price $1.35/Bu.	935	735	1,135	935	935
Demand Price ($/Bu.) at fixed wheat quantity 1,400 Mil. Bu.	1.20	1.12	1.26	1.04	.74

[1] Equation (16), C = 5,039 —30.4P, the supply equation is (14).
[2] C = 4,839 — 30.4P.
[3] C = 5,239 — 30.4P.
[4] C = 2,987 — 15.2P. Slope is reduced ½ from (16), same demand quantity at $1.35.
[5] C = 1,961 — 7.6P. Slope is reduced ½ from 4, same demand quantity at $1.35.

results in Table 4 are based on a fixed feed wheat demand quantity. Because in reality the feed wheat demand is not fixed, the elastic feed demand for wheat would buffer the price drops predicted in Table 4. The results in the table do emphasize, however, that under a considerable range of assumptions the export market alone could not be expected to hold wheat prices at high levels with unrestricted wheat production.

Wheat Programs With Higher Government Costs

Several types of programs could effectively raise farm incomes from wheat above free market levels. One method, increasing farm market power, was illustrated in the previous section. An advantage of increased market power or supply management is higher farm income at nominal government expense. A disadvantage is restricted freedom in production and marketing by farmers or processors. As additional freedom to produce and market is introduced, the cost of raising farm income above free markets by a given amount tends to shift from the market to taxpayers (Table 5).

In this section, the two-price supply control plan of Table 2 is compared with (a) direct lump-sum payments to wheat growers, (b) voluntary diversion programs with grants to farmers for removing land from wheat production, and (c) market subsidies, with the government paying the difference between the farm price and the demand price in markets to utilize the wheat supply. Free markets are not included in Table 5 because either output controls or government outlays are necessary to reach the prescribed $1,229 million net farm income from wheat. To facilitate comparisons among programs, all programs in Table 5 are adjusted to give the **same** net farm income as the two-price supply control program in Table 2.

Two criteria are used for comparison; (a) net social cost and (b) increase in net wheat income over the free market level per government dollar. But by the description of the program, the reader can form certain judgments about the means used to implement the plan. For example, despite similar social and taxpayer costs, one program may be rated more acceptable than another because it offers greater freedom in production and marketing.

Program Description

Under the **direct payment** program V, a lump-sum government grant is paid farmers to raise free market net income to $1,229 million. Farmers are paid to remove land from production under the voluntary **acreage**

Table 5. Implications of Selected Programs in Achieving a Prescribed Net Farm Income from Wheat of $1,229 Million.

		Voluntary Programs						
	Supply Control	Direct Payment	Acreage Diversion		Market Subsidies			
					Allotments		No Allotments	
Item	Two-Price[1]	Lump Price[2]	Efficient[3]	Less Efficient[4]	Efficient[5]	Less Efficient[6]	Efficient[7]	Less Efficient[8]
	III	V	VI	VII	VIII	IX	X	XI
Price ($/Bu.)	1.22-2.00	1.20	1.73	1.28	1.50	1.50	1.49	1.49
Quantity (Mil. Bu.)	1,388	1,480	703	1,184	1,480	1,480	1,570	1,570
Market returns ($ Mil.)	2,120	1,783	1,212	1,519	2,225	2,225	2,340	2,340
Government payments ($ Mil.)	----	442	386	414	50[9]	232[9]	166[9]	271[9]
Gross returns ($ Mil.)	2,120	2,225	1.598	1,933	2,225	2,225	2,340	2,340
Total nonland cost ($ Mil.)	891	996	369	704	996	996	1,111	1,111
Net farm returns ($ Mil.)	1,229	1.229	1.229	1,229	1,229	1,229	1,229	1,229
Planted acres (Mil.)	59.4	66.3	24.6	46.9	66.3	66.3	74.3	74.3
Yield per planted acre (Bu.)	23.4	22.3	28.6	25.2	22.3	22.3	21.1	21.1
Treasury cost ($ Mil.)[10]	Small	442	386	414	50	232	116	271
Income increment above free market per unit treasury cost (Dol.)	Large	1.00	1.15	1.07	8.84	1.91	2.66	1.63
Social cost ($ Mil.)	14	Small	386	75	Small	Small	8	8

[1] See the two-price plan, Table 2. Throughout the table, data may not be exact because of rounding errors.

[2] The difference between the free market equilibrium in Table 2 and the prescribed income is made up by a direct payment to farmers. This payment must be independent of future production or equilibrium prices and quantities will change as well as other implications above.

[3] Through market and production contract discrimination, the government cost is assumed to be the area A, Figure 2.

[4] More realistic than the "efficient" program, government cost is the area ABCD, Figure 2.

[5] Allotments are at the free market level 66.3 million acres. Government cost is A, Figure 3. The government cost or subsidy is not paid directly to farmers, but is included indirectly in market receipts.

[6] Government cost is ABC in Figure 3

[7] Government cost is A, Figure 3.

[8] Government cost is ABC in Figure 3.

[9] The government costs are included in farm receipts, thus need not be added as in other cases to gross farm returns.

[10] Does not include administration and storage cost.

diversion programs. Sealed bids are assumed to reduce government costs to area A, Figure 2 under program VI. The government is less "efficient" in the use of funds (area ABCD, Figure 2) to remove production under the more realistic programs VII. Here the terms "efficient" and "inefficient" do not refer to waste or mismanagement in administering programs, but rather to the extent of effort to pay individual producers the minimum required to reduce production or pay individual processors the minimum subsidy between market support price and demand price for utilizing wheat. A conscious decision to use treasury funds with reduced efficiency may be judged optimum because of inability to differentiate markets and producers, or because of possible friction and disfavor from such attempts.

Market subsidy programs can be administered by issuing government subsidies to exporters as necessary to move desired quantities, or the government can first purchase quantities in excess of market needs at desired prices, then export the excess at whatever terms are possible. Barter, sales for foreign soft currencies or loans might be used to increase sales. If market discrimination is practiced, government costs in programs VIII and X are as low as A, Figure 3. Less efficient market discrimination in the more realistic programs IX and XI involve government costs of ABC, Figure 3.

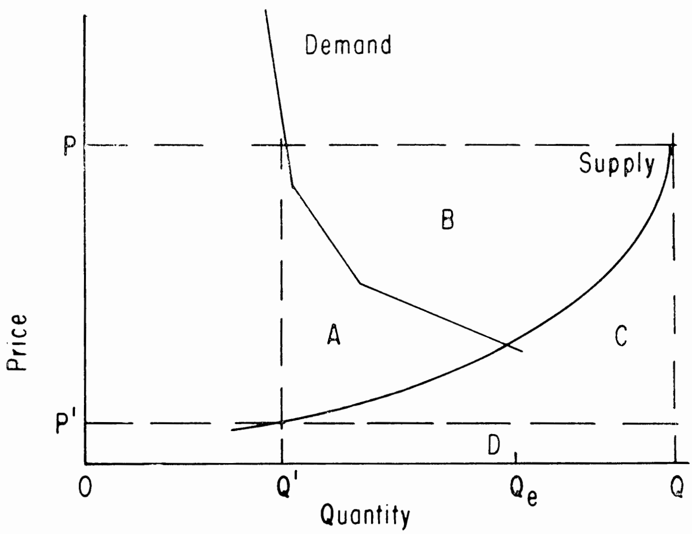

Figure 2. Hypothetical examples of government costs with voluntary acreage diversion programs operated at different levels of efficiency.

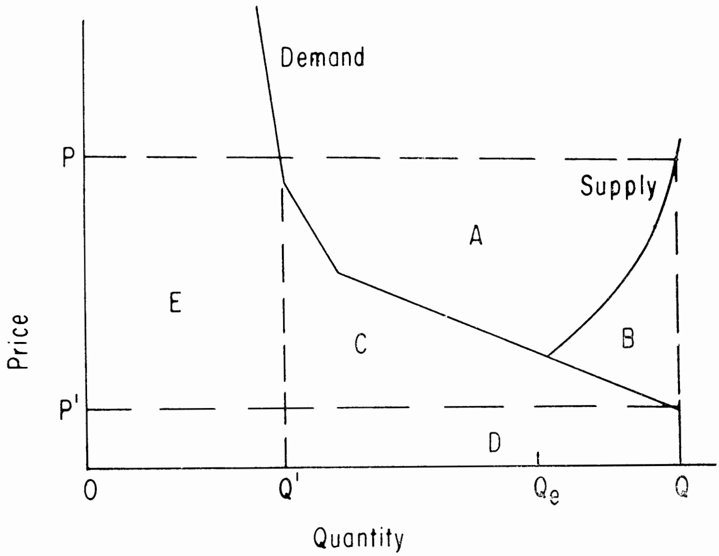

Figure 3. Hypothetical examples of government costs with market subsidy programs operated at different levels of efficiency.

The implications are based on wheat demand expressed in equation (9). The equation includes all commercial demand of domestic and foreign sources, plus a 100 million bushel fixed government demand. This government purchase, used to meet foreign aid obligations, is not charged here as a government expense since the entire cost is assumed to be compensated by increased foreign good will, foreign currency, barter, etc.

Government Costs

Government cost is highest for the direct payment program V and lowest for the supply control program II. Acreage diversion programs are nearly as expensive as the direct payment program. Programs such as VI and VII are expensive for wheat because they reduce production in an area of elastic demand so that **market** revenue **falls.** Production has to be severely restricted to the inelastic portion of the demand curve to increase receipts, a quantity so low that major social cost is incurred. It follows that the acreage diversion programs used **alone** may not be satisfactory for reaching the wheat income target in Table 5.

The income advantages alone of the market subsidy programs over free markets might induce farmers to restrain output to free market levels and reduce government costs. If so, and if administered efficiently, income would be increased almost $9 above free market levels for each government dollar spent. A wheat price of $1.49 per bushel encourages output to exceed the free market level with programs X and XI. Without production restraints, wheat production is 1,570 million bushels on 74.3 million planted acres. Even with market discrimination in program X, the treasury cost to raise farm income is 116 million.

Market subsidies cannot in practice be administered as in programs VIII and X, thus programs IX and XI conform more closely to actual experience. The incremental income above the free market per government dollar is $1.91 and $1.63, respectively, hence these programs for wheat allow treasury funds to go farther than the direct payment and acreage diversion programs.

Each of several nonallotment market subsidy programs give the same social cost and farm income, but the source of farm income shifts between the government and the market according to how the program is administered. Since prices are supported above market demand, the government pays a subsidy equal to the difference between the market price and the support price. Farmers supply 1,570 million bushels at $1.49 per bushel, but the market price is $1.18 per bushel. The support price is $1.49 per bushel, hence the subsidy per bushel is $.31. If **all** units are subsidized, (area ABCE in Figure 3) the government cost is $487 million and the income increment above the free market per treasury dollar is only $.91. If the government does not subsidize the portion E that will move commercially at $1.49 per bushel, the subsidy is $.31 per bushel on 862 million bushels or $271 million. Areas ABC are shown in Figure 3 and the income increment per government dollar is $1.63 (Program XI, Table 5).

Social Cost

Social cost tends to be low except for the acreage diversion programs. The concept of social cost used in this study is the area between the demand and supply curves, bounded by the actual and competitive equilibrium quantity. No attempt is made to evaluate the net utilities associated with U.S. treasury outlays.

In summary, there is no one best program in Table 5 viewed from the standpoint of least controls, lowest treasury cost or low social cost. Supply control program II costs the treasury little, but does involve controls and a social cost. The low social cost and freedom from controls are favorable merits of direct payment program V, but government cost is high. Acreage diversion programs offer freedom of participation, but rank low under the minimum social and treasury cost criteria. Market subsidies rank somewhat intermediate in the criteria used to measure merits of the programs.

A Joint Wheat and Feed Grain Program

Voluntary acreage diversion has been the core of feed grain programs in recent years and has been used on a smaller scale for wheat. Freedom of individual participation and flexibility of the program have led to suggestions that wheat be combined with other grains under the feed grain type program. (10,11) Export subsidies on wheat would be greatly curtailed, and only one price would prevail in the domestic and export markets. Wheat would be priced according to its value as a feed grain. The result would be essentially the same as program VII, Table 5. Wheat price is $1.28 per bushel in all markets, 631 million bushels are utilized in the domestic feed, food, seed and industry market and 553 million bushels are exported.

A slight variation of program VII to conform more closely to expected conditions would be to expand government exports so that total wheat exports would be 675 million bushels, the 1958-1962 average. At a wheat price of $1.30 per bushel, 316 million bushels would be utilized for commercial exports (equation 15), 359 million bushels for government exports and 613 million bushels for domestic food, feed, seed and industry. Production would be 1,288 million bushels on 53 million acres yielding 24.3 bushels per acre. At $1.30, wheat farmers would supply 1,514 million bushels according to equation (14), thus the diversion payments totaling approximately $294 million would remove 226 million bushels from production. Gross wheat receipts of $1,674 million plus government diversion payments less production costs of $794 million would net wheat growers $1,174 million. Total government cost would be $294 million for acreage diversion plus $467 million realized cash cost of government exports, or a total of $761 million. If the recovery value on government exports is half the realized cost, then the real cost to the government of the above program is $528 million (excluding administration, storage and handling cost).

To reduce program costs and encourage resource adjustments, acreage diversion might be supplemented with a long-term cropland retirement program removing whole farms, or with sizeable noninterest nonrecourse loans made to land owners to convert land to soil conserving uses for extended periods.

Net income to wheat growers would be somewhat lower than under recent type wheat programs discussed subsequently. Some measures might be taken to ease the burden of adjustment, especially for farmers who purchased land at prices inflated by capitalized benefits of recent programs. Alternatives to raise farm income and cushion the adjustment might be to combine with acreage diversion (a) a two-price plan with gradual reduction of prices in the high price domestic market over (say) a 10 year period to $1.30, (b) direct payments, or (c) adjustment loans.

Implications of Recent-Type Wheat Programs—Allowance for Institutional Restraints

Wheat programs of recent years have tended to be combinations of the basic types presented earlier. Recent programs also have incorporated institutional restraints on pricing and output that were not considered in the previous programs. Tables 6, 7, and 8 give implica-

Table 6. Estimated Farm Receipts, Costs and Net Income from the 1962 and 1964-Type Wheat Programs in 1967.

Item	1962-type	1964-type
	XII	XIII
	(Million Dollars	
Food, Seed, Industry		
550 million bushels at $1.80 per bushel	990.00	
545 million bushels at $2.00 per bushel		1,090.00
Feed		
50 million bushels at $1.30 per bushel	65.00	65.00
Export		
Commercial dollar sales:		
392 million bushels at $1.30 per bushel	509.60	509.60
Government assistance on commercial sales:		
392 million bushels at $ .50 per bushel	196.00	
392 million bushels at $ .25 per bushel		98.00[1]
Nondollar sales (P.L. 480, etc.):		
248 million bushels at $1.80 per bushel	446.40	
129 million bushels at $1.55 per bushel		199.95
124 million bushels at $1.30 per bushel		161.20
Government payments for land diversion		
5 million acres, 24.8 bu. per acre x 50 percent at $1.80 per bushel[2]	111.60	
3 million acres, 24.8 bu. per acre at $.26 per bushel		19.34
Gross farm returns	2,318.60	2,143.09
Total production cost[3]	750.00	750.00
Net farm returns	1,568.60	1,393.09

[1] In practice, commercial exporters are required to purchase certificates valued at $.25 per bushel, and the government pays the exporter a subsidy equal to the difference between the world price and the domestic price plus certificate value. In 1967, it is assumed that the export subsidy and certificate value are equal.

[2] Diversion payments in 1962 on the first 10 percent reduction below the allotment (based nationally on 55 million acres) were based on 45 percent of the normal yield. For diversion above 10 percent and not to exceed 40 percent of the base allotment, payments were based on 60 percent of the normal yield.

[3] Costs exclude family labor, land and taxes.

tions of the 1962 and 1964-type wheat programs applied to 1967 yield conditions and markets as depicted by equations (1) to (14).

The 1962-type wheat program features a 55 million acre allotment, a five million acre voluntary land diversion program and 50 million acres planted. Applied to expected 1967 conditions, wheat production is 1,240 million bushels. Wheat prices supported at $1.80 per bushel on 1,190 million bushels, plus $1.30 per bushel on 50 million bushels of feed wheat, gross $2,207 million. In addition, farmers receive $111.60 million in acreage diversion payments. The total income from wheat, $2,318.60 million less $750 million production expenses, nets wheat farmers $1,568.60 million (Table 6).

Unrestricted production without government price and income supports would net farmers $787 million, hence, a sizeable portion of farm net income from wheat under the 1962-type program is imputed to government action.

The efficiency of government dollars in raising wheat incomes depends on the recovery value of wheat exported under government programs. The total subsidy on dollar export sales is $196 million ($.50 per bushel on 392 million bushels). The 600 million bushel domestic sales plus 392 million bushel dollar export sales leave 248 million bushels for export under P.L. 480 and other programs. If the recovery value on the 248 million bushels is zero, then the wheat program cost to taxpayers is $754 million (excluding storage and administration costs). While a 40 percent recovery value has been assumed for the 1955-62 period, in one study, (12) it is possible that the recovery value would be higher in 1967 because of growing dollar reserves in developing countries. Arbitrarily setting the recovery value at 50 percent of nondollar export sales, the wheat program government costs total $753.80 million (Table 7). Each government dollar raises net farm income $1.04 and $1.47 dollars (above free market levels) respectively, based on the higher and lower estimate of government cost. Thus, the 1962-type program is less efficient per government dollar in raising farm income than most of the programs depicted in Tables 2 and 5. The "efficiency" of tax dollars is lower in Table 7 because the feed and commercial export markets are not fully exploited. Efforts of the U.S. government to maintain feed grain prices and world wheat prices by limiting wheat sales in these markets means that the full potential of government dollars in raising farm incomes is not realized according to the results of this study. However, restraints imposed by groups concerned with maintaining feed grain and world wheat prices may make the 1962-type program a realistic alternative.

Table 7. Estimated Government Cost in 1967 of the 1962 and 1964-Type Wheat Programs.[1]

Item	1962-type	1964-type
	XII	XIII
	(Million Dollars)	
Acreage diversion	111.60	19.34
Export assistance	642.40	459.15
Total cash government cost	754.00	478.49
Net farm income per government dollar	1.04	1.27
Total government cost less 50 percent allowance on nondollar exports	530.80	297.91
Net farm income per "discounted" government dollar	1.47	2.03

[1] Administration and storage costs not included.

The 1964-type Wheat Program

The 1964 wheat program is a multiple-price certificate plan made voluntary to individual farmers. A $1.30 basic support plus certificates valued at $.70 raise domestic food wheat to $2.00 per bushel. Forty-five percent of the normal production on a 49.5 million acre allotment is eligible for this support. The basic support plus certificates valued at $.25 raise the export wheat price to $1.55 per bushel. Again 45 percent of normal production on alloted acres is eligible for this price. To qualify for certificates, farmers must divert to soil conserving uses acres equal to 10 percent below the old base allotment level (55 million acres)—giving the new base of 49.5 million acres. An additional 20 percent below the new base can be diverted at a rate of $.26 per bushel (one-fifth of the base support) times normal yield. This diversion payment is lower than in the past.

Because the provisions and results of the 1964 program were still preliminary when this study was made, the implications in Table 6, 7, and 8 are tentative and must be interpreted accordingly.

Lower supports on export wheat and reduced acreage diversion payments reduce 1964 expected net returns from wheat to $1,393 million. This return is well above the free market level and also higher than the supply management programs discussed earlier. It is possible that wheat acreage planted will be considerably higher than the indicated 50 million acres. However, much of this wheat acreage would substitute for acreage now in feed grains. Because returns per acre would not be altered appreciably by such substitution, this wheat income might be more realistically included with feed grain. It is not included in Table 6 to preserve comparability with other programs presented.

The 1964 program, because it tends to move away from acreage diversion and export subsidy features, and more toward the two-price program, can be efficient in use of government dollars to raise income (Table 7). If allowance is made for recovery value of government exports, the increment in farm income per government dollar is $2.03 for the 1964-type program versus $1.47 for the 1962-type program.

Implications of Alternative Allotment and Government Expenditure Levels for Wheat Programs

The efficiency of government dollars in raising farm income is a function of the allotment level, government expenditure and type of farm program. In this section, the net farm income and efficiency of government dollars are computed for two types of programs with allotments at 40, 50, and 60 million acres and government outlays at $250, $500, $750, and $1,000 million.

Single Price Program

The program is similar to the 1962-type, with mandatory allotments and the same support price on all production. To conform with institutional restrictions, the government will provide a domestic subsidy between the domestic and world price only large enough to export 300 million bushels in commercial dollar markets. The difference between production and domestic wheat sales plus commercial dollar sales of 300 million bushels is "dumped" in the foreign non-dollar export market for a fixed recovery value of $250 million. This recovery value is somewhat arbitrary and would not apply to exports far outside the range ex-

Table 8. Estimated Wheat Supply and Utilization under the 1962 and 1964-Type Programs in 1967.

	1962-type	1964-type
	XII	XIII
	(Million Bushels)	
Supply		
Stocks beginning of year (20 million tons)[1]	666	666
50 million acres at 24.8 bushels per acre	1,240	1,240
Total	1,906	1,906
Utilization		
Food, seed, industry	550	545
Feed	50	50
Export:		
Commercial	392	392
Government	248	253
Total	1,240	1,240
Stocks end of year	666	666
Total	1,906	1,906

[1] It is assumed that prior programs would reduce stocks to 20 million tons by 1967.

perienced from 1960-62. The program would not require certificates and could be administered by a government agreement to purchase (and dispose in non-dollar markets) all wheat that would not sell either in domestic markets at support rates or in commercial export markets at support prices less export subsidy per unit. How the program support price and domestic sales are computed is described below.

Domestic food, feed, seed, and industry demand is assumed to be equation (17). It is equation (1) plus feed demand C_f fixed at 50 million bushels. Autonomous export demand C_a is omitted. C_d is the domestic demand quantity in million bushels and P is wheat price in cents per bushel. At $1.80 per bushel, the demand quantity is 600 million bushels.

$$(17) \quad C_d = 645 - .25P \qquad 100 < P < 250$$

The wheat price P in cents per bushel is maximized subject to the subsidy and allotment levels by a process similar to that used for previous programs discussed in this study. The government subsidy in the dollar export market for 300 million bushels is (18) where P is wheat price in cents per bushel, and 133 is the world commercial export price.

$$(18) \quad 300(P - 133).$$

The unrecovered value of wheat exported for foreign currency, barter, grants, etc. is the total allotment quantity A less the domestic quantity C_d and dollar exports. The unredeemed or government cost of these wheat exports is (19).

$$(19) \quad P[A - (C_d + 300)] - 25{,}500$$

Equation (20) results from combining (18) and (19), simplifying terms, and equating the total to the government outlay G. G does not include wheat storage costs, payments for acreage diversion and administrative cost.

$$(20) \quad P(A - C_d) = 64{,}900 + G$$

Given values of A and G, equations (17) and (20) are solved simultaneously for the two unknowns P and C_d. The computed farm price and income from wheat for three allotment levels and four government expenditure levels are included in Table 9.

The 250 million government cost level with a 60 million acre allotment is not a feasible alternative. Net farm income is less than under free markets because government payments do not fully compensate for the returns foregone from commercial export sales by restricting output. If government payments are not large with the Table 9 type programs, farmers would fare better income-wise under free markets.

Table 9. Estimated Farm Cost and Income from Wheat with Market Subsidies and Allotments at Alternate Levels.

Wheat Price at Farm Level	Farm Variables: Total Revenue	Farm Variables: Total Cost	Farm Variables: Net Revenue	Government Cost[1]	Increased Net Income Per Government Dollar
(Dol. Per Bu.)	(Million Dollars)				(Dollars)
	1.0 Bil. Bu. or 40 Mil. Acre Allotment				
1.98	2.076	600	1.476	250	2.76
2.46	2,585	600	1,985	500	2.40
	1.2 Bil. Bu. or 50 Mil. Acre Allotment				
1.43	1,772	750	1.022	250	.94
1.80	2,230	750	1,480	500	1.40
2.22	2,751	750	2,001	750	1.62
	1.4 Bil. Bu. or 60 Mil. Acre Allotment				
1.15	1,607	900	707	250	---
1.46	2,040	900	1,140	500	.71
1.76	2,459	900	1,559	750	1.04

[1] Does not include government cost for storage and administration. The difference in acreage between 55 million and the specified lower allotment level would have to be idled or put in soil conserving uses without diversion payments.

Table 9 illustrates that tighter allotments make government payments more efficient in raising farm income. As allotments are extended from 40 to 60 million acres, the increment of net farm income (above free market) per government dollar falls from $2.40 to $.71 with a $.5 billion government outlay.

A Multiple-Price Certificate Plan

The approach in Table 9 was patterned after the 1962 program—that in Table 10 is patterned after the 1964 certificate plan. The assumption is that the government will purchase the difference between "desired" marked utilization and the allotment level. The utilization is fixed at 545 million bushels in the domestic food, seed, and industry market. 50 million bushels in the feed market and 300 million bushels in the commercial dollar market—a total of 895 million bushels. With a 50 million acre allotment, 1,239 million bushels are produced. Thus, the government must purchase 344 million bushels and dispose of them outside commercial markets. If funds totaling $500 million are available to purchase this quantity, then the government can afford to pay $1.45 per bushel for this quantity. The domestic nonfeed certificate wheat always brings $2.00 per bushel. Feed and commercial export wheat are sold at going market prices. Gross receipts are: 545 million bushels at $2.00 per bushel (certificate) plus 50 million bushels at $1.33 per bushel (feed) plus 300 million bushels at $1.33 per bushel (commercial export) = $1,556 million plus the government outlay. In contrast to the

Table 10. Estimated Farm Cost and Income from Wheat with Market Subsidies and Allotments at Alternate Levels.

Wheat Price on Export Certificate Quantity[1]	Farm Variables: Total Revenue	Total Cost	Net Revenue	Government Cost	Increased Net Income Per Government Dollar
(Dol. Per Bu.)	(Million Dollars)				(Dollars)
	1.0 Bil. Bu. or 40 Mil. Acre Allotment				
1.60	1,806	600	1,206	250	1.68
3.20	2,056	600	1,456	500	1.34
	1 2 Bil. Bu. or 50 Mil. Acre Allotment				
1.45	2,056	750	1,306	500	1.04
2.18	2,306	750	1,556	750	1.03
	1.4 Bil. Bu. or 60 Mil. Acre Allotment				
1.00	2,056	900	1,156	500	.74
1.50	2,306	900	1,406	750	.83
2.00	2,556	900	1,656	1,000	.87

[1] Prices in other markets given in the text.

assumption used in Table 9 of a fixed $250 million recovery value on exports, a zero recovery value at any allotment or government outlay is assumed in Table 10. This assumption may not be realistic. The government outlay can be interpreted as **realized** rather than **real** costs. Or the table results can be interpreted to imply a (say) 50 percent recovery value on wheat in nondollar markets. If so, the implication of a $250 million government outlay will be interpreted from what is now recorded as a $500 million outlay. The efficiency of government dollars also would have to be adjusted.

In conclusion, Tables 9 and 10 and the programs discussed earlier show that government dollars will go farther to increase farm income if: (a) programs are administered to utilize feasible commercial markets, discriminating among them when feasible, (b) allotments are restrictive, (c) programs are operated at lower government cost, and (d) certain types of programs such as voluntary acreage diversion are minimized and market subsidies and certificate plans are utilized. These conclusions do not necessarily apply for commodities other than wheat.

Summary and Conclusions

The national average price of wheat without government price supports or production restrictions was estimated to be $1.20 per bushel (Table 11). Other assumptions, particularly regarding export markets, could lead to a lower equilibrium price. Depending on weather, domestic and foreign government policies, and storage, the wheat price could be expected to fluctuate around the equilibrium levels indicated. Under

Table 11. Summary of Estimated Implications of Selected Programs for Wheat in 1967.

Program	Table[1] Text	Price Wheat	Acres Planted	Net Farm Wheat Income	Government Cost	Income Increment above Program I Per Treasury Dollar	Social Cost
		($/Bu.)	(Mil.)	($ Mil.)	($ Mil.)	(Dollar)	($ Mil.)
I Unrestricted production, no supports	2[2]	1.20	66.3	787	Small	—	Small
III Two-price supply control	2[2]	1.22-2.00	59.4	1,229	Small	Large	14
V Direct subsidy farm payment with no controls	4	1.20	66.3	1,229	442	1.00	Small
VII Acreage diversion (farm payments for cutting wheat acreage)	4	1.28	46.9	1,229	414	1.07	75
IX Market subsidy with allotments	4	1.50	66.3	1,229	232	1.91	Small
XI Market subsidy with no allotments	4	1.49	74.3	1,229	271	1.63	8
XII 1962-type	6,7,8	1.80	50.0	1,569	531-754	1.04-1.37	[3]
XIII 1964-type certificate plan	6,7,8	1.30-2.00	50.0	1,393	298-478	1.27-2.03	[3]

[1] See the text and indicated tables for a more complete explanation of the program assumptions and ramifications.
[2] See Table 3, programs I' and III' for alternative estimates using a lower export demand elasticity.
[3] Not computed.

the free market program I, wheat would be planted on 66 million acres, and net farm returns from the crop would total $787 million. A two-price supply control or certificate plan III would increase net returns to $1.2 billion without government subsidy.

An acreage diversion program VII does not appear to be an acceptable single program for wheat, based on the criteria of social cost and efficiency of government dollars. Programs ranked from highest to lowest in efficiency of government dollars to raise farm income from wheat are: (a) multi-price certificate or supply control, (b) market subsidies, (c) acreage diversion, and (d) direct payments.

Social costs do not appear high except for the acreage diversion program. Net social costs, as measured for wheat programs in this study, rank in the following order from highest to lowest: acreage diversion programs, monopoly (supply control) programs, market subsidy or direct payment programs and finally unrestricted (free market) programs.

The 1962 and 1964-type programs appear to require more treasury funds per dollar increase in farm income than do some other programs presented. Estimates suggest that net farm returns under the 1964-type program would be slightly below returns under the 1962-type program in 1967. However, the 1964-type program is more efficient in use of taxpayers' dollars.

The wheat program alternatives presented in Tables 2 and 3 possess the common feature of nominal government cost. The net farm income generated by each program reflects various degrees of market power. Estimates in Table 12 can help to answer the question, "Would increased market power give equitable returns to wheat growers without government subsidies and resource adjustments from wheat-growing to other uses?" To the extent that the 1962-type program gives "equitable" returns to wheat growers, Table 12 suggests that increased market power would not compensate for resource adjustments and government price supports. The pricing and output under the three-price monopoly structure results in a net farm income from wheat totaling 78 percent of the net income under the 1962-type program.

Finally, it is again cautioned that the implications computed for the programs are subject to several limitations. The publication treats all classes of wheat as perfect substitutes when, in fact, they are not. The single national average price used throughout needs to be adjusted to any specific area, crop quality, etc. Also, the estimates are influenced by unpredictable variation in states of nature and government action.

Table 12. Net Farm Income from Wheat under Alternative Wheat Programs, Estimated for 1967.

Program		Text Table	Net Farm Wheat Income	Net Income as Percent of 1962-Type Program
I	Unrestricted production	2	787	50
II	Supply control, one-price	2	819	52
III	Supply control, two-price	2	1,229	78
IV	Supply control, three-price	2	1,231	78
XII	1962-type wheat program	6,7,8	1,569	100
XIII	1964-type wheat program	6,7,8	1,393	89

The estimates show aggregate changes in income, but do not indicate how this income is distributed among wheat growers. Total acreage changes are indicated, but the results do not specify whether wheat acreage expansion or contraction is on farms now growing wheat, or whether certain geographic areas will shift in or out of wheat production. In general, lower wheat prices can be expected particularly to reduce acreage in areas east of the Missouri-Mississippi where alternatives to wheat are most favorable. However, exact answers to these latter questions are beyond the scope of this study. (5)

Several programs, in addition to those presented in the text, could be used to raise farm income from wheat. These include:

(a) Demand expansion programs to expand wheat sales through research for new wheat uses, food stamp plans or advertising at home and abroad;

(b) Programs to retire cropland, including long-term land retirement taking out whole or part farms on a bid or other basis; purchase by the government of the rights to grow wheat (other crops could be grown); noninterest loans of indefinite duration for farmers to not grow wheat or to place all cropland in soil conserving uses;

(c) Income supplements on actuarial basis with farmers paying into an "insurance" fund in good years and withdrawing funds in depressed years; and

(d) Programs to encourage labor mobility through education and training for nonfarm employment, subsidies for migration of excess farm labor, and programs to increase farm knowledge of nonfarm job opportunities.

Appendix A

Export Demand[7]

Commercial demand for U. S. wheat in foreign countries equals the difference between the foreign demand and foreign supply of wheat, corrected for differences in transportation costs. Institutional restraints both at home and abroad now severely distort the commercial demand and supply structure for world wheat. The foreign demand and supply equations were estimated by least squares for the 1901-38 period when commercial market forces were considered to have a sizeable impact on wheat sales and price determination. Dummy variables were used to accommodate a changing market structure during and immediately following World War I. It is recognized that use of the 1901-38 period to determine demand and supply parameters relevant for 1967 is not without risk, and the estimates should be interpreted accordingly.

The estimated commercial foreign demand for wheat is (1) with the variables defined below. With 31 degrees of freedom, the computed

$$(1)\quad P_t' = -30.25 + \underset{(1.426)}{.038N_t} - \underset{(5.110)}{.035C_t''} + \underset{(5.295)}{.665P'_{t-1}} + \underset{(3.496)}{.488Y_t} + \underset{(2.324)}{15.433D_1} - \underset{(5.157)}{40.714D_2}$$

P' = Liverpool wheat price index, deflated by the British wholesale price index, 1910-14 = 100,

P^* = expected wheat price, $P_t^* = .5\ P'_{t-1} + .33\ P'_{t-2} + .17\ P'_{t-3}$,
P_c = deflated corn price, Liverpool,
N = foreign population, million persons,
C' = foreign wheat production, million bushels,
C'' = foreign wheat consumption, million bushels,
Y = British per capita income deflated by the British wholesale price index.
D_1 = dummy variable, 1914-16 = 1, zero elsewhere,
D_2 = dummy variable, 1917-20 = 1, zero elsewhere, and
T = time, 1901 to 1938.

t-values (in parentheses) for the coefficients of all variables except N differ significantly from zero at the 95 percent probability level. The multiple coefficient of determination is .85. The magnitude of the

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[7] Raymond McKinney, Graduate Student, Department of Agricultural Economics, Oklahoma State University, Stillwater is co-author of this appendix and spent many hours obtaining data on exports. Sources of these data are available from the Department of Agricultural Economics, Oklahoma State University.

coefficient of P'_{t-1} means that the adjustment rate is estimated to be .34, and approximately one-third the equilibrium adjustment of world price to world production is made in one year. The long-run demand elasticity computed from (1) is —.2 assuming $P' = 100$ and $C' = 5{,}000$. The estimate is much greater (absolute value) than for the domestic U. S. market because many developing foreign countries have a relatively high price (and income) elasticity of demand for wheat.

Equation (2) is the foreign supply of wheat, estimated from annual 1901-38 data by least squares.

$$(2)\ C'_t = 1637.74 + \underset{(6.487)}{66.950T} + \underset{(4.006)}{14.332P_t^*} - \underset{(.725)}{.128C'_{t-1}} - \underset{(4.598)}{801{,}000P_{ct-1}} - \underset{(2.291)}{248.571D_3} - \underset{(1.360)}{455.187D_4}$$

D_3 = dummy variable, 1915-18 = 1, zero elsewhere, and
D_4 = dummy variable, 1919-22 = 1, zero elsewhere.
C', P^* defined under equation (1).

Except for C'_{t-1} and D_4, the computed t-values (shown in parentheses below the coefficients) are significantly different from zero at the 95 percent probability level. The R^2 is .90. The adjustment rate does not differ significantly from unity, hence the adjustment rate appears quite rapid once expectations of price are formed. The short-run elasticity of supply (1-2 years) is .14, the long-run elasticity .28 (given $P' = 100$ and $C' = 5{,}000$).

Solving for C''_t and setting constants at the estimated 1967 level in (1), the foreign demand equation for wheat is (3). The shipping rate per bushel is assumed to be $.19 so that $P' = P + 19$.

$$(3)\ C''_t(D) = 9{,}916 - 16.1(P+19)$$

The supply equation (2) is simplified also by setting constants at the expected 1967 levels to form (4). The long-run export demand quantity C_e of American wheat is the difference between foreign supply and demand at a given price P, i.e., $C_e = C'_t(D) - C'_t(S)$. Subtracting (4)

$$(4)\ C'_t(S) = 4{,}812 + 14.3(P+19)$$

from (3) and simplifying, the commercial export demand equation for U. S. wheat is equation (5b). Equation (5a), $C_e = 0$, states that

$$(5a)\ C_e = 0 \qquad 143 < P < 250$$

$$(5b)\ C_e = 4{,}344 - 30.4P \qquad 100 < P < 143$$

commercial U. S. wheat exports would be nominal above a wheat price of $1.43 per bushel. Equation (5) is an intermediate-run equation, and would not be relevant until at least three years after institutional restraints were dropped. At P = 120, the export demand elasticity is —5.2. The equation has little predictive value for quantities exceeding 650 million bushels. At that quantity, commercial markets would tend to be saturated and the demand curve would turn down sharply.

Commercial export demand is assumed to be supplemented by a constant autonomous U.S. government demand C_a of 100 million bushels for export at all prices.

World Wheat Imports

Major changes in the structure of world markets influence the validity of Appendix equation (5). Appendix Table 1 shows changes in net imports and import shares of major wheat importing countries in selected periods. One of the major changes has been a substantial decline both in the import volume and share of the six nations in the European Eonomic Community. Nearly half of the net world imports were to EEC countries in the early 1900's, now the share has dropped to about one-tenth. During this period France and Italy changed from sizeable importers to net exporters of wheat. Trade and price policies in the common market are designed to bring eventual self sufficiency in wheat.

Other western European nations, dominated in trade volume by the United Kingdom, have maintained their volume of wheat imports, but have declined in import share in the face of expanding total world imports.

The major expansion in import volume has been from Communist nations, free Asia and South American nations. Brazil and Peru increased their combined share of world imports from 4 percent to 10 percent between 1909-13 and 1955-59. Asia (excluding Communist nations) had nominal net imports in the early 1900's, but now has approximately one-third of the world import share.

From 1961 to 1964 Red China imported from 148 to 192 million bushels annually—about double the average annual net imports of the combined EEC countries in the last period in Appendix Table 1.

Import data are not included for Communist China in Appendix Table 1 due to inadequate data prior to 1960. The U.S. does not sell wheat directly to Red China, but gains wheat sales indirectly to an unknown extent from Australia and Canadian markets which the latter countries forego in selling to China. The fact that Communist China is the largest single wheat importer in some recent years, ranks among the lowest of

Appendix Table 1.—Average Annual Net Imports of Principal Importing Countries & Areas in Selected Periods.[1]

	1909-1913		1925-1929		1930-1934		1955-1959	
	Quantity (Mil. Bu.)	Share (Pct.)	Quantity (Mil. Bu.)	Share (Pct.)	Quantity (Mil. Bu.)	Share (Pct.)	Quantity (Mil. Bu.)	Share (Pct.)
EEC								
Belgium & Lux.	51[2]		41[2]		43[2]		15	
W. Germany	69		74		13		15	
France	43		42		33		—33	
Italy	53		74		30		— 6	
Netherlands	22		29		27		37	
Subtotal	238	46.5	260	38.4	146	24.4	87	11.5
South America								
Brazil	20		33		32		61	
Peru	2		3		36		73	
Subtotal	22	4.3	36	5 3	4	6 3	10	9.7
W. Europe, Non EEC								
Finland	5		5					
Norway	4		7		9		12	
Switzerland	17		16		19		14	
United Kingdom	216		204		220		185	
Greece	5		20					
Subtotal	247	48.2	252	37.2	271	47.1	227	30.1
Asia								
India	) —50		) —1		) —1		90	
Pakistan	)		)		)		24	
Japan[3]	4		17		10		89	
Korea, South[3]	[3]		[3]		[3]			
Philippines	---		---				13	
Subtotal	[4]	[4]	16	2.4	9	1.6	229	30.3
Miscellaneous								
Yugoslavia	[4]	[4]	11	1.6	5	.9	34	4.5
Egypt	8	1.6	10	1.5	4	.7	36	4.8
Other Principal Importers[5]	43	8.4	92	13 6	104	18.1	69	9.1
Total[6]	512	100.0	677	100.0	575	100 1	75	100.0

[1] Data from USDA, Agricultural Statistics, U. S. Government Printing Office, Washington, D. C., 1940 and 1963.
[2] Luxembourg not included.
[3] Japanese and Korean data not comparable between pre and post World War II periods.
[4] Data not adequate for estimating quantity or share.
[5] Does not include Communist China imports due to lack of data.
[6] Component shares may not total exactly 100 percent due to rounding.

world nations in per capita income, and yet her wheat imports are commercial (for cash, hard credit or other full value received) suggests the potential for increased wheat sales to other developing nations.

World Wheat Exports

The major change in the export market structure is the increase in the U. S. share and decrease in the U.S.S.R. share between 1909-13 and 1960-62 (Appendix Table 2). Since the 1925-29 period, Argentina has had a lesser role both in quantity and share of world wheat markets, while Australia has increased in volume.

In summary, the major changes in world wheat markets are (a) growing ability of technologically advanced nations in North America and Europe to supply wheat for domestic and foreign needs, and (b) declining ability of developing nations with rapidly growing populations and lagging technology in Asia and South America to feed themselves. Communist nations such as Red China and Russia show declining ability to meet even domestic needs. Japan has also greatly expanded imports, mainly because of growing demands from a positive income elasticity and changing tastes toward wheat rather than from a burgeoning population or retarded farm technology.

The volume of world wheat exports fluctuated around 800 million bushels annually in the pre-World War II period. Table A-3 shows that world exports in the 1960's (excluding 1963 exports of 2,045 million bushels as typically high) have averaged approximately 1,600 million bushels, or double the pre-war exports.

U. S. gross exports, as a proportion of the world exports, were over 40 percent in each year of the 1960's. U. S. commercial exports averaged only 214 million bushels annually in the five years 1959-63, and comprised 13 percent of the world total. These "commercial" exports were subsidized by the difference between world and domestic U. S. prices. In the 1959-63 five year period, U.S. exports under government programs averaged 77 percent of the U. S. total wheat exports.

A major question is: What would be the level of commercial exports at alternative prices if government program exports were terminated or greatly curtailed? Past commercial export demand as embodied by Appendix equation (5) is only a rough estimate because of the changing structure of export demand.

Developing nations in Asia and South America constitute a growing source of demand for U. S. wheat, but are handicapped by lack of dollar

Appendix Table 2.—Average Annual Net Exports of Principal Exporting Countries for Selected Periods.[1]

	1909-1913		1925-1929		1930-1934		1955-1959		1960-1962	
	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share
	(Mil. Bu.)	(Pct.)	(Mil. Bu.)	(Pct.)	(Mil. Bu.)	(Pct.)	(Mil. Bu.)	(Pct.)	(Mil. Bu.)	(Pct.)
United States	105	21.1	154	21.4	58	9.7	440	42.5	668	46.6
Canada	94	18.9	307	42.6	220	36.9	293	28.3	345	24.1
Australia	50	10.0	83	11.5	128	21.4	95	9.2	198	13.8
Argentina	85	17.1	159	22.1	144	24.1	94	9.1	74	5.2
U.S.S.R.	164	32.9	18	2.5	47	7.9	114	11.0	148	10.3
Total (above)[2]	498	100.0	721	100.0	597	100.0	1,036	100.0	1,433	100.0

[1] Data from USDA, Agricultural Statistics, U. S. Government Printing Office, Washington, D. C., 1940, 1963; and USDA, *Wheat Situation,* WS-190, October, 1964.

[2] Exports do not equal imports (Table A-1) because neither all exports nor all imports are inluded in the respective tables.

Appendix Table 3.—U. S. and World Gross Wheat Exports, 1955 to 1963.[1]

		United States Exports					
		Commercial		Under Government Program		Total Gross Exports	
Year	World Exports	Quantity	Portion of World Total	Quantity	Portion of World Total	Quantity	Portion of World Total
	(Mil. Bu.)	(Mil. Bu.)	(Percent)	(Mil. Bu.)	(Percent)	(Mil. Bu.)	(Percent)
1955	1,065	105	9.9	241	22.6	346	32.5
1956	1,328	173	13.0	375	28.2	548	41.2
1957	1,190	155	13.0	247	20.8	402	33.8
1958	1,321	139	10.5	303	22.9	442	33.4
1959	1,351	134	9.9	375	27.8	509	37.7
1960	1,576	203	12.9	458	29.0	661	41.9
1961	1,749	228	13.0	491	28.1	719	41.1
1962	1,582	152	9.6	485	30.7	637	40.3
1963	2,045	355	17.4	495	24.2	850	41.6

[1] Data from U. S. Department of Agriculture, *Wheat Situation,* WS-190, October, 1964.

reserves. Whether the large and growing wheat demand in developing nations will be too stifled by lack of dollar exchange to constitute the commercial demand depicted by (5) is not known. Equation (5) is used to represent commercial export demand for U. S. wheat in lieu of a better measure, but it represents an upper rather than lower limit on commercial exports when government program exports are reduced to 100 million bushels.

Appendix B

Marketing Margins for Wheat

The following variables were used to estimate factors influencing the farm-retail price spread between wheat and bread:

P_R = Retail price per pound loaf of white pan bread,

P_F = farm value of the wheat ingredients in one loaf of white pan bread,

P_F' = farm value of all farm produced ingredients in one loaf of white pan bread,

W = factory wage rate per hour, and

T = a time trend; the last two digits of the current year.

All variables except T are deflated by the implicit price deflator of the Gross National Product, 1954 = 100. Data in equations labeled 0 are in original values; data in equations labeled L in Appendix Table 4 are in logarithms. T is in original values in the L equations, however. The data extend from 1920 to 1963 and exclude the years 1942 to 1947.

The price of bread at the retail level is considered to be a function of the cost of farm ingredients, the wage rate and a time trend to reflect gradual changes in production techniques and efficiency, volume, etc.

The past year retail bread price variable P_{Rt-1} is included to allow adjustment of the current price P_{Rt} to the equilibrium (specified by the explanatory variables) with a distributed lag.

The first two equations in Appendix Table 1 estimate the retail bread price from the price of wheat ingredients. The coefficients except on P_{Rt-1} are significant and the R^2 is high, as might be expected. The t-values are in parentheses.

The equations estimated in original observations explain slightly more variation in retail price than the logarithm forms. One interpreta-

Appendix Table 4.—Coefficients, t-Values (in Parenthesis) and R^2's for Wheat Marketing Margin Equations.[1]

Equation	R^2	Constant	P_{F_t}	P'_{F_t}	$P_{R_{t-1}}$	W_t	T
1-0	.9993	3.53	1.11		.057	.075	—.068
			(11.81)		(.936)	(13.143)	(7.163)
2-L	.997	—.15	.13		.34	.47	—.0026
			(3.42)		(4.86)	(4.50)	(1.9003)
3-0	.9994	3.50		.91	.078	.073	—.069
				(12.85)	(1.378)	(13.726)	(7.781)
4-L	.997	—.11		.16	.37	.41	—.0019
				(3.25)	(4.85)	(3.29)	(1.2064)

[1] See text for description of variables. Data from U. S. Department of Agriculture, *Farm-Retail Spreads for Food Products,* Miscl. Pub. No. 741, Table 66, p. 117, data from 1958-1964, U. S. Department of Agriculture, *Marketing and Transportation Situation,* February, 1964, Table 11, p. 25; *Economic Report of the President,* 1964, Table 6, p. 214, 1929-1963; 1919-1929, U. S. Department of Commerce, *Historical Statistics of the United States,* Series F 1-5, p. 139; U. S. Department of Agriculture, *Farm Income Situation,* Historical Tables, July, 1963, p. 41; and U. S. Department of Labor, *Employment and Earnings,* April, 1964, Table C-1, 1919-1963, p. 35.

tion is that the mark-up over the farm price is a constant amount rather than a fixed percentage of the farm price.

A 10 cent increase in nonfarm wages raises the retail bread price .7 cents based on (1) and (3). Given the level of nonfarm wages and the price of farm ingredients, the farm-retail margin has declined approximately .1 cents annually. This decrease is made possible by labor saving machinery, larger volume per bakery, and improved handling practices in retail stores, along with other reasons.

The coefficients of the lagged retail price in (1) and (3) are not significantly different from zero, implying an adjustment rate of one. That is, a change in the farm price of wheat and other farm ingredients is fully reflected into retail bread prices within about one year.

The highly significant short-run coefficient of the farm ingredient price P_F' is .91 in (3), meaning that a 10 cent increase in farm ingredients raises the bread price nine cents in one year. The long-run coefficient ("long-run" is not much longer than one year) is the short-run coefficient .91 divided by the adjustment rate $1 - .078 = .922$; or .99. Thus, a one cent increase in the cost of farm ingredients is quickly and quite completely passed to consumers through higher bread prices based on equation (3). A 10 cent increase in ingredients raises the bread price 10 cents, and the marketing margin remains stable.

Use of all farm ingredients in bread P'_F rather than wheat alone P_F gives a slightly preferable explanation of the retail bread price. In 1963, the retail bread price in current dollars was 21.6 cents per pound loaf. The value of wheat ingredients was 2.5 cents and of all farm ingredients was 3.1 cents. The assumption used in describing the implications above of (3) is that marketing margin responses to wheat prices are similar to the responses to all farm ingredients. No conclusions are reached about the effect of changing wheat prices on margins for cake flour, pasta, and other nonbread food uses of wheat. (13)

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