FORWARD

With the exception of a few years, American agriculture in the post-WW II period has had to cope with the problems associated with productive capacity growing faster than has aggregate demand. The policy response has been acreage reductions accompanied by income/price support programs, with intermittent attention to export expansion. Paradoxically, while acreage reduction programs are aimed at reducing agriculture's capacity to Produce, price/income support programs have encouraged more intensive use of the acres remaining in production so that output has expanded regardless of attempts to control production.

It has long been argued that farmers bear a greater burden of the adjustment costs associated with economic growth and progress in the sector than do other members of society, and should, therefore, be assisted accordingly on equity grounds. Curiously this assistance has generally taken a form that leads to price distortions and resource misallocations rather than a form that would bring about needed adjustments of resources. The current interest in "decoupling" farm income support from production decisions, on the other hand, places greater emphasis on adjustments based on market signals. Given the current surplus situation in agriculture and the interest in such policy approaches as "decoupling," it is timely to reconsider issues surrounding surplus capacity, agriculture's capacity to adjust to that output level that would clear the market at prevailing prices, and public policies and programs aimed at adjustment assistance.

Accordingly a symposium on Surplus Capacity and Resource Adjustments in American Agriculture was held in St Louis, MO. on Jan 23-24, 1989. The symposium was organized by a subcommittee of NCR-151 and sponsored jointly by NCR-151, the Agricultural and Trade Analysis Division of Economic Research Service, USDA, and the Farm Foundation. The symposium was designed to address the following questions: Is there surplus capacity in American agriculture? Do excess resources remain in this sector? Do existing policies impede resource adjustments in this sector? Would new policy approaches facilitate more appropriate adjustments in agriculture? Are there significant differences in adjustment issues and prospects in the various regions of the country? The initial session of the symposium examined the issue from a national aggregate perspective --- what is the productive capacity of the sector, how do we estimate surplus capacity and overinvestment in agriculture, and what has been the past record of adjustments in agriculture. While the symposium was intended to be national in scope, it was also structured so as to examine regional differences in surplus capacity and/or resource adjustments. Thus the second session was devoted exclusively to regional issues. A final session concentrated on public policies which impede resource adjustments and public policies which might encourage more rapid or more rational resource adjustments.

So that all participants had a common base from which to prepare their remarks, a background paper summarizing the "free-market" results of the various quantitative models available was prepared in advance of the symposium. This paper provides a summary of several U.S. models and of the leading global free-trade models for which results are available. The paper drew on reports prepared for the pre-AAEA modeling conference held at Knoxville, TN on July 29-30, 1988 as well as on published works that are available: Derek Baker, Milton Hallberg, and David Blandford. "U.S. Agriculture Under Multilateral and Unilateral Trade Liberalization --- What the Models Say." The Pennsylvania State University Department of Agricultural Economics and Rural Sociology, A.E.& R.S. 200. January 1989.

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CHAPTER 1. TECHNOLOGICAL PROGRESS, PRODUCTIVITY, AND THE PRODUCTIVE CAPACITY OF AMERICAN AGRICULTURE

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The important conclusions of this paper are that (1) surplus or excess production capacity in American agriculture fell substantially in 1987 and 1988 even after adjustment for weather and (2) longer-term trends in supply and demand suggest less excess capacity on average for the 1990s than experienced in the 1980s. Occurrence of another of the periodic "world food crisis" such as experienced in 1966-67 and 1973-74 is a real possibility at some point in the 1990s. Production capacity of American agriculture is large, however, from on-the-shelf technologies. Hence chronically increasing real farm and food prices are unlikely; real prices are likely to return to cost of production after transitory rises.

This paper analyzes trends in excess production capacity and reserve stocks, and in supply-demand trends for the 1990s that build to these conclusions. The paper first outlines a conceptual framework. It then examines trends in excess production capacity and stocks before projecting trends in supply and demand.

RELATING TECHNOLOGY, PRODUCTIVITY, AND PRODUCTION CAPACITY

To address the assigned topic as given in the title, I define terms and present a conceptual framework. Technology, defined as the process for converting inputs to outputs, is not the same as productivity. This is illustrated in Figure 1 with production possibility curves showing combinations of food and nonfarm commodities producible with a given technology and resource base. The combination of food and nonfood attainable with technology of the initial period is T_0 and with technology of a subsequent time period is T_1 although aggregate resource volume remains the same between periods.

Productivity is measured by the proportional change in real revenue or income Y produced by the available technology and production resources. The highest revenue or real income Y_0 attainable in the initial time period is isorevenue line R_{00} tangent to T_0 at A and intersecting the food axis at Y_0/P_{f0} and the nonfood axis at Y_0/P_{n0}. With new technology and an unchanged price ratio P_n/P_f (the slope of the isorevenue line), the new equilibrium at B is for a very different combination of food and nonfood but productivity as measured by real income Y_0 has not increased. Of

*Comments of Carl Zulauf are greatly appreciated.

course, if the isorevenue line would have been tangent to T_0 above A initially, the new technology would have decreased productivity by moving to a lower Y. Then producers would not adopt technology T_1. On the other hand, if the initial terms of trade line had been R_{01} tangent to T_0 below A at C in Figure 1, the new technology represented by T_1 would have increased the isorevenue line to R_{11} and productivity by the proportion Y_1/Y_0 with production at point D. It is apparent that a change in technology does not necessarily change productivity and that prices used to weight quantities influence measures of productivity. The latter is the so-called index number problem which has no exact solution.

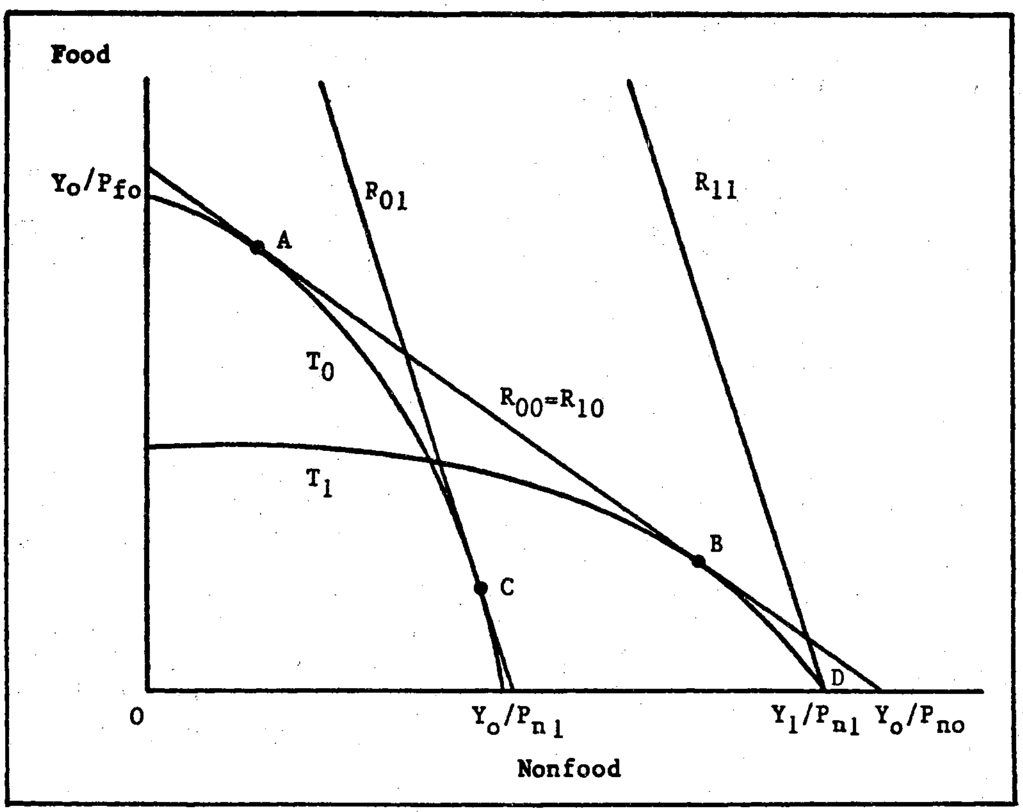

Figure 1. Isorevenue Lines R and Production Possibility Curves for Food and Nonfood Commodities under Technologies T_0 and T_1.

Technology in Figure 1 was viewed as an autonomous change increasing real income. In fact, technology is produced by scarce resources of education, science, knowledge, and ingenuity bringing forth a durable stream of future income (output). Hence technology is a form of capital. This distinction is important because it recognizes that technology is not free "manna from heaven" but instead requires savings and investment in an appropriate institutional and cultural environment. Thus economics has a great deal to say about technology, including how best to allocate limited resources to produce it, conventional capital, human capital, or consumption goods. A concern is opportunities for technology to change productivity and future supply-demand balance -- an important issue given the decline in excess capacity and productivity advances noted subsequently.

Excess Capacity

Various flow concepts of reserve resource capacity (as opposed to commodity stock reserves) are illustrated in Figure 2 (see also Yeh, Tweeten, and Quance; Dvoskin). The framework is designed to be useful in addressing either issues of food abundance or shortage -- the latter calling for drawing on reserve capacity to produce. Social supply and demand curves for farm output are respectively S_f and D_f giving equilibrium free market clearing price P_f and quantity q_f.

Excess capacity is defined as normal (weather corrected) production q in excess of what the market will absorb at price P. The degree of excess capacity is especially a function of the nonrecourse loan rate under past commodity programs presumed to give incentives represented by prevailing market price P. In the early 1960s I defined excess capacity as production capacity in excess of what markets will absorb at socially acceptable prices. In reality, current prices were used. Recognizing that the prices were set by political forces operating through the federal government, I later referred to excess capacity at politically acceptable prices. This emphasizes that excess capacity is a creation of and exists at the will of government; at some price the market will clear. Typically, excess production capacity is expressed as a rate, that is, as a percent of expected production q in Figure 2.

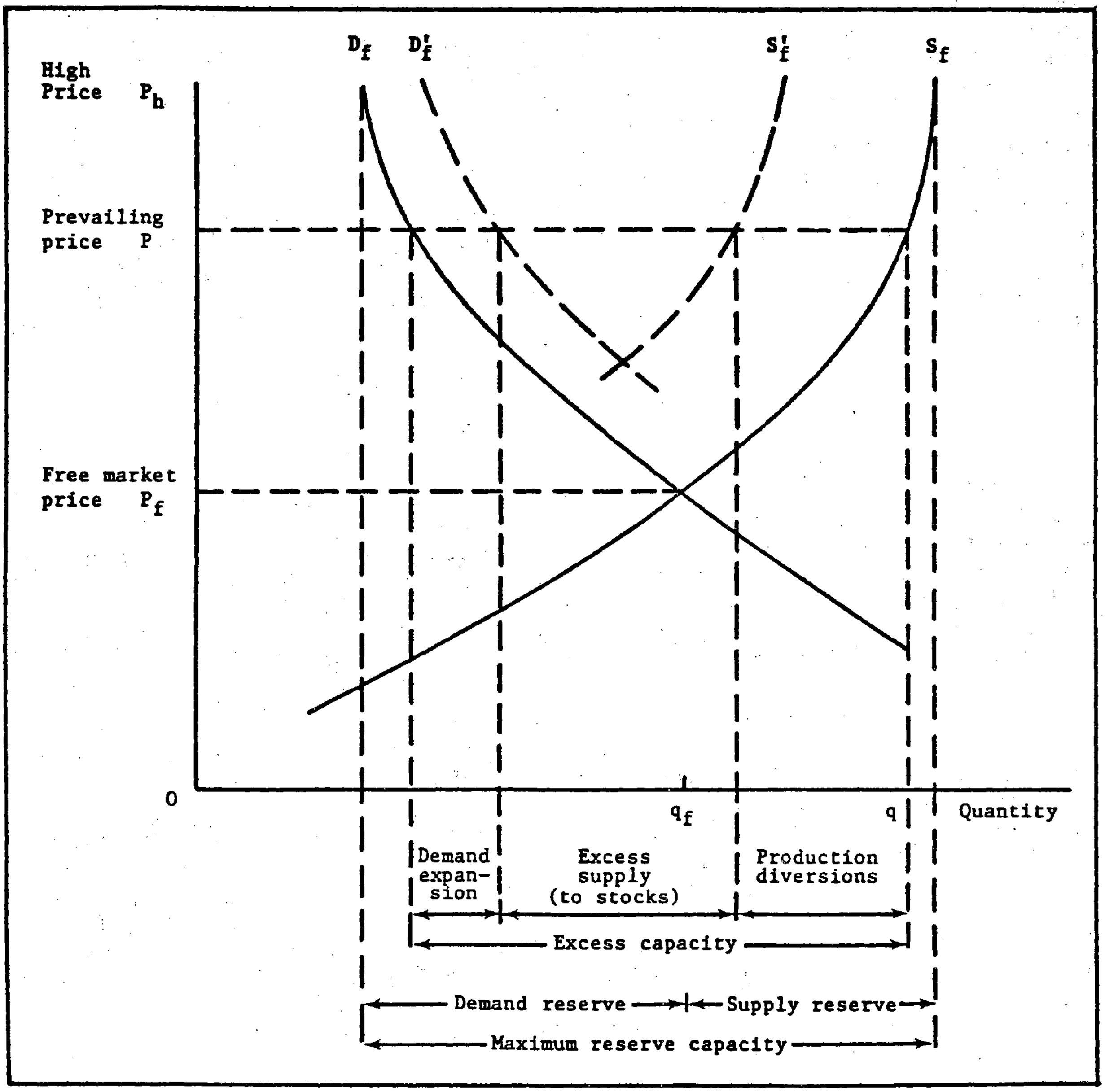

Figure 2. Supply and Demand Curves Illustrating Concepts of Reserve Capacity.

Excess capacity has three components: demand expansion, production diversion, and excess supply. Demand expansion programs such as export credits, subsidies, and grants along with dairy diversions to dispose of excess output in noncommercial markets. Production diversion reduces supply through programs such as paid diversion, acreage reduction in return for eligibility for nonrecourse loans and deficiency payments, and the

Cropland Retirement Program. Excess supply remaining after demand expansion and production diversion is removed by another demand component, commodity stock accumulation.

Maximum reserve capacity is at an arbitrarily high price P_h at which D_f and S_f become perfectly inelastic. Although attractive to laypersons, the concept largely is academic because it is difficult to conceive of any realistic price so high that raising it will not reduce consumption or expand output by at least a small increment. On-the-shelf technology can shift the supply curve to the right. Maximum reserve capacity was so large in the mid-1970s that the U.S. alone could have provided sufficient calories to feed the world if transport and other obstacles could have been overcome (Yeh, Tweeten, and Quance). That scenario is not of much interest, however, and I focus herein mainly on excess production capacity at a lower price P.

Critique and Defense of Excess Capacity Measure

Refinements in measuring excess capacity include adjustments for changes in prices (see Tyner and Tweeten) and weather over time. I prefer to normalize yields for weather by using long-term projected yields. Dvoskin, in his thorough recent work, used a 7-year moving average of excess capacity to adjust for weather. A problem with this procedure is that the most current numbers are not adequately adjusted -- precisely those numbers of greatest importance for current policy purposes.

Other suggestions that have been advanced from time to time for improvement or refinement include:

1. **Eliminate the concept,** a suggestion lacking merit but originating from free market advocates and supply control advocates alike. Market advocates say the concept implicitly and unfortunately legitimizes government intervention and denigrates the role of market clearing prices in agricultural markets. To address this issue, I usually include a disclaimer noting that excess capacity would not exist without government intervention in markets.

   In contrast, Walter Wilcox, chief economist in the U.S. Department of Agriculture in the 1960s, suggested I replace the pejorative excess with the term reserve capacity because of his belief that government support of farm prices and income was entirely appropriate -- it was a useful buffer against an unfortunate and unpredictable turn of weather or other events. "Reserve" emphasizes that excess production capacity has been convenient from time to time such as during various wars, the world food crises of 1966-67 and 1973-74, the corn blight of 1970, and the great droughts of 1934, 1936, 1983, and 1988.

Excess production capacity indeed has value for reserves but also has a social or deadweight cost indicated by the "triangle" bounded by the area beneath the price P bounded by the demand curve D_f and the supply curve S_f down to price P_f in Figure 2. The deadweight loss or full national income foregone C by various levels of excess capacity quantity EX and expressed as a percentage of gross farm receipts is approximately (Tweeten, 1979, p. 485)

$$C = 50 \left(\frac{1}{\alpha} \quad \frac{1}{\beta}\right) \left(\frac{EX}{100}\right)^2$$

where α is the supply elasticity and β is the demand elasticity for farm output. Assuming $a = .17$ and $\beta = -.25$ in the short run, then C for various proportions of excess capacity is:

EX (Excess capacity) (%)	C (Deadweight loss as % of farm receipts)
2	.2
4	.8
6	1.8
8	3.2.

With a farm gross of $150 billion, the social cost of maintaining 4 percent excess capacity is $1.2 billion but of maintaining 8 percent excess capacity is $4.8 billion. Thus social costs rise geometrically with higher EX. Commodity stock reserve capacity generally is cheaper to hold and is more readily available than is resource flow excess capacity measured by EX.

In summary, some transitory excess capacity generated by a nonrecourse loan rate P above P_f may be socially desirable to generate buffer stocks to ensure adequate food and fiber supplies in an uncertain environment of variable weather and other exigencies. But holding excess capacity in the form of diverted acres and demand expansion programs has often been uneconomic because alternative stabilization measures such as commodity stocks, future markets, and revenue insurance would have cost less.

2. **Avoid use of excess capacity to measure short-term impacts of removing government interventions.** This suggestion has merit because excess capacity numbers lend themselves to frightening scenarios of immediate repercussions from removal of government price and income support programs. A typical average excess capacity rate for the 1960s and 1980s was 5 percent. A typical

short-run elasticity of demand for farm output is E = -.25. The implications of an immediate release of that excess capacity on the market, before resources and costs adjust, are for a drop in aggregate prices, gross receipts, and net farm income as follows:

Concept	Measure (release of 5% excess capacity)	Impact
Farm prices	Price flexibility $F = 1/F = -4$	$F \times 5 = -20$
Gross receipts	$1 + F = -3$	$(1+F) \times 5 = -15$
Net income	$(1+F)\,\frac{R}{N} = -9$	$(1+F) \times 3 \times 5 = -45$

where the ratio of gross receipts R to net farm income N is 3. Termination of government programs is predicted to decrease farm prices 20 percent, receipts 15 percent, and net income 45 percent in the short run before supply adjustment. If direct payments also would be terminated, net farm income could be zero or negative.

Although providing ammunition used by special pleaders to justify continued large interventions in farm markets, these numbers are not meaningful estimates of the implications of a market-centered farming industry for several reasons:

* No serious economist or politician proposes to shift farming "overnight" or "cold turkey" to a free market. A transition program is essential, including direct payments and mobility assistance to aid farmers while they make adjustments.

* Demand and supply elasticities are in reality higher than those commonly used. Commodity stocks in the short run and export demand in the longer run are especially responsive to price.

* Except in the very short run, both supply and demand responses work to reduce excess capacity (see Tweeten, 1989). The elasticity of excess capacity with respect to price is the sum of the demand elasticity E_d (sign reversed) and the supply elasticity E_s. If the sum of these elasticities is respectively .5 in absolute value in an intermediate run of five years and 1.0 in the longer-run of 10 years or more, then 5 percent excess capacity can be eliminated by reducing price P by 5 percent for five years or only 2.5 percent for 10 years or more. These numbers are less onerous than the short-run results for producers.

* Agricultural land prices are the third component along with output supply and demand in making economic adjustment. Land values adjust to absorb expected long-term changes in farm net returns so that rates of resource returns on efficient commercial farms are equal to those elsewhere in the economy. Net farm income and rate of return on resources probably would be very similar with or without commodity programs on the average over a long run of over five years (Tweeten, 1989).

3. **Excess capacity cannot be measured objectively.** The three major components of excess capacity (excess supply, production diversion, and demand expansion) cannot be measured with equal accuracy. Excess supply as defined in Figure 2 can be readily measured by the change in commodity stocks. Measuring diverted production conceptually is more elusive but tractable. On the average, only two out of three diverted acres will be harvested in the absence of controls. This slippage varies by crop but can be objectively measured in that statistical analysis has given consistent results when performed by various researchers over alternative time periods (Tweeten, 1979, p. 484; Dvoskin, p. 25).

The most troublesome component is demand expansion, especially government subsidized exports. Based on now dated Ph.D. research by Pinstrup-Andersen, 50 percent of Public Law 480 exports would have sold commercially in the absence of the program. Hence in previous analysis I attributed half the value of PL 480 to excess capacity and farm price and income support and attributed the other half to real foreign aid.

Export subsidies such as GSM credit, the Export Enhancement Program (EEP), and Targeted Export Assistance (TEA) divert production from markets as indicated in Figure 3. With price P_o and quantity q_o without subsidies, export receipts are 1 + 4. An export subsidy decreases export price to p_1 and increases exports to q_1. If the export subsidy discriminates among markets, its cost is 1 + 2 and it generates extra market receipts of 2 + 3.

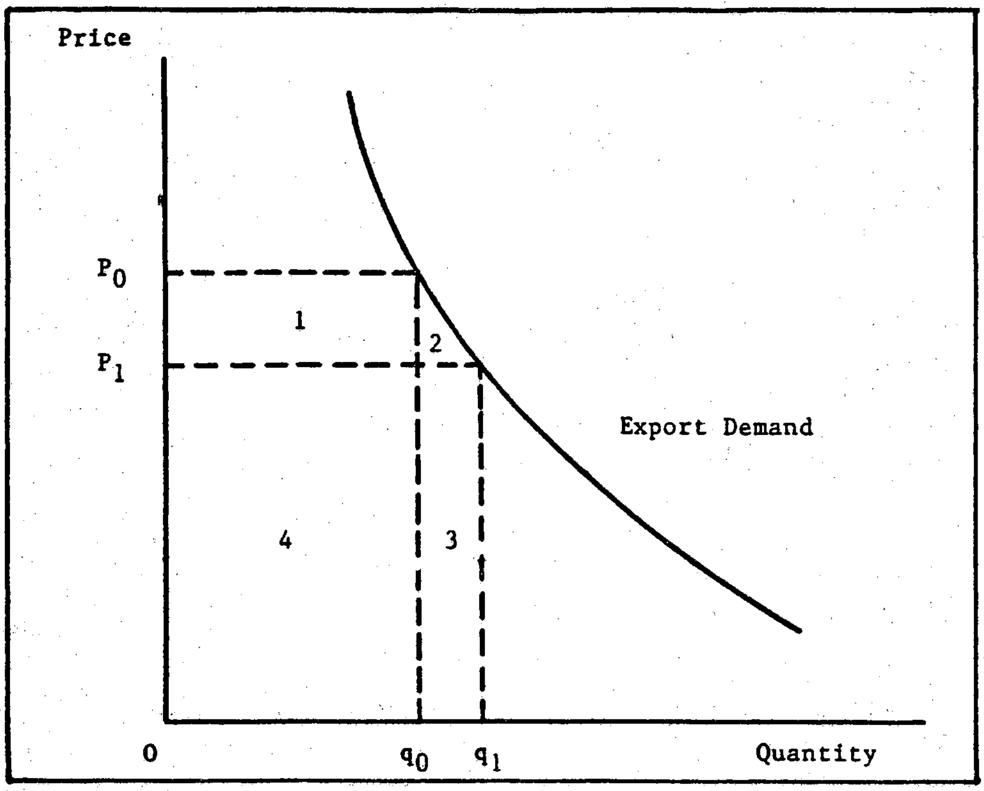

Figure 3. Contribution of Export Subsidies to Export Receipts.

Hence the receipts generated per subsidy dollar are:

$$\frac{\Delta qp}{\Delta pq} = \frac{2 + 3}{1 + 2} = \frac{3}{1} = E$$

or the elasticity of export demand E. Each dollar spent on GSM (not face value but interest subsidy), EEP, and TEA generates revenue per program dollar spent equal to the elasticity of export demand. A crude approximation is that E is unitary in the markets and short-term time horizon relevant for these programs. Hence each dollar spent on the programs adds a dollar to farm receipts. By this accounting GSM, EEP, and TEA added just over $1 billion to farm receipts in fiscal 1988 -- a rather modest contribution to removing farm excess capacity.

4. Another criticism is that **excess capacity is a dynamic concept influenced by technology and other factors not accounted for in the static economic framework** of Figure 2. Excess capacity is indeed a useful concept for measuring ability to respond to a world food crisis or other setback. But those concerned with ability to respond to a world food crisis often focus excessively on the quantity of various classes of cropland that have not been diverted from production but could be utilized to produce food. This has been a futile digression in part because it ignores supply and demand responses in Figure 2. Potential cropland that has not been diverted is unresponsive to price. More importantly, such focus on potential cropland diverts attention from the prominent sources of additional output such as fertilizers, other conventional capital, and improved technology. These far overshadow land as potential sources of supply to meet longer-term food and fiber needs.

Holding excess capacity and raising farm prices are means to respond to future food needs. Rather than using price to move up the supply curve and restrain demand, with adequate lead time it is far less costly to raise output by shifting the supply curve to the right in Figure 2. Such a shift in the supply curve through investment in productivity-enhancing education, research, and extension requires prior planning because of the long lag between application of nonconventional inputs and farm output response. As noted later, such dynamic long-term approaches can be handled in the supply-demand framework of Figure 2 for analyzing ability to respond to food and fiber abundance or shortage. We will examine shifts in supply and demand after reviewing recent estimates of excess flow and stock capacity.

EMPIRICAL ESTIMATES OF EXCESS CAPACITY AND RESERVE STOCKS

Figure 4 shows estimated excess production capacity as a percentage of output at current prices for 1980 to 1988.

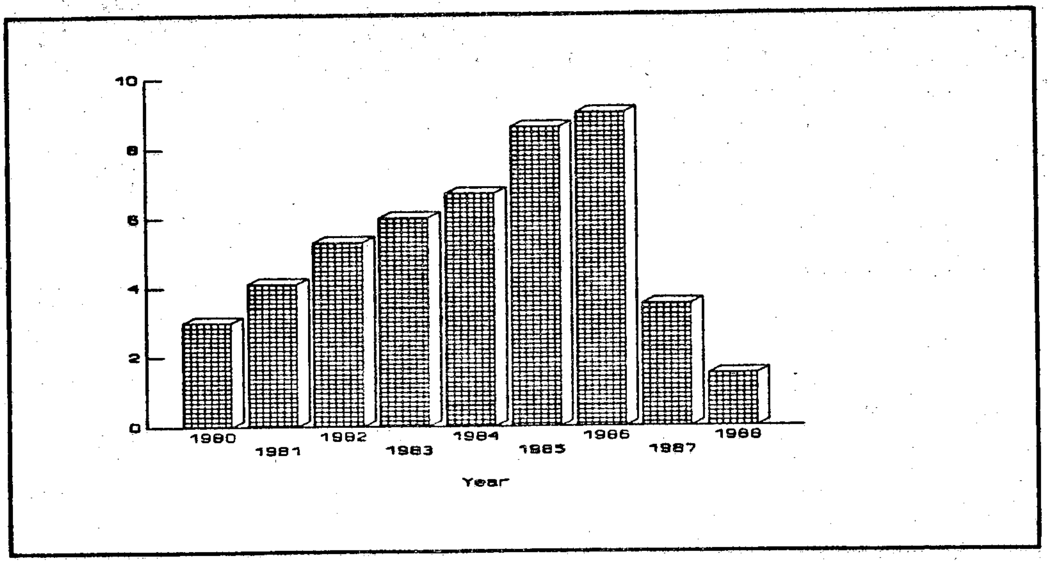

Figure 4. Excess Production Capacity as Percent of Farm Output and Adjusted for Weather.
Source: 1980-86 data from Dvoskin adjusted for weather by 7-year moving average. Estimates by Tweeten for 1987-88 adjusted to normal weather by long-term yield trend.

The 1987 and 1988 estimates are my preliminary calculations using long-term yield trends (see later tables) to adjust for weather. The seven-year moving average estimates from Dvoskin for 1980-86 are thus not strictly comparable with the 1987 and 1988 estimates. In addition, the 1980-86 estimates do not include the Conservation Reserve Program which I included in 1987 and 1988.

Excess capacity gives a somewhat symmetric pattern for the 1980s, rising from 3 percent in 1980 to a peak of approximately 9 percent in 1985 and 1986, then falling to near 4 percent in 1987 and 2 percent in 1988. Reasons for the change in excess capacity are discussed later.

Figure 5 illustrates sources of excess capacity in 1987. Production diversion constituted the largest component, $6.8 billion, of excess capacity. Of this, acreage diversion accounted for $5.3 billion and the Conservation Reserve Program (CRP) for $1.5 billion.

Demand expansion accounted for an estimated $3.4 billion with $1.6 billion of that due to export PIK (EEP, TEA) and export credit (GSM), $1.0 billion due to food for peace (PL 480), and $0.8 billion due to dairy purchases by government.

Weather adjusted excess supply as measured by inventory reduction totaled $5.2 billion and nearly offset acreage diversion. The implication is that with normal weather and with prices and other conditions prevailing in 1987, retention of demand and CRP programs but termination of the acreage diversion programs and a more nearly optimal crop mix would have left commodity inventory nearly unchanged.

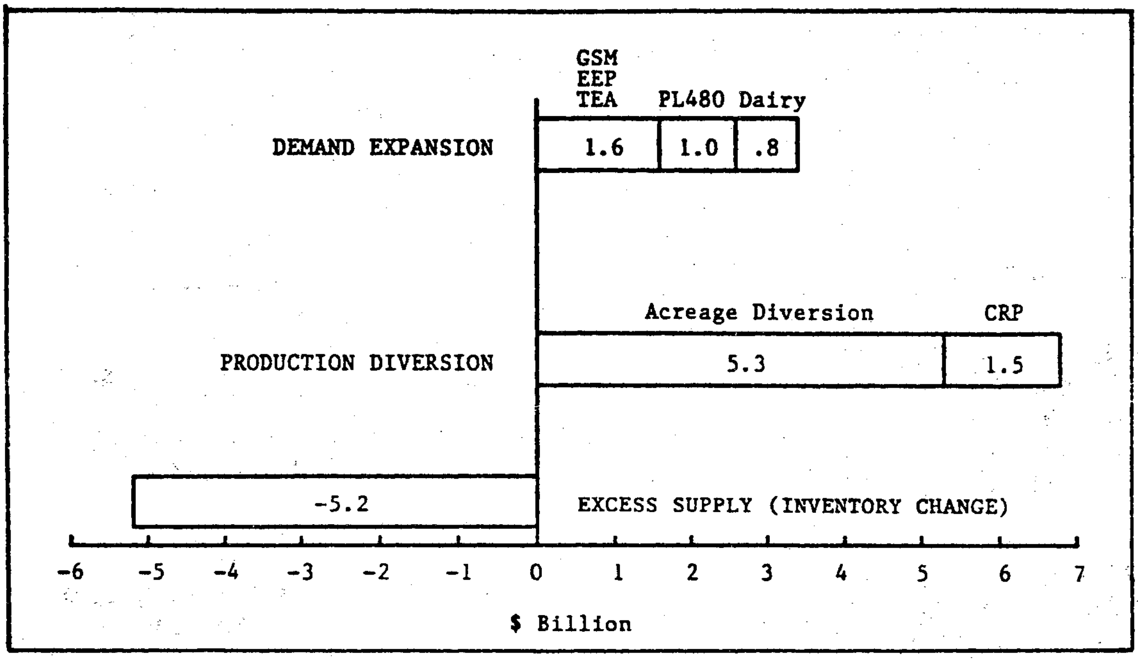

Figure 5. Sources of Excess Capacity in 1987. (See Figure 2 for definitions.)

As noted earlier, short-run reserve capacity can be a stock (commodity buffer stocks) or a flow (excess capacity), the latter a measure of reserve resources that would be utilized to meet commercial demand. The most readily available reserve is commodity stocks which also are low as apparent from USDA (November 1988) preliminary estimates of anticipated end-of-year inventories for year 1988/89:

	(million bushels)
Wheat	52
Rice (million cwt.)	28
Soybeans	128
Feed grain total	2,084
Corn	1,407
Sorghum	439
Barley	159
Oats	81

Based on my earlier procedure (see Tweeten, 1983) for estimating ending reserves required to avoid a stock shortfall 49 out of 50 years (a number closely aligned with prior estimates of economically optimal stock levels), buffer stock requirements measured in ending inventories are 900 million bushels of wheat, 360 million bushels of soybeans, and 2,500 million bushels of feed grains. Stocks need to rise considerably to meet these desired carryover levels.

Because excess capacity declined from 1987 to 1988 as noted in Figure 4, it appears that acreage diversion programs (except CRP) need to be eliminated or the actual 10 percent grain diversion ignored if adequate stocks are to be maintained given normal weather. Lower target prices can further reduce excess capacity but probably by a modest amount. An offsetting factor is higher prices in 1989 which will restrain demand and expand supply. Furthermore, excess capacity is not evenly distributed -- it is heavily concentrated in corn production because of program distortions. For reserve capacity to reach an equilibrium of zero, less production of corn and more of soybeans, barley, and oats is required.

With sharply lower excess production capacity and stock reserves, future prospects hinge on trends in supply and demand. These trends discussed in the next two sections will heavily influence real farm and food prices in the 1990s given diminished worldwide food reserves.

PRODUCTIVITY AND SUPPLY: THE PUZZLE OF DECLINING PRODUCTIVITY GROWTH

Evidence of the declining rate of growth in agricultural productivity since 1950 is now compelling. The unmistakable decline has been slow to unveil because trends have been obscured by the "noise" of weather and other random shocks.

The rate of gain in productivity of American agriculture is slowing by nearly all measures shown in Tables 1 and 2.

Table 1. Livestock and Livestock Products Productivity Trends.[a]

Item	Equation[b]	R^2	Predicted 1950	1970	1986	2000[c]
			(percent per year)			
All livestock production per hour	ln-linear	.998	6.51	6.51	6.51	6.51
	ln-ln 1950	.998	6.57	6.51	6.45	6.41
All livestock production per breeding unit	ln-ln 50	.968	2.06	1.47	1.20	1.03
Milk production per dairy cow	linear	.995	4.81	2.45	1.76	1.41
Pigs per litter	ln-ln 50	.688	0.40	0.29	0.24	0.20
Meat animal production per hour	ln-linear	.980	0.10	0.07	0.06	0.05
Milk production per hour	ln-linear	.988	7.86	7.86	7.86	7.86
Poultry production per hour	ln-ln 50	.998	11.00	7.85	6.39	5.50

[a] Estimated from annual data for 1950 through 1986.
[b] Selected from following equations giving highest R^2
Linear $Yi = a + bT$
ln-linear $\ln Yi = a + bT$
ln-ln 50 $\ln Yi = a + b\ln T$ (T = 50, 51, ... 86)
ln-ln 1950 $\ln Yi = a + b\ln T$ (T = 1950, 1951, ... 1986)
where Y_i is productivity measure and T is time trend.
[c] Predicted outside range of data.

Table 2. Crop Productivity and Total Output per Production Input (Multifactor Productivity) Trends.

Item	Equation[b]	R^2	Predicted 1950	1970	1986	2000[d]
			(percent per year)			
All crop production per hour (1950-86)[a]	ln-ln 50	.998	11.00	7.85	6.39	5.50
All crop production per acre (1950-86)	ln-ln 50	.953	2.60	1.86	1.51	1.30
Wheat production per acre (1950-88)	ln-ln 50 with ln harvested acres[c]	.916	2.97	2.12	1.73	1.49
	ln-ln 50	.898	2.82	2.02	1.64	1.42
Corn production per acre (1950-88)	ln-ln 50	.885	3.98	2.84	2.31	1.99
Soybean production per acre (1950-88)	ln-ln 50	.748	1.57	1.12	0.91	0.79
Cotton production per acre (1950-88)	ln-ln 50	.655	1.58	1.13	0.92	0.79
Total output of crops and livestock per all production inputs (1950-86)	ln-ln 50	.962	2.59	1.85	1.51	1.29

[a] Period of estimation from annual data.

[b] Selected from following equations giving highest R^2.
Linear $Yi = a + bT$
ln-linear $\ln Yi = a + bT$
ln-ln 50 $\ln Yi = a + b\ln T$ (T = 50, 51, ...)
ln-ln 1950 $\ln Yi = a + b\ln T$ (T = 1950, 1951, ...)
where Yi is productivity measure and T is time period.

[c] Included current harvested acres of wheat as independent variable. Wheat was only case where this variable was significant.

[d] Predicted outside range of data assuming continuation of 1950-86 (88) trend.

Productivity measures were fitted to time trends by four equations allowing for a constant absolute change, a constant percentage change, or for varying percentage changes over the period 1950 to the most recent year of available data. The "best fit" equation was selected as measured by the coefficient of determination R^2 adjusted for degrees of freedom. The period beginning with 1950 was chosen to depict the long-term trend minimally distorted by unrepresentative transitory weather or economic conditions. Trends since 1960 gave similar results not only for the U.S. but for foreign crops (see Tweeten, November 1988).

Only livestock production per hour and milk production per cow did not display significantly slowing productivity growth (Table 1). Livestock and milk production per hour showed percentage gains respectively of approximately 6.5 percent and 7.9 percent annually for the 1950-86 period -- rapid gains indeed. Crop production per hour showed sharp early gains (11 percent in 1950) with extensive mechanization but by 1986 the trend had slowed to a 6.4 percent annual rate (Table 2), the same rate as for livestock production per hour.

By 1986 the rate of increase in all livestock production per breeding unit and all crop production per acre had slowed to nearly half the trend rate of 1950. That tendency for annual gains to halve is apparent for a number of measures in Tables 1 and 2.

Productivity gains in pigs per litter and meat animal production per hour were never very large over the 1950-86 period but are falling. If past trends continue, these indicators also will show rates of gain by year 2000 only half those of a half century earlier. Productivity gains for animals have been primarily for dairy and poultry rather than for hogs and beef cattle.

Farm labor could be increased almost without limit with appropriate incentives. Cropland and cropland yield enhancement opportunities are more limiting, hence productivity per acre is a more meaningful measure of production capacity restraint than is production per hour. Yield trend annual increases slowed for all individual crops shown in Table 2 -- by 1986 yield trend increases were only 1.7 percent for wheat, 2.3 percent for corn, and 0.9 percent for soybeans and cotton.

The most comprehensive estimate of overall productivity gains and hence the rightward shift in the supply of total farm output is aggregate crop and livestock output per unit of production inputs, the last measure in Table 2. This aggregate multifactor productivity measure decreased from a trend rate of 2.6 percent in 1950 to 1.5 percent in 1986. If the 1950-86 trend continues, aggregate farm output supply will increase only 1.3 percent in year 2000. The supply curve could increase also from decreasing input prices. But real input prices are likely to increase for labor, fertilizers, energy, and other inputs. A recent CAST study indicated that world petroleum reserves will be substantially depleted in 50-75 years and phosphate rock reserves in 90 years if past rates of usage continue. These absolute numbers must be interpreted with caution -- reserves will not run out but usage will become more costly as prices rise to ration available supplies. Restraints on nitrogen fertilizer and pesticide usage for environmental protection could further slow productivity gains.

I (Tweeten, 1987) have posited that productivity gains are characterized by technological revolutions as noted in Figure 6. The first revolution in productivity of conventional crop and livestock resources began about 5000 BC when food gatherers and hunters domesticated plants and animals, irrigated, and cultivated crops with simple tools such as the hoe. The industrial revolution beginning in the United States about 1850 brought the railroad and mechanical technologies such as the reaper and steel plow. These induced a mechanical revolution of mainly labor-saving technologies that improved productivity by modest proportions compared to the 1950s but radical proportions compared to the gains prior to 1850. Diminishing returns are obvious from the technological revolution that began in the 1930s when farm productivity was expanded by the internal combustion engine and tractor, improved animal genetics and crop varieties, and application of chemical fertilizers and pesticides. This was the first but not the last agricultural productivity revolution from applications of science. Each technological revolution indicated in Figure 6 eventually displays diminishing returns but the megatrend envelope curve of successive revolutions shows increasing returns.

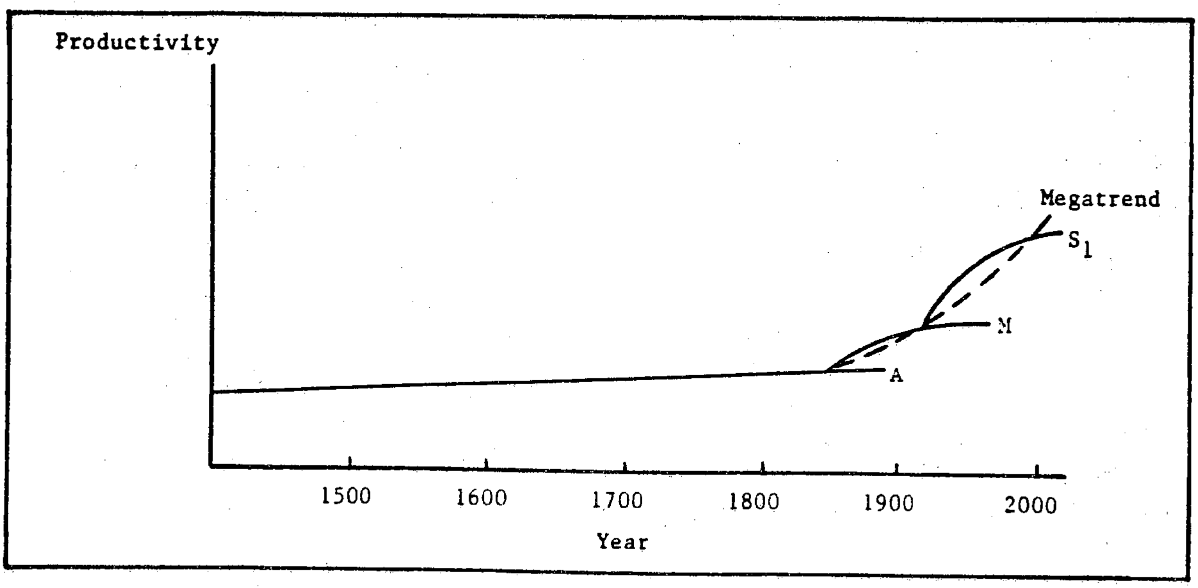

Figure 6. Farm Productivity Long-Term Megatrend under the Agricultural Revolution A, Mechanical Revolution M, and First Scientific Revolution S_1.

Technological revolutions are difficult to predict because they are the result of complex forces including luck, institutions, and investment in education, science, and knowledge. We can observe the beginnings of the next revolution originating from biotechnology (recombinant DNA, tissue culture, growth stimulants, etc.) and computers (artificial intelligence, information systems, etc.), and dimly perceive the promise of nuclear fusion power and superconductors. At issue is not whether but when will these impact on agriculture.

A delphi panel of scientific experts assembled by the Office of Technology Assessment (OTA) predicted productivity gains in milk production per dairy cow averaging 4 percent per year from 1982 to 2000. That prediction now seems grossly optimistic based on trends apparent for dairy shown in Table 1. Vaccines, hormones, ice-minus bacteria to protect against frost, and corn and soybeans resistent to pesticides are products of genetic engineering making appearances as proven technologies. But these and other products of the emerging scientific age are unlikely to have a large impact on farm productivity before year 2000. Much adaptation and environmental impact research awaits. Thus the slowdown in productivity to year 2000 predicted from past trends in Tables 1 and 2 is likely to continue in the early 1990s but by year 2000 rates are likely to rise as emerging technology intervenes.

Reasons for declining rates of increase in productivity are numerous. The principal reason is that agricultural mechanization, commercial fertilizers, improved varieties, and (to a lesser extent) pesticides display diminishing returns and new technologies are not compensating. Emerging use of no-till, low-till, ridge-till, conservation-till, and sustainable agriculture systems, however commendable in their own right, are not likely to accelerate productivity gains from those depicted in Tables 1 and 2.

DEMAND AND EXPORTS: THE QUESTION OF RISING DEMAND

Domestic demand can be projected with some precision -- it will increase about 1 percent annually to year 2000. On the other hand, export demand can be predicted with even less reliability than productivity discussed above.

After extensive analysis in a recent paper, I projected exports would increase 2 to 5 percent per year on average to year 2000 (Tweeten, September 1988). The single best estimate of a 3 percent annual gain coupled with the above domestic demand forecast gives a weighted average increase of 1.5 percent in aggregate demand -- a number that just happens to coincide with the rate of increase in supply due to productivity gains for 1986 noted in Table 2. Supply could increase more slowly as apparent from extension of the 1950-86 trend to year 2000 in Table 2 and demand could increase more rapidly from exports.

Dramatic U.S. farm export gains averaging 15 percent per year in fiscal 1987 and 1988 are the product of many forces including lower U.S. price supports and export subsidies under the 1985 farm bill, income growth abroad, lower dollar, changes in European Community policy, rapproachment with the Soviet Union, weather, and other factors. Some of the changes are transitory but others are long-term. Out of them emerges a scenario of potentially substantial U.S farm export growth in the 1990s.

Acreage of grains has been reduced abroad in recent years and foreign productivity trends show tendencies similar to those in Tables 1 and 2. Gramm-Rudman-Hollings legislation and President George Bush have committed the nation to a balanced federal budget by 1993. In a full employment U.S. economy with low savings rates, private individual and corporate savings supply private investment needs only, leaving the federal deficit dissavings to be financed largely by savings from abroad. Foreigners acquire dollars to finance the U.S. budget deficit by running trade surpluses so that the trade deficit closely follows the federal budget deficit. If (and that's a big _if_) the federal budget is balanced by 1993 and our current trade account behaves similarly, then the current account deficit of $140 billion coupled with an additional $60 billion of interest will require a $200 billion increase in exports (nearly 10 percent per year) if imports remain at current levels. Such rate of gain is unrealistic especially for farm products because the dollar will be low primarily for industrial country importers whose food price elasticity is low and who protect their agriculture. But a 5 percent per year increase in U.S. farm exports is possible. Combined with domestic demand, such an export gain implies a 2 percent per year gain in overall demand for U.S. farm output -- a number well in excess of the aggregate productivity extrapolation in Table 2.

These supply-demand projections combined with the diminished excess production capacity and stock figures reported earlier outline a scenario of a more prosperous U.S. agriculture on average in the 1990s than in the 1980s. The government profile in agriculture commodity supply control would be lower under this scenario unless the political process raises loan rates.

CONCLUSIONS

No economist has had a good forecasting record projecting long-term rising real prices and prosperity for agriculture. I am not about to embrace that position. Yet the above tighter supply-demand balance scenario has enough hard evidence behind it to be worthy of attention.

It also has severe limitations. To be sure, excess capacity is likely to average less in the 1990s than in the 1980s (unless Congress markedly raises nonrecourse loan rates which establish the extent of excess capacity). And I project more years of profitability for farmers in the

1990s than in the 1980s. But rising farm prices are self-correcting: Technological adoption accelerates and demand growth, especially for exports, slows. Both demand and supply of farm output are more responsive to economic incentives than is commonly thought (see Ray and Plaxico). Real farm prices tend to revert to the cost of production after a relatively short (about 5 years) period of adjustment (see Tweeten, 1989). Despite the slowdown in rate of growth, productivity continues to rise, lowering real production costs. There is reason to conclude that reasonably well-managed commercial farms can make needed adjustments and earn favorable returns on resources on the average in the 1990s even without major intrusions of government in farm markets (Tweeten, October 1988). Of course, we are all well aware of the annual uncertainties of weather which unpredictably interrupt any long-term trends. Despite some especially good years for producers (bad for consumers) likely during the 1990s, real farm prices are likely to continue their downtrend on average.

The message for farm policy is clear. I have often emphasized that farm policies must be designed "for all seasons" -- to cope with abundance or shortage. How much better for the public to err on the side of investing in science to improve productivity and find production capacity unchallenged and even excessive than to err on the side of neglect of science and find capacity lacking and real food prices rising. The federal government in particular needs to reverse its downward trend in real outlays for basic and applied agricultural science and technology.

Supply-side economics suffers from its unhappy and unjustified confounding with Laffer-curve neoKeynesian economics of federal deficits under Reaganomics. The nation is seriously underinvesting in high payoff public investments in non-military science, technology, general education, vocational-technical training, and infrastructure. Restoring fiscal responsibility while pursuing true supply-side economics of expanding savings and investment in high payoff activities such as agricultural science require highest priority in the 1990s if agriculture and the nation are to maintain competitiveness abroad and rising living standards at home.

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CHAPTER 2. EXCESS CAPACITY OR OVERINVESTMENT: RELEVANCE FOR POLICY REFORM IN U.S. AGRICULTURE

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INTRODUCTION

The notion that U.S. agriculture has "excess capacity" is again of concern in the agricultural economics profession. For much of the past 40 years, productive capacity has grown faster than aggregate demand. This condition is expected to continue at least through the end of the century (Council for Agricultural Science and Technology, p. 19). Reform of policies that may have contributed to surplus production, as well as to high Federal agricultural program costs, are under discussion.[1]

The organizers of this symposium on capacity and adjustment problems recognized that a clearer understanding of excess capacity is necessary in order to understand economic impacts that alternative policies may have on the structure and competitiveness of U.S agriculture. Keeping this broad goal in mind, we will attempt to clarify the concept and relate it to a current measurement procedure. In addition, we will propose that the extent of overinvestment may be more relevant than excess capacity to the policy issues of concern in this Symposium.

CONCEPTS OF EXCESS CAPACITY

Chamberlin's Concept of Excess Capacity

Chamberlin is credited with originating the term "excess capacity." Focusing on the long-run use of all factors in an industry with a differentiated product, many firms, free entry, and non-aggressive price competition, he showed that "excess productive capacity could result for which there is no automatic corrective" (Chamberlin, p. 109).

His concept is presented in Figure 1. Demand curve D_1 faces any firm in the industry; prices from all firms are identical. The position of D depends upon the number of firms in the industry. As entry occurs, D shifts leftward, scale of production falls, and long-run costs rise. Depending, then, upon the number of firms, equilibrium price could be

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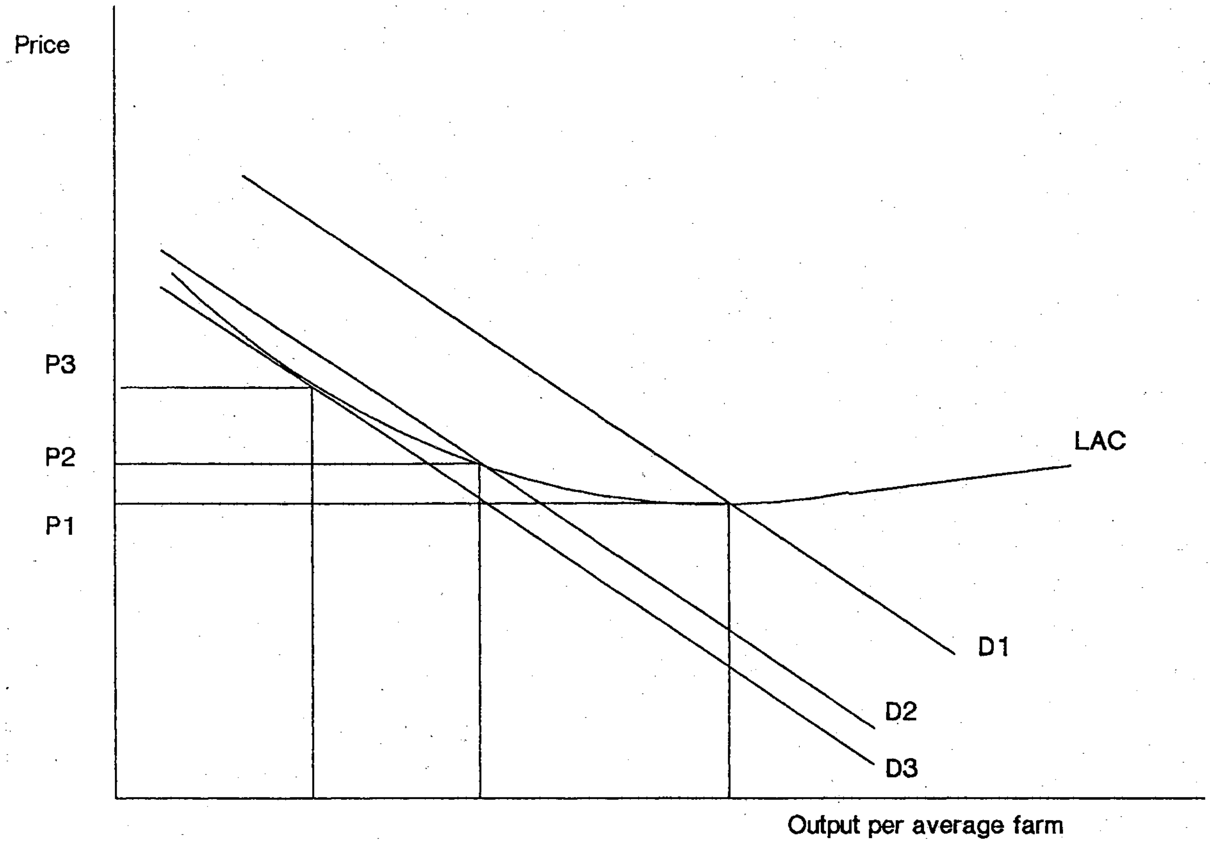
[1]Surplus production, high Federal budget costs, and advantages of free trade underlie the U.S. proposal that all trading countries eliminate "all forms of support and protection to agricultural production" (Yeutter, p. 1).

Figure 1. Chamberlin's concept of excess capacity



Source: Adapted from Chamberlin's Figure 15 between P_1, the price which covers minimum long-run average costs, and P_3, the price at which D_3 is tangent to LAC. Further entry of firms into the industry would not allow long-run costs to be covered.

It is crucial to understanding Chamberlin's excess capacity to recognize that P_2 is a "stable" price. There are no market forces which would cause price to change. However, if price was at P_1, for example, and resources entered the industry "perhaps due to miscalculation or persistent efforts of others to enter" (Chamberlin, p. 105), then D_1 would shift back to D_2, and all firms would gradually raise price to P_2, another stable price, to cover costs. The limit to such adjustment would be D_3 and P_3. Further entry of firms into the industry would not allow long-run costs to be covered. Although any price between P_1 and P_3 would be "stable", the possibility of successful entry into the industry at any price below P_3 "gives a strong tendency for the maximum equilibrium price (P_3) to be set" (Chamberlin, p. 106). Because of product differentiation and non-aggressive pricing, there is no tendency for firms to exit. "The excess capacity is never cast off and the result is high prices and waste". In terms of Figure 1, the degree of excess capacity depends upon the current stable price and is the excess in resource costs above the minimum point on the LAC. For example, at price P_3, excess capacity is the area under LAC and between P_3 and P_1.

A policy implication of Chamberlin's concept is that there will nearly always exist a national-level, long-run advantage but not a movement to increasing scale economies in production and realizing more efficient resource allocation. Such structural adjustment is thwarted by the condition of monopolistic competition and non-aggressive price behaviour.

A Current Measure of "Excess Capacity"

Cassels noted in 1937 that Chamberlin's concept of excess capacity was often easily misinterpreted and that it was often used in a short-run sense and associated solely with a firm's use of fixed factors. He cited "mills standing idle and factories working shortened shifts..." as popular examples of the misinterpreted concept (Cassels, p. 257). Because of the similarity in the shapes of the two sets (short- and long-run) of curves as Chamberlin drew them and the "convenient way in which such interpretation seems to connect up with current observations of reality", the danger of misinterpretation is "considerable."[2]

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[2]Simply because of the 2-dimensional, mechanical relation between short-run and downward sloping long-run cost curves, it is true that any output less than that which would minimize long-run costs would also include some small amounts of (short-run) excess capacity in the fixed factors. However, no indication of this amount is obtainable from a comparison of the given output with the optimum that is indicated by Chamberlin's LAC in Figure 1.

Forty years later, Spielmann found the concept to be still a source of confusion. He wrote that "no satisfactory measure of excess capacity exists nor is there a viable, generally acceptable definition of the term" (Spielman, p. 31). In early 1988, Dvoskin noted that economists use the term both to designate "production below the optimum level (as in the imperfect competition case) or production above the optimum level (as in the case of agriculture)" (Dvoskin, p. 4).[3]

In order to develop an accounting method of excess capacity, Dvoskin accepted the short-run concept that excess capacity exists if a firm can increase production while reducing average production costs. His measurement approach is essentially the same as that of Tyner and Tweeten and Quance and Tweeten. From the latter source, excess capacity is production in excess of market utilization at socially acceptable prices. Operationally, it is the value of production diverted from the market by Government production control, storage, and subsidized exports relative to potential output at current prices (Quance and Tweeten, p. 57).

Dvoskin's estimate is the physical quantity difference between commercial demand and potential supply at prevailing domestic prices[4] (see Figure 2). As defined, commercial demand is the value of production that can be cleared by the commercial market (domestic + foreign). While it excludes domestic food gift programs and the non-commercial portions of PL-480 and GSM-credit programs, it does not account for subsidies under the Export Enhancement Program. It does not include public stockholding demands to ensure orderly markets. As defined, potential supply includes actual production plus imports plus potential production from acres set-aside in federal commodity programs. It does not include potential production from acres idled for environmental reasons. Thus, it does not include the 10-year acreage enrollments of the Conservation Reserve Program. To smooth out annual variation (but not to change to a long-run

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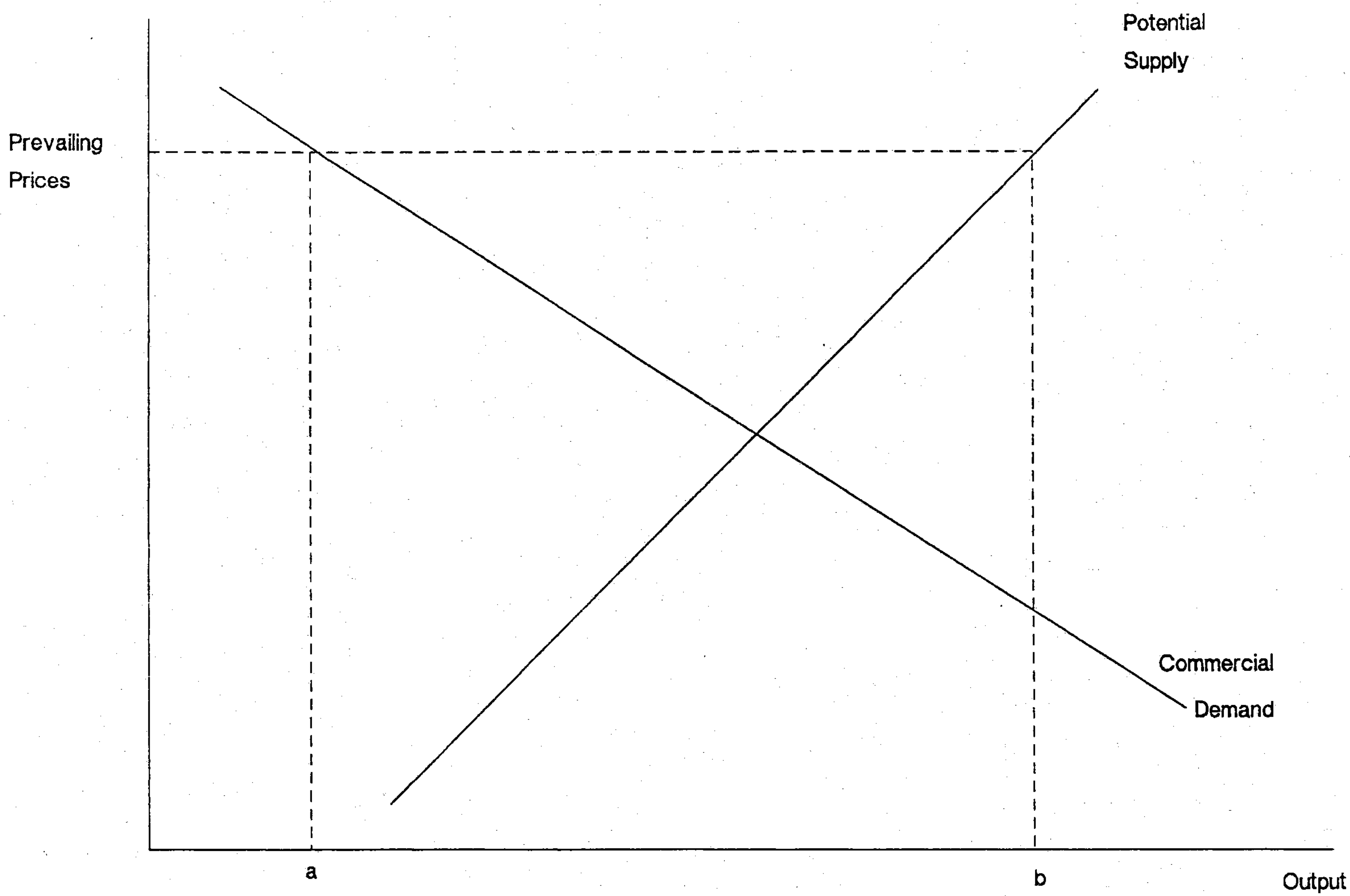
[3]Some other interpretations of excess capacity cited in (Dvoskin) include:

- o excess capacity is the "... difference between potential supply and demand at prevailing product price levels higher than market clearing prices (attributed to Tyner and Tweeten).
- o it is associated with "reserved capacity" (attributed to Brandow).
- o "excess supply capacity" is the difference between aggregate demand and supply under price supports above free-market equilibrium prices (attributed to Yeh, Tweeten, and Quance).

[4]The accounting method only measures the current annual difference between potential supply and commercial demand at pervailing prices. It does not estimate the supply and demand curve drawn in Figure 2.

Figure 2. A current measure of "excess capacity"



Source: Dvoskin

concept), annual results are also presented as a seven-year moving average.[5]

Figure 3 (and Table 1) suggests a dramatic decrease in measured excess capacity in 1987 from the high reached in 1985. Continued high exports and the 1988 drought are expected to extend this decline. The 1985 peak exceeded the previous peak reached in the 1960's as the result of greater agricultural output in the early 1980's and declines in exports after 1981. As the domestic market has become increasingly subject to movements in international markets over the past decade, year-to-year variation in excess capacity appears to have risen. The figure suggests that excess capacity fell between 1985 and 1987 because exports and domestic use of major commodities both increased and because acres planted plus set-aside decreased.

OVERINVESTMENT

Neither the Chamberlin nor Dvoskin approaches seem appropriate to current concern about agricultural policy reform and the resource adjustments that may follow. Chamberlin's excess capacity is a long-run concept that exists in any industry characterized by monopolistic competition and non-aggressive price behavior. U.S. agriculture is much more closely identified with pure competition and aggressive price behavior. Chamberlin's excess capacity derives from market structure and not from public policy. Its greatest value may be that it presents a long-run framework to understand potential national-level gains that could result from realizing economies of scale.

Dvoskin's measure although easy to apply empirically has conceptual shortcomings that limit its usefulness for policy analysis. First, it makes no distinction between the short-run and long-run, between changes in use/value of variable and fixed inputs. Second, the measure has large annual accounting variations that are generally discussed in terms of current change in supply and demand but not in terms of the policies that may be influencing these changes. Random weather events like the 1988 drought can have a large impact on actual production and hence on excess capacity. Third, while the free-market price, P_W, in Figure 2 would appear to be important to the measure, the accounting procedure does not discuss changes in P_W or policies that cause it to change. Further, the measure does not address the level of or tendencies toward resource misallocation brought on by policy nor the structural adjustment that could occur under domestic or trade policy reform.

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[5]Dvoskin also calculates "excess supply." It is the difference between total demand (commercial + non-commercial) and actual supply (production + imports). Measured in physical production units, it is the amount of product that is not sold or given away in any calendar year.

Figure 3. Excess capacity in 12 commodities, as percent of their total production

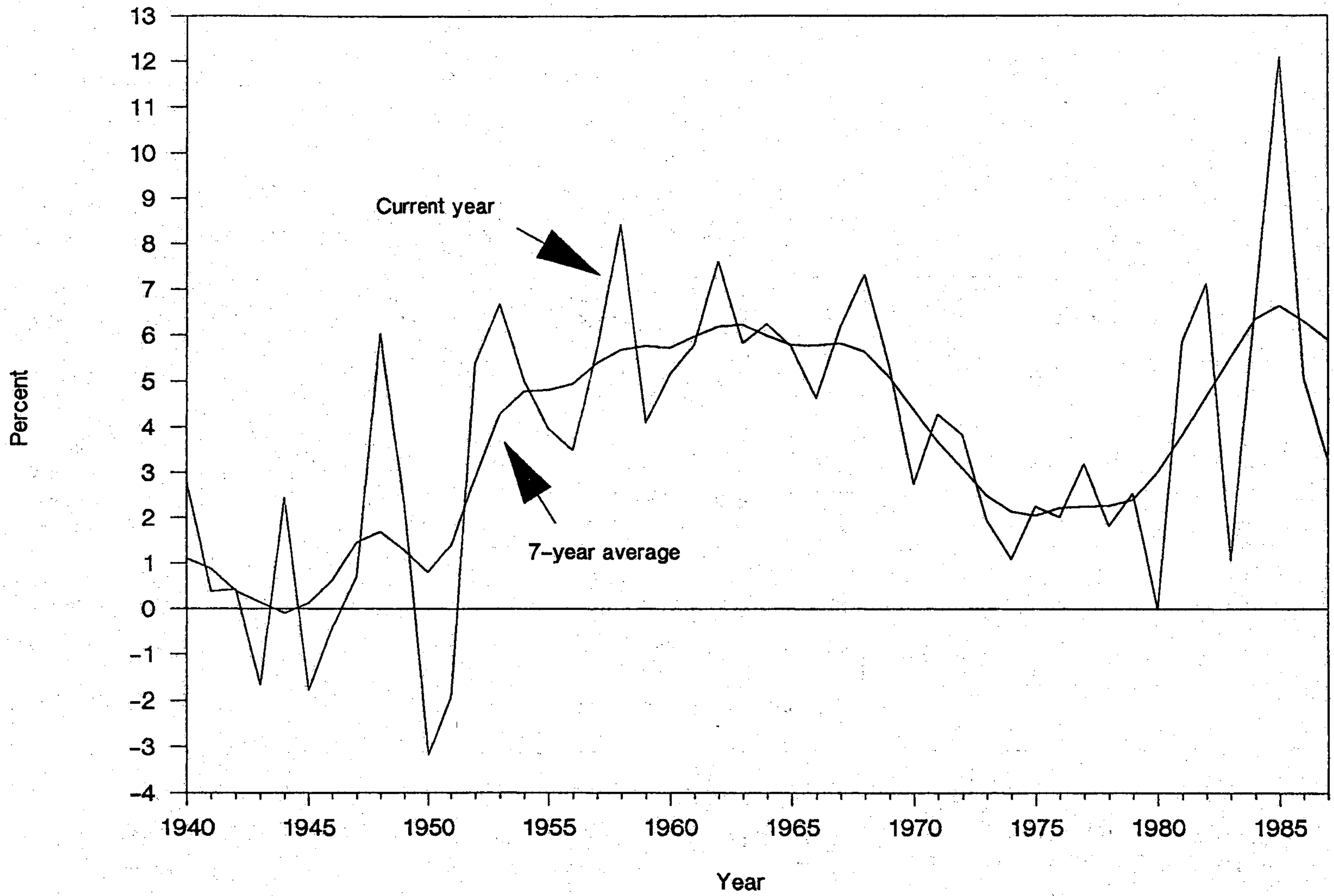

Table 1. Excess Capability of U.S. Agriculture: Actual Data Analysis, 1985

Crop	Harvested Acres (1)	Yields (2)	Actual production (3)	Imports (4)	Domestic use (5)	Total exports (6)	Excess supply (7)[1]	Noncommercial exports: PL-480 (8)	Noncommercial exports: GSM-Credit (9)	Effective set-aside (10)
	1,000 acre	Units per acre	Million units							1,000 acre
Wheat	64,734	37.5	2,425	15	1,045	915	480	116	178	14,100
Corn	75,224	118.0	8,876	11	5,255	1,241	2,391	23	70	3,304
Oats	8,177	63.7	521	28	543	2	4	0	0	66
Barley	11,603	51.0	592	9	500	22	79	0	10	462
Sorghum	16,782	66.8	1,121	0	691	178	252	22	18	522
Cotton	10,229	630.0	13	0	6	2	5	0	0	2,268
Soybeans	61,584	34.1	2,099	0	1,139	740	220	56	40	0
Total crops	248,333									20,722
Total value			51,182	134	28,843	11,299	11,173	827	1,168	

Blanks indicate not applicable.
Source: Dvoskin, p. 8.

[1]Col. 7 = (col. 3 + col. 4) - (col. 5 + col. 6).

Table 1--Continued

Crop	Set-aside production[2] (11)[3]	Excess capacity Amount (12)[4]	Excess capacity Proportion (13)[5]	Average farm prices (14)	Value of ex. capacity (15)[6]	Proportion of crop production (16)[7]	Acreage equivalent (17)[8]
	----Million units----		Percent	Dollars per unit	Million dollars	Percent	1,000 acres
Wheat	423	1,196	42.0	3.19	3,816	21.0	34,759
Corn	312	2,796	30.4	2.49	6,961	38.4	24,356
Oats	3	7	1.4	1.42	10	.1	128
Barley	19	107	17.6	2.09	225	1.2	2,199
Sorghum	28	320	27.8	3.99	1,276	7.0	4,892
Cotton	2	8	49.8	.55	2,079	11.5	6,453
Soybeans	0	316	15.1	5.41	1,709	9.4	9,272
Total Crops			29.7		16,077	88.7	82,059
Total value	2,908	16,077					

Blanks indicate not applicable
Source: Dvoskin, p. 8.

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[2]Yield adjustment factor on set-aside land - 0.8.

[3]Col. 11 = (col. 10) * (col. 2) * yield adjustment factor.

[4]Col. 12 = (col. 7) + (col. 8) + (col. 9) + (col. 11)

[5]Col. 13 = (col. 12) over ((col. 3) + (col. 11)).

[6]Col. 15 = (col. 12) * (col. 14).

[7]Col. 16 = (col. 15) over total of (col. 15).

[8]Col. 17 = ((col. 12) - (col. 11)) over (col. 2) + (col. 10).

A more relevant concept than excess capacity may be overinvestment in factor inputs or misallocation of resources caused by public policies. Tyner and Tweeten recognized this in 1966 saying "excess production is symptomatic of the more fundamental problem of excess resources committed to agriculture (Tyner and Tweeten, p. 613). Formulating national Cobb-Douglas production functions for each decade from 1912 to 1961, they calculated the optimal level and combination of inputs that would have a) minimized cost of production and b) made their marginal value products equal to earnings in alternate uses. Their focus was on the types of resource adjustments to produce historical output levels more efficiently. Building on this work, Quance and Tweeten later analyzed the ability of the farm sector to adjust to elimination of public support programs. Their analysis considers a variety of short-run/long-run supply and demand elasticities under rising and declining producer prices.

Our graphical presentation of overinvestment is based on Cassels' 1937 definition: overinvestment is the extent to which resources actually used in an industry exceed the amount that the industry would ideally use in order to maximize national product. In our context, it measures the additional resources drawn into agriculture as a result of government producer support policies. Although it has a short-run aspect, it is most appropriately a long-run concept. We will develop the concept for a policy that includes price supports and acreage set-asides in Figures 4 - 6.

Short-run Price Support Impacts

In Figure 4a, P_W is the equilibrium world market price and q_W is production of a typical firm in the absence of producer price support. The firm's total cost of agricultural production is $P_W * q_W$. Factors are earning their opportunity rate of return. The following factor-price equilibrium condition helps to describe the adjustment in inputs and output to the support price:

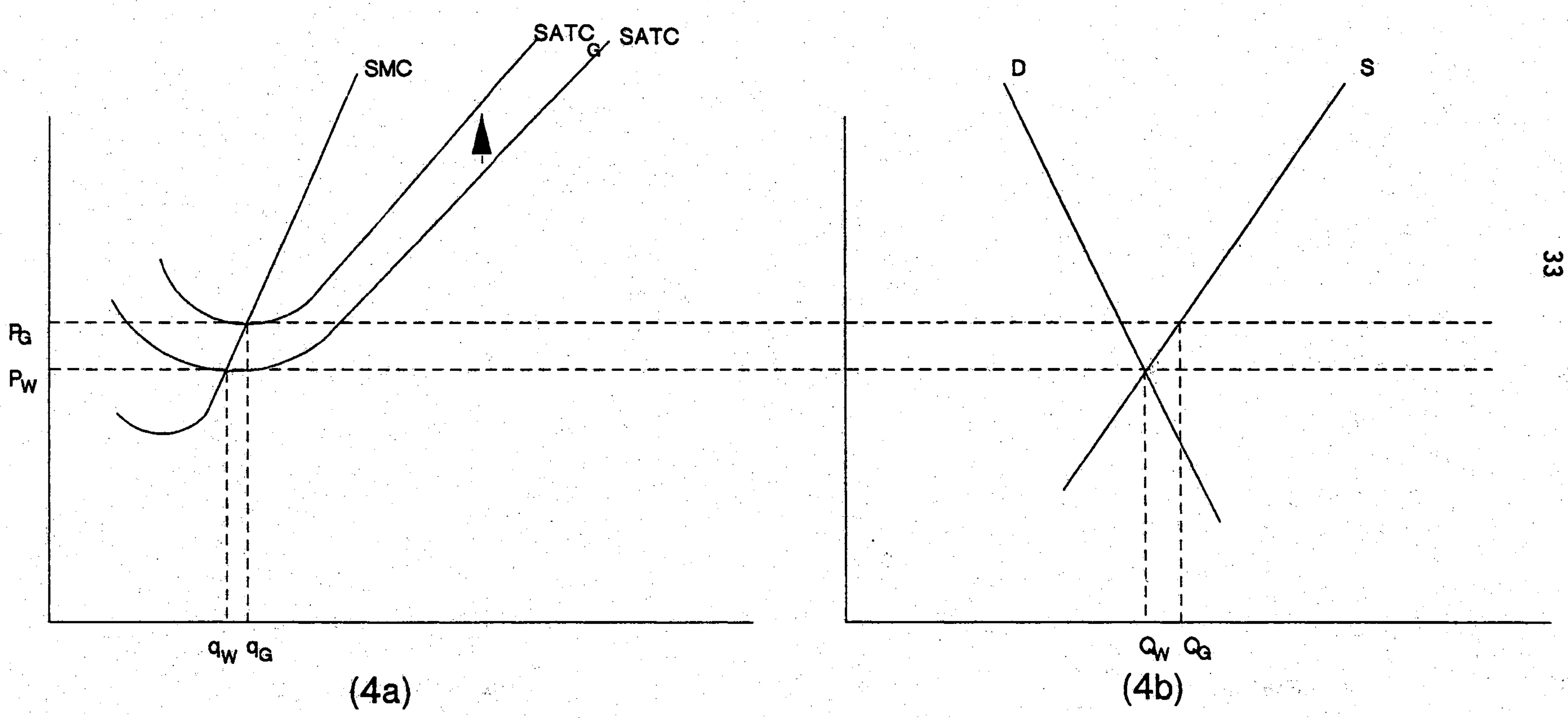
$$\frac{VMP_L}{MFC_L} = \frac{VMP_K}{MFC_K} = \frac{VMP_N}{MFC_N} = \frac{MR}{MC} = 1$$

where MFC is the marginal factor cost and VMP, value marginal product, is the product of commodity price, P, and marginal physical product, MPP, of the input. VMP and MFC are the value marginal product and marginal factor cost of land, capital, and labor, respectively.

If a price support program raises market price to P_G, factor-product equilibrium conditions imply that the firm's short-run average total cost curve, SATC, will shift up leading to a higher level of production, q_G. The firm's cost of production is now ($P_G * q_G$). Aggregating firms, we find a short-run <u>indication</u> of the value of overinvestment in the industry to be the difference in resource costs ($P_G * Q_G$) - ($P_W * Q_W$).

Input adjustments explain the shift in the firm's SATC and the increase in production. First, due to the rise in product price, P_Q, VMP

Figure 4. Short-run impacts of price supports



of all factors rise by the same percentage. Similarly, their rates of return rise above opportunity cost levels. Land, the factor most inelastic in supply experiences the most immediate and greatest rise in factor cost and its rate of return declines to the pre-support price equilibrium level. As a result of the large increase in land prices, a lesser rise in capital costs, and the small rise in fully variable costs (such as labor, fertilizer, and chemicals) the firm's SATC shifts up to $SATC_G$.

Second, as land becomes more costly, the firm increases use of variable inputs per acre thus moving up its short-run marginal cost curve, SMC, to P_G. The change in factor use depends upon relative factor prices and degree of factor substitutability. As the marginal physical products of labor and capital fall, so also do their VMPs, and the firm returns to factor-product equilibrium. It is important to realize that the equilibrium is not that of a free market but is policy-induced. At the industry level, production increases in the short-run on an unchanged supply curve.

Commodity support prices that promote commodity production foster social over-use of environmental services such as the inherent stock of soil fertility and unpolluted water.[6] Generally, these factor inputs are not priced by free markets; nor are their marginal contributions to production normally included in the factor-product calculus. Resource conservation policies act to express, partially at least, society's value for unpriced inputs. These policies typically pay producers to reduce soil erosion or install management practices to protect water quality rather than levy costs on production.[7]

Short-run Set-aside Impacts

In Figure 5a, short-run effects of an acreage set-aside program are shown. In the aggregate, the set-aside requirement forces an idling of a prescribed proportion of the nation's cropland base, not only the cropland

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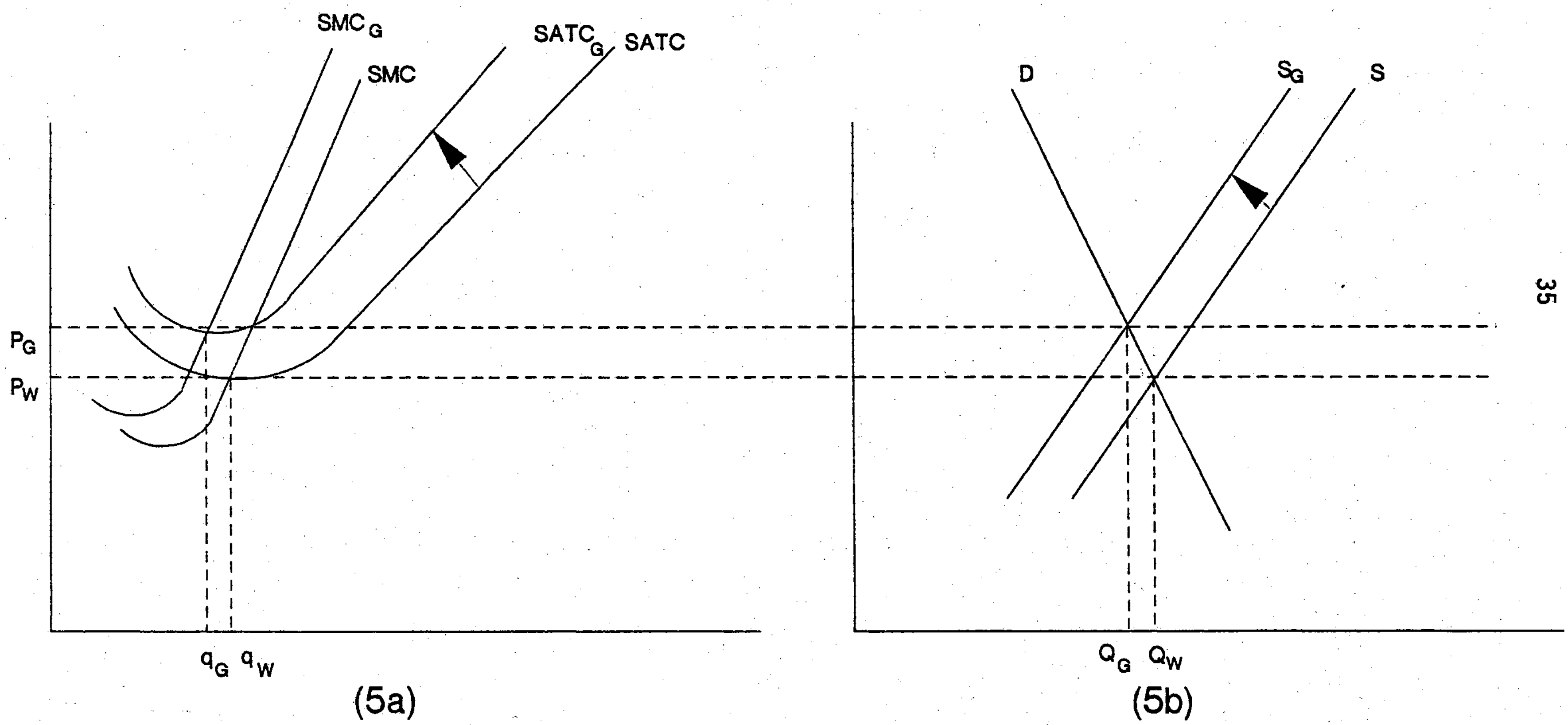
[6]The Federal Government also has policies to subsidize factor inputs. In the 17 western states, the Bureau of Reclamation subsidizes irrigation water on Bureau projects. The Bureau of Land Management subsidizes grazing rights on public lands. Such input subsidies lowers their cost to agricultural production and promotes factor use above the social optimum.

[7]Several provisions of Title XII of the 1985 Food Security Act were intended to be an exception to producer payment policies. Rather they would increase producer costs (the conservation compliance provision) or disqualify producers for commodity program benefits if they converted fragile land to program crop production (conservation compliance, sodbuster, and swampbuster provisions). To the extent that commodity program benefits will contract in the future, the effectiveness of these provisions decreases.

Figure 5. Short-run impacts of acreage set-asides



with the highest unit costs of production.[8] Because production costs on the most productive cropland are lower than on marginal land, weighted average marginal costs of producing a given quantity will rise. Cropland available for program crops becomes scarcer (or less in surplus) and its cost rises. Fixed costs (which now include the added component of opportunity cost equal to the value of production foregone on set-aside acres) are now spread over less output. At the farm level, this desired decline in output may be countered by increased application of purchased inputs to the smaller acreage cropped. At the industry level, such slippage in supply reduction may also occur due to nonprogram farmers intensifying cropland use and/or expanding acres cultivated.

In sum, for the set-aside provision, farm-level SMC rises to SMC_G; SATC shifts up and to the left to $SATC_G$. Output falls to q_G.[9] Leftward shift in industry supply depends on the slippage noted above. In addition, it depends on the difference between P_W and P_G since program participation rates (and thus increase in marginal costs) are higher at larger differences of the two prices (Lin). The net impact of a policy having both support price and set-aside provisions depends upon the relative strengths of the two provisions.[10]

Long-run Impact of Price Supports On Overinvestment

In the long-run, the policy forces leading to misallocation of resources in the short-run strengthen because fixed factors become variable. The result is greater overinvestment. The high support price

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[8] Generally, without government programs it is only the high cost land that would be idled if individual farmers were responding only to free market price signals.

[9] P_G, a consequence of the set-aside provision, is not necessarily the same as P_G, the prescribed support price of Figure 4. Both are the result of government policy however.

[10] Lin estimates the combined "long-run" effect of the 2 provisions on corn output and price. His "breakeven approach" recognizes that supply elasticity is different with and without programs. He explicitly considers the breakeven price where producers are indifferent between participating and not participating and also that not all set-aside acreage would return to production. For 3 of the 4 crop years during the period 1984/85 to 1987/88, the combined effect of the 2 provisions was to induce more production than otherwise would be the case (Lin). Their combined effect caused corn prices to be higher than without programs in only 2 of the years (1984/85 and 1985/86). His "long-run" equilibrium analysis indicates an annual period of adjustment.

P_G, which raises land prices causes the LATC to shift up (see Figure 6).[11] At the same time, producer income support increases the income and wealth positions of existing owners of cropland thus creating a greater income and equity base upon which to finance an expansion in scale of production as well as alter combinations of all factors. They achieve economies of scale by bringing new cropland into production (for example with drainage), use of more efficient farm structures and machinery, and improved management. This investment is driven by P_G. The SATCs of these expansion firms moves down and to the right along the higher but downward sloping LATC and their output increases. Industry supply due to price supports shifts down and to the right.[12] The value of overinvestment is $(P_G * Q_G) - (P_W * Q_W)$.

The change in relative factor prices also leads to development and adoption of land-saving and capital-using technology. Factor proportions continue to shift toward a more land-intensive agriculture with greater per acre application of purchased inputs and capital investment. Adoption of new technology causes the firm's SATC to move down along a LATC that has shifted down. Although the downward shift is not shown (simply to avoid cluttering the figure), the movement is very important because it further increases industry overinvestment.

The net change in industry supply depends upon the relative strength not only of price supports but also of set-aside provisions. However, Lin's results cited in footnote 11 and Dvoskin's calculation of excess supply in 12 of the 17 years from 1970 to 1986 suggests that S has shifted down and to the right.[13]

Overinvestment and Policy Reform

The overinvestment framework and its attention to policy can be useful for analyzing supply response under policy reform that lowers producer prices and eliminates acreage set-aside requirements. Such reform creates several forces whose relative strengths and impacts on production need empirical estimation.

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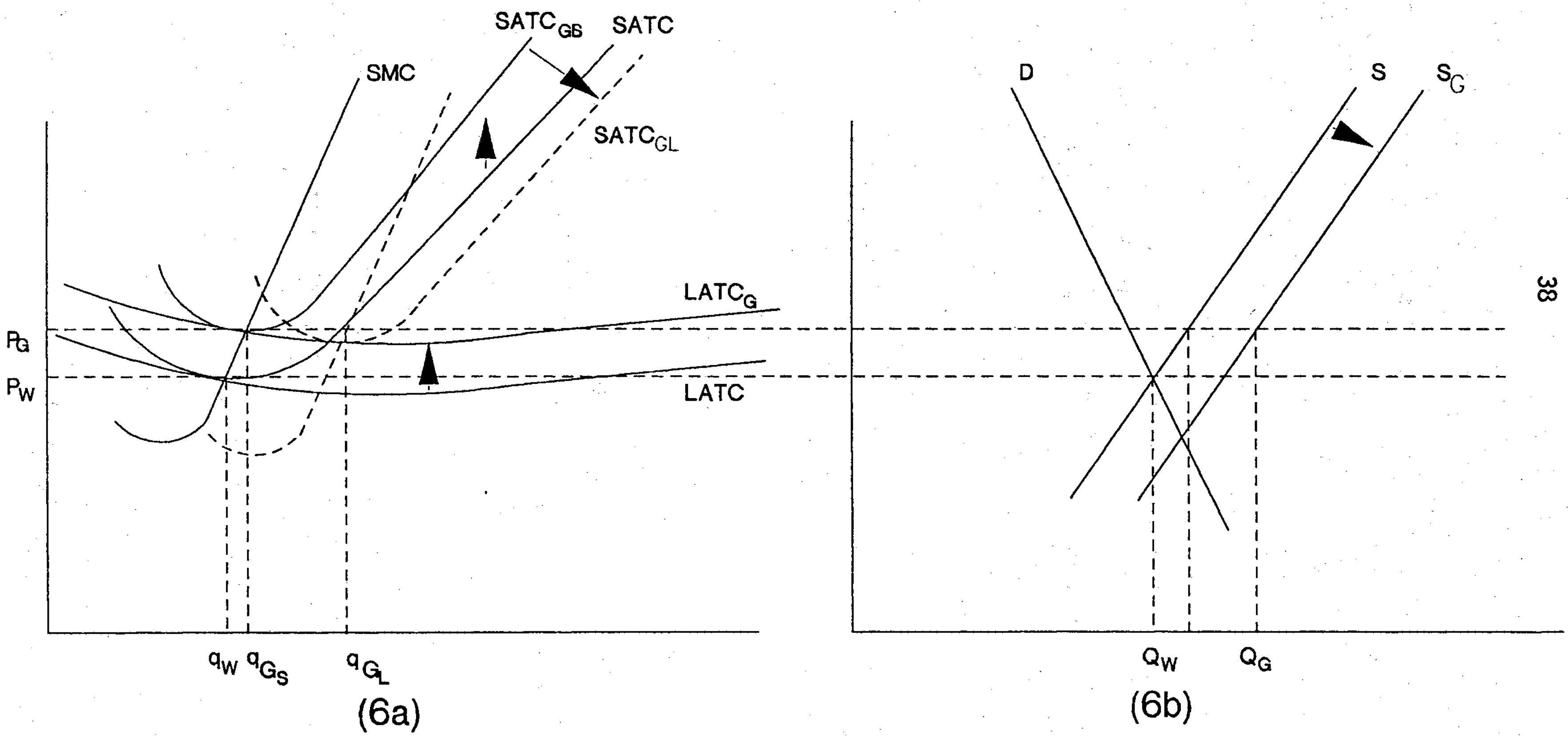
[11]The typical firm shown in Figure 6 is in long-run disequilibrium. Such a condition seems reasonable for several reasons such as insufficient capital to make desired factor changes, lumpiness of factor use, adjustment lag to new technology, and so forth.

[12]To the extent that expansion firms buy or rent existing cropland, the number, scale, and/or output of the selling firms falls. This makes the change in industry output ambiguous. It is not clear that new firms would enter the industry since anticipated program supports are capitalized into fixed assets rather quickly.

[13]Excess supply is actual production less use (domestic plus net exports). (Dvoskin, p. 8).

Figure 6. Direction of long-run impacts of price supports



In the short-run, lower commodity prices lead to lower land values, a downward shift in SATC, and use of less variable inputs per acre of land. Industry output declines. Removal of set-aside requirements make additional land available for production. Land prices fall again taking the brunt of the factor price adjustment; SATC drops down and to the right. Production increases due to removal of set-aside requirements depends upon the proportion of idled land returned to production, decline in intensity of use, change in output mix, and acreage and yield responses of producers who did not participate in commodity programs. In the short-run, the acreage response may overwhelm the yield response and output increases.

In the long-run, the fall in price of cropland and fixed assets such as farm machinery and farm and family labor will lead high-cost firms to exit. Physical capital need not necessarily leave the sector as other firms acquire depreciated assets at their salvage values. The result may be fewer, larger farms, and a lower LATC, that is, a more efficient industry. The use of cheaper land relative to other inputs and capital may increase. Because the opportunity cost of capital is also determined by its use in the non-agricultural sector, expectation of lower commodity prices will tend to reduce new capital investment. On the other hand, because land's opportunity cost is very low outside of agriculture it will continue to be farmed as long as returns remain at least equal to opportunity cost. Other assets with higher opportunity costs will exit. Capital investment as well as technological development that does take place will be more oriented toward land-using, capital saving techniques. The degree of structural adjustment will depend on free-market commodity demand and the cost structure of farms in the sector.

TOWARD A MEASURE OF OVERINVESTMENT

The study of overinvestment has several implications including:

a) the analytic focus should be to determine effects that reform of national policies would have on national and regional resource allocation and product. This will not be easy because such analysis moves beyond our historical knowledge.

b) policy reform that moves commodity prices toward free-market levels will entail structural adjustments largely because of the drop in asset values, especially those of land. High-cost firms will exit as other firms purchase assets depreciated to their salvage values. The degree of adjustment will vary by region.

c) the degree of resource adjustment that would result from policy reform depends upon short-run and long-run elasticities of commodity supply and demand and substitutability of factor inputs. Knowledge about regional and national supply response without public support programs is very limited. Lessons might be learned from study of resource adjustments in countries that have only limited support programs or have shifted from support to no support.

d) With respect to demand, there is little consensus on estimates of price elasticity of export demand for major agricultural commodity exports. Many studies indicate that short-run demand is price inelastic but becomes more elastic in the longer run. There are substantially fewer studies that estimate long-run elasticities and the estimates vary widely (Gardiner and Dixit).

The overinvestment framework may be helpful in estimating supply response and structural adjustment to policy reform that lowers producer supports. Such reform creates many interacting forces whose relative strengths need empirical estimation.

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CHAPTER 3. RESOURCE ADJUSTMENTS IN AMERICAN AGRICULTURE

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INTRODUCTION

The aim of this paper is to provide some perspective on the types and magnitudes of adjustments that have occurred in U.S. agriculture in recent decades, and to inquire as to the existence of the likely impediments to future adjustments in this sector. My focus, in the main, will be on broad, aggregate adjustments rather than on subsector adjustments or on regional contrasts.

I will attempt to demonstrate that from a secular point of view the U.S. agricultural sector has made significant adjustments to economic stimuli in the past. I will also argue that there is every reason to expect this tendency of the sector to make such adjustments to continue in the future. The case cannot be so easily made for short-run adjustments, but here too the more severe constraints to adjustments alluded to in previous writings (see, e.g., Brandow) seem to have been significantly relaxed. The most important barriers to futher adjustments would appear to be those imposed by outside forces --- government policy, economic conditions in the non-farm sector, lack of job retraining programs, etc.

In preparing this paper, I was struck by the fact that the inquiry probably generates more questions than it provides answers. Two very important issues, for example, are whether or not the sector adjusts rapidly enough and in the right direction. But what is "rapidly enough" and what is the "right direction"? The former is not easily resolved, and I make no attempt to do so here. The latter depends, in great measure, on the collective values of the voting public. Another significant issue is what happens to the people caught up in the adjustment process? Do they suffer unreasonably? How do we tell? Should assistance be provided those who must adjust. If so, in what form? As a profession we worry more about projected adjustments and impediments to adjustments than we do about the dynamics of the adjustment process itself, or of the people affected by the process! It is small comfort to note that agricultural economists were confronted with these same issues 30 years ago as they grappled with Agricultural Adjustment Problems in a Growing Economy (Heady, et al.).

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*I appreciate the comments of Robert Weaver on an earlier draft of this paper.

SOME OVERALL TRENDS

Labor and Capital Use

The U.S. agricultural sector has made significant adjustments over the course of the past several decades. Table 1 shows that the number of farms has decreased by over one-half since 1950[1/] and average farm size measured in acres has more than doubled. Further, farm population has declined from fifteen percent of the total U.S. population in 1950 to two percent in 1987. A similar reduction has occurred in the number of farm workers as a proportion of total U.S. employment. Capital, of course, has substituted for much of this labor, but here too the amount of capital expenditures on buildings and equipment has declined both absolutely and in relation to other expenditures. As a proportion of total production expenses, capital expenditures on buildings and equipment showed a slight downward trend between 1950 and 1980, and a steep downward trend following 1980.

Table 1. Farm Population and Farm Households, Farm Employment, Capital Expenditures in Agriculture, Number of Farms, and Acres per Farm in the United States, 1950-87.

	1950	1955	1960	1965	1970	1975	1980	1985	1987
Percent of U.S. Population									
Living on Farms	15.1	11.5	8.65	6.36	4.74	4.10	2.66	2.24	2.05
Living in Rural Areas	41.0	35.6	30.1	28.3	26.5	26.4	26.3	26.2	26.2
Population per Household									
In the U.S.	3.50	3.47	3.42	3.38	3.23	3.03	2.81	2.78	2.74
On Farms	3.67	3.43	3.82	3.69	3.57	3.52	2.49	2.35	2.31
Total Farm Employment									
Percent Hired Workers	23.5	24.3	26.7	26.4	26.0	30.3	35.2	40.0	37.4
Percent of U.S. Employment	16.8	13.5	10.7	7.89	5.75	5.06	3.73	3.14	2.85
Capital Expenditures on Building and Equipment									
Percent of Pdn Expenses	24.0	18.7	16.4	18.1	16.4	17.8	14.8	7.87	8.70
Percent of Cash Receipts	16.4	14.1	13.1	15.5	14.4	15.0	14.1	7.32	7.78
Farms in the U.S. (thou)	5,648	4,654	3,963	3,356	2,949	2,521	2,433	2,275	2,176
Acres per Farm	213	258	297	340	374	420	427	446	461

The number of farm households has declined at a rate consistent with the decline in farm population (Table 1). The size of farm families for many years was larger than that of nonfarm families. Since 1980, however, the size of farm households has been smaller than the size of nonfarm

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[1/] The Census definition of a farm was changed in 1978 and this change reduced markedly the number of farms in the U.S. following 1978.

households due to the fact that the farm population is getting older. Surveys by the Bureau of the Census show that the median age of the farm population is now significantly higher than that of the nonfarm population (5.4 years higher in 1986). The farm population is not only getting smaller, it is also producing proportionally fewer individuals who in the future may become surplus workers.

Farm Size

Measuring farm size in acres can be misleading because of the differing intensities with which different agricultural enterprises use the land resource. For a clearer perspective on the issue of growth in farm size, the distribution of farms by annual gross sales shown in Table 2 is helpful. In 1960, only 2.9 percent of the farms had annual cash sales of $40,000 or more, whereas today about 27 percent have annual cash sales of $40,000 or more. Farms with $40,000 or more annual cash sales accounted for 30.6 percent of total U.S. farm sales in 1960, but 85 percent of the total in 1987!

There are also problems associated with examining the farm size issue from the perspective of cash sales. It is clear that $40,000 in 1960 is not the same as $40,000 in 1987. The effect of inflation needs to be taken into account. Unfortunately, our statistics are not reported in a way that enables us to adjust satisfactorily for inflation. We can gain some insight, though, by comparing the earning power (net income per farm from farm sources) of different sized farms with the average money income of all families in the United States. The lower portion of Table 2 shows that in 1960 farms with annual cash sales of between $10,000 and $19,999 netted, on average, nearly as much as the average money income of all U.S. households, whereas in 1987 farms in this sales category were, on average, not even in the ballpark! In fact, through most of the 1980s, net farm income for farms in this category was negative! On the other hand, farms in the $40,000 to $99,999 sales category in 1960 netted an income well above the average money income of all U.S. households in that same year. In 1986-87, farms in this sales category netted, on average, slightly less than half as much as the average money income of all U.S. households.

What must be kept in mind here is that both technology and prices have changed considerably over the past nearly forty years, and at different rates for different commodities. Consider a dairy farmer milking fifty cows and deriving eighty percent of his/her cash sales from the sale of milk. Assuming that in 1960 the cows produced at the national average rate of 6,977 pounds of milk per cow and that the farmer's milk sold for the U.S. average price of $4.21 per cwt, this farm would have fallen into the $10,000 to $19,999 sales category. In 1987, on the other hand, assuming this farmer's cows produced at the 1987 national average of 13,786 pounds of milk per cow and that this milk sold for the U.S. average price of $12.54 per cwt, this farm would have fallen into the $100,000 to $249,999 sales category!

Table 2. Numbers of Farms, Percentage Distribution of Gross Farm Sales, and Relative Earning Power of Farms by Sales Class in the United States, 1950-1987.

	1950	1955	1960	1965	1970	1975	1980	1985	1987
Number of Farms by Sales Class as a Percent of All Farms in the United States									
Under $5,000	na	na	62.2	57.9	57.5	44.5	38.1	37.4	38.5
$5,000-$9,999	na	na	16.7	15.1	12.6	12.3	12.8	13.2	13.9
$10,000-$19,999	na	na	12.5	13.8	12.3	12.5	11.8	11.6	11.1
$20,000-$39,999	na	na	5.7	8.3	10.2	12.5	11.5	9.9	9.6
$40,000-$99,999	na	na	2.3	3.7	5.6	12.5	14.5	14.0	13.1
$100,000-$249,999 [a]	na	na	0.6	1.1	1.2	3.8	6.8	9.5	9.2
$250,000-$499,999	na	na	na	na	0.4	1.5	3.3	3.3	3.3
$500,000 and over	na	na	na	na	0.1	0.4	1.0	1.1	1.3
Percentage Distribution of Annual Gross Farm Sales by Sales Class									
Under $5,000	na	na	16.1	11.6	10.2	5.3	4.3	4.1	3.6
$5,000-$9,999	na	na	15.0	10.4	6.8	3.4	2.7	2.6	2.6
$10,000-19,999	na	na	20.6	17.6	12.1	6.1	3.9	3.4	3.2
$20,000-$39,999	na	na	17.7	19.6	18.7	11.4	6.7	5.3	4.9
$40,000-$99,999	na	na	14.6	17.9	20.7	24.1	17.9	15.6	14.2
$100,000-$249,999 [a]	na	na	16.0	23.0	10.1	15.8	18.2	23.7	22.1
$250,000-$499,999	na	na	na	na	7.7	13.1	18.9	18.7	16.9
$500,000 and over	na	na	na	na	13.7	20.7	27.5	26.6	32.4
Net Income per Farm from Farm Sources as a Percent of Mean Money Income per U.S. Household									
Under $5,000	na	na	19.5	15.9	-0.1	-4.4	-6.7	-4.2	-4.5
$5,000-$9,999	na	na	59.3	45.6	22.8	3.9	-4.0	-1.8	2.9
$10,000-$19,999	na	na	94.1	78.4	52.8	19.0	-4.0	-2.6	6.4
$20,000-$39,999	na	na	167.7	121.7	104.1	47.3	1.8	9.0	18.9
$40,000-$99,999	na	na	255.1	214.8	198.4	124.3	28.6	35.2	58.5
$100,000-$249,999 [a]	na	na	556	469	401	302	121	131	162
$250,000-$499,999	na	na	na	na	917	712	331	395	402
$500,000 and over	na	na	na	na	6,317	4,383	2,444	2,079	2,307

[a] This sales class is $100,000 and over in 1960 and 1965.
na - Data not available.

For cash grain farms the comparison would be similiar although somewhat less dramatic. The point is that what was a relatively large farm in terms of gross sales by 1960 standards cannot begin to support a family by today's standards. Today a farm must have annual sales of $100,000 or more to sustain a family at the level of the average U.S. household. Furthermore, not all farms have grown larger in terms of physical size (animal units or acres), as might be suggested by a cursory examination of the data; some have merely moved to different sales categories over the years as both productivity and nominal prices have increased. Some people argue that midsized family farms are disappearing from agriculture, resulting in a "bimodal" distribution of farms; many small, many large, and few in between. The truth is that many of the midsized family farms of the past have merely moved into the larger sales categories as prices and productivity have increased. The most significant change in their character has been increased annual cash sales!

Clearly most cash grain farms have increased in physical size. Below I argue this has been a rational response to changing economic conditions in the input markets. In general, though, and following the above argument we can say that some of the previously midsized farms have become large farms almost by definition. Some have also become small, part-time farms as they have found the farm alone could not support the family. The small, part-time farms of today were small, part-time farms a quarter of a century ago as well. My guess is that many of these will remain part-time farms well into the future.

Farm Ownership and Tenancy

About 60 percent of the farms in the United States are operated by full owners, but only slightly more than one-third of the acreage is operated by full owners (Table 3). These percentages have remained fairly stable since 1950. Apparently a higher percentage of small farms are operated by full owners. Indeed, based on a 1979 USDA farm survey (Boxley), nearly 75 percent of the land operated by farmers with annual cash sales of less than $20,000 was owned by their operators.

Table 3. Farm Ownership and Tenancy in the United States, 1950-82.

	1950	1954	1959	1964	1969	1974	1978	1982
	- - - - - - - - - - - - Percent- - - - - - - - - - - -							
Farms Operated by:								
Full Owners	57.4	57.2	57.1	57.6	62.5	61.5	57.5	59.2
Part Owners	15.3	17.9	21.9	24.8	24.6	27.2	30.2	29.3
Full Tenants	29.6	24.4	20.5	17.1	12.9	11.3	12.3	11.6
Farm Acres Operated by:								
Full Owners	36.1	34.2	30.8	28.7	35.3	35.3	32.7	34.7
Part Owners	36.4	40.7	44.8	48.0	51.8	52.6	55.3	53.8
Full Tenants	18.3	16.6	14.9	13.1	13.0	12.0	12.0	11.5

Part owners now operate about thirty percent of the farms and about 55 percent of the farm acreage. The percentage of farms and of farm acreage operated by part owners has steadily increased. The relative importance of full tenants has diminished; they now operate only about twelve percent of the farms and twelve percent of the farm acreage. Many full tenants have transferred out of agriculture or become part owners.

Consistent data on the form of business organization in farming is available only from the last two censuses, so precise information on trends here is unavailable. In 1982, however, 87 percent of the 2.2 million farms were operated by individuals or families, ten percent by partnerships, and about three percent by corporations. Of the slightly more than one billion farm acres, 65 percent were operated by individuals or families, fifteen percent by partnerships, and thirteen percent by corporations. (Another seven percent of the farm acres were operated by a small number of other business forms, including agricultural cooperatives and government or institutional units.)

Changes in farm ownership and tenancy in the U.S. over the past nearly 40 years have been much less dramatic than have other changes in this sector. The individual family, though, is still the dominant unit in American agriculture. Corporate acquisition of farms cannot be used to explain the growth in farm size since 1950. Although rates of return on commercial sized farms are not nearly as low as would be indicated by examining estimates of rates of return for the agricultural sector in the aggregate,[2/] they are probably not high enough to attract significant non-farm corporate capital into the sector in the future.

ADJUSTMENTS TO PRICE CHANGES

Changes in Real Commodity Prices

It is well known that real market prices of the major farm commodities have declined significantly since 1950 --- by as much as one-half or nearly so for oats, sorghum, soybeans, peanuts, steers, lamb, and milk, and by one-fourth for wheat, corn, rice, and broilers (Table 4). Real prices paid, on the other hand, have decreased slightly, if at all, and in fact were higher during the 1970s and early 1980s than in the 1950s and 1960s. It is clear that farmers have been facing a seemingly never-ending price-cost squeeze since 1950.

Since supply and demand for most agricultural commodities are both highly price-inelastic at least in the short-run, small shifts in either of these two schedules will lead to quite sizable changes in price. This situation, coupled with the fact that agricultural output is quite sensitive to the vagaries of nature, leads most of us to assume that prices of agricultural commodities will be highly variable. In a recent report I examine the variability of commodity prices in some detail (Hallberg). In particular, I document that most agricultural commodities experienced greater levels of price variability during the period

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[2/]Returns on assets for agricultural as a whole were 2.2 percent in 1982 and 5.7 percent in 1987. Returns on assets for farms in the $500,000 and over sales class were 10.4 percent in 1982 and 21.2 percent in 1987 (U.S. Department of Agriculture).

Table 4. Real Prices of Selected Agricultural Commodities and Real Prices Paid by Farmers in the United States, 1950-87.

	1950	1955	1960	1965	1970	1975	1980	1985	1987
Prices Received by Farmers, deflated by CPI (1967=100)									
Wheat ($/bu)	2.77	2.47	1.96	1.43	1.14	2.21	1.58	0.99	0.75
Corn ($/bu)	2.11	1.68	1.13	1.23	1.14	1.58	1.09	0.77	0.46
Oats ($/bu)	1.10	0.75	0.68	0.66	0.53	0.91	0.73	0.38	0.46
Barley ($/bu)	1.65	1.15	0.95	1.08	0.83	1.50	1.15	0.61	0.47
Rye ($/bu)	1.82	1.32	0.99	1.04	0.85	1.46	1.07	0.64	0.44
Sorghum ($/bu)	1.46	1.22	0.95	1.04	0.98	1.47	1.89	1.23	0.75
Soybeans ($/bu)	3.43	2.77	2.40	2.69	2.45	3.05	3.07	1.68	1.49
Cotton (cents/lb)	55.5	39.9	33.8	22.2	18.9	31.6	30.1	17.4	17.5
Rice ($/cwt)	7.06	6.00	5.13	5.22	4.45	6.28	4.50	2.09	1.32
Sugarbeets ($/ton)	16	14	13	13	13	17	19	10	10
Peanuts (cents/lb)	15.1	14.6	11.3	12.1	11.0	12.2	10.2	7.6	8.0
Tobacco, Burley (cents/lb)	71.7	66.3	68.7	68.9	62.7	63.6	61.7	51.1	45.6
Potatoes ($/cwt)	2.08	2.21	2.25	2.68	1.90	2.78	1.94	1.22	1.28
Choice Steers ($/cwt)	40.06	27.63	28.39	26.58	25.25	27.67	27.13	18.12	18.99
Choice Veal Calves ($/cwt)	44.38	32.42	32.69	29.63	38.69	24.81	30.60	18.09	23.15
Lamb ($/cwt)	38.18	23.54	20.18	24.13	22.70	26.12	25.73	21.14	22.90
Barrows and Gilts ($/cwt)	25.55	18.94	17.99	22.54	18.87	29.98	16.22	13.90	15.19
Wool (cents/lb)	86.1	53.4	47.4	49.8	30.5	27.7	35.7	19.6	27.0
Broilers (cents/lb)	38.0	31.4	19.1	15.9	11.7	16.3	11.2	9.3	8.4
Turkeys (cents/lb)	35.4	33.7	28.6	23.5	19.4	21.6	16.2	14.6	10.1
Eggs (cents/dozen)	50.3	49.3	40.6	35.7	33.6	32.5	22.8	17.7	15.8
Milk, Fluid ($/cwt)	6.05	5.61	5.29	4.90	5.20	5.60	5.36	4.00	3.72
All Apples (cents/lb)	4.4	4.7	5.4	4.6	3.9	4.0	3.5	5.4	3.6
All Grapes ($/ton)	94	54	61	48	81	88	97	53	76
All Lemons ($/box)	4.98	3.48	2.16	3.50	4.17	2.39	3.29	2.02	1.87
All Oranges ($/box)	3.11	2.41	3.10	3.33	1.80	1.71	1.97	2.85	2.14
All Pecans (cents/lb)	39.9	40.9	34.9	18.9	33.5	24.7	31.6	21.1	16.6
Indices of Prices Received and Prices Paid (1977=100), deflated by CPI (1967=100)									
All Commodities	77.7	63.6	58.6	57.1	51.6	62.7	48.6	39.7	37.3
All Crops	74.9	67.3	58.6	57.1	44.7	65.1	51.1	37.2	31.2
All Livestock	80.4	61.1	59.8	57.1	57.6	60.8	57.9	42.2	42.9
Prices Paid	51.3	49.9	49.6	49.7	47.3	55.2	55.9	50.6	47.6
CPI (1967=100)	72	80	89	95	116	161	247	322	340

of food and energy shortages of the 1970s. This variability was true of both supported and nonsupported commodities, although less so for the latter. Interestingly enough, even though farm policy (promolgated in part for the purpose of providing order and stability) has been in effect continuously over the entire 1950-87 period for wheat, rice, feed grains, cotton, wool, and honey, prices of these commodities have not been stable. On the other hand, prices of tobacco, peanuts, and milk have been quite stable --- even during the 1970s. The stability of the latter commodities can undoubtedly be attributed to their effective isolation from foreign competition and/or very tight controls on price and production.

I also found that a number of agricultural producers have been operating successfully in the face of considerable price variability but without price and income support or protection from foreign competition. This is the case for producers of potatoes, apples, hogs, and the major fruits. (Marketing orders for lemons and oranges help to stabilize seasonal prices. These orders, however, do not use price supports buttressed with government purchases nor supply control to stabilize annual fruit prices.) Furthermore, some industries have managed to maintain reasonably stable prices completely on their own --- e.g., the broiler, egg, tomato, and snap bean industries.

Many farmers, then, have managed to successfully cope with price variability. It may well be that production has been more costly as a result. It may also well be that farmers' investment behavior, borrowing behavior, input use, and enterprise mix would have been different with less price risk as suggested by Nelson and Cochrane. I am persuaded, however, that Nelson and Cochrance attribute more stability to farm programs of the 1950's and 1960's than is justified.

Productivity Increases

Farmers have been able to survive the price-cost squeeze alluded to above by rapidly adopting those technologies that enable them to increase productivity. Cochrane uses the "treadmill" thesis to explain not only the persistence of chronic disequilibrium in agriculture, but also to explain the fact that farmers have been forced to adopt the technology bringing about this chronic disequilibrium in order to survive. Clearly farmers have adjusted by rapidly adopting the new technology as the data in Table 5 shows. People fed per farm worker has increased from a mere fifteen in 1950 to almost 76 in 1987. People fed per farm worker is often used as a summary measure of the tremendous growth in agricultural productivity. It is, of course, simply another measure of the rapid rate of decline of farm workers relative to the total population. Nevertheless, it does indicate much about the productive capability of farm workers over time.

Crop and animal yields give more evidence on the productive capability of agriculture. Some of the more dramatic trends shown in Table 5 relate to crop and animal yields. In every case yields are up significantly. The greatest yield increases have been observed in corn and milk production (and we have not even begun commercial use of bovine somatotropin, the laboratory-produced hormone that stimulates milk

Table 5. Crop and Animal Yields and General Productivity Measures in United States Agriculture, 1950-87.

	1950	1955	1960	1965	1970	1975	1980	1985	1987
People Fed/Farm Worker	15.3	19.8	25.6	34.6	45.3	49.7	61.3	70.9	75.9
Crop and Animal Yields									
Wheat (bu/acre)	17	20	26	27	31	31	34	37	38
Corn (bu/acre)	38	42	55	74	72	87	91	118	119
Oats (bu/acre)	35	38	43	50	49	49	53	64	54
Barley (bu/acre)	27	28	31	43	43	44	50	51	53
Sorghum (bu/acre)	23	19	40	52	50	49	46	67	70
Soybeans (bu/acre)	22	20	23	25	27	29	26	34	34
Rice (cwt/acre)	237	306	342	426	462	456	441	542	548
Cotton (lbs/acre)	269	417	447	527	439	453	401	631	708
Milk Pdn (lbs/cow)	5,242	5,772	6,977	8,089	9,669	10,279	11,938	12,994	13,786
Egg Pdn (eggs/layer)	172	192	209	218	218	232	242	247	247
General Productivity Measures (Ratios of Indices, 1977=100)									
All Output/All Inputs	60	68	78	85	87	98	95	140	153
All Output/Land Input	56	64	74	80	80	98	95	136	144
All Output/Labor Input	23	31	43	57	75	90	102	152	167
All Output/Chemical Input	321	265	238	167	112	114	80	107	130
All Output/Machine Input	85	83	92	103	99	99	97	159	176
Crop Output/Labor Input	22	29	41	53	69	88	96	153	167
Crop Output/Machine Input	82	76	87	95	91	97	91	160	176
Lvstck Output/Labor Input	26	36	46	62	88	90	115	131	128
Lvstck Output/Machine Input	97	95	99	111	116	99	109	137	135

Table 6. Farm Inputs Used in United States Agriculture, 1950-87.

	1950	1955	1960	1965	1970	1975	1980	1985	1987
Index of Quantity of Farm Inputs (1977=100)									
Farm Labor	265	220	177	144	112	106	96	85	78
Fertilizers and Pesticides	19	26	32	49	75	83	123	121	100
Feed, Seed & Livestock	58	66	77	86	96	93	114	105	100
Power and Machinery	72	83	83	80	85	96	101	81	74
Taxes and Interest	83	89	95	101	102	100	100	91	90
Farm Real Estate	109	108	103	103	105	97	103	95	90
All Farm Inputs	101	102	98	96	97	97	103	92	85
Hours of Farmwork/Acre Planted	55	45	39	34	27	22	19	17	17
Commercial Fertilizer and Lime Use per Acre Planted (lbs)									
Nitrogen	6	11	17	31	51	52	64	67	63
Phosphate	11	13	16	24	31	27	31	27	26
Potash	6	11	13	19	28	27	35	32	32
Liming Materials	169	117	139	189	177	187	193	152	158
Wheel and Crawler Tractors per 100 Acres Planted									
Number of Tractors	1.0	1.2	1.4	1.6	1.6	1.3	1.3	1.4	1.5
Horsepower	26	36	47	59	69	67	85	91	102

production). Rather large yield increases have been observed in sorghum and cotton production as well. Many have looked at the new research area referred to as "biotechnology" as something that will revolutionize agriculture and cause huge agricultural adjustment problems. It might well be said, however, that a technological revolution in agriculture is nothing new, nor are adjustment problems associated with technological change!

Input Use and Input Prices

Table 6 shows the trends in quantities of farm output and quantities of key farm inputs since 1950. Among other trends, this table highlights the steep decline in labor use and the corresponding steep increase in machinery and fertilizer and other chemical use. The total number of tractors and crawlers per 100 acres planted has not changed significantly between 1950 and 1987. Total tractor horsepower used per 100 acres planted, however, has nearly quadrupled since 1950.

Per acre use of nitrogen has increased tenfold and per acre use of potash has increased fivefold since 1950. Per acre use of phosphate has also increased, but on a much less dramatic scale; about two and one-half times since 1950. Increased fertilizer use has brought about much of the crop yield increases observed in Table 5.

Most of the output-to-input ratios shown in Table 5 exhibit a strong upward trend, indicating increasing productivity with respect to the inputs. Notice, however, that in the case of chemicals and power and machinery, the ratios have varied considerably in recent years. One reason for this variability is the variability in relative prices of these inputs as can be seen from Table 7.

Table 7. Ratios of Quantities of Farm Inputs and Ratios of Prices of Farm Inputs in the United States, 1950-87.

	1950	1955	1960	1965	1970	1975	1980	1985	1987
Ratios of Input Quantities (Ratios of Indices, 1977=100)									
Land/Labor	41	49	58	72	94	92	107	112	115
Power-Machine/Labor	27	38	47	56	76	91	105	95	95
Chemicals/Labor	7	12	18	34	67	78	128	142	128
Chemicals/Land	17	24	31	48	71	86	119	127	111
Chemicals/Power-Machine	26	31	39	61	88	86	122	149	135
Power-Machine/Land	66	77	81	78	81	99	98	85	82
Ratios of Input Prices (Ratios of Indices, 1977=100)									
Land/Labor	61	62	69	80	68	88	123	72	62
Tractors/Labor	114	107	103	103	86	96	108	116	104
Chemicals/Labor	236	207	167	145	86	141	106	88	71
Chemicals/Land	390	334	242	181	126	160	87	122	114
Chemicals/Tractors	208	193	162	141	100	146	99	76	68
Tractors/Land	188	173	149	129	126	110	88	160	168

Table 7 highlights the substitution of inputs in agricultural production as well as the incentives for input substitution. Land input in agriculture has remained fairly constant since 1950 while labor use has declined by a factor of 3.4. Thus, the steady increase in the ratio of land to labor use since 1950 should not be surprising. It is also well-known that chemical and machine use in agriculture has increased quite rapidly (at the expense of labor) through the 1950s, 1960s, and early 1970s. The increase in the remaining ratios shown in Table 7 are also well known. The quite large output-to-chemical input ratios shown for the 1950s and early 1960s are simply a reflection of the fact that there was relatively little use of herbicides, pesticides, insecticides, and commercial fertilizer during these years.

The implied substitutions in inputs indicated here were in large part influenced by corresponding changes in their relative prices. For example, as the ratio of machine prices to wage rates falls, farmers substitute the relatively less expensive machines for the relatively more expensive labor. Through at least the 1970s, this is precisely what happened in American agriculture.

Kislev and Peterson suggest that all this is what we should expect of a rational economic unit (see also Hayami and Ruttan). Increasing urban incomes relative to income from farming for many farm families or to wage incomes for many farm workers, increased education of rural people, and removal of other barriers to the mobility of rural people have led to the out-migration of farm labor. At the same time a reduction in the price of mechanical inputs relative to the opportunity cost of farm labor encouraged the substitution of machinery for labor. The mechanical inputs, in turn, permitted farm families to cultivate larger acreages purchased or rented from those who left farming. The end result has been not only input substitutions, but also larger farm sizes.

Notice that during the 1980s, most of these price ratios began to turn down; some actually oscillated a bit. In response, farmers' substitution of machinery and chemical inputs for labor also slowed down. Of particular significance is the fact that farmers' substitution of machinery for labor has stabilized, and maybe even declined a bit, through the 1980s.[3/] If this trend continues, we can expect the demand for large farm machines to remain somewhat weak, and to see the growth in size of farms to slow down. If farmers refuse to buy more and larger machines, they are not likely to be able to farm larger acreages, and thus farm sizes will stabilize in spite of speculation to the contrary (Office of Technology Assessment). Indeed, judging from the trend in "acres per farm" shown in Table 1, one must conclude that growth in farm size has slowed markedly since 1975.

[3/] This may have been a more important factor responsible for the problems of the farm machinery industry than was the 1983 PIK program.

ENTERPRISE ADJUSTMENTS

Farm Enterprise Mix

A growing total population in the United States has bid away some cropland acreage from the farming sector, but the decline in farm acreage since 1950 has been quite small--only about seventeen percent over the 38-year period (Table 8). The proportion of farm acreage planted to crops and harvested has remained quite stable over the period. The proportion of acreage devoted to wheat and the major feed grains has changed very little since 1950. Oat production has declined since less of this commodity has been needed for animal feed. Cotton production has declined slightly over the period as the demand for cotton has decreased. Soybean production increased significantly in the early years of the period under study as the demand for protein feed increased and soybeans became a more popular crop. Of those crops not shown in Table 8, harvested acreages of sugar, tobacco, and peanuts are about equal and about one-half as large as rice acreage. Sugar acreage (beet plus cane) has increased only slightly; tobacco acreage has decreased by about one-half; and peanut acreage has remained quite stable since 1950.

The proportion of total cash receipts from farming derived from the various farm enterprises is shown in the lower portion of Table 8. Again the relative stability in the percentages over the 38-year period is quite remarkable. In some cases (hogs, eggs, tobacco, and cotton), noticeable but small declines are evident, while in other cases (poultry, feed grains, and oil-crops) small increases are noted. For most enterprises the changes in relative importance are quite small or non-existent over the period. The explanation for this stability is to a large degree to be found in the stability of relative output prices (see Table 4)!

Off-Farm Income

Another form of "enterprise adjustment" that can be and has been made by farm families relates to their decisions regarding allocation of available family labor among farm and non-farm occupations. Part-time farming has been a part of agriculture for a long time. The earliest report of research on the phenomenon I have been able to find was published by Kenneth Hood of Cornell University in 1936. Hood argued that part-time farming was a response to the "rural-urban" movement which had begun at least a half century earlier. In addition to the fact that part-time farming has been part of agriculture for a long time, it has long been recognized that part-time farming is, under certain situations, consistent with utility maximizing behavior of farmers. Lee, for example, demonstrates theoretically that as long as the non-farm wage rate is below the marginal rate of return from farming, the farmer will allocate his labor to farming. Because of diminishing returns to farm work, however, there will be a point at which the marginal rate of return to farm work will fall below the non-farm wage rate. From that point on the rational farmer will allocate any remaining work time to a non-farm job. Before taking up off-farm work, the farm will be operated in a labor intensive way, the marginal utility of work will be low, and there will be much leisure time. With a combination of farm and off-farm work, the marginal utility of farm work will rise, and leisure time will fall. Most likely this dual occupation will necessitate adjustments of farm enterprises, technology use, etc.

Table 8. Farm Acreage, Harvested Acreage, and Cash Receipts from Selected Farm Enterprises in the United States, 1950-1987.

	1950	1955	1960	1965	1970	1975	1980	1985	1987
Farm Acreage									
Total Farm Acreage (mil)	1,202	1,202	1,176	1,140	1,102	1,059	1,039	1,014	1,003
Percent Harvested	28.0	27.6	26.9	25.5	26.2	31.4	33.9	33.7	29.3
Harvested Acreage of Selected Crops as a Percent of Total Harvested Acreage									
Wheat	18.3	14.2	16.4	17.0	15.1	20.9	20.2	18.9	19.0
Corn	21.5	20.6	22.7	19.0	19.9	20.3	20.7	22.0	20.2
Oats	11.7	11.8	8.4	6.4	6.4	3.9	2.4	2.4	2.4
Barley	3.3	4.4	4.4	3.2	3.4	2.6	2.0	3.4	3.4
Sorghum	3.1	3.9	4.9	4.5	4.7	4.6	3.6	4.9	3.6
Soybeans	4.1	5.6	7.5	11.8	14.6	16.1	19.3	18.0	19.2
Rice	0.5	0.6	0.5	0.6	0.6	0.8	0.9	0.7	0.8
Cotton	5.3	5.1	4.8	4.7	3.9	2.6	3.8	3.0	3.4
Cash Receipts from Farming									
Percent from Livestock	56.6	54.1	55.4	55.6	58.5	48.5	48.7	48.5	55.2
Percent from Hogs	11.3	9.1	8.4	9.2	8.9	8.9	6.4	6.3	7.5
Percent from Beef	19.9	17.8	21.5	22.7	27.0	19.7	22.5	20.2	21.7
Percent from Dairy	13.1	14.3	13.9	12.8	12.9	11.2	11.7	12.5	12.9
Percent from Poultry	3.3	3.6	3.3	3.3	3.1	3.4	3.2	4.0	4.6
Percent from Eggs	5.5	6.0	5.1	4.5	4.2	3.2	2.3	2.3	2.3
Percent from Crops	43.4	45.9	44.6	44.4	41.5	51.5	51.3	51.5	44.8
Percent from Feed Grains	7.5	8.7	8.7	9.4	10.1	13.7	13.1	15.6	9.5
Percent from Food Grains	6.8	6.7	7.2	5.2	5.0	9.2	7.4	6.2	3.9
Percent from Wheat	7.2	6.3	6.9	4.5	3.6	8.5	6.3	5.5	3.5
Percent from Soybeans	2.6	2.8	3.5	5.5	6.4	8.6	10.2	7.7	6.9
Percent from Tobacco	3.7	4.2	3.4	3.0	2.7	2.4	1.9	1.9	1.3
Percent from Cotton	8.6	8.7	6.9	5.9	2.5	2.6	3.2	2.6	2.9
Percent from Fruits and Nuts	4.2	4.3	4.5	4.2	4.1	4.0	4.7	4.8	5.7
Percent from Vegetables	5.0	5.7	5.8	6.7	5.6	6.0	5.2	5.9	6.7

All this tells us that the persistence of part-time farming is definitely the product of rational decision-making by farm operators. It also suggests that as farming returns vary, variations in the amount of off-farm work can be expected. Alternatively, as the relative earning power of the farm falls, the amount of off-farm income of farm families can be expected to rise. To test this hypothesis, I estimated the following regression equation for each of the eight sales classes of farms defined by Economic Research Service using data for 1960-87:

$$OFF_t = b_0 + b_1 RELFMY_t + b_2 UNEMPLOY_t + e_t$$

where

OFF=Off-farm income of the farm family in dollars per farm,

RELFMY=Ratio of net farm income plus government payments per farm to money income of all U.S. households,

UNEMPLOY=Percent unemployment rate in U.S.,

e=a random error satisfying the usual least squares assumptions, and

t=an index for time.

UNEMPLOY was included here to capture employment conditions in the non-farm job market.

The regression results and other statistics are shown in Table 9. The coefficient on UNEMPLOY was not significantly different from zero in any of the regressions and frequently had the wrong sign, so it was removed from the regression in generating the final estimates. Apparently this variable does not adequately represent employment conditions in the sectors in which farm families seek alternative employment.[4/]

The coefficients on RELFMY, however, were highly significant and had the expected signs in all but the very largest farms, thus confirming my original suspicions. That is, as the relative earning power of the farm increases, the percentage of off-farm income declines. This would suggest that farm families do indeed adjust to the relative earning power of the farm by reallocating family labor between farm and non-farm work when income from the farm is low. For the mid-sized farms this relationship was fairly strong. For the three largest size categories the relationship was not significant suggesting that on these farms little surplus labor exists and the farm operation is dominant. For the two smallest sized farms the relationship was significant but not very strong. Here the farm makes such a small contribution to family income (it has actually detracted from family income in recent years) that relative farm earnings are of little consequence.

These results should be interpreted as being preliminary and subject to errors of model specification. Nevertheless, they would seem fairly clearly to support the conclusion that farm families do adjust their labor resources in response to changes in the level of farm income. It is clear

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[4/] I also experimented with a variable representing the ratio of farm labor earnings to wage rates in food manufacturing. Here again the results were inconclusive.

that for some, part-time farming is a temporary situation until the family can adjust out of farming completely. For others part-time farming is a way-of-life (see, for example, Hallberg, Findeis, and Lass). For still others, part-time farming is a temporary expedient to get them by a short-run cash flow problem.

Table 9. Response of Off-Farm Income to Changes in Ratio of Income from Farm Sources Relative to Money Income of all U.S. Households, 1960-87[a/]

Sales Class	Elasticity of Off-Farm Income with Respect to Ratio of Farm Income to Household Income	R^2	Mean of Off-Farm Income	Mean of Farm to Household Income Ratio
$500,000 or More	n.s.	----	$19,473	2,675
$250,000-$499,999	n.s.	----	11,191	458
$100,000-$249,999	n.s.	----	8,933	322
$ 40,000-$ 99,999	-0.806*	0.66	6,310	163
$ 20,000-$ 39,999	-0.839*	0.70	7,215	85
$ 10,000-$ 19,999	-0.738*	0.82	8,766	47
$ 5,000-$ 9,999	-0.575*	0.87	9,839	25
Less than $5,000	-0.228*	0.67	11,948	5

* - Elasticity calculated from coefficient that was significantly different from zero at 1 percent level.

[a/]For the two largest sales class, data on off-farm income is only available since 1975. For the third largest sales class, data on off-farm income is only available since 1965.

IMPEDIMENTS TO RESOURCE MOBILITY

Labor

Historically there have been severe impediments to the adjustment of farm workers out of agriculture and into nonfarm jobs in order to prevent the persistence of low returns. These impediments have included lack of education and skills, lack of knowledge about nonfarm job opportunities, employment barriers created by organized labor, and lack of availability of nonfarm jobs in the area where these surplus labor resources could feasibly relocate.

For the most part these types of impediments have by now been removed or at least eased so that much of the surplus labor in agriculture has migrated to the non-agricultural sector. Nevertheless, there are still instances in which nonfarm jobs requiring the skills possessed by surplus agricultural workers are not available. In these instances, the excess labor resources cannot move out of agriculture. Also changing to a different type of agricultural production involves major shifts in capital which is never easy and sometimes simply not possible. It is relatively easy for the Midwestern grain farmer to shift production from corn to soybeans or even from corn to hay. It is quite another matter for the dairy farmer to shift from milk production to corn production, or even for him or her to shift from milk production to beef production. The intensity of resource use in dairy and beef are vastly different so that with the same resources, a Wisconsin dairy farmer simply could not produce the same level of net (or gross) receipts with beef as he or she can with dairy.

These kinds of problems are of paramount concern in the principal dairy regions of the country at the moment. We currently have a surplus of milk in the aggregate in the U.S. the solution of which is to move resources out of dairy production. Unfortunately, as may well be reflected by the relatively low participation rate among Upper Midwest and Northeast dairy farmers in the dairy herd buyout program authorized by the Food Security Act of 1985, the farming alternatives available to dairy farmers in these regions are quite limited. In the long run they will exit. In the short-run, though, some stickiness is to be expected.

Capital

Conventional economic theory assumes that markets are such that there is only one price for any given asset and that an entrepreneur can purchase additional quantities of that asset or sell some portion of that asset he now owns at this competitively determined price. Conventional theory also assumes perfect mobility of factors. G. L. Johnson (Johnson and Quance) was one of the first applied economists to recognize that, in the farm sector at least, the real-world situation is much more complicated. Johnson observed that many farm assets have an acquisition price that is generally much higher than their selling price (or salvage value), and that this leads to a considerable range over which output price can vary before changes are made in input use and therefore in product output.

A variety of assets can be so characterized. Durable assets such as fruit trees, fencing, farm buildings, drainage tile, etc. the salvage value of which is near zero or even negative (e.g., there will be a cost associated with digging up fruit trees and disposing of them unless this cost could be completely recovered by selling the wood for firewood) are fixed over wide ranges of prices for the industry and the individual farm although they may not be fixed for individual farm enterprises. That is, tiling and fencing are useful regardless of whether the farmer is growing corn or soybeans, silos are useful regardless of whether the farmer is producing corn silage or hayledge, etc. Specialized durable assets such as corn pickers, grain combines, hay balers, forage choppers, etc. have a very low salvage value since they have little use outside of agriculture. These assets are probably fixed over wide ranges of prices for the industry and relatively fixed for individual farm enterprises. A hay baler, for example, is not very useful in corn or soybean production. A corn picker is not useful in sunflower production. Thus such assets will be used to produce specialized products until they are completely depreciated, almost without regard to product prices.

Land has a low salvage value in nonfarm uses in most areas and it responds very little to product prices. Using data for the period 1955-1987, I estimate the elasticity of cropland supply to be 0.08 in the short-run and only 0.10 in the long-run.5/ Apparently the opportunity cost of keeping land in crop production is very low, and the cost of cropping land not previously used for crops is relatively high. Thus supply is very inelastic for both falling and rising crop prices. The supply of grassland for grazing can also be expected to be quite inelastic. As a practical matter, much land for grazing is controlled by the Bureau of Land Management which limits the number of animals that can be grazed on publicly owned but privately operated lands in federal grazing districts.

Thus over a wide range of output prices and in the short to intermediate run, aggregate supply for farm products tends to be quite inelastic. Even so, durable inputs fixed to the industry tend to be less fixed on individual farms and much less so for individual commodities. Land input may be fixed in the aggregate, but there is little to prevent changes in the crops or livestock grown on that fixed input. This explains why supply tends to be more elastic for individual farm products than for aggregate farm output. Furthermore, as I have suggested earlier, farm labor does not appear to be as fixed in agriculture as it once was. Finally, operating inputs (chemicals, fuels, seed, repairs, etc.) which have a low (even zero) salvage value once committed to farming, are consumed quickly and their useage level can be adjusted in the subsequent production period. Thus, it seems to me, asset fixity is in large measure only of concern in the very short run. Given a slightly longer period of time, significant adjustments are made. Farmers certainly did respond to favorable output prices between 1970 and 1979 with increased input use. Similarly they responded with reduced input use between 1979 and 1986-87 when output prices fell!

SUMMARY

Significant adjustments have been made in U.S. agriculture since 1950. There are fewer farms, fewer farm workers, and fewer farm people. Capital has substituted for much of the exiting labor, but capital use as

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5/These estimates were derived from a distributed lag model in which acres planted in the U.S. was the dependent variable, and acres idled and the index of prices received by farmers for crops were the independent variables.

a percentage of annual cash receipts from farm marketings has also declined. Since 1950 farms have, on average, doubled in size as measured by acres. If size is measured by sales volume, all U.S. farms would have increased in size since 1950 even without an increase in acres or number of animals simply because of increases in nominal prices received, labor productivity, and animal and crop yields. Some changes have occurred in farm ownership and tenancy since 1950, but the changes here have not been dramatic. The family unit is still dominant in American agriculture.

There has been a slight decline in the total acreage farmed, but little change of significance in the mix of crops harvested or in the percentage of total cash receipts derived from the different farm enterprises. There has, however, been considerable change in the mix of inputs used by the farming sector. Interest and depreciation now constitute a higher proportion of total production expenses, and purchased inputs are now more important than farm-produced inputs. Farm debt has increased substantially so that farmers, particularly the larger farmers, are now much more vulnerable to high interest rates and short-term erosion of asset values.

The evidence points to considerable capacity of American agriculture to adjust to changes in technology and demand. Relative prices of farm inputs have a considerable impact on farmers' use of different inputs and, therefore, on the substitutability of inputs. Further changes in these relative prices could significantly affect the future structure of the farming sector. Farmers also alter their input useage when commodity prices change. Sometimes farm incomes are high and there are capital gains. Sometimes there are losses. Sometimes off-farm work becomes important. Rates of return on commercial sized farms, though, appear to be competitive in the long run. Calculated rates of return on the smaller sized farms probably understate the "true" returns to farm families on these farms.

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CHAPTER 4. TRADE LIBERALIZATION AND RESOURCE ADJUSTMENTS IN SOUTHERN AGRICULTURE

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INTRODUCTION

The Southern region, as defined in this paper, is composed of the Appalachian, Southeast, and Delta production regions.[1] The farmers of this region bring human capital, natural and man-made resources, and climate together to produce a uniquely Southern combination of commodities. The soils are generally productive but low in fertility. Rainfall and underground water are generally abundant. The growing season is long and temperatures are typically moderate. This combination of characteristics creates unique opportunities and special problems for the region.

The purpose of this paper is to examine the economic consequences of trade liberalization in agriculture on the Southern region. Two scenarios of trade liberalization will be considered--unilateral trade liberalization by the United States and multilateral trade liberalization. In both cases U.S. government price and production programs for agriculture would be phased out.

The remaining sections of the paper are organized as follows. The immediately following section describes the resource base for the Southern region including farm numbers, farm workers, cropland, and commodity mix. The third section describes the competitive position of the Southern region relative to the rest of the nation. Its competitive position is based on what has happened in the last 15 years, a period characterized by internationalization of American agriculture. The fourth section is a more formal modeling section in which previous research is reviewed and utilized to analyze the impact of changes in prices and government programs on Southern agriculture. The fifth section describes the implications of the study.

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[1]The Appalachian region includes Kentucky, North Carolina, Tennessee, Virginia, and West Virginia. The Southeast region includes Alabama, Florida, Georgia, and South Carolina. The Delta region includes Arkansas, Louisiana, and Mississippi.

SOUTHERN RESOURCE BASE

Farm Structure

Southern agriculture is briefly described in this section as a foundation to understand potential adjustments. The Southern region is composed of 12 states and three subregions (Table 1). The overall region accounts for 28.8 percent of U.S. farms and 14.8 percent of U.S. cropland. Hence, the average farm size in the Southern region is only half the size of other U.S. farms. The region accounts for 20.3 percent of U.S. cash receipts from agriculture.

The Appalachian region is especially dominated by small farms, accounting for 15.3 percent of U.S. farms. With 22.5 million acres, the Appalachian region has slightly more cropland than the Delta, and the Southeast has about 4 million acres less than either of these. However, the Southeast generates more farm income than the other two regions, largely because of Florida's contributions. The leading Southern states in terms of cash receipts are Florida, North Carolina, Georgia, and Arkansas. All of the other Southern states had less than $3 billion in farm sales.

Agricultural Production

Cash receipts in the Southern region are almost equally split between livestock and crops (Table 2). The distributions of cash receipts by commodity groups and subregion are reported in Table 2. The Southern region produces 20 percent of the nation's cash receipts from livestock. Half of the Southern region's cash receipts for livestock products are from poultry and eggs. This region accounts for over half of the nation's receipts from poultry. The region produces only 10-12 percent of the nation's receipts from meat and dairy products.

The Southern region produces 20 percent of the nation's crop receipts (Table 2) on 15 percent of the nation's cropland (Table 1). The region accounts for a disproportionate share of tobacco, cotton, oil crops, vegetables, and fruits/nuts. It produces 5.8 percent of the nation's feed grains and 12.4 percent of the nation's food grains.

Poultry is important in all three subregions, ranking first or second in terms of cash receipts (Table 2). Meat animals, poultry/eggs, and tobacco are the top three commodities in the Appalachian region in terms of cash receipts. In the Southeast, poultry is ranked above meat animals, fruits/nuts and vegetables. The top commodities in the Delta are poultry/eggs, oil crops, meat animals, and cotton.

Table 1. Farm Numbers, Cropland, and Cash Receipts for Southern States and as a Percent of the United States, 1986.

Region/State	Number of Farms		Cropland		Cash Receipts	
	Thousands	Percent of U.S. Total	1000 Acres	Percent of U.S. Total	Million Dollars	Percent of U.S. Total
Appalachian	339	15.3	22,555	5.4	9,935	7.4
Kentucky	99	4.5	5,863	1.4	2,389	1.8
North Carolina	73	3.3	6,661	1.6	3,782	2.8
Tennessee	96	4.3	5,578	1.3	1,924	1.4
Virginia	50	2.3	3,394	.8	1,613	1.2
West Virginia	21	1.0	1,059	.3	227	.2
Southeast	166	7.5	18,042	4.3	10,797	8.0
Alabama	51	2.3	4,492	1.1	2,009	1.5
Florida	39	1.8	3,440	.8	4,688	3.5
Georgia	49	2.2	6,535	1.6	3,206	2.4
South Carolina	27	1.2	3,575	.8	894	.7
Delta States	132	6.0	21,909	5.2	6,178	4.6
Arkansas	50	2.3	8,112	1.9	3,022	2.2
Louisiana	36	1.6	6,403	1.5	1,372	1.0
Mississippi	46	2.1	7,394	1.8	1,785	1.3
South	637	28.8	62,506	14.9	27,450	20.3
United States	2,212	100.0	420,792	100.0	135,155	100.0

Source: U.S. Department of Agriculture. "Economic Indicators of the Farm Sector - State Financial Summary." ERS. 1986.

Table 2. Cash Receipts by Commodity Groups for the Southern Region and as a Percent of the United States, 1986.

Commodity Group	Appalachian	Southeast	Delta	Southern Region: Total	Southern Region: Percent of U.S. Total
	(Million Dollars)				(Percent)
All Commodities	9,935	10,797	6,178	27,450	20.31
Livestock Products	5,801	4,768	3,564	14,133	19.75
Meat Animals	2,169	1,220	710	4,099	10.47
Dairy Products	1,100	681	332	2,114	11.86
Poultry/Eggs	1,958	2,685	2,293	6,936	54.71
Miscellaneous Livestock	574	182	229	985	59.92
Crops	4,134	6,030	2,614	12,777	20.09
Food Grains	96	83	562	741	12.45
Feed Crops	609	204	224	1,037	5.81
Cotton	153	176	665	994	34.03
Tobacco	1,526	242	NA	1,768	92.18
Oil Crops	834	972	780	2,586	24.01
Vegetables	274	1,385	112	1,771	20.35
Fruits/Nuts	171	1,340	41	1,552	22.49
All Other Crops	474	1,627	232	2,332	26.31

Source: U.S. Department of Agriculture. "Economic Indicators of the Farm Sector - State Financial Summary." ERS. 1986.

NA = Not applicable.

Farm Labor

Information on farm workers and wages for the Southern region and the United States is reported in Table 3. The Southern region accounts for 23.4 percent of the U.S. farm workers. In the Southern region 45 percent of these workers are in the Appalachian subregion, 31 percent in the Southeast and 23 percent in the Delta. Over half of the workers are hired workers in the Southeast compared to 28.2 percent hired workers in the Appalachian subregion and 34.3 percent hired workers in the Delta.

The average wage rate is $4.54 per hour in the Southern region compared to $5.18 per hour for the nation (Table 3). The highest wage rate within the region is in the Southeast, followed by the Appalachian subregion and then the Delta.

THE COMPETITIVE POSITION OF THE SOUTHERN REGION

The 1970s and 1980s have been characterized as a period of internationalization of American agriculture. It is important to understand how farmers in the Southern region have responded in an era of expanded international trade. This section compares production trends in the Southern region with those for the nation. Regional and national production trends are analyzed in order to identify possible emerging changes in competitive position.

A region is said to be experiencing a changing competitive advantage in a particular commodity if the commodity grows at a different rate than the national average. If the percentage change is less than the national average, the region's competitive advantage is declining. Conversely, if the percentage change is greater than the national average, evidence indicates an increasing competitive advantage. Changes in competitive advantage can be related to the interaction between supply and demand for commodities.

The 1971-1986 production trends for the Southern region and the nation are reported in Table 4. In terms of growth in overall production, the nation clearly outperformed the Southern region. While agricultural production for the nation expanded 20.7 percent it expanded from 2.0 to 5.3 percent in the three Southern regions. However, the greatest increase in production for any commodity group for the nation was for poultry and eggs, which is of major importance to the Southern region. On the basis of poultry, the growth rates for all livestock in the Southern region were higher than the national average. However, the nation clearly outperformed the Southern region for meat and dairy products and all crops. The brightest spots among crops in the Southern region were feed grains in the Delta, food grains in the Delta and Southeast, sugar crops in the Southeast, and oil crops in the Appalachian region.

Table 3. Farm Workers and Farm Wage Rate for the Southern Region and as a Percent of the United States, October 1988.

	Appalachian	Southeast	Delta	Southern Region Total/Average	Southern Region Percent of U.S. Total
	(Thousands)				(Percent)
Number of Workers					
All Farm Workers	308	213	160	681	23.4
Self Employed	166	82	80	328	23.4
Unpaid	55	23	25	103	19.4
Hired	87	108	55	250	25.6
	(Dollars)				(Percent)
Farm Wage Rate	4.61	4.78	4.08	4.54	87.6

Source: Georgia Department of Agriculture, Georgia Agricultural Statistics Service. Georgia Farm Report. Vol. 88, No. 30. Athens, GA. November 30, 1988.

Table 4. Trends in Commodity Production in the Southern Region and United States, 1971-1986.

Commodity	Percentage Change in Production, 1971-1986			
	Appalachian	Southeast	Delta	United States
	(Percent)			
Farm Output	5.3	2.0	3.2	20.7
Livestock (All)	23.5	15.6	13.5	10.0
Meat Animals	5.7	-13.7	-24.8	-2.9
Dairy Animals	6.2	2.1	-13.2	21.9
Poultry and Eggs	73.9	42.9	50.0	41.5
Crops (All)	-3.2	-6.8	-3.3	26.7
Feed Grains	19.3	-43.4	285.6	33.7
Hay and Forage	1.9	-0.9	18.0	9.3
Food Grains	15.7	71.5	106.9	32.1
Vegetables	-7.4	45.5	-43.6	21.9
Fruits and Nuts	-17.3	-6.1	-53.2	28.7
Sugar Crops	NA	109.9	2.2	9.3
Cotton	-23.5	-49.8	-30.2	-9.2
Tobacco	-27.3	-43.5	NA	-29.2
Oil Crops	41.4	-2.5	-22.5	61.8

Source: U.S. Department of Agriculture. "Economic Indicators of the Farm Sector--Production and Efficiency Statistics, 1986." Washington, D.C. ERS. June 1988.

NA = Not applicable.

ESTIMATED IMPACTS USING ECONOMETRIC MODELS

Southern Region Models

Shumway and Alexander estimated regional output supply and input demand models for 10 production regions. The models were complete systems of output supply and input demand relationships derived by duality from the indirect restricted profit function. For purposes of this study, Shumway and Alexander's three models for the Appalachian, Southeast, and Delta regions are used as a basis for simulation of trade liberalization models.[2]

Under unilateral U.S. trade liberalization, crop prices were assumed to increase slightly and livestock prices were assumed to decline by 7.6 percent. Under multilateral trade liberalization, crop prices were assumed to increase from 10 to 19 percent and livestock prices were assumed to decline 10 percent. These assumptions were based on BLS estimates reported in Baker, Hallberg, and Blandford. Government payments were assumed to decline 80 percent from actual levels.

Simulation results for the Southern region under 1982 base conditions with trade liberalization are reported in Table 5. With trade liberalization, feed grains and oil crops are expected to expand. Revenues and profits are expected to decline under unilateral trade liberalization and increase slightly under multilateral trade liberalization. For the Southern region as a whole unilateral trade liberalization would reduce revenue by 3.76 percent and net farm income by 14.59 percent. Under multilateral trade liberalization, revenue would increase by 1.99 percent and net farm income would increase by 6.83 percent. However, these results are based on 1982 government payments which are lower than current levels.

The Georgia Model

Maligaya and White estimated the dual restricted profit function for Georgia using the normalized quadratic form. This model assumed competitive behavior and exogenous prices of outputs and nonland variable inputs. The inverse demand for the quasi-fixed factor land is obtained by differentiating the profit function with respect to land to obtain the shadow-value equation. At equilibrium the shadow price is equated to land rent. A supply function for farmland is incorporated into the model. Farming and forestry are considered to be residual claimants on the land resource. Hence, such factors as population and per capita income are hypothesized to influence the quantity of land available for farming and forestry uses. To account for competition of forestry with farming, forest product prices are included in the supply equation for farmland.

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[2]Appreciation is expressed to Richard Shumway for sharing the data necessary to conduct the simulation analysis.

Table 5. Impacts of Trade Liberalization on the Southern Region.

	Appalachian		Southeast		Delta	
	Unilateral[a]	Multilateral[b]	Unilateral[a]	Multilateral[b]	Unilateral[a]	Multilateral[b]
	(Percent)					
Materials	-0.61	-1.80	-0.48	-1.08	-0.57	-1.03
Hired Labor	1.87	10.94	0.00	0.00	1.46	-2.48
Machinery	0.62	2.77	0.26	0.94	2.00	5.03
Energy	0.94	3.13	-0.21	-0.03	-1.49	-3.00
Feed Grains	1.43	4.20	5.35	13.40	1.34	5.05
Food Grains	-0.56	-1.40	-0.15	-0.62	3.05	3.86
Oil Crops	1.89	5.83	1.92	5.16	-1.56	-3.03
Other Crops	1.00	4.79	-0.31	-0.72	8.51	3.14
Livestock	-1.10	-3.74	-1.07	-2.49	-1.04	-2.28
Cash Flows						
Revenue	-2.27	4.93	-3.22	1.48	-2.55	2.68
Costs	0.24	1.46	-0.24	-0.40	-0.10	-0.42
Profits	-10.70	12.83	-15.00	4.83	-20.09	0.00

[a]Under unilateral trade liberalization the following changes in prices are assumed: feed grains increase 1.5%, food grains increase 1.8%, oil crops and other crops no change, livestock decreases 7.6%. Diversion payment rates are assumed to be zero and government payments are assumed to decline by 80%.

[b]Under multilateral trade liberalization the following changes in prices are assumed: feed grains increase 11.6%, food grains increase 18.7 percent, oil crops and other crops increase 10 percent, livestock decreases 10%. Diversion payment rates are assumed to be zero and government payments are assumed to decline by 80%.

The output supply, input demand, and land supply and demand relationships were estimated using aggregate data for Georgia agriculture. The time series data used in the estimation were annual observations for the years 1950 through 1985. The model included two output categories (crops; livestock and poultry) and four input categories (land, hired labor, machinery, and materials). Exogenous variables included product prices, variable input prices, quantity of family labor, government payments, a dummy variable for the 1983 Payment-in-Kind (PIK) program and a time variable. The endogenous variables are quantities of outputs and inputs. To aggregate price data for the input and output variables, the Tornqvist-Theil index, a discrete approximation to a Divisia index, was used with 1977 as the base period. Revenue and expenditure shares were used as weights. Aggregate quantity indices were computed by dividing aggregate revenue and expenditures by the aggregate price indices.

The profit function is considered to be theoretically valid, because it meets the necessary regularity conditions. Linear homogeneity is met by normalizing prices, and symmetry is imposed. The Hessian matrix for prices was a positive definite matrix, indicating convexity. Monotonicity was not violated at any observation.

The results for Georgia are reported in Table 6. Changes in prices, which are from Baker, Hallberg, and Blandford, are used to drive the changes in the model. Also, government payments are assumed to decline 80 percent from observed levels. Livestock production is projected to decline under unilateral trade liberalization, but no change is projected for crop production. Under this scenario net farm income is projected to decline 22 percent. Under multilateral trade liberalization, crop production is projected to increase and livestock production is projected to decrease. Net farm income is projected to decrease by 11 percent under multilateral trade liberalization.

IMPLICATIONS

Farm Structure

Farm numbers were fairly stable during the prosperous period of the 1970s but have declined dramatically during the 1980s, a period in which prices have been depressed. Trade liberalization would lead to lower livestock prices, and therefore tend to reduce the number of livestock farms. Unilateral trade liberalization would not have much impact on crop prices but would reduce government payments, and hence farm income, so farm numbers would likely decline under this policy. Under multilateral trade liberalization, crop prices would increase but government payments decrease, so this policy's net effect on farm structure is uncertain.

Table 6. Impacts of Trade Liberalization on Georgia Agriculture.

	1987	Impact of Trade Liberalization	
		Unilateral	Multilateral
	(Million $)	(Percent Change)	
Crops			
Receipts	1,347[a]	-3.0	16.4
Prices		-3.0[b]	12.0[b]
Production		0.0	5.0
Livestock			
Receipts	1,826[a]	-14.7	-19.1
Prices		-7.7[b]	-10.0[b]
Production		-7.6	-9.9
Production Costs	2,533[a]	-5.5	-3.4
Government Payments	245[a]	-80.0[b]	-80.0[b]
Net Farm Income	1,215[a]	-22.0	-11.3
Rental Rate for Farmland		-11.0	-16.2

[a]Source: Georgia Department of Agriculture. Georgia Agricultural Facts. Georgia Agricultural Statistic Service. Athens, GA. 1988.

[b]Source: Baker, Hallberg, and Blandford.

Impacts by Commodity

Poultry is an important commodity in the South, but only 3.3% of U.S. poultry production is exported. Unilateral trade liberalization would eliminate U.S. export subsidies on poultry, but the direct effects of unilateral liberalization would be small. The indirect effects of lower prices for beef and pork would be expected to lower poultry meat prices. However, almost half of the cash receipts from poultry comes from eggs. Considering poultry prices to be a weighted average of poultry meat and egg prices, the effects of unilateral trade liberalization are not expected to have as large an impact on poultry prices as hog and beef prices. Multilateral trade liberalization would be expected to result in expanded U.S. poultry exports, because of reductions in subsidized European poultry exports which represent major competition to U.S. poultry products. Again, poultry prices would not be impacted to the extent of hog and beef prices under multilateral trade liberalization.

Dairy production in the Southern region is aimed primarily at the fluid milk market and is generally characterized by high production costs. As evidence of the marginal nature of production in the region, most Southern states experienced heavy participation in the dairy-termination program. Alabama, Georgia, and Mississippi ranked among the top eight states in the percentages of milk production removed from the market under the termination program (Carley). Hence lower milk prices resulting from trade liberalization would be expected to result in lower milk production in the region, creating a deficit in the region's fluid milk market. However, a major structural change in dairy production is underway in the South with numerous large dairy farms being developed. A deficit in the fluid milk market would likely encourage further development of such large dairies.

Beef farms in the Southern region are predominantly small with over 95 percent of the farms having less than 100 head (U.S. Department of Commerce). Also, per farm income on beef farms in the Southern region is only one-third the level of income per farm outside the region. These beef farms are mainly cow-calf operations with many of its feeder calves moving to the West for grain fattening.

Higher crop prices from trade liberalization would be expected to result in an expansion of double cropping in the Southern region. Double cropping is a method for increasing production capacity quickly in response to favorable crop prices. Double cropping is well suited to the Southern region which has long growing seasons and an abundance of rainfall evenly distributed throughout the year. The Southern region experienced a tremendous growth in double cropping during the 1970s when crop prices were relatively high followed by major reductions in double cropping in the 1980s. Soybeans following small grain, such as wheat, has been a popular double-cropping system in the Southern region. In 1986 22.6 percent of soybeans were double cropped, which is considerably higher than the U.S. level of 6.0 percent for the same year (USDA, Crop Production). The introduction of higher yielding wheat varieties and recent developments in herbicides have had positive effects upon double-cropping winter wheat and soybeans in the Southern region. The expansion in double-cropping wheat and soybeans has increased the relative importance of wheat production in the Southern region. Increased wheat production, as a consequence of double cropping, could complicate agricultural programs designed to control acreage and production. For example, elimination of deficiency payments of wheat is expected to reduce planted acreage of the crop. This reduction in wheat acreage will directly affect planted acreage of double-cropped soybeans. It was estimated that each acre reduction of wheat corresponded to a .65 acre decrease in double-cropped soybean acreage (Shideed and White). The lack of one-to-one correspondence is due to the availability of other types of double cropping. This implies that an additional .35 acre of other second crops, e.g., sorghum, will be withdrawn from cropland as a result of each acre reduction in wheat acreage.

Feed grain production expanded rapidly in the South in the late 1970s due to higher crop prices. However, feed grain production declined in the mid-1980s for two reasons: lower prices and frequent droughts. During the last 11 years, the South has been plagued by at least 6 droughts. If longer term weather patterns dominate in the future, an abundance of rainfall could encourage another expansion in feed grain production in the South.

Speed of Adjustment

Econometric Adjustment Rates

The econometric results utilized in the simulation above were based on a static model. Hence these results do not indicate how long it takes to adjust to equilibrium. For that reason dynamic econometric results are considered to indicate how quickly resources would be expected to adjust to their long-run equilibrium values.

Taylor and Monson estimated dynamic factor demands for the Southeast. Their results indicated a 55 percent rate of adjustment for capital, as it adjusts to long-run equilibrium. The rate of adjustment for land was estimated to be 18 percent toward the equilibrium value. Alexander estimated rates of adjustment using multiple-output and multiple-input technology and nonstatic price expectations. Her results indicated that the adjustment rate for capital is 61 percent and the adjustment rate for land is 29 percent. These adjustment rates imply that capital would adjust to 90 percent of long-run equilibrium in 3 to 4 years, and land would adjust to 90 percent of long-run equilibrium in 7 to 10 years.

Long-Term Acreage Retirement

The Southern region is expected to have a high participation rate in the Conservation Reserve Program by the time it takes out over 40 million acres nationwide. Participation in this program somewhat limits the Southern region's ability to adjust to trade liberalization initiatives in the future. Also, it is important to consider how farmers in the region might respond after the program is terminated.

The Conservation Reserve Program (CRP) is a multi-year, multi-objective program of the 1985 Food Security Act scheduled to retire 40 million acres by 1990. Current enrollment is 8.9 million acres with most coming from the Plains and Mountain States (Dicks, Reichelderfer, and Boggess). The participation of the Southern states in the CRP is presented in Table 7. The Appalachian, Southeast, and Delta States have 4, 6, and 3 percent of the U.S. total enrollment, respectively. The participation rate in the Southeast was the highest compared to any region in the United States.

Based on historical experience from the Soil Bank, an earlier long-term acreage retirement program, farmers in the Southern region placed productive land in the land retirement program. As soon as government payments ended and crop prices warranted, the land was converted back to crop production. Farmers responded to the favorable economic conditions for field crops during the 1970s by increasing the acreage of a number of commodities, primarily corn and soybeans. As a result, marginal, submarginal, and soil bank land previously in pasture and timber was placed in crop production (White, et al.). Likewise, the current Conservation Reserve Program is expected to limit adjustments of the Southern region to trade liberalization, but when government payments end and crop prices warrant, this land will be converted to crop production.

For marginal and submarginal land, the potential adjustment is more complicated. A more recent study shows that growing pine trees represents a potential alternative to the growing of field crops in Georgia, especially on marginal land (Shideed, et al.). Under current legal and economic conditions pine production is an efficient solution for marginal land. Alternatively, marginal land currently in crop production would be placed in the Conservation Reserve Program. The trade-off between using the marginal land for pine or the Conservation Reserve Program is determined by the outlook for the market of forest products, government programs, and the planning horizon for landowners.

Environmental Considerations

Pesticides, fertilizer, and sediment are delivered to water bodies primarily by water runoff. Runoff transports dissolved water-soluble chemicals, as well as chemicals that are bonded to sediment particles. Runoff can originate from both rainfall and irrigation, but only rainfall is considered in this study. Table 8 reports both annual and growing season potential direct runoff.

For example, in high rainfall regions, especially those with erosive soils (Appalachian and Southeast), the aggregate potential contribution to sediment yields from extensification would be among the highest in the nation. These findings are supported by Wischmeire's work which provides a more direct regional comparison of this particular pollutant.

Table 7. Performance of the Conservation Reserve Program, Southern States, 1986.

Region/State	Eligible Acres	Acres Accepted in 1986	Percent of U.S. Total Accepted
	(1,000 Acres)	(Acres)	
Appalachian	4,973.0	313,277	3.51
Kentucky	1,431.4	124,897	1.40
North Carolina	1,142.0	32,338	.36
Tennessee	1,589.6	140,178	1.57
Virginia	606.3	15,731	.18
West Virginia	203.7	133	.00
Southeast	2,211.5	490,911	5.50
Alabama	842.2	165,310	1.85
Florida	388.8	44,573	.50
Georgia	766.2	190,056	2.13
South Carolina	214.3	88,676	.99
Delta	1,736.8	278,270	3.12
Arkansas	65.6	63,589	.71
Louisiana	178.3	21,506	.24
Mississippi	1,092.9	193,175	2.16
Southern Region	8,920.5	1,082,458	12.13
U.S. Total	69,435.9	8,925,569	100.00

Source: Dicks, Reichelderfer, and Boggess.

Table 8. Selected Agricultural Environmental Factors by Region in the United States: Percent Cropland, Runoff, Erosion, and Sediment.

	Percent Cropland By Region	Growing Season Runoff[a]	Wischmeier Erosion Index	Potential Contribution to Watershed Sediment Yields[b]	Ranking Index of Potential Per Unit Sediment Yield
Northeast	10-24.9	0-7	50-250	Low to Moderate	860
Lake States	50-79.9	0-1	75-150	Low to Moderate	230
Corn Belt	50-100	1.1-7	150-200	High to Very High	470
Northern Plains	25-49.9	0.3	50-250	Low to Moderate	400
Appalachian	10-24.9	0.7	150-400	Low to Very High	1430
Southeast	10-24.9	1.1->7	300-600	Low to High	1140
Delta States	25-74.9	3.1->7	250-600	Moderate to High	500
Southern Plain	10-50	0->7	100-400	Low to High	670
Mountain	10-24.9	NA	NA	Low	570
Pacific	10-24.9	NA	NA	Low	570

[a]Growing season is defined as planting to harvest.

[b]Weighted as a percent of total region in cropland.

Source: Clifton, Ivery D., Webb M. Smathers, Jr., Fred C. White and Wesley N. Musser. "Regional Environmental Consequences of Increases in Agricultural Production in the United States." The University of Georgia College of Agriculture Experiment Stations. Research Bulletin 277. Athens, Georgia. April 1982.

A final difference in regional environmental impacts is related to the influence of weather on pest problems. The density and diversity of both insect and plant pests are greater in the southern states than in the northern states. This ecological problem is due largely to the higher temperature and extended growing season in the former regions.

Regions which have more growing season days and also more pests would be expected to require a large number of applications of herbicide and pesticide treatments as well as more concentrated doses. In addition, the relationship of the amount of rainfall to pest problems can be observed by comparing pesticide applications in areas with similar growing seasons and temperatures but different rainfall, such as the Northern Plains versus the Corn Belt and the Southern Plains versus the Southeast.

Linkages Between Farm and Nonfarm Sectors

The impact of trade liberalization in agricultural products will reach beyond the farm gate to affect the overall economy of the region and the nation. Changes in agricultural production affect an area's economy in two ways. First, a change in agricultural production causes a direct change in net farm income and farm labor earnings. Secondly, this change is felt throughout the economy as it produces changes in income in other sectors. A change in agricultural production affects income and employment in agribusiness firms that process and handle agricultural products and supply inputs to farming. Subsequently, agribusiness firms purchase from other industries, and workers in agriculture and agribusinesses spend money for goods and services produced by other industries.

Reductions in agricultural production will have a pronounced impact on the farm input supply industry. With reduced production, farmers use less fertilizer, chemicals, seed, labor, and operating capital. A reduction in output would also reduce the demand for fixed capital, land and equipment.

Selected agricultural multipliers for the various states in the Southern region are reported in Regional Multipliers (U.S. Department of Commerce). The estimated output multiplier indicates that each dollar in agricultural output generates $2.12 of output on the average. The average earnings multiplier indicates that one dollar of agricultural output generates $0.55 of earnings. The average employment multiplier indicates that one million dollar in agricultural output in the Southern region generates 58 jobs.

Using these multipliers the aggregate impact of trade liberalization on the Southern region was analyzed. Unilateral trade liberalization would reduce agricultural output by $863.3 million and total economic activity by $1.8 billion. Multilateral trade liberalization would expand agricultural output by $288.0 million and total economic activity by $610 million.

CONCLUSIONS

The Southern region appears to have considerable excess capacity that could be brought into crop production if price relationships warrant. In response to the favorable prices of the 1970s the Southern region expanded production in feed grains, food grains, and oil seeds. Some of this production has been curtailed in response to lower prices in the 1980s and drought conditions. However, more favorable long-term rainfall patterns are expected to occur in the future, making expanded crop production feasible. Double cropping, which expanded rapidly during periods of favorable prices, is one way for the Southern region to expand crop production rapidly. An increase in crop prices relative to beef prices would be expected to result in conversion of pasture to crop land. The development of irrigation from abundant underground sources expanded in response to higher prices but has more recently almost stopped. These water resources can be developed further if price relationships appear to make such developments economically feasible.

Implementation of the United States' proposals for trade liberalization in agricultural products and reduced government programs for agriculture have important implications for the South. Trade liberalization will influence commodity prices, the commodity mix, level of agricultural production, farm structure, non-point source pollution, and aggregate economic activity. Crop prices would likely fare better under trade liberalization than livestock prices, resulting in an increase in crop production and a reduction in livestock production. However, proposed reductions in government payments would tend to limit income from crop production. Lower livestock prices and government payments would place more pressure on an already financially stressed farm sector, leading to the demise of numerous farms. Fewer farms and lower income on farms will be felt beyond the farm gate in agribusinesses, rural communities, and entire regions.

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CHAPTER 5. AGRICULTURAL RESOURCE ADJUSTMENTS IN THE CORN BELT

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INTRODUCTION

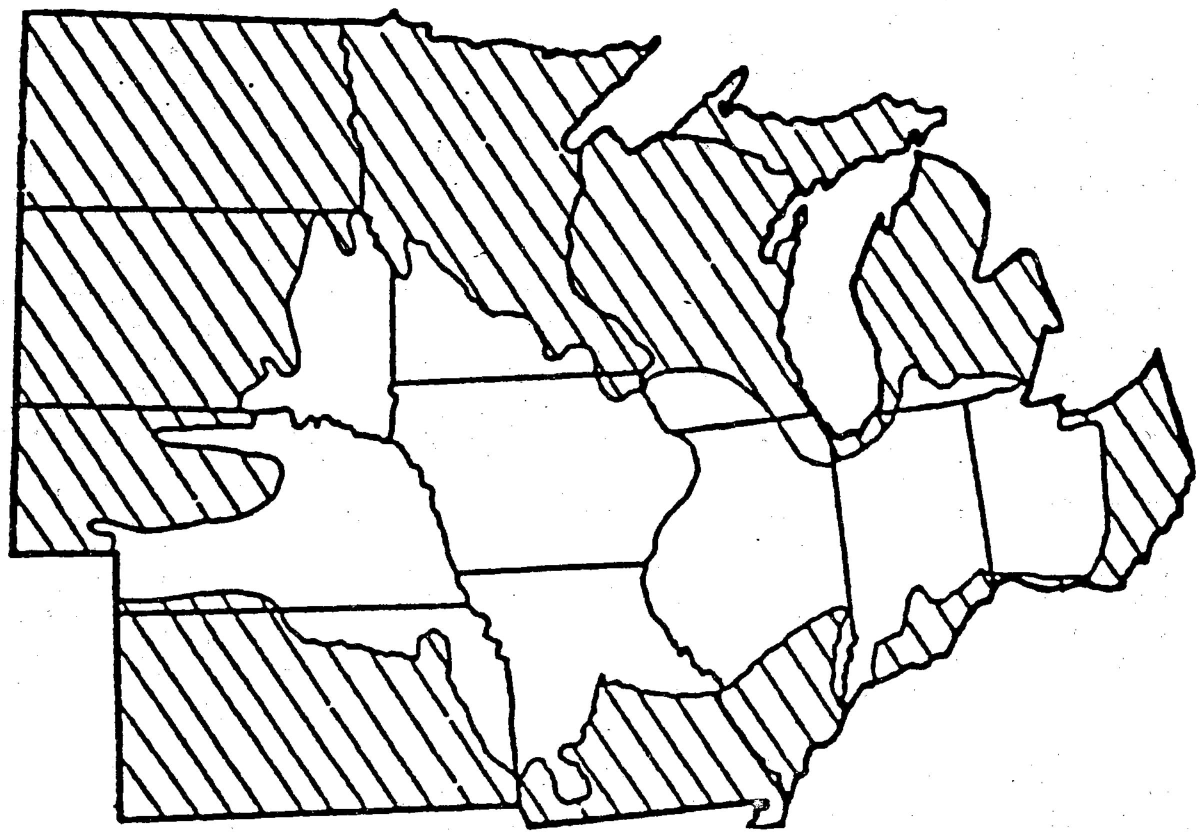
In order to establish a baseline perspective against which to comment relative to the topic of past and future resource adjustments in the Corn Belt, I have drawn mainly on data for the period 1984-86. Recent improvements in U.S. export markets may act to dampen somewhat the magnitude of the resource adjustment problem in the Corn Belt as compared to 1984-86.

The term "Corn Belt" is somewhat ambiguous. Thus a brief discussion of geographical boundaries to this region seems appropriate. The so called "Corn Belt Soil Area" is generally described as falling into major or minor portions of 11 states as shown in Figure 1. For most statistical purposes, the Corn Belt is defined as the 5 states of Iowa, Illinois, Indiana, Missouri and Ohio. But, for purposes of my discussion I have drawn on data from a 7-state region, the 5 above listed states plus Minnesota and Nebraska. My reasons for doing so is that these are the 7 states in which more than half of the cropland used for principal crops has, in recent years, been used for corn for grain and soybeans (Table 1). And, it is probably around the corn for grain-soybean production acreage that some of the major issues of regional resource adjustment are centered. In addition to the average of about 88 million acres used for corn for grain and soybeans for 1984-86 (Table 1), an average of about 5.2 million acres of corn base acreage was set aside in the ARP programs for that period.

Clearly there are major resources committed to other agricultural activities in the Corn Belt, including those for forage crops and livestock. Increasingly, however, cropland use in support of livestock enterprises can be separated from that used for crops marketed off the farm. And, except for a modest overcapacity in dairy production, and cyclical production variability in hog production, no substantial resource adjustments have occurred in recent years in the livestock sector nor do any appear imminent.

Finally, by way of introduction, the states of Minnesota, Nebraska and Missouri do have substantial acreage of crops other than corn and soybeans, but these are grown mainly outside of the area of Corn Belt soils. In the case of Minnesota and Nebraska, a high proportion of the other crops are small grains grown on the "Plains" soils of these states and will be discussed elsewhere.

Figure 1. Location of the Corn Belt Soil Area Within the North Central Region



Source: Adapted from "Soils of the North Central Region of the United States." North Central Regional Publication 76, 1960.

Table 1. Corn-Soybean Acreage in the Corn Belt, Average for 1984-86.

State	Corn Acreage Harvested for Grain*	Acreage Planted to Soybeans	Total Corn for Grain & Soybean Acreage	Total for Corn & Soybeans as a Percent of Total Acreage Planted to Principal Crops
	(Thousands of Acres)			
Illinois	10,900	9,167	20,067	87.7
Indiana	5,926	4,400	10,326	84.8
Iowa	12,833	8,433	21,266	86.4
Minnesota	6,180	5,100	11,280	56.0
Missouri	2,277	5,433	7,710	55.1
Nebraska	7,133	2,500	9,633	53.1
Ohio	3,883	3,800	7,683	72.7
Total 7 States	49,132	38,833	87,965	72.0
U.S.	72,110	64,122	136,232	41.8

* Corn acreage harvested in Missouri was exceeded in Michigan, South Dakota and Wisconsin. However, the intensity of total cropland use for corn for grain and soybeans was lower in these states. In order to separate corn produced for grain from that for silage, the corn grain acreage reported here is for harvested acreage.

Source: U.S. Department of Agriculture, National Agricultural Statistics Service.

EXCESS CAPACITY FOR CORN AND SOYBEANS

Dvoskin has estimated that the U.S. capacity (measured in output volume) in excess of commercial demand averaged about 23.4 percent for corn and about 11.5 percent for soybeans over the period 1984-86. His methodology "accounts for changes in these annual components: commodity surpluses as the difference between production and total utilization, noncommercial exports, and potential production from acres diverted under government programs." And, although this level of percentage excess capacity for corn was higher than for any previous 3-year period since 1940, the level of excess capacity for soybeans was much lower than in the mid 1960s. As mentioned earlier, the export market has strengthened since 1986 and thus the current and future excess production capacity for corn and soybeans, particularly the latter, may be well below that calculated for 1984-86. Moreover, I believe that noncommercial exports can be reasonably considered a normal component of effective demand.

CORN ACREAGE REDUCTIONS VIA ARP

There is another measurable phenomenon which relates to excess cropland capacity in the seven Corn Belt states for 1984-86. This is the corn base acreage which was set-aside by producer participants in the annual acreage diversion program (ARP). Corn base acreage in the 7-state region averaged about 53.4 million acres for 1984-86. Diversions of corn base acreage for this period are shown in Table 2.

With the build up in stocks which occurred over several years, financial terms for participation in the 1986 ARP were made very attractive. As a result more than 8.715 million acres of corn base (16.4% of the 7-state total) were set aside in that year compared to a 3 year average of 5.223 million acres. Despite this large set aside of corn base acreage, total ending stocks of corn increased by about 3.875 billion bushels between August 30, 1984 and August 30, 1987. Though these numbers on acreage set-aside and stock accumulation <u>do not</u> measure an excess production capacity as such, they do suggest that market demand for corn grain during 1984-86 could have been supplied with several million acres (perhaps as much as 8 million acres) less than the 53-54 million acre corn base in the Corn Belt along with proportional reductions in corn acreage in other regions.[1]

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[1] Alternatively, of course, the reduction in cropland used for producing corn could come entirely from regions outside of the Corn Belt or entirely from within the Corn Belt states.

Table 2. Corn Base Acreage Set Aside in ARP in the Corn Belt, 1984-86.

State	Corn Base Acreage Set Aside (Thousand Acres)			
	1984	1985	1986	Ave. 1984-86
Iowa	927.8	1,177.1	2,405.7	1,503.5
Illinois	598.7	833.4	1,846.9	1,093.0
Indiana	269.5	407.6	949.0	542.0
Minnesota	402.1	538.1	1,160.1	700.1
Missouri	99.0	158.0	402.9	220.0
Nebraska	501.7	640.4	1,392.0	844.7
Ohio	163.3	238.5	558.3	320.0
Total 7 States	2,962.1	3,993.1	8,714.9	5,223.0
Set Aside as a Percent of Total Corn Base Acreage	5.5%	7.5%	16.4%	9.8%

Source: U.S. Department of Agriculture, Agriculture Stabilization and Conservation Service.

GOVERNMENT SUBSIDIES

In addition to the "excess capacity phenomenon" discussed above, as one considers the potential adjustment requirements associated with a move toward trade liberalization via reduced government intervention in Corn Belt agriculture, it seems instructive to review briefly the extent to which the U.S. corn and soybean production sectors have realized governmental subsidies in recent years. A U.S.-level depiction of average producer subsidy equivalents for 1984-86 is shown in Table 3. The magnitude of the average total annual subsidy equivalent for corn producers ($6.06 billion) is influenced heavily by very large direct payments made in the form of deficiency payments in 1986.

It is clear from Table 3 that corn producers have been realizing very large subsidies via governmental intervention. Moreover, per unit of value producer subsidy equivalents for corn in 1984-86 were about 2.9 times the magnitude of those for soybeans. The implication is clearly that financial impacts associated with a reduction in the level of governmental intervention would fall very heavily on the corn production sector component of Corn Belt agriculture. This suggests again that it was mainly the corn production sector which was seriously out of adjustment (relative to a free market scenario) in 1984-86.

In summary, my strong inclination is to suggest that we have, in recent years, had significant excess capacity in the Corn Belt which has centered heavily on corn for grain. But, rather than undertake any substantive analysis of the future demand for corn (and soybeans), I will concentrate my remaining discussion on the magnitude of recent and future production adjustments for these crops in the Corn Belt. Clearly, however, the magnitude of required future resource adjustments will be closely tied to the behavior of export markets for these crops.

Table 3. U.S. Producer Subsidy Equivalents* for Corn and Soybeans in the U.S., Averages for 1984-86.

	Corn	Soybeans
Value to Producers, $ mil	21,995	10,237
Subsidies by Category $ mil:		
Direct Payments/Levies	4,162	21
Input Subsidies	921	403
Marketing	117	47
Long-term	376	218
Other	484	303
Total	6,060	992
Total Subsidies in $/ton	28.80	18.22
Subsidies as % of Unit Value	28.26	9.84

* Producer subsidy equivalents are a measure of the change in producer revenue due to governmental actions. The latter includes both government expenditures and the wedge that a policy instrument (or mix of instruments) drives between domestic and external prices.

Source: U.S. Department of Agriculture, 1988.

RESOURCE ADJUSTMENTS

Human Resource Adjustments

Acreage production adjustment pressures do not necessarily translate into a reduction in farm numbers or human resources, or even into a reduction in acres planted to crops. In fact, most Corn Belt cropland will probably not go idle in the near term without some strong economic incentive(s) to do so either as a part of a long term CRP or a short term acreage diversion program.

It is my judgement, however, that some modest economic incentives do exist for further increases in the size of corn and soybean enterprises on individual farms in the Corn Belt. This will probably translate, over time, into a reduction in the number of crop farm operating units. Moreover, livestock enterprises continue their secular trend to increased size and decreased numbers. A consequence will be a continuation of the trend to fewer commercial farms and fewer farm operators.

Table 4 shows the size distribution of the largest 60% of corn and soybean enterprises (in planted acres) from a USDA sample of Corn Belt operating units in 1983. The very large enterprises are from the largest 10 percent of operating units, large enterprises from the next largest 20 percent and medium enterprises from the next 30 percent. Production cost economies averaged 12.4% for corn and 6.1% for soybeans for the very large enterprises compared to those of medium size. Despite the problems associated with allocating some costs to individual enterprises, this analysis suggests that there are still some modest efficiency gains to be had from further size adjustments to existing technology. Though the farm financial crisis of 1984-86 likely slowed this secular adjustment process to larger enterprise size, it probably did not stop it.

Coupled with, and part of the reason for, the continuation of the trend to fewer and larger farm operating units is the increasing technological complexity of both crop and livestock farming. Thus, those farm operators who invest in gaining the managerial skills required for modern, high technology farming will be in the strongest competitive position to remain in farming.

In summary of human resource adjustments, there will likely continue to be a modest adjustment to fewer "commercial farm" operators. But, the rate of adjustment will continue to be much slower than that of recent decades. As a result, I do not expect major future "labor displacement" problems in Corn Belt farming though the relative economic vitality of rural communities will influence the severity of the labor adjustment problem. The more economically viable a local rural economy, the better the off-farm employment opportunities and the easier the labor adjustment process.

Table 4. Enterprise Size Economies for Corn and Soybeans from Selected Corn Belt Areas.

	Average Size (Planted Acres)		
Enterprise	Very Large	Large	Medium
Corn (4 states)	998	403	233
Soybeans (3 states)	763	417	241

	Size Economies Per Bushel Very Large Compared to Medium Size Enterprise
Corn	12.4 percent
Soybeans	6.1 percent

Source: Computed by Cooke and Sundquist from ERS-FEDS Cost of Production Sample Data in Iowa, Illinois, Indiana and Ohio.

Recent Adjustments in Land Use

Since 1986 a significant amount of Corn Belt cropland has been signed up in the long term Conservation Reserve Program (CRP). As of completion of the 7th CRP sign up in 1988, 6.726 million acres of land were accepted for enrollment in the 7-state region resulting in an associated reduction of 2.103 million acres of corn base and 1.474 million acres of wheat and oats base for the 10-year duration of the contract. Even after accounting for so called "slippage" in the CRP program, this is a significant adjustment in cropland use and particularly for the erosion prone portions of the Corn Belt. Of the 6.726 million acres of CRP land, more than 6 million acres is in the 4 Western Corn Belt states of Iowa, Minnesota, Missouri and Nebraska alone. When coupled with modest state sponsored land use adjustment programs, such as the RIM program in Minnesota, significant opportunities exist for farmers desiring "whole farm" land retirement options. And in Minnesota, for example, 30% of CRP contracts have been for essentially whole farms.

A second, but more modest land use adjustment exists in the acquisition and/or retention of land by rural residents, both new and old.

And, this phenomenon is expected to continue as more people choose a rural life style. In total some several hundred thousand acres of cropland maybe removed from corn and soybean production over the next decade or so via its relegation to lower intensity land use by rural residents and hobby farmers.

Despite the above mentioned cropland adjustments, there probably continues to be an excess capacity of several million acres of Corn Belt cropland.

Adjustments in Technology

One of the least easily determinable future adjustments in Corn Belt farming is that associated with technological change. Corn and soybean yields continue their modest upward trend of the past several decades. But in recent years the rate of productivity gains from chemical technologies has declined as the per acre use of chemical fertilizers and pesticide inputs has about stabilized. As a result, annual usage of these inputs is closely tied to acres planted. More than 95 percent of the acreage of both corn and soybeans in the 7-state Corn Belt region receives treatment with herbicides. And, use of chemical fertilizers for both corn for grain and soybeans has stabilized in recent years (Table 5), with nitrogen use in 1987 actually down slightly from year earlier levels.

Table 5. Per Acre Fertilizer Use on Corn and Soybeans for Acres Receiving Fertilizer Treatment, 1987.

	Corn			Soybeans		
State	N	P	K	N	P	K
Illinois	161	82	110	39	57	105
Indiana	136	65	107	14	46	66
Iowa	132	58	73	13	45	55
Minnesota	121	49	65	17	26	51
Missouri	134	57	73	31	43	67
Nebraska	135	41	16	15	27	15
Ohio	143	76	109	13	52	96

Source: U.S. Department of Agriculture. Agricultural Resources: Inputs Situation and Outlook Report, AR-9, Economic Research Service. January, 1988.

One of the key unanswered questions relative to production technology for corn and soybeans is whether or not the current high levels of chemical pesticides and fertilizer use can be maintained in light of extensive and worsening problems of ground water contamination. Since chemical fertilizers, in particular, are land augmenting, any restrictions in their use would effectively increase the cropland required for a given level of commodity output. But, any major restriction on fertilizer use rates is not likely to occur within the next several years. This may not be the case, however, for pesticides. Should pesticide use be restricted, the major impact will probably be in the form of increased mechanical tillage and biological control inputs.

Indications are that most farmers are now using fertilizer and chemical pesticides at or near optimal profit levels. And, in the absence of environmental constraints, it would probably take substantial changes in commodity prices, and/or the prices of fertilizers and pesticides, to change per acre application rates significantly.

Potential Land Price Adjustments

Farm land prices in the Corn Belt have recovered some from their recent 1987 year lows.[2] But, it seems apparent that current price levels for Corn Belt cropland are supported in no small degree by existing government programs for corn producers (see PSE levels Table 3). Should these government subsidies be removed, or even substantially reduced, the result would almost certainly show up in the form of declining land prices (perhaps by as much as 20 to 30% from 1988 levels). It is not obvious, however, that such declines, even should they occur, would have any substantial impact on land use. The major impact would probably be in the form of cash flow problems, particularly for those farmers with substantial farm real estate debt.

CONCLUSIONS

It is not my intent to try to project the resource adjustments which will occur in Corn Belt agriculture over the next several years since this would require projections of both 1) commodity exports in general, and for corn and soybeans in particular and 2) government interventions in production agriculture in general, and for corn and soybeans in particular. In neither case do I think these future outcomes can be predicted with accuracy. But, if one assumes as a benchmark a relatively "free market" scenario, one can draw some tentative conclusions about the nature of future adjustment pressures.

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[2] Increases ranging from 4 percent in Missouri to 19 percent in Iowa were reported for 1988 compared to 1987.

First by way of demand perspective, I see only a modest secular increase in the use of corn and soybeans for industrial purposes, and, even if the use of corn sweeteners increases substantially, the impact on total demand for corn will be modest. Key to the projection of only modest increases in industrial uses for corn is a projection that any increase in the use of corn for ethanol production is likely to be a very modest one.

With respect to human resource adjustments: A continued decrease in commercial operating units can be expected in both the crop and livestock subsectors. This will result from continued technological change, increased specialization and realization of modest size economies. But, this decline will probably occur at a much slower rate (certainly on an absolute basis and likely on a percentage basis) than in the past several decades. Some of the projected human resource adjustment will occur through retirements. Ability of the local communities to absorb the balance depends on the extent of opportunities in the non-farm sector.

With respect to adjustments in cropland use: It appears that there are still several million acres of "excess capacity" in corn and soybean cropland in the Corn Belt. This cropland will either be 1) put to use in production and exert strong downward pressure on commodity (particularly feed grain) prices, 2) held idle under government programs, or 3) some combination of the two. There do not appear to be either 1) alternative crops for more than a small portion of this excess capacity cropland, or 2) alternative domestic uses for more than a small amount of additional corn and soybeans.

With respect to adjustments in water use: With the exception of Nebraska, supplemental irrigation is not a major factor in Corn Belt agriculture. Even in the case of Nebraska, major adjustments in water use resulting from a draw down in the Ogalalla reservoir are probably some years away. This is particularly true if available conservation practices in water use are implemented by farmer irrigators. Although reduced use of irrigation water in other regions of the country could ease the overall excess capacity in U.S. agriculture (including that in the Corn Belt), this is not likely to be a major factor in the near term. Longer term, reduced public subsidization of water resources in the West could be a significant development in reducing the use of water for irrigation.

With respect to adjustment in purchased inputs: For the near term, use of chemical inputs in the Corn Belt will probably remain quite stable on a per acre basis. Thus any substantial adjustments will be tied closely to changes in cropland use and/or to regulatory restrictions on input use.

The existing stock of farm machinery and equipment has diminished in recent years. And, future adjustments in machinery use will probably be mainly a continuation of the shift to larger and fewer tractors and machines with fluctuations around this trend resulting from the short term cash flow position of farmers. At the same time, one can probably expect some modest increase in purchase of reduced tillage equipment.

Adjustments in energy use by Corn Belt farmers are not expected to be very substantial in the near term although higher petroleum prices could spur the further adoption of energy efficient technologies in grain drying and irrigation.

Adjustments in capital use will probably be mainly a function of 1) inflation related increases in production costs, and 2) capital supply (and interest rate) conditions in national capital markets. And, although farm land prices have recovered substantially from their recent lows, future increases will probably be very modest and highly dependent on a continuation of government programs.

With respect to ownership and managerial control of production resources: I believe one might reasonably expect Corn Belt agriculture to remain mainly a family scale type of operation for the foreseeable future. But, to some extent as a continued result of the financial problems of the 1984-86 period, operators can be expected to make increased use of rented cropland and leased machinery and of contract production for livestock, particularly for hogs.

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CHAPTER 6. ADJUSTMENT ISSUES IN THE PLAINS AND WESTERN RANGE AREAS

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INTRODUCTION

Adjustment has always been a prominent topic in the literature of Agricultural Economics in the Great Plains. As the background for this symposium states, it has long been argued that farmers bear a greater burden of the adjustment costs associated with economic growth and progress in the sector than do other members of society. In the Plains, it has also often been argued that farmers in the region bear a greater burden of adjustment than do farmers producing competing crops in other regions.

Over the years, considerable evidence supports these statements. A good example is the concentration of CRP land in the region in the late 50's and again today, where 50 percent of the current CRP land is in the Great Plains (Hewes; Vermeer and Slaughter; ASCS). Since the region was homesteaded, the structural changes in agriculture and the concurrent changes in rural communities of the Plains and the western range areas rival, if not surpass, the adjustments of any other region of the United States.

This paper briefly reviews the region in terms of the forces of change and adjustment, unique features affecting the region's ability to adjust, adjustment issues and problems, the resulting implications for policy, and concludes with a look at adjustments over the last 20 years. While adjustments have always been made, they are not always painless. Policies to smooth the process and ameliorate adverse impacts are as important today as ever.

THE FORCES OF CHANGE AND ADJUSTMENT

Assumed Exogenous Forces Requiring Adjustment

Gradually Declining Real Farm Prices

In a recent paper evaluating long-term prospects for U.S. farm exports, Tweeten concluded that the best guess is for exports of farm products to grow at an average rate of 3 percent annually to the year 2000. However, productivity gains in the U.S. will continue to outpace demand expansion over the same period. This supply-demand balance is sufficient to avoid major downsizing of the U.S. agricultural plant, but insufficient to create major capital gains, challenge U.S. production capacity, or raise real farm commodity and food prices. In fact, these trends suggest that real farm prices will gradually diminish as in the past. (Tweeten, 1988b).

Variability

In the same paper, Tweeten also observed that while the prospect for a major upward or downward trend in real farm prices is small, the one constant to expect in exports is variability. Importing practices of the centrally planned economies will be a continuing source of instability in world grain prices. While trade liberalization could potentially reduce this variability, Tweeten expects that the best that can be hoped for in the Uruguay round of GATT negotiations is enough liberalization to offset the mounting worldwide food market interventions of recent years. Coping with the high annual and cyclical variability in export markets will continue to be a major challenge of U.S. farm policy.

U.S. Price Support Loan Rates Below World Markets

The 1985 farm bill set the tone toward reducing average U.S. price support loan rates to below market clearing levels in most years. It makes little sense to restrict domestic production and hold grain prices above world market levels just because world trade markets are imperfect and other countries subsidize exports and production. I feel this policy direction will be continued, with the loan rate providing only a "safety net" of price protection, instead of being used as an income transfer mechanism. It will allow future downward pressures on real farm prices to be reflected in farm product markets and avoid increasing excess capacity in the 1990 farm bill.

I find Tweeten's conclusions about price trends and variability convincing because they closely follow my own over the last few years (Miller, et al., 1985; Miller, et al., 1986; Edwards, 1985).

Changes in Financial Variables and Markets

The Plains, along with much of the rest of the United States, has just about completed adjustment to a major change in land values, balance sheets and other financial variables. Unfortunately, the forces behind this adjustment are not gone forever--many stem from underlying changes in the general economy and in U.S. and world financial markets. U.S. macroeconomic policy has changed and become recognized as one of the major forces affecting the farm sector through inflation, interest rates, exchange rates, and economic growth rates. Financial markets have become more volatile with deregulation of U.S. and world financial instruments and markets. These changes in macroeconomic and financial markets have increased the financial risks faced by U.S. farmers and farm lenders and are likely to remain an important factor in future farm adjustments (Miller, et al., 1985b).

Changes in Technology

Technology has been recognized as an important force affecting the structure and competitiveness of U.S. agriculture, although it is only one of several such forces. Over the next 15 years, emerging biotechnologies and information technologies will generate additional marked changes in the structure of the farm sector and in the rural communities that support agriculture (Office of Technology Assessment). Adapting these technologies will be critical to maintaining the ability of U.S. agriculture to compete in the international marketplace. The consequences of these technologies will be to continue the push toward commercial scale farm units, more emphasis on management skills, and additional pressure toward a new financial structure with more complex business arrangements in farming.

Pressure to Reduce Government Costs and Decouple Farm Subsidies

The continuation of high Federal budget deficits is increasing calls for reduction in farm program spending. Important legislation was introduced in the last Congress to phase out deficiency payments for U.S. grain producers. At the international level, GATT negotiations have included discussion of decoupling government farm subsidies from prices and production decisions, as well as discussion of eliminating agricultural subsidies altogether. Many have argued that the present scheme of agricultural subsidies in the United States may distort trade, hamper needed domestic adjustments, and have distributional characteristics among farmers of different income levels that can be questioned.

U.S. farmers should take notice of these pressures against current farm programs. While I have no crystal ball that forecasts the likelihood of decoupling, phasing out, or eliminating farm subsidies, it is high time for both farm organizations and policy analysts to carefully consider the consequences. For grain producers, and especially wheat producers in the Great Plains, the severity of the adjustment required (at least in the short run and for current farmers) by elimination of deficiency payments certainly rivals any other foreseeable adjustments.

Forces of Lesser Likelihood or Importance

Downsizing to Eliminate Excess Capacity

When the description of this symposium was first sent out, I concluded that the major concern was the current excess capacity in U.S. agriculture and the eventual necessity of downsizing the sector to match market demands. Two reasons now lead me to downplay this premise: (a) the simple logic that surplus production in agriculture results mainly from government price supports above market clearing levels (Paarlberg, p. 114) and (b) more recent evidence that anticipated overall aggregate U.S. farm export growth of 3 percent annually "is sufficient growth to avoid major downsizing of the U.S agricultural plant" (Tweeten, 1988b, p.25). I do not feel that downsizing is a major issue at this time for Plains agriculture.

Adjustments to Higher Free-Market Prices

On the other hand, the "free-market" background paper prepared for this conference finds that multilateral trade liberalization (all exporting and importing countries adopting free trade) would result in higher world prices for all major agricultural commodities (Baker, et al.). Since U.S.

prices for wheat and feed grains follow world levels under the loan levels of the 1985 Farm Act, these results suggest higher prices for Great Plains grain producers. These results would also seem to contradict the excess capacity view, if a trend toward multilateral trade liberalization becomes a reality.

Analyses of "free-market" production adjustments have been around longer than this analyst; they need not be cited here. Internationally, the recent GATT stalemate illustrates the low likelihood of such a scenario in the near future. Unilateral actions by the United States, even if politically possible, would not offer the same advantages. As a research strategy, such analyses may point the way to eventual adjustments, but again they may not. The profession may be devoting more scarce research resources to the topic of "free" markets than its importance deserves.

THE UNIQUENESS OF THE PLAINS AND WESTERN RANGE AREAS

A number of features somewhat uniquely affect the ability of the region to make adjustments to these forces. These factors either make adjustments more difficult or highlight special policy issues and needs.

The Depressed Economy of the Region

The current expansion of the U.S. economy is in its sixth year and is the longest peacetime expansion in history. Unfortunately, all regions of the United States have not enjoyed this growth. Table 1 contrasts growth in the Plains and Mountain states with overall U.S. growth rates during the last four years. The first column shows that the percent change in Gross State Product from 1982-1986 for the region averaged only about half the growth of the GNP for the nation. The second and third columns contrast current growth rates in nonfarm personal income and employment; note that the region is producing new jobs at less than half the rate of the national average. Three states even lost jobs in the past year.

The Plains and Mountain states have been severely impacted by declines in the oil, gas, mining, and construction sectors. In Colorado for example, employment in these sectors declined from 125,200 in 1982 to 81,300 in 1988, a decline of 35 percent (Colorado Business/Economic Outlook Committee). A significant number of mining dependent counties are found in the region (Figure 1). This decline in employment affects most of the region, but is especially severe in these counties. It places a severe constraint on the ability of the nonfarm economy to absorb displaced agricultural labor.

This point is emphasized by the significant population decline experienced by rural communities in the region during this period (Figure 2). A major factor in this decline has been the excess labor resulting from decline in the above mentioned sectors. Continued farm consolidation in the region has also magnified this pressure for outmigration from rural communities.

While the general economy of the region has now bottomed, it remains to be seen how long it will take it to match national growth rates. Much of this depends on the recovery of the energy and mining sectors and the construction industry. My concern is that the local and regional economies of the region will continue to find it difficult to absorb agricultural sector resources displaced by technological advance, or changes in structure, markets, or policy. These nonagricultural factors constrain and make agricultural adjustment more difficult.

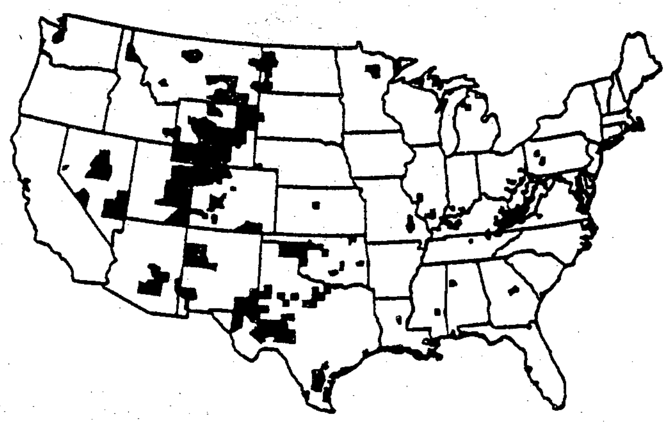
Table 1. Indicators of Economic Growth Rates in the Plains and Mountain States Compared to Averages for the United States.

State or Region	Gross State Product 1982-1986	Nonfarm Pers. Income 87II-88II	Nonfarm Employment 8-87 to 8-88
		(Percent change)	
North Dakota	4.3	4.8	1.2
South Dakota	25.1	5.6	1.9
Nebraska	24.8	6.7	1.3
Kansas	27.6	5.3	2.4
Northern Plains	23.7	5.7	1.8
Oklahoma	2.3	5.5	0.4
Texas	19.3	5.8	1.9
Southern Plains	16.9	5.8	1.7
Montana	10.5	4.2	-0.1
Wyoming	-10.6	2.2	-1.7
Colorado	30.8	5.3	-0.4
New Mexico	17.9	5.5	2.2
Idaho	26.2	6.2	2.5
Nevada	40.9	11.2	5.7
Utah	34.2	5.9	2.5
Arizona	58.5	6.2	1.4
Mountain States	33.8	5.0	1.5
Ten Great Plains States	18.8	5.6	1.4
United States	35.0	7.7	3.7

Source: U.S. Department of Labor; U.S. Department of Commerce

Figure 1

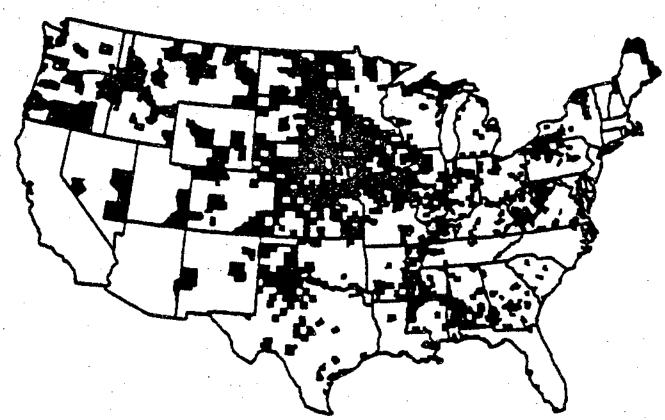
Mining-Dependent Counties



Mining-dependent counties are those where mining income equaled 20 percent or more of total labor and proprietor income in 1979.

Figure 2

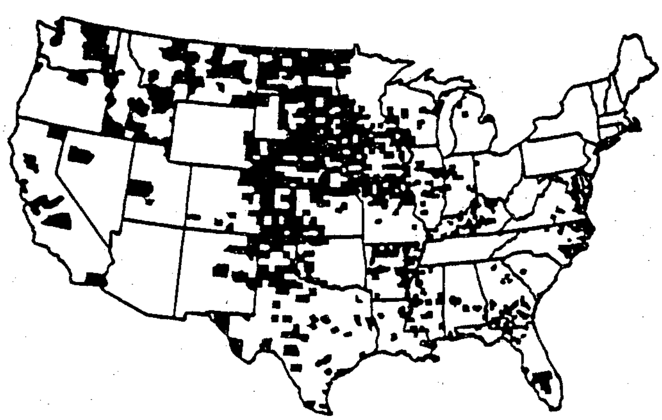
Nonmetro Counties with Population Decline, 1980-86



Source: Bureau of the Census.

Figure 3

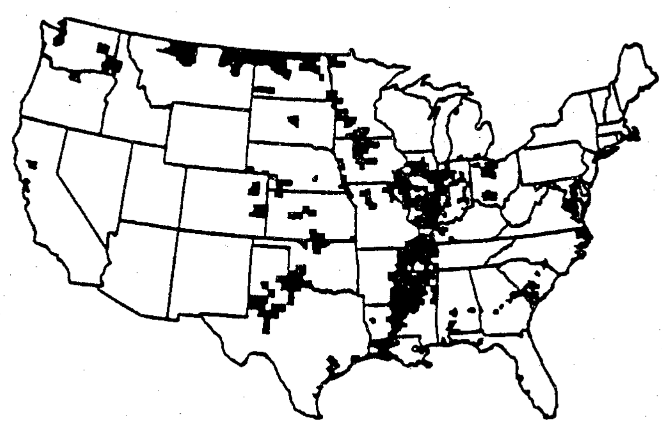
Farming-Dependent Counties



Farming-dependent counties are those where farming contributed a weighted annual average of 20 percent or more to total labor and proprietor income, 1975-79.

Figure 4

Nonmetro Counties Dependent on Farm Exports



The 419 export counties are those with 50 percent or more of total farm sales from corn, wheat, soybeans, cotton, and rice in 1982.
Source: 1982 Census of Agriculture.

Unique Agriculture of the Region

A number of other factors make the region unique and will only briefly be mentioned here.

Farm and Farm Export Dependent Counties

The region has a high proportion of farm dependent counties (311 in the 10 GP states in 1979) and farm export counties (Figures 3 and 4). The nature of farm dependent rural communities and the problems they face have been described by Bender, et al, Flora, and others. Rural communities in the Great Plains have historically exported raw materials, including agricultural crops and livestock, timber, minerals, especially oil and gas, and educated young people. In such an extractive, export economy, retained resources and profits tend to be limited, and capital accumulation difficult. Past declines in farm numbers and substitution of capital for labor have depopulated much of the region, decreased the number of small trade centers, and severely strained the ability of institutions like schools and local government to adjust. Increasing distances to alternative employment centers are making labor adjustments more difficult.

Variability and Risk of an Arid Agriculture

The weather variability and risk of agricultural production in an arid dryland environment are well known. While these features need not be described again here, their pervasive impact on the nature of farm management, production, structure, and investment should not be forgotten. Managers in this risky environment often require an additional risk premium to invest and produce and to adjust to the forces of change. More research is necessary before we understand how this high background level of natural risk affects the ability of producers to adapt to an <u>increasingly</u> risky market environment--e.g. continued increases in export market variability accompanied by reduction in government price supports. The Plains may have difficulty adapting to this added risk.

Vulnerable Large Farm Financial Structure

Structural aspects of the agricultural sector in the Plains have recently been described by Harrington. Significant features in 1987 were: the four Northern Plains states had a very high percent of farms in a vulnerable financial position; the 1982-87 decline in land values in the non-mountain areas of the region were as large as anywhere in the U.S.; the dominance of large farms in the region, the dependence of farms on export crops, and the dependence of rural communities on the farm sector all exacerbated the financial stress; and, the region is the most heavily dependent on government payments of any region in the United States. These structural features may further constrain the ability of the region to adjust, or highlight potential stress points in the process.

Marginal Adjuster of the United States

An important feature as far as the adjustment question is concerned is the historical role the Plains has always played as the marginal adjuster of the United States (Hewes; Tweeten, 1987, p. 92-95). While Great Plains farmers in the past have shown a "remarkable ingenuity in adjusting to change," they need supportive local, state, and federal policies. These unique policy issues and needs have been discussed earlier, and do not appear to change greatly over time (Great Plains Agricultural Council, 1975 and 1977). I will conclude this discussion with a review of these needs.

ADJUSTMENT ISSUES IN THE REGION

This look at the resulting adjustment issues in the region will focus on the wheat and range livestock sectors and on the local communities that support these sectors. While I do not mean to imply that other products are not important in the region, this focus will highlight issues about the wheat and range beef sectors of U.S. agriculture, as well as issues that are more unique to the region.

Adjusting Production to Meet Prospective Demands

As introduction to this section. I also want to make a clear distinction between two categories of adjustments--adjustments of the quantity of production and productive capacity verses adjustments in income, farm structure, and asset values. First, a look at the issues involved in production adjustments.

Adjustments to Trends

Farm production in the Plains and western range areas should have little problem adjusting to anticipated trends in world markets. Anticipated future long-term rates of change required in production appear to be well within the capacity of the region to adjust. Over time, productive capacity can also adapt to these trends to maintain excess capacity at no more than current levels.

History offers numerous examples of past adjustments in production. One example would be the Wyoming sheep industry--stock sheep numbers declined over 66 percent from 1959 to 1986, a sustained annual rate of decline of 4.2 percent. As another example in the opposite direction, total cropland harvested in the Plains and Mountain states expanded from 114 million acres in 1972 to 133 million acres in 1975, (an expansion of 5.1 percent per year for the period) and to 137 million acres in 1982. While these expansion rates are only slightly higher than the U.S. average, such experience demonstrates the region's capacity to adjust production when needed.

Adjustments to Variability

Coping with the prospective variability around this trend may present more of a problem in an already risky region. Annual and cyclical instability present special problems because production must be adjusted, but not productive capacity. In particular, export market variability leads to a boom and bust roller coaster ride for U.S. wheat and feed grain farms. Since most of the price side variability stems from grain export markets, increasing dependance on export markets increases the variability faced by producers even if export markets themselves do not become more variable. The need to idle resources for a few years at a time, instead of permanently, presents special problems in the Plains where arid conditions sometimes make it difficult to establish cover crops.

Maintaining a viable agriculture in the face of high annual and cyclical instability requires a great deal of flexibility, diversity, and resiliency--a flexible technology and production plant, a diversified production mix, a diversified and resilient financial structure, a resilient farm structure and community structure, and a diversified economic base at the local, state, and regional level.

The Plains may have difficulty measuring up to these requirements. Adapting to an increase in variability may be more of a problem than adapting to a particular level of variability, since past levels and means of risk management are no longer adequate. A higher weather related yield variability must be added to increasing demand side variability--this results in a higher total risk. Most farms and ranches follow a monoculture agriculture, lacking diversity. The financial structure, with many farms currently at risk, may lack the reserves to weather another roller coaster dip right now. Finally, the high proportion of farm dependent economies, counties loosing population, and weak overall economy of the region limits the ability of the nonfarm sector to act as a buffer.

I am concerned that a boom/bust (demand side) agriculture may thus place a special burden on Plains farmers. If production adjustments become problems, it will be in keeping up with annual or cyclical variability in demand, rather than in keeping up with long run trends in demand.

Adjusting to Reductions in Farm Subsidies

Adjustments to changing income levels caused by possible changes in farm programs could be much more of a problem for the region. Here the issue is income changes, not production changes.

Certainly "farm subsidies" (to use the value laden term) can be challenged on many grounds. Since deficiency payments are proportional to production under the 1985 Farm Act, most income supplement goes to farms in higher income classes. Furthermore most support goes to farmers with higher family income levels and net worths, compared to the average U.S. nonfarm family. These distributional concerns cause me to feel uneasy about the current subsidies.

Others argue that the sector is in reasonably good adjustment and that there is evidence that farmers could adjust to get along without subsidies. Rates of return to resources on commercial farms in the U.S. have generally been as high as similar resources would earn elsewhere (Tweeten, 1988b). In addition, resource uses and prices adjust quickly enough to a new set of conditions that resource returns would quickly move back to equilibrium if farm subsidies were eliminated.

My purpose here is not to support continuation of farm income supports. Rather, it is to call attention to the aggregate importance of the current deficiency payments to the agricultural sector in the region and the importance of such payments to the total income of many rural communities. The adjustments--financial and structural--that would result from eliminating such subsidies could be severe.

Possible Impact on Farm Income

The current level of deficiency payments is important to Plains producers. Table 2 shows the importance for states in the region. In 1987, deficiency payments provided 11.4 percent of the region's aggregate gross farm income, and 45.7 percent of its net farm income. These payments are more important to net farm income in the region than for the average U.S. farm where they make up only 36.2 percent of net farm income.

Since government payments are primarily available to wheat and feed grain producers, these aggregate state comparisons understate the importance to specialized producers of such crops. Table 3 compares returns from wheat production in Colorado under the 1985 Farm Act with returns from wheat production by nonparticipants. 1987 is used as an example because it is the most recent year unaffected by the drought. Wheat Program increased net returns for 100 acres of wheat land from $1,412.00 to $5,363.68, thereby accounting for 73.6 percent of the net returns for participating wheat producers.

This discussion has intentionally not made a linkage between the level of government deficiency payments and the level of wheat production. Under the rules of the 1985 Farm Act, the size of a wheat producers deficiency payment is not affected by the amount produced, and the program provides little incentive to overproduce. The costs in Table 3 suggest that market clearing prices without the payments would still cover all direct production costs, as well as all economic costs except land. The implication is that the primary adjustment to elimination of the program would be in returns to farmer owned resources and the values of these resources, and not in production.

Impact on Land Values and Financial Measures

If current supports are capitalized at rates found by Reinsel and Krenz (1970), removal of these supports could significantly reduce land values. The last column of Table 2 shows the contribution of payments to aggregate real estate values, assuming the 20 percent capitalization rate for benefits suggested by Reinsel and Krenz. This capitalization would suggest that government payments could account for 17 percent of the current real estate values in the 10 Great Plains states and 26 percent in the Northern Plains states. Note this calculation applies to all real estate in the region, not just wheat and feed grain land.

Comparisons of residual returns to wheat land in Table 3 are even more significant; $40.03 per acre under the program and $-0.55 per acre without. Land values in this part of the wheat region were about $250 per acre in 1987, or a $500 investment for each acre of wheat. These data suggest an 8 percent return on the land investment for participants

Table 2. Importance of Government Payments to Farm Income and Real Estate Value In the Plains and Mountain States Compared to Averages for the United States.

State or Region	1987 Govt. Payments	Government payments as percent of: Gross Farm Inc.	Net Farm Inc.	Capitalized RE Value[a]
	(mil. $)		(Percent)	
North Dakota	719.8	22.9	55.4	31.9
South Dakota	504.8	14.9	52.4	32.1
Nebraska	476.1	5.5	23.1	14.4
Kansas	966.3	13.3	57.3	29.0
Northern Plains	2,667.0	11.9	48.8	25.5
Oklahoma	362.8	10.4	39.2	14.2
Texas	1,441.2	11.5	38.7	12.3
Southern Plains	1,804.0	11.3	8.8	12.7
Montana	352.3	19.0	100.9	18.5
Wyoming	36.0	4.8	58.3	3.9
Colorado	342.0	8.5	44.5	14.6
New Mexico	93.3	7.0	32.0	8.4
Idaho	234.4	9.1	37.5	15.5
Nevada	3.9	1.5	8.0	1.2
Utah	44.5	5.9	25.3	5.0
Arizona	97.3	4.7	16.2	6.4
Mountain States	1,203.7	8.9	41.2	11.5
Ten Gr. Plains States	5,294.6	11.4	45.7	17.1
United States	16,746.7	9.9	36.2	16.0

[a]Contribution of government payments to real estate (RE) values assumes payments are capitalized into land values at a capitalization rate of 20 percent as found by Reinsel and Krenz.

Table 3. Comparison of Winter Wheat Returns Under the 1985 Farm Act With Returns of Nonparticipants, Colorado, 1987.

Item	1985 Farm Act	Without Program
Acres of Crop (27.5 Percent Acreage Production)	72.5	100
Yield Per Acre (bu.,recognizing slippage)	35	30
Production (bu.)	2,538	3,000
Local Market Price	$2.47	$2.47
Cash Receipts from Crop Sales	$6,268.86	$7,410.00
Deficiency Payment on 2538 bushels @ $1.78	$4,517.64	--
Gross Return	$10,786.50	$7,410.00
Cash Expenses (72.5 Acres Under 1985 Act):		
Seed	$ 181.25	$ 250.00
Fertilizer and Herbicide	770.68	1,063.00
Fuel, Oil and Repairs	516.92	713.00
Harvest Cost	929.45	1,282.00
Storage Costs ($.05/cwt/mo. for 6 mo.)	456.84	540.00
Interest on CCC loan (redeemed after 6 mo.)	95.07	--
Maintaining 27.5 Diverted Acres ($12.50/Ac.)	343.75	--
Interest on Operating Capital	150.86	182.00
Total Cash Expenses	$3,454.82	$4,030.00
Other Fixed Costs (100 Acres):		
Machinery Replacement, Taxes, and Insurance	$1,068.00	$1,068.00
General Farm Overhead	700.00	700.00
Real Estate Taxes	200.00	200.00
Total Fixed Costs	$1,968.00	$1,968.00
Total Direct Costs	$5,422.82	$5,998.00
Net Return to Land, Labor, Capital, and Mgt.)	$5,363.68	$1,412.00
Economic (full ownership) Costs, Other than Land:		
Return to Nonland Capital (5 percent)	$ 175.00	$ 175.00
Operator Labor ($5.00 per hour)	643.80	693.00
Management and risk (10 % of direct costs)	542.28	599.80
Total Economic Costs	$1,361.08	$1,467.80
Residual Returns to Land	$4,002.60	$ -55.80

Source: Dalsted, et al. and Trock

in 1987, and no return for nonparticipants. While economic returns to other fixed factors would probably decline to ease land market adjustments, these comparisons suggest to me that land values in wheat areas would decline at least as much in response to eliminating current income supports as they did during the 1982-86 period.

Impact on Income of Farm Dependent Counties

Income from government payments to farmers also makes up a substantial proportion of the total income earned by all residents of farm dependent counties. We recently completed a study of 1984 income in farm dependent counties in Colorado and found that for the 15 farm dependent counties, 19.9 percent of the total income came from government farm program payments (Miller, Trock, and Gray). For some counties the figures were much higher, ranging up to 44 percent for Kiowa county in the heart of eastern Colorado's wheat area. The individual county proportions are:

Kiowa	44.1%	Dolores	9.9%
Cheyenne	33.2%	Elbert	9.9%
Baca	30.8%	Yuma	8.9%
Washington	28.9%	Saguache	8.7%
Kit Carson	28.6%	Costilla	5.1%
Phillips	24.4%	Crowley	1.7%
Sedgwick	20.0%	Ouray	0.5%
Lincoln	16.3%		

Average for all 15 Farm Dependent Counties 19.9%

While data for other Plains counties have not been compiled, similar relationships would be expected in those counties where wheat and feed grains are the primary crops. Since government farm payments in Colorado increased from $153.6 million in 1984 to $342.0 million in 1987, the percentages would undoubtedly be higher in 1987. These data suggest a very important link between the economic well being of rural communities and government payments to farmers. Elimination of such payments could potentially reduce total county income (all farm and nonfarm residents) in many farm dependent, export dependent counties by up to one-half. While there are only a few hundred such communities in the Plains, the adjustment problems created would certainly be severe.

These data suggest that deficiency payments under the current government commodity programs make up an important share of the region's farm income, not only on specialized wheat farms, but also in the aggregate. Eliminating these payments would severely affect the income, investment returns, resource values, and financial well-being of farmers, put pressure on the farm credit industry, and significantly depress the income and economic health of farm dependent rural communities. Negative adjustment impacts would be especially severe in the first few years after elimination of these payments and for the current owners of farm assets.

Adjustments in the Range-livestock Industry

By some measures, the range-livestock sector of the West appears less affected by the forces of adjustment identified herein than does the crop sector. Direct government payments, except for the wool incentive payments, have not played an important role in the income of range operations, and reduction in or eliminating such programs would have a smaller impact on ranch income and the income of the associated rural communities. For example in the county income data presented above, Elbert, Crowley, and Ouray counties (where cattle ranching or feeding operations predominate) show little importance of government payments to total county income.

The livestock industry does benefit from the price stabilization effect of feed grain programs, and would be disadvantaged by any increased variability that may result from further lowering of the CCC loan "safety net." However the higher risk may be somewhat offset as lower feed grain prices tend to strengthen prices of calves and feeder cattle.

Much more important issues are being raised by public challenges to the indirect government subsidies received by the range livestock industry. One example is the current fee structure for grazing public lands. Many argue for elimination for the "subsidy" between the current fee of $2.25 per AUM and the value of private grazing rentals in the $10.00 per AUM neighborhood.

Interestingly, this year's National Western Stock Show in Denver witnessed a demonstration by Earth First against the grazing of public lands. Both environmentalists and recreationists are challenging the multiple use principle which allows grazing on public lands, arguing that grazing causes erosion, loss of desirable plants, and is incompatible with conservation objectives.

U.S. meat import quotas likewise protect prices and domestic markets of livestock producers. Changes or elimination of any of these policies could result in substantial and difficult adjustments on ranches in the West. In particular, the public land grazing fee issue is critically important. Fourfold increases in the fee could seriously cut ranch income and substantially reduce the value of the deeded land associated with current grazing permits, again placing a severe financial burden on current asset owners.

Multilateral trade liberalization, if it becomes a reality, will apparently not have the same favorable result on domestic U.S. beef prices as on crop prices. Recent modeling efforts show U.S. beef prices are generally expected to fall under multilateral trade liberalization, but not necessarily beef production (Baker, et al.). In terms of expected product price impacts, it appears that the range-beef industry would loose relative to the Plains grain producer under trade liberalization.

Past structural adjustments in the range livestock sector have been rather severe, and there is little to suggest that similar structural change will not continue in the future. Financial structure adjustments on ranches in the 1980s have been at least as large as on crop farms. While beef price cycles have had different timing than crops cycles, the cost price squeeze has been just as severe, and beef producers have coped with these problems without the safety net of government payments. The range livestock industry has learned to adapt and live with these forces of change--the best scenario I visualize for the future is for a continuation of the same process.

IMPLICATIONS FOR POLICY

The last two objectives for this conference focus on policy: to examine how policy impacts agriculture's capacity for resource adjustments and to identify viable policy options that bear directly on adjusting resources to achieve a more socially optimal output level. Parts of this paper have already dealt with these questions. A few specific observations for policy for the region's agricultural sector are made here.

The region's farmers and ranchers need supportive local, state, and federal policies in order to keep up with changing technology, markets, and economic and financial conditions. In particular, policies to improve international markets, CRP policies to aid in cropland adjustments, grain reserve stock programs, and human resource programs for displaced farmers (and non-farmers in rural communities) should be considered.

Income Assistance That Does Not Distort Trade or Hamper Adjustment

While this paper has briefly mentioned problems with current income supplement programs (i.e., distributional, capitalization, and trade distortion problems), it has also pointed out the importance of this subsidy to the wheat and feed grain sector and to farm dependent counties in the region. Elimination of subsidies would cause severe adjustments in resource values and in businesses on main streets in rural communities.

Changes in the way subsidies are paid and who is eligible would avoid some of these problems and allow or encourage adjustments that could potentially make future reductions more palatable. In GATT, "decoupling" has been mentioned as the direction of future farm policy. Proposals to lessen farm impacts of decoupling or phasing out direct payments such as a "producer entitlement guarantee" (Blandford) or "exit Annuity" (Teigen) have the potential of easing the adjustment burden to less costly and distorting farm programs. These policy tools could be self liquidating, would not affect land values or production, and would not reduce resource mobility or retard structural change, as have past programs which have focused primarily on adjusting the land resource. Focusing future subsidies or assistance on those with an income need of adjustment assistance would certainly make them more efficient.

Policies to Deal With Variability

A number of existing policy tools provide important help in dealing with the variability problems discussed earlier in this paper; these programs should not be forgotten as we move ahead. The Farmer Owned Reserve for wheat and feed grains is very important for multi-year and between-year smoothing or shock absorption. Determining the appropriate level of reserve stocks to meet export market commitments is a major policy issue highlighted by 1988 drought conditions and the desire of the U.S. to be a reliable world supplier of food (Tweeten, 1988a, p. 25). A simple subsidy payment for grain storage has also been mentioned at this symposium as an efficient way to increase reserve stocks. Increased reliance on export markets increases the need for such programs.

The Conservation Reserve provision of the 1985 Farm Act is also very important to assist Plains farmers in making land use adjustments. As cited in the introduction to this paper, 50 percent of the cropland currently placed under this provision is in the Great Plains states; continuation of such programs is important to meet conservation goals. This program would be more effective as an adjustment tool if steps were taken to reduce the current high slippage rates. There is also need to give more attention to the use of this land after the contracts expire.

Other policy tools to provide a safety net for farmers or increase resource mobility also fill important needs. The safety net feature of commodity loan programs and Federal crop insurance programs remain important to manage instability and risk faced by producers in the region. Credit programs through FHA, and FCA all increase capital mobility and reduce adjustment burdens.

Human Resource and Community Development Programs

Finally in the Plains where so many counties are farm dependent, nonfarm policies that focus on the adjustment problems of people and communities should receive high priority. Space limits do not allow a long review or justification of such programs in this paper. However the evidence presented makes it clear that human resource programs for displaced farmers and programs to broaden the economic base of rural communities are particularly important in this region.

CONCLUDING FOOTNOTE

As a conclusion to this paper on future adjustments, it is interesting to look back over the past 20 years and compare this paper with one that could have been written in 1969, when many of the same questions were being asked. In some ways, little has changed; the late 1960s saw concern for excess capacity, production adjustments, and the impact of eliminating government supports. In other ways problems have increased: U.S. farmers have become more dependent on export markets, more affected by inflation, exchange rates and macroeconomic policy, and faced with increased product price instability. I wonder if U.S. farmers have not also become more dependent on government payments.

It is also not clear that the current commercial farm structure of the Plains is more resilient or more capable of making adjustments to changing markets, technology, or government programs. In fact, it is tempting to cite arguments that the gradual loss of the family farm structure has reduced the capacity of the farm sector to adjust. Research evidence on this issue is mixed.

For purposes of this symposium, it is perhaps more illuminating to consider events of the intervening years, rather than to compare the present with the late 1960s. These 20 years have seen both surpluses and scarcities of farm products, peaks and valleys in farm income, financial booms and busts, and sharp swings in policy sentiments. Finding ways to adjust, or even to keep up with this type of chaos, remains the greatest challenge to Plains and Western range agriculture.

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CHAPTER 7. RESOURCE ADJUSTMENT ISSUES IN SOUTHWEST AGRICULTURE

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This paper discusses resource adjustment prospects and problems from the perspective of Southwest agriculture. The nature of agriculture in the area is summarized first in the section that follows. Then, a theoretical framework for analyzing resource allocation and product mix is reviewed. Next, the major forces that cause disequilibria are discussed along with the resource adjustments that would be required to achieve new equilibria. Since adjustments are seldom instantaneous, resource mobility or the ability of Southwest farmers to readily make indicated adjustments in land, capital and labor resources is investigated. Some projections on changes in crop mix under freer markets are presented. Finally, results from a free market simulation of an Oklahoma farm sector model are briefly discussed.

SOUTHWEST AGRICULTURE

For the purposes of this paper the Southwest includes Oklahoma, Texas, New Mexico and Arizona. Climatic and soil conditions change dramatically across the region both geographically and seasonally. High rainfall and moderate temperatures typify the far eastern portions of Oklahoma and Texas. Summer temperatures increase and annual rainfall diminishes from east to west.

Nearly half of Oklahoma's farmland is in cropland, 28 percent in Texas, but only about 5 percent of the farmland in New Mexico and Arizona is cropped (Table 1). Little of the cropland in Oklahoma and Texas is irrigated, but irrigation is of great importance in New Mexico and especially in Arizona. Four percent of the cropland in Oklahoma is irrigated, 15 percent in Texas, 37 percent in New Mexico, and 73 percent in Arizona. Farm sizes vary considerably, but averages range from 445 acres in Oklahoma to 2,895 in New Mexico.

Three-quarters of Oklahoma's 1987 farm receipts was from the sale of livestock and livestock products (Table 2). Livestock receipts also dominated crops sales in Texas and New Mexico but crops accounted for the majority of farm receipts in Arizona. Cattle and calves comprised as much as 78 percent of livestock receipts. Poultry and dairy receipts accounted for most of the remaining livestock receipts with each contributing about equally in Oklahoma and Texas. In the other two states, poultry shares were small and milk's share of livestock receipts were in the 16 to 24 percent range.

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*Comments on an earlier draft by Larry Sanders, Pat Norris and Art Stoecker were much appreciated.

Table 1. Selected Characteristics of Southwest Agriculture, 1985.

	Oklahoma	Texas	New Mexico	Arizona
Farmland (mil. acres)	32	131	47	38
Cropland (mil. acres)	14	37	2	2
Pastureland (mil. acres)	15	86	42	33
Percent of Cropland Irrigated (%)	4	15	37	73
Number of Farms (thous.)	72	185	13	7
Average Size (acres)	445	707	2895	2324

Source: Womack, Letricia M. and Larry G. Traub. "U. S. State Agricultural Data." USDA-ERS Agriculture Information Bulletin No. 512, April 1987.

Table 2. Cash Receipts Components of Southwest Agriculture, 1987.

	Oklahoma	Texas	New Mexico	Arizona	Southwest
Total Cash Receipts (mil. $)	2,752	9,086	1,147	1,781	14,766
Livestock	75%	67%	71%	43%	66%
Crop	25%	33%	29%	57%	34%
Total Livestock Receipts (mil. $)	2,052	6,059	817	774	9,702
Cattle and Calves	78%	76%	71%	62%	75%
Dairy	7%	10%	16%	24%	11%
Poultry/Eggs	9%	10%	2%	1%	8%
Total Crop Receipts (mil. $)	700	3,027	330	1,007	5,064
Food Grains	41%	10%	7%	2%	13%
Feed Grains	5%	17%	8%	1%	12%
Hay	8%	4%	21%	9%	6%
Cotton	13%	32%	10%	34%	28%
Oil Crops	12%	5%	3%	1%	5%
Vegetables/Fruits/Nuts	7%	15%	37%	38%	20%
Food Grains Receipts (mil. $)	290	308	24	23	645
Wheat	100%	75%	100%	100%	88%
Rice		25%			12%
Feed Grains Receipts (mil. $)	33	525	25	14	597
Grain Sorghum	82%	52%	56%	36%	53%
Corn	12%	46%	40%	21%	47%

Source: USDA. "Economic Indicators of the Farm Sector: State Financial Summary." ERS EC1FS-7-2, November, 1988.

Table 3. Southwest Shares of U.S. Cash Receipts for Selected Commodities, 1987.

	Oklahoma	Texas	New Mexico	Arizona	Southwest
Cattle and Calves (% of U.S.)	5	14	2	1	22
Wheat (% of U.S.)	6	5	1	1	13
Grain Sorghum (% of U.S.)	3	27	1	1	32
Hay (% of U. S.)	3	5	3	4	15
Cotton (% of U. S.)	2	24	1	9	36

Source: USDA. "Economic Indicators of the Farm Sector: State Financial Summary." ERS ECIFS-7-2, November, 1988.

Wheat is the largest source of crop receipts in Oklahoma while cotton is still king in Texas. Wheat, grain sorghum, and corn provide substantial receipts. Cotton and vegetables/fruits each represent over a third of Arizona's crop receipts. Vegetables, fruits, and hay are important crops in New Mexico. The region accounts for 36 percent of the nation's cotton receipts, 32 percent of U.S. grain sorghum receipts, 22 percent of the cattle and calf receipts, and 13 percent of wheat receipts (Table 3). In this region, Texas supplies the largest share of the commodities mentioned, except for wheat.

THEORETICAL UNDERPINNINGS

Theory suggests several necessary conditions for the farm sector to maximize income. These are, of course, well known, but since adjustment implies moving from one equilibrium to another, it may be well to summarize the conditions as part of the discussion.

One condition is the minimum factor requirement. This condition implies that three other conditions are satisfied when viewed across farms. First is the factor-factor condition which states that the marginal rate of technical substitution of any pair of inputs is the same for all farms. Hence, it should be impossible to produce the existing output level with fewer resources by rearranging input quantities among farms. The second condition is the factor-product condition which says that the marginal physical product of an input used to produce a product should be the same for all farms. The third condition, or corollary, implied by the first general requirement is the product-product condition. This condition requires the marginal rate of product transformation between any two products to be the same for all firms that produce the product.

A second general requirement is that the marginal rate of product transformation for any two (farm or food) products on the production side must equal the marginal rate of commodity substitution for the products on the consumer side. If this condition holds, it is impossible to make either consumer or producer better off, in terms of satisfaction for consumers or profits for producers, by shifting the mix.

A third general requirement for farming to be efficient concerns the size of the industry. The size of the farm industry should be such that the total output of the industry is consumed or taken off the market at prices which cover the opportunity costs of the resources involved. This is the case if the marginal rate of product transformation for farm and nonfarm goods in the production sector is equal to the marginal rate of commodity substitution for farm and nonfarm goods in the consumer sector. This simply says that the mix of farm and nonfarm goods should be geared to the strength of the demand for these outputs.

Hence, for the farm sector to be producing at maximum efficiency, farm products must be produced at minimum cost, the mix of farm products must be appropriate as must be the mix of farm and nonfarm products. With a static economic environment, agriculture could once and for all solve the problem of getting the theoretically optimum mix and levels of resources and products. But, of course, agriculture operates in a dynamic environment with forces that constantly affect the efficient allocation of resources.

In general, any change that affects the marginal productivity of inputs (the marginal rate of technical substitution among any two inputs), a commodity's cost structure (the marginal rate of product transformation among any two products), consumer demand preference (the marginal rate of commodity substitution of any two products), input prices (ratio of any two input prices), or commodity prices (ratio of any two commodity prices) causes disequilibria and a need for adjustment.

FORCES THAT REQUIRE RESOURCE ADJUSTMENT

Among the major forces that cause disequilibria are technology, economic development, and changes in policies of domestic and foreign governments that affect relative prices or regulate quantities. These forces cause disequilibria in one or more of the three sets of conditions. In fact, usually more than one is affected. Due to vastly differing income elasticities -- among food products and between food and nonfood products -- income growth changes the equilibrium mix of farm products and the equilibrium farm industry size relative to the nonfarm industry. Unlike most industries, aggregate agricultural demand in advanced economies is virtually unaffected by growth in domestic incomes and economic growth.

Technological advances usually affect all three equilibrium conditions. Productivity of resources used in agricultural production is affected differentially by a given technological change; a technological advance lowers the per unit cost of producing products but it does not lower costs of all farm products uniformly; and the expansion effect of technological advance disrupts the farm-nonfarm balance.

Both technological advance, resulting from heavy investment in agricultural research, and economic development are disequilibrating forces that are long-term and relatively gradual. Both are clearly important policy objectives of the United States. Together they account for the bulk of the long-term down-sizing of U.S. agriculture relative to the nonfarm economy. These forces are expected. And, historically, farm programs have been credited with facilitating the process by providing a stable environment for adopting technology (Tyner and Tweeten, Ray and Heady) and with buffering the enormous adjustments that have taken place in agriculture. Hallberg's chapter 3 (in this volume) documented the dramatic changes that have occurred in agriculture since 1950. In addition to the pervasive and continuing disequilibria-creating forces of economic and population growth, technological advance and long-term changes in price ratios, periodic but very irregular export cycles -- in which commercial grain exports explode for a few years and then plummet -- cause disruptions in the equilibrium conditions. It is easy to be myopic and to think that exports have been a significant proportion of U.S. agricultural markets only since 1973.

USDA historian Wayne Rasmussen points out that exports were of great importance to early settlers. The imposition of stiff export taxes by Great Britain was high on the list of grievances that resulted in the Declaration of Independence and farm exports continued to be important in the early to mid 1800s, comprising as much as 80 percent of total exports, but then became relatively less important in the last third of the 1800s.

World War I brought increased needs for food and fiber, especially in war-torn Europe. This surge in exports was on top of an already buoyant market for agricultural products. During most years between 1915 and 1925, export values as a proportion of cash receipts exceeded the high-export period of 1973 to 1984. In both periods, export values comprised 20 to 30 percent of cash receipts (Cochrane, p. 232-233 and USDA p. 412 and p. 508). Obviously, exports had influenced the agricultural economy in a big way long before the 1970s.

Since the turn of this century, there have been three periods of export-driven financial prosperity for agriculture. Two were the periods during and immediately following the two world wars, and the third began in 1973 and peaked in 1981. As is well-known by now, the last surge in exports also had significant political roots emanating from the Soviet Union, OPEC, bank deregulation, highly expansive monetary policies, and "new agricultural era" declarations by opinion shapers.

In contrast to economic development and technology, which exert a relatively steady adjustment pull on agriculture, multi-year export cycles put agriculture on an adjustment roller coaster. The upward portion of the export cycle results in economically appropriate realignment of variable input levels and combinations. But it also causes inappropriate (in hindsight) and wasteful over-investments in intermediate and long-term inputs of equipment and land. Land prices sky rocket as tight demand-supply balances and high net returns are extrapolated infinitely into the future and capitalized into land prices. The "numbers" appear to justify substantial capital investment, but the result is an enormous misallocation of resources and a painful wrenching of the industry just a few years later. Yet, when viewed over decades, it is well-know by agricultural economists that real agricultural prices trend downward and speculative bubbles eventually burst.

RESOURCE ADJUSTMENTS TO ACHIEVE NEW EQUILIBRIA

To re-establish the equilibrium conditions following a change in marginal rates of substitution or price ratios requires adjustments in the mix and levels of resources used in agriculture. After a technological advance increases the marginal physical product (MPP) of input x, the equilibrium marginal rate of technical substitution is re-achieved by using a larger quantity of input x which lowers its MPP (assuming diminishing returns) and often by using fewer units of other inputs. Resource mix and quantity adjustments are similarly required to accommodate changes in price ratios of inputs and products, including a general decline in agricultural product prices relative to nonfarm goods.

To the extent that these adjustments take place, resources will be used efficiently in agriculture. Comparative static analyses have a number of limitations; especially lacking is information on the adjustment path between equilibriums. There may also be conceptual problems. For example, perhaps farmers should consider more than one set of prices when determining input levels. Three sets may be needed: one set reflecting current or expected production-period prices for evaluating optimum use of variable inputs, another set of prices for resources that have a two to five-year life, and finally a set or trajectories of long-term real prices for determining the optimal investment in resources that provide services for many years into the future, such as land. The experience of the seventies suggests that farmers used current commodity prices and extrapolations of current prices in determining input demands regardless of input type or its length-of-run. However, farmers' behavior may have reflected the type of price information and interpretations provided during aberrational periods of increasing real farm prices.

ABILITY OF RESOURCES TO ADJUST

Of course, even under otherwise ideal conditions, distinguishing fundamental changes in relative productivities and especially relative prices from noise and longer-term aberrations enormously complicates the real-world process. The focus of this section of the conference implies that decision makers are aware of the changes to be accommodated. Rather the question is: are there resources that are not readily adjusted-out in times of excess capacity and if so why?

Following the usual delineation, the mobility of land, labor, and capital between farm and nonfarm industries can be investigated. If there is excess capacity and government supports are removed or lowered, product prices will decline. This drop in prices will decrease returns to the factors of production equally since the value of the marginal product (VMP) = marginal physical product times product price (MPP x P_p) and MPP is constant in the short-run. The earnings for all the factors have declined, so the change in the mix and levels of resources to get returns up to a desirable level will depend on the opportunity costs of the resources, that is, the long-run elasticity of their demand in nonfarm activities.

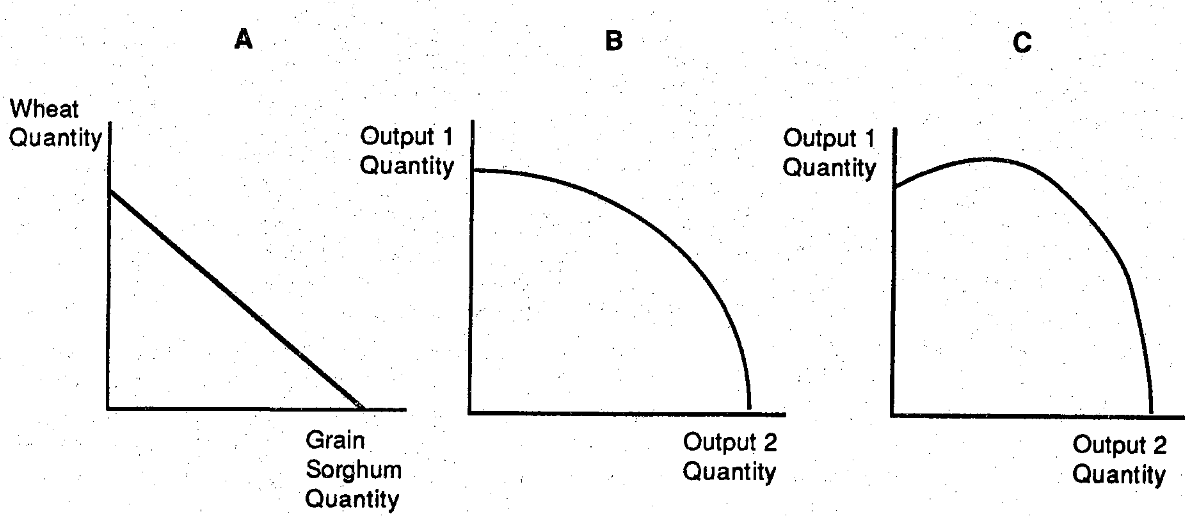
Land

There are basically three uses of agricultural cropland: 1) farm-use, 2) nonfarm-use, and 3) idleness. In most cases, nonfarm-use is not feasible and idleness -- except as part of a government program -- is not attractive since taxes and other fixed costs continue. Hence, farmland-use tends to be unresponsive to farm output prices in the short-run and in the long-run. This is in stark contrast to other industries which gauge plant-use (land-use in farm parlance) to match output with incoming orders and desired inventory changes while holding price relatively firm. Currently, in the midst of a sizable industrial expansion due to export growth, nonfarm plants are operating at about 84 percent of capacity which is considered to be extremely high by wall street analysts. At the other extreme, when a nonfarm industry chronically experiences excess capacity plants are sold for use in a <u>different industry</u>.

With lower farm output prices and altered price ratios, the crop mix may change and the land may be used more extensively. For the most part, land is not shifted from agricultural use to nonagricultural use but from its existing use to another, perhaps less intensive, agricultural use. However, if all realized prices, including livestock prices, declined proportionally, little change in land-use would be expected in many agricultural areas.

A basic relationship involved in land-use decisions is the production possibility curve; the curve which traces the various quantity combinations of different crops that can be produced on a given amount of land. Generally, the hot, dry summers over much of the Southern Plains and Southwest constrain agriculture to a small set of crops -- crops that either tolerate such conditions or have growing seasons which avoid the summer months. Soil quality can further narrow crop choices. Soil and weather conditions in some areas virtually make wheat and grain sorghum the only cash-crop choices. Farmers in other areas with more fertile soil and/or more rainfall can consider additional crops including alfalfa, pecans, peanuts, cotton, and speciality crops.

Each of the three production possibility curves in figures below is applicable in discussion of the region. Panel A explains why farmers in many parts of the Southern Plains and Southwest tend to specialize in one crop to maximize profits. Although to reduce income variability, a farmer may select some combination of the two crops. Panel B is the usual, although here only two dimensional, representation of various combinations of alternative crops that can be produced on a given amount of land in a given time period. The slope of the curve, in relation to the net price ratios of the crops, determines the profit maximizing combination. Panel C is relevant in the winter wheat areas. Stocker cattle winter grazing of wheat is an important income source for many farmers in parts of Oklahoma and Kansas. Per acre net returns from stocker cattle winter grazing can exceed returns from wheat production in North Central Oklahoma (Kletke and Ray).



Focusing on the winter wheat areas, in one sense, there is very little crop flexibility. Other crops provide little economic competition to wheat. However, in another sense, a cattle and crop operation has considerable flexibility. Winter wheat can be and is grazed in many areas during the winter months and then harvested for grain (Walker, et al.).

However, depending on relative wheat and cattle prices, condition of other pastureland, etc., a farmer may decide not to harvest the grain but to graze it out or make it into hay. These possibilities, along with fallow, provide a means of gaining additional livestock-based return from the land without taking the more long-term step of converting to perennial pasture.

With decoupling, a free market, or the elimination of wheat bases, wheat would likely continue to be the highest and best use of most current wheat cropland in the Southern Plains under a wide spectrum of economic conditions. Again, over time, whether the land goes to the next best agricultural enterprise, cattle (or sheep) production, will depend on the strength of the shift in price ratios in favor of livestock and how permanent the shift is thought to be.

Significant cotton and peanut acreage (and wheat acreage in some Southwest areas) would be shifted into other agricultural uses, if acreage base and production history were of no concern. Cotton acreage is likely to be affected the most, with some shifts to pasture and hay, but there would also be significant shifts to wheat and grain sorghum. In fact, in terms of acreage for program crops, the net effect of doing away with commodity programs in the Southwest may be an increase in wheat and feed grain acreages with less acreage in other program crops. With no inducement to idle, only the most desolate land would be totally retired from agricultural use, and the percentage going to nonfarm uses would be insignificant.

In other areas of the region with better soil and more rainfall or relatively inexpensive irrigation, doing away with program bases or shifting to free markets would further push acreage from grains and hay to vegetable and fruit production. This accelerated conversion would especially occur in areas close to high density population centers or where a processing infrastructure has been developed or is under development. In more rural or less organized areas, farmers would allocate cropland to wheat, grain sorghum, cotton, alfalfa, or permanent pasture based on relative prices and perceived net returns over a period of years.

In many areas of the region, the least productive cropland has already been put into the Conservation Reserve Program (CRP) and more is being entered (Table 4) . Since, theoretically, the cropland which would be the most likely to leave with lower prices has already been withdrawn from production, land supply may be more inelastic as a result of CRP.

Table 4. Acreage in the Conservation Reserve Through the Sixth Signup, Southwest.

	Oklahoma	Texas	New Mexico	Arizona
Acres in CRP (thous.)	943	3,158	459	0
As % of Eligible Acres (%)	32	23	56	0
As % of Farmland (%)	3	2	1	
Base Reduction (thous.)	71	326	2	0

Source: USDA Extension Service. Soil and Water Conservation, Rural Development and Natural Resources, Washington, DC.

Capital

The adjustment in capital resources to lower prices would be similar to other areas of the country. Quantities of fertilizer, pesticides and other variable inputs would be responsive to lower prices and to tighter capital constraints. However, fertilizer is also one of the most productive inputs, so with a lower output price the new equilibrium quantity would be down but the decline would be proportionally less than for many other inputs. Variable expenses as a percent of cash receipts for hard red winter wheat has grown from 56 percent in 1984 to 88 percent in 1986, largely due to low wheat prices over the period (Table 5). This trend would suggest farmers would be increasingly sensitive to changes in prices. However, over the period, tighter operating capital constraints of many farmers were eased substantially by government payments. Farmers would reduce the number of machinery trips across fields to a minimum and otherwise try to reduce fuel and equipment repairs.

Table 5. Variable Cash Expenses as a Percentage of Total Cash Receipts for Hard Red Winter Wheat Production, U.S. and Southern Plains, 1984-1986.

Region	1984	1985	1986
		(%)	
U.S.	44.1	54.1	67.2
Southern Plains	56.1	66.2	88.4

Source: USDA, Economic Indicators of the Farm Sector, Cost of Production, 1986, ECIFS 6-1, ERS (pp. 48-52).

In the short-term, machinery would be fixed in the industry but over time would leave the industry as it is worn out. The level and mix of long-run purchases of machinery would depend on availability of credit, the degree of price and income variability, risk preferences of remaining farmers, the extent to which the quantity of the labor (and management) input has been adjusted downward, and economies of size. Having come through the last 7 or 8 years with relatively little investment in machinery, the degree of excess capacity of farm machinery would logically have been reduced. For many years, even the most efficient farmers were not replacing or upgrading machinery and equipment.

Labor

The rural areas containing most of the cropland in the Plains and Southwest are already very sparsely populated. The commercial farm population has been declining for decades and will continue to do so in the future. As is the case elsewhere, those farmers in their fifties or older are essentially fixed in agriculture until retirement. Nearly two-thirds of the farmers in the Southern Plains (Oklahoma and Texas) are 45 or older. Nationally about half are over 45 years old (Table 6).

Lower price and income prospects would reduce the number of new entrants into farming. Also, younger existing farmers tend to be more mobile; they are more willing to latch onto local nonfarm employment opportunities or to move to distant communities to accept fulltime, nonfarm employment. Many of the farm operators who have failed since 1981 have been the better educated and most production-efficient farmers in their areas (Harrington and Carlin, p. 18). Agriculture has lost many of its best and brightest due to what is now called -- and historically would have been called -- unsound (financial) management practices. But at the time decisions to aggressively buy and leverage land was consistent with the general optimism and implicit, if not explicit, advice of most federal policy makers, lenders and academics.

Some parts of the region with especially rough topography, such as southeastern Oklahoma, have little acreage of the major crops but have small cow and calf herds. Due to a highly immobile labor force, unemployment and underemployment are extremely high in such areas. Labor adjustment in these areas would be affected little by changes in farm policy or farm prices.

REGIONAL FARM INCOME IMPACT OF FREE MARKETS

An agricultural model of Southwest agriculture is unavailable to investigate the aggregate farm income impact in the region of eliminating U.S. commodity programs. However , a model of Oklahoma agriculture was used to estimate the effect of free markets on the Oklahoma farm economy over the period 1988 to 1996 (Del Valle and Ray). The unilateral free market assumptions used in the modeling preconference of the 1988 AAEA meetings, as summarized in the background paper by Baker, et al., were used to define the simulation run.

Table 6. Age of Farm Operators, U. S. and Southern Plains.

Age	U.S.	Southern Plains
	(%)	
< 25	12	7
25-34	16	12
35-44	21	18
45-54	21	30
55-64	20	24
> 64	10	9

Source: USDA. "The Agricultural Work Force of 1985." ERS AER Report 582, p. 23, March 1988.

The Oklahoma model contains sixteen equations to estimate acreage, yield, production, value of production for wheat, cattle production, value and cash receipts, several other components of gross income, total production expenses, and net farm income. National crop and livestock price estimates are required for the specific simulation situation to operate the model. The POLYSIM national price estimates as reported in the background paper were used in the analysis.

Elimination of loan rates, target prices, diverted acres, direct payments, and other features of commodity programs severely impact Oklahoma agriculture (Table 7). Wheat cash receipts decline by 29 percent during the first five year period following free markets and by 11 percent during the last 5 years of the 9 year simulation period. Most of the decline in cattle receipts occurs in the latter years of the analysis period as additional livestock reach the market in response to lower grain prices and increased supply of forage. Net income is down throughout the period -- an average of 42 percent from 1988-1992 and 45 percent during the last 5 years of the simulation period.

Table 7. Free Market Simulation, Percent Change From Variable Levels with Continuation of Present Programs, 1988-92 and 1992-96, Oklahoma.

	1988-92	1992-96
	(% Change)	
Wheat Gross Income	-29	-11
Cattle Cash Receipts	-5	-16
Net Farm Income	-42	-45

SUMMARY

Adjustments in resource levels and mix occur continuously. Many of the forces that cause a need for resource adjustment in agriculture, such as economic growth, changes in input price ratios and technological advance, are long-term and are expected and ellicit gradual changes in agricultural resource use and structure. Other forces such a periodic, multi-year export cycles can give erroneous long-term price signals -- price signals that lead to massive additional investments in fixed agricultural assets. After a few years when real prices return to more normal levels, the inflated resource base becomes financially burdensome and greatly exacerbates resource adjustment and income problems in agriculture.

Climate and the natural resource base of Southwest agriculture narrows its set of crop possibilities relative to other parts of the country. Yet, the adjustment process in land, labor and capital quantities to lower prices following a move to freer markets would likely be similar to other regions. Use of land for agricultural output tends to be unresponsive to lower commodity prices in the short-run and long-run. The crop mix may change and the land may be used more extensively. However, in the areas of the Southern Plains in which wheat is grazed as well as grown for grain, wheat would likely continue to be grown under a wide spectrum of economic conditions. Some cotton acreage would be shifted to pasture but significant acreage may be planted to other program crops including wheat and grain sorghum. With no inducement to idle, only the most desolate land would be totally retired from agricultural use, and the percentage going to nonfarm uses would be insignificant.

Crop yields would decline somewhat as variable input-use responded to reduced commodity prices and tighter capital constraints. In the short-run, excess machinery would remain but over time would leave the industry. Lower price and income prospects would reduce entrants into farming but have limited effect on the majority of farmers who have part-time jobs and/or are over 45 years old.

A model of Oklahoma agriculture was used to estimate the aggregate effects of free markets on the Oklahoma farm economy over the period 1988 to 1996. With the elimination of commodity programs including direct payments, Oklahoma net farm income drops by nearly one-half.

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CHAPTER 8. U.S. DAIRY SECTOR PRODUCTION CAPACTIY ADJUSTMENTS: IMPLICATIONS FOR THE TRADITIONAL DAIRY REGIONS

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INTRODUCTION

Academics would have a difficult time persuading many dairy processors that there is excess capacity in the U.S. dairy sector. Short-term demand for available milk supplies has driven the open market price for milk to its highest level above the government support price since the inception of the Agricultural Act of 1949. Short-term market conditions and long-term excess capacity are, of course, different matters. Historically, chronic excess capacity in the U.S. dairy sector has not been a major problem. Capacity change and structural evolution via reductions in the number of dairy farms and the size of the U.S. dairy herd have generally allowed for capacity rationalization in the U.S. dairy sector. There has been a significant excess capacity problem in the U.S. dairy industry over the past decade. The excess capacity arose from the interaction of policy and market decisions between the feed grain and dairy sectors.

This paper attempts to review the history and dynamics of productive capacity adjustment in the U.S. dairy sector. Particular attention is focused on the implications of adjustment for traditional dairy production regions of the U.S. The paper concludes that there will be significant structural adjustment within these traditional dairy regions. Significant change to major dairy institutions, although unlikely, might arise because of stresses unleased by the structural transformation taking place within the U.S. dairy sector.

DAIRY CAPACITY ISSUES IN PERSPECTIVE

A History of Adjustment

For most of the 20th century the U.S. dairy industry has been gradually adjusting to capacity limitations for the industry. Per capita consumption has declined substantially during this period until leveling off to about 540 pounds in the mid 1970's. Until 1983, only population growth allowed for increased marketings of dairy products. Between 1900 and 1982 dairy farm numbers dropped from 4.5 million to 278,000. Average herd size has gone from four cows to 40 cows. Total milk production went from 63 million pounds produced by 16.5 million cows in 1900 to 142.5 million pounds produced by 10.3 million cows in 1987 (McDowell, et al., 1987, p. 4).

*The authors appreciate the constructive comments of Larry J. Connor.

The first dairy price support program did not come along until the Agricultural Act of 1949 was passed and signed. The price support program does not interfere with capacity adjustment so long as the support price is low enough to force inefficient resources out of the industry.

The Degree of Excess Capacity

Under the dairy price support program, the U.S. government is the market of last resort for butter, non-fat dry milk powder and cheese which, at the price levels set by the program, are not needed by the commercial market.

The USDA removes these products from the market. USDA net removals of dairy products is an indication of the extent of surplus milk production capacity in the U.S. Table 1 indicates the proportion of U.S. milk production that was accounted for by USDA net removals. For the decade 1965 to 1974 the USDA purchased the equivalent of less than four percent of U.S. milk production on an average annual basis. Because of intra-seasonal storage requirements needed in the sector, these levels of surplus purchases did not significantly exceed those needed to maintain adequate "pipeline" inventories. The period 1975-1979 produced some of the lowest USDA net removals in dairy price support history. The decade of the 1980s saw a reversal of the normal dairy sector adjustment pattern with some extremely large USDA net removal levels.

Recent Excess Capacity Problems in the Dairy Sector

Both Table 1 and Figure 1 illustrate the nature of the causes and consequences of excess capacity in the U.S. dairy sector. The period 1975-1979 had such low CCC net removals because of the significant financial stress put upon the dairy sector by the movement of the U.S. feed grain sector into international markets. Increased U.S. feed grain export sales; the consequent increases in land prices; and the rapid rise in interest and energy costs all put significant financial stress on America's dairy farmers.

The US dairy industry, with its sophisticated political abilities, was able to alter the Food and Agriculture Act of 1977 to amend the Agricultural Act of 1949 to raise the dairy price support level to 80 percent of parity and to provide for semi-annual adjustments of 50 cents per hundredweight if dairy production costs increased. It takes approximately two years to get a supply response in the dairy sector.

Figure 1 illustrates what happened to the U.S. dairy sector. The trend line was generated from the period 1969 through 1979 and is fairly representative of the dairy industry's milk herd adjustment process through history. Beginning in 1980, there was a significant reversal of the long-term historical trend of declining cow numbers. Cow numbers increased four consecutive years. The 1984-85 Milk Diversion Program lowered cow numbers but they rebounded in 1986. The 1977 Act was responsible for bidding excess capacity into the dairy industry.

Table 1. Milk Production and USDA Net Removals, 1965-1988.

Year	Average Milk Production	Average Net Removals[1]	Percent of Milk Production
	(Million Lbs.)		
1965-69	119,231.4	4,673.2	3.92
1970-74	117,335.0	4,387.2	3.74
1975-79	120,608.6	2,842.8	2.36
1980-84	134,360.6	12,278.8	9.14
1985-87	142,996.6	10,169.3	7.11
1988[2]	145,000.0	8,700.0	6.00

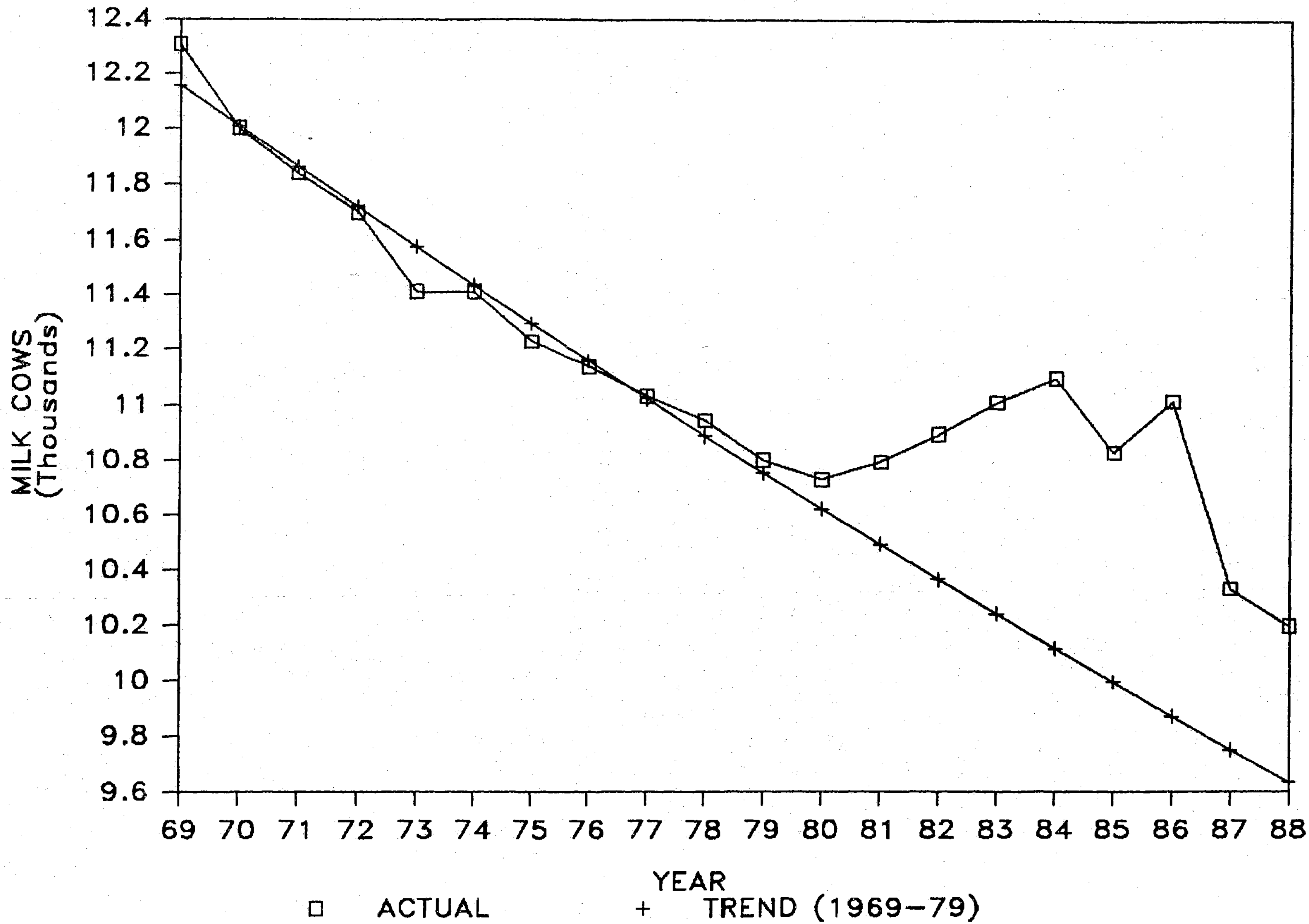
[1] Milk Equivalent Basis

[2] Estimated

SOURCES: USDA, "Dairy Situation and Outlook Yearbook," ERS, DS-416, August 1988.

USDA, "Dairy: Background for 1985 Farm Legislation," ERS, Agriculture Information Bulletin No. 474, September 1984.

Figure 1. U.S. Milk Cow Numbers, 1969-88



SOURCE: USDA, ERS

By 1981 the significance of the excess capacity was evident to even those in the dairy industry. Since 1981 there have been nearly annual changes to the dairy price support program designed to deal with the excess capacity. In spring of 1981, the dairy price support was frozen at its highest level of $13.10 per hundredweight for 3.67 percent butterfat test milk. Between 1981 and the passage of the Food Security Act of 1985, the dairy price support was lowered $1.50 to $11.60.

In addition, several innovative programs and initiatives were tried in the dairy industry. Since 1981 the dairy industry has intermittently had user pay systems. In these programs, producers are assessed a certain amount per unit of production in order to pay for the implementation and operation of their price support program. These deductions further lowered the effective dairy price support. Another initiative was the passage in 1983 of a mandatory research and promotion checkoff. Also, this period saw the first use of voluntary supply management programs. The first voluntary supply management program was the Dairy Diversion Program which paid producers 10 cents per hundredweight to voluntarily reduce the marketing of milk from their operation. As shown in Table 1 and Figure 1 for the period 1980-1984 none of these measures was successful. Thus, the first half of this decade saw significant excess production capacity in the dairy sector.

Food Security Act of 1985

It became apparent to industry observers and policy makers that a price reduction plan by itself would not remove the excess capacity from the U.S. dairy industry. Although the price support in the 1981-85 period had been reduced nearly 12 percent, production was still increasing. The 1985 Food Security Act provided for a direct and what some would call drastic initiative to eliminate excess capacity. Producers were allowed to bid to voluntarily leave the dairy business for a period of five years by killing or exporting all of their female dairy animals and refraining from allowing their dairy facilities to be used to produce milk for a contractual five year period. The Dairy Termination Program (DTP) attempted to remove 12 billion pounds of surplus milk production capacity. It was predicated on the principle that in an industry with significant asset fixity it is quicker and perhaps cheaper to bribe excess resources out of the business rather than to starve them out. The DTP was responsible for the elimination of 1.6 million female dairy animals and resulted in a significant drop in CCC net removals (Table 1) and in cow numbers (Figure 1).

The 1985 Act provided that should the Dairy Termination Program (DTP) not stem excess milk production, the Secretary of Agriculture could reduce the price support 50 cents per hundredweight a year if he determined that CCC purchases would exceed 5 billion pounds for the year. In addition, this period also saw the implementation of the Gramm-Rudman-Hollings Act which resulted in additional user pay assessments on individual dairy farmers. Through 1988 the dairy price support has been lowered to $10.60, $2.50 lower than its 1983 peak of $13.10.

Many industry critics and policy makers predicted that the DTP, the second use of voluntary supply control in the U.S. dairy sector, would be a failure. Although surpluses declined, they did not decline precipitously. The reason for this could be found in the remaining titles of the 1985 Food

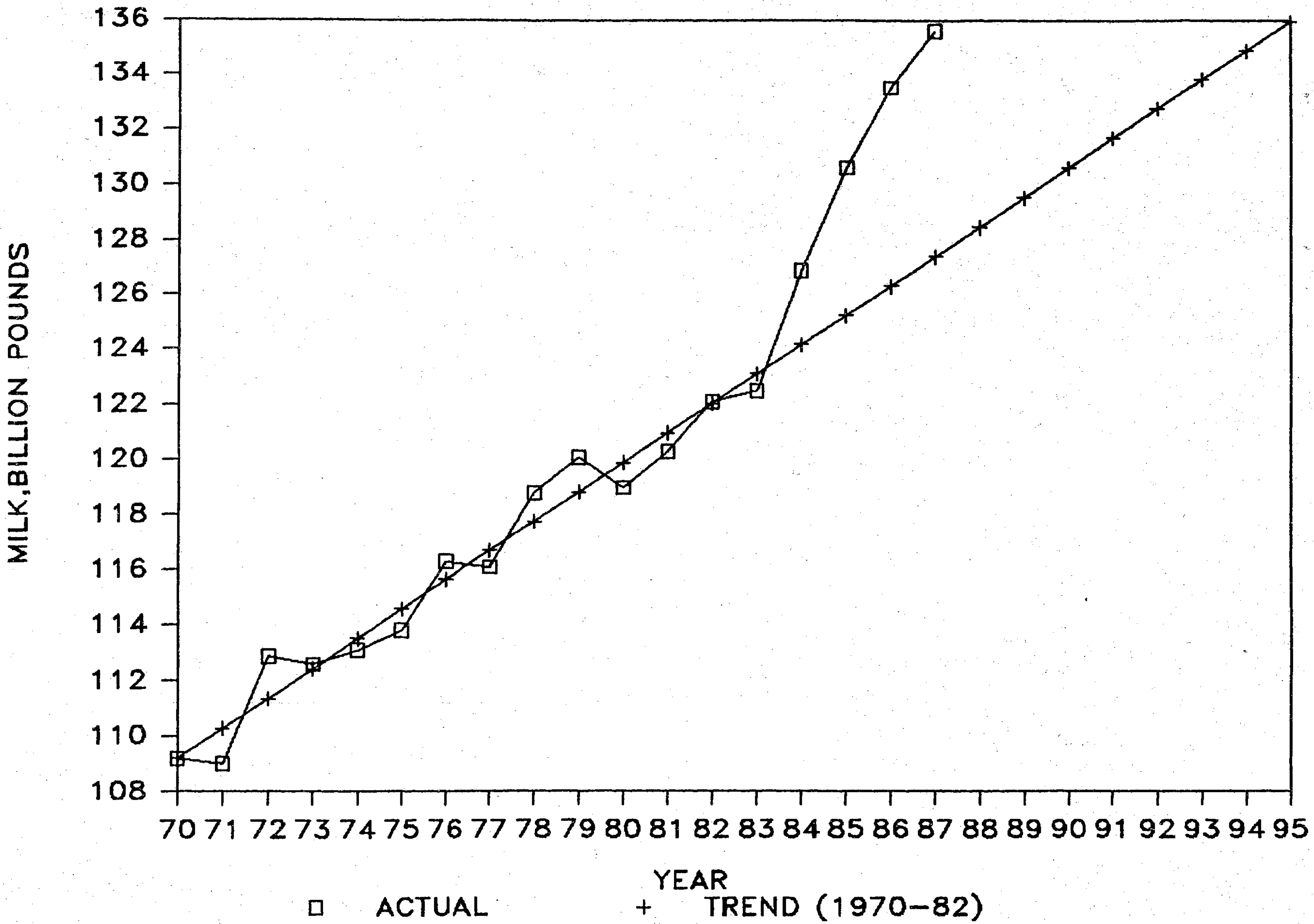
Security Act. As with the five year period a decade earlier (1975-79), dairy sector policy was counteracted by policy toward the grain sector. The grain sector's willingness to have the lowest possible open market prices (with hefty deficiency payments) in order to regain export sales resulted in low cost feed grains to the livestock sectors, including dairy. So while the U.S. dairy price support was being reduced to its lowest level in a decade, the margins available to producers who were primarily purchasing their feed continued unabated. This again illustrates that conditions in the feed grain economy feedback on attempts to maintain an equilibrium capacity position in the dairy sector.

Current Situation

The nearly 20 percent reduction in dairy price supports with no offsetting income transfer payments caught up to the dairy industry with the drought of 1988. This can be illustrated with the help of Figure 2. Since 1983, the combination of reduced price supports resulting in stable real dairy product prices, the rapid growth in the U.S. economy and the increase in dairy industry promotion resulted in a significant change in the demand pattern for dairy products. Disagreement rages as to whether the consumption pattern change is due to a change in demand (promotion) or a change in the quantity demanded (moderating real prices). The trend line in Figure 2 was generated by using consumption patterns from 1970-1982. Through 1987, the actual commercial disappearance (the industry's commercial demand measure) of U.S. milk products is about 8.2 billion pounds greater than that trend line would have indicated. Returning to Figure 1, it appears that the U.S. production capacity has returned to the same trend slope experienced in the decades before the 80's. However, the intercept has changed. For 1987, the actual number of milk cows in the U.S. dairy herd is approximately 580,000 more than would have been projected by past trends. If those 580,000 cows produced the U.S. average production per cow of 13,790 pounds for 1987, the additional 580,000 would have produced 8 billion pounds more milk.

In early 1989, the U.S. dairy industry appears to be at or close to a capacity equilibrium. The spot shortages of milk occurring in the traditional dairy areas (Northeast and Midwest) have resulted in an open market price for dairy of $1.94 above the U.S. price support. This is the largest margin between market price and price support since the inception of the dairy price support program. Whether the U.S. dairy industry continues to be in capacity alignment will depend on many factors including whether dairy product consumption can continue to grow. However, it does appear that after a decade of significant excess capacity the U.S. dairy sector may be able to return to its long-term historic capacity adjustment mechanisms and trends.

Figure 2. Commercial Disappearence: Total Milk 1970-1995



SOURCE: USDA, ERS

REGIONAL DYNAMICS OF CAPACITY ADJUSTMENT

Since the 1981 excess capacity build-up in the U.S. dairy sector, the industry has been through a traumatic period. Between April 1, 1981 and January 1, 1988 the dairy industry experienced 15 separate government policy actions that affected the net price received by American dairy farmers. Coping with these policy changes has set in motion dynamic changes within the industry.

Table 2 shows what has happened to the location of milk production by region between the years 1975 and 1987. The Mountain and Pacific area has had a large proportional gain in total U.S. milk production. Their 5.2 percent increase exactly equals the declines in milk production experienced in the Corn Belt, Northern Plains, Appalachia, Southeast and Delta production regions. The traditional dairy regions of the Northeast and Lake States maintained their relative position in milk production through 1987. The Northeast and Lake States account for over 48 percent of U.S. milk production and as a combined area dominate other regions.

Although the regional shifts illustrated in Table 2 were rather dramatic, industry response to these shifts were somewhat muted with perhaps the exception of the Southeast. Because dairy does not dominate the farm economies in many of the affected states and because producers had other alternatives, the regional shift took place without major debate. However, further reduction in these regions may not be readily forthcoming. Future regional shifts most likely will occur from the traditional dairy regions towards the Pacific and Southern Plains areas. That conclusion can be reached by examining Table 3.

The purpose of Table 3 is to illustrate the dynamics that have occurred in the per hundredweight cost of production across three regions in the U.S. The Pacific, Northeast, and Lake States regions account for over 70 percent of the U.S. milk production. Although there is significant growth occurring in the Southern Plains region (primarily in Texas), the remaining analysis concentrates on these three dominate production regions. Between 1979 and 1986 according to the USDA cost of production figures, the reduction in cash receipts between the two years has been almost identical for all three regions (line 4). While income has remained nearly static over the eight year period, expenses have risen. Cash expense increases were significantly higher in the Upper Midwest (Michigan, Wisconsin, Minnesota, and South Dakota) and the Northeast (New York, Pennsylvania, Ohio and the New England states) then they were in the Pacific region of California and Washington. As a result, receipts after paying for cash expenses and capital replacement declined substantially more ($1.36 and $1.34 in the Upper Midwest and Northeast, respectively) than they did in California.

A similar pattern is evident when examining the residual remaining for return to management and risk in the dairy enterprises in the various regions. Producers in the Pacific Region actually gained during the period while producers in the Upper Midwest and Northeast lost substantial ground.

The 1986 data shown in Table 3 are the latest ones available from the USDA. There were 50 cent decreases in the dairy price support in both 1987 and 1986 which resulted in reduced farm milk prices across the U.S. These

Table 2. Regional Shares of U.S. Milk Production.

Region	1975	1980	1985	1987	Change 1975-1987
			(Percent)		
Northeast	20.4	20.4	20.0	19.8	-0.6
Lake States	28.0	28.7	28.7	28.4	0.4
Corn Belt and Northern Plains	18.2	16.6	15.7	15.3	-2.9
Appalachia, Southeast and Delta	13.0	12.1	11.0	10.7	-2.3
Southern Plains	3.7	3.7	3.6	3.8	0.1
Mountain and Pacific	16.7	18.6	21.0	21.9	5.2

SOURCE: USDA, "Dairy Situation and Outlook Yearbook," ERS, DS-416, August 1988.

Table 3. Milk Production Costs and Returns Per Hundredweight of Milk for the Pacific, Upper Midwest and Northeast Regions, 1979 and 1986.

	Region					
	Pacific		Upper Midwest		Northeast	
Item	1979	1986	1979	1986	1979	1986
	Dollars Per Cwt.					
Milk	11.49	11.83	11.64	12.15	12.28	12.72
Cull Cows	1.16	0.70	1.75	1.13	1.43	.89
Total Cash Receipts	12.65	12.53	13.39	13.28	13.71	13.61
Change Between 1979 and 1986	-.12		-.11		-.10	
Total, Variable Expenses	7.54	7.61	5.66	6.32	6.49	7.38
Total, Fixed Expenses	1.13	1.31	2.14	2.71	1.40	1.73
Total Cash Expenses	8.67	8.92	7.80	9.03	7.89	9.11
Receipts-Cash Expense	3.98	3.61	5.59	4.25	5.82	4.50
Capital Replacement	.83	.68	1.70	1.72	1.47	1.49
Receipts-Expenses and Replacement	3.15	2.93	3.89	2.53	4.35	3.01
Change Between 1978 and 1986	-.22		-1.36		-1.34	
Total Economic Costs	9.78	9.43	11.03	11.74	11.03	12.14
Residual Return to Management and Risk	2.87	3.10	2.36	1.54	2.68	1.47
Change Between 1978 and 1986	+.23		-.82		-1.21	

SOURCE: USDA, "The Dairy Industry Since 1970," Dairy Situation and Outlook, ERS, April 1988, p. 39.

milk price reductions exacerbated the margin situation observed in Table 3 and are causing significant financial stress (see Table 8 below) on dairy farms in the traditional dairy production regions.

The 1985 Food Security Act triggers price support cuts if surplus purchases by the Commodity Credit Corporation (CCC) are anticipated to exceed 5 billion pounds milk equivalent in the forthcoming calendar year. Because of the margin data presented in Table 3, production in the Pacific region (and Southern Plains region) has continued unabated. This increased production has found its way into government warehouses and therefore is credited by producers in the traditional dairy regions for being responsible for their price decreases and financial stress (Hamm, 1987).

The response has been different from each of the traditional dairy regions (Hamm, 1987a). Last year the Northeast, through its representative who is chairman of the Senate Agricultural Committee, proposed "regionalizing" U.S. price support policy thereby making those regions responsible for surplus production bare the direct price consequences of their increased production. Since both the Upper Midwest and the Pacific region are areas of surplus milk production, the Northeast region proposal was not well received. Likewise, the Upper Midwest region is looking for ways to increase its average price and/or reduce margins in other regions. The Upper Midwest (primarily Wisconsin and Minnesota) has proposed changes to the Federal Milk Marketing Order (FMMO) system which Upper Midwest producers feel is biased against the region (Manchester). The proposed changes to the FMMO's system are perceived to be threatening to the interests of the Northeast Region dairy producers.

The debates on the location of surplus production and on proposed changes to dairy marketing and policy institutions is prima facie evidence of the potential for significant structural change within the traditional dairy regions. The dynamics of the process is complex (Hamm, 1987). The 1988 drought, the subsequent reduction in milk supply, and the rebirth of market conditions in the dairy industry have blunted much of the regional bickering seen the last two years. This is a temporary hiatus from debate if all of the excess production capacity to be taken out in the future has to come from these traditional dairy regions.

FUTURE REGIONAL PATTERNS

Are downsized Northeast and Upper Midwest dairy production regions inevitable? Is there no future for the traditional family dairy farm production pattern seen in these regions? The large scale western dairies have captured the attention of many dairy experts and observers of the industry. Most farm level dairy simulation models show the inherent cost effectiveness of these large scale units (National Milk Producers Federation and Wisconsin Dairy Task Force). Although the size distribution of dairy units will certainly change, it is not clear whether regional shares will shift significantly.

Adjusting for Productivity

The numbers in Table 3 are shown on a per hundredweight or unit of production basis. Therefore, differences between regions can be attributed to both a difference in cost structures and to differences in productivity across regions. The 1987 average production per cow in the Northeast and Lake States was 13,666 and 13,590 pounds, respectively. The comparable figure for the Pacific region farms (including Alaska and Hawaii) was 17,804 pounds (U.S. Dept. of Agriculture, 1984, p. 37). Not only is productivity significantly higher in the Pacific region but the rate of growth is also more rapid.

Table 4 uses the 1986 USDA cost of production figures to try to adjust, in a crude way, for yield differences across regions. In 1986, the surveyed firms in each region had production per cow equal to 17,698 pounds, 13,861 pounds, 14,889 pounds for the Pacific, Upper Midwest, and Northeast regions, respectively. The third and fifth columns in Table 4 adjust the USDA's cost of production numbers by increasing the variable cash expenses to make up for the increased production in the Upper Midwest and Northeast regions necessary to have productivity levels equal to that of the Pacific region. It was assumed that this additional production could be obtained by using the existing fixed assets structure and therefore there were assumed no changes in the fixed cash expenses or capital structure. Alternatively, increases in costs could be some combination of fixed and variable costs. Variable costs could be lowered to reflect the spreading of the feed costs associated with metabolic maintenance of the dairy cows. Fixed costs might be higher to cover the higher interest costs of Northeast and Upper Midwest producers buying more productive cows. The numbers reported in Table 4 are on a per cow basis in order to make these comparisons.

With productivity levels comparable to the Pacific region, the gross cash return (receipts minus cash expenses and replacement costs) in the Upper Midwest and Northeast regions rose to comparable levels to these experienced in the Pacific region. The USDA implicit residual returns to management and risk, while improving in the Upper Midwest and Northeast, do not rise to levels currently being experienced in the Pacific region.

With improved productivity in the Northeast and Upper Midwest regions, cash flow on a per cow basis can reach levels comparable to those being experienced in the Pacific region. Many farms in these regions already have these productivity levels (see Table 7). Much of the inherent disadvantage being experienced in the traditional dairy regions can be overcome by improved productivity. The dairy farms in the traditional dairy regions tend to have higher capital costs per cow which offset their advantages gained through less expensive feed supplies. This is one reason why the 1985 Food Security Act was so regionally biased (Hamm, 1987a). By increasing output through their existing capital facilities, dairy farmers in the traditional regions can overcome some of that cost burden.

However, the lower returns being recorded to management and risk indicate that economic returns still favor the Pacific region. Part of that is due to the fact that dairy returns are imputed to the owned inputs and the unpaid family labor of the dairy farmers in these regions. Given that the USDA assumes fairly modest rates of return in their calculations, productivity increases alone can not overcome what appears to be an absolute

Table 4. A Comparison of Milk Production Costs Per Cow in the Upper Midwest, Northeast and Pacific Regions, 1986.

Item	Pacific	Region Upper Midwest		Northeast	
Production Per Cow (lbs.)	17,698	13,861	17,698[1]	14,889	17,698[1]
CASH RECEIPTS					
Milk	2,093.84	1,683.73	2,149.93	1,894.06	2,251.49
Cull Cattle, Calves, and Replacements	123.29	155.74	155.74	132.13	132.13
TOTAL	2,217.13	1,839.47	2,305.67	2,026.19	2,383.62
CASH EXPENSES					
Total Variable Cash Expenses	1,349.14	873.49	1,115.99	1,100.19	1,307.57
Total Fixed Cash Expenses	232.74	375.63	375.63	259.18	259.18
Total Cash Expenses	1,581.88	1,249.12	1,491.62	1,359.37	1,566.75
Receipts-Cash Expenses	635.25	590.35	814.05	666.82	816.87
Capital Replacement	121.08	237.58	237.58	220.28	220.28
Receipts-Cash Expenses and Replacements	514.17	352.77	576.47	446.54	596.59
ECONOMIC COSTS					
Total	1,675.47	1,624.69	1,867.19	1,809.90	2,017.28
Residual Return to Management and Risk[2]					

[1]Figures calculated by adjusting variable cash expenses to reflect higher milk production figures. Adjustment factors come from per hundredweight cost data for each region on pages 141 and 147 of the source document.

[2]Calculated by subtracting total economic costs from total cash receipts.

SOURCE: Economic Indicators of the Farm Sector: Costs of Production, 1986, USDA, Economic Research Service ECIFS 6-1, November 1987.

advantage of Pacific area dairy producers. However, returns to dairy in these regions (the Upper Midwest and Northeast) still probably exceed those that are obtainable from many or most other feasible agricultural enterprises.

Other recent analyses of these same data have concluded that producers in the specialized dairy regions of the Northeast and Upper Midwest are able to compete with producers in Texas, California, and Washington (Office of Technology Assessment). But without some significant changes in capital structure, producers in Northeast and Lake States are more likely to receive less for the use of their labor and owned capital then they would otherwise like or that the market might require if they were all to be purchased (Office of Technology Assessment, p. 7).

Structure in the Next Decade

A recent USDA study investigating the interrelation of the introduction of bovine somatotropin (bST) and the U.S. dairy industry provides some simulation results as to the possible future structure of the U.S. dairy industry (Fallert, et al.). The Economic Research Service study linked a quarterly model of the U.S. dairy sector with a farm level model that projected net worth of representative dairy farms. The purpose of the model was to investigate the introduction of bST under various possible price level scenarios. The data in Table 5 are taken from this study. It attempts to look at the projected regional shifts in dairy farm numbers and cow numbers across regions in the United States between 1986 and 1996. The ERS study contained one scenario which assumed a support price in 1990 of $10.10. Under the 1985 Food Security Act this appears to be the most likely price support level in 1990. The Table presents only those numbers without the introduction of bST. The introduction of bST under this scenario produced numbers that were not significantly different than those shown in Table 5.

The fifth and the tenth column give the simulated annual percent change in farm numbers and cow numbers, respectively, for each of the USDA production regions. Only the Lake States and the Northeast have annual percent changes greater than those anticipated for the US as a whole. Both these regions according to the model will loose farm numbers and cow numbers faster than other regions. Since both these regions have significantly lower average production per cow than the Pacific region, the regional share of milk production that could be expected to come from the traditional dairy areas will slip. However, the traditional dairy regions will probably retain their combined ranking as the nation's largest milk producing area.

The USDA's simulation model also looked at the distribution of farms by average herd size although these numbers are not presented in Table 5 (Fallert, et al., p. 102). The model projected that the Lake States and the Northeast would loose a total of 26,332 dairy herds milking under 100 cows. These two regions combined are projected to loose over 1 million dairy cows (Table 5). All new farms in the region were projected to be larger than 100 cows with the greatest gain on those farms with 200 or more dairy cows. So, irrespective of the fact that the traditional dairy regions will maintain their historic dominance or that their slightly reduced regional share will also be the largest of the U.S. dairy sector, the disruptions caused by the removal of this many resources will be noticed.

Table 5. Change in Farm and Cow Numbers Between 1986 and 1996 With a 1990 Dairy Price Support of $10.10.

Region	Farm Numbers					Cow Numbers				
			% of U.S.[1]		Annual Percent Change			% of U.S.[1]		Annual Percent Change
	1986	1996	1986	1996		1986	1996	1986	1996	
Appalachia	11,562	11,045	6.6	7.6	-.45	769,374	743,087	7.1	7.8	-.34
Corn Belt	32,709	29,614	18.7	20.4	-.95	1,366,364	1,258,871	12.6	13.2	-.79
Lake States	67,067	51,051	38.3	35.1	-2.39	3,499,604	2,897,633	32.3	30.4	-1.72
Northeast	49,759	40,629	28.4	27.9	-1.84	2,231,800	1,831,806	20.6	19.2	-1.79
Pacific	8,595	7,958	4.9	5.5	-.74	1,865,439	1,726,665	17.2	18.1	-.74
Southeast	2,848	2,778	1.6	1.9	-.25	662,056	655,814	6.1	6.9	-.09
Southern Plains	2,460	2,332	1.4	1.6	-.52	439,354	418,889	4.1	4.4	-4.7
U.S. Total	175,000	145,408	100.0	100.0	-1.69	10,833,991	9,532,764	100.0	100.0	-1.20

[1] May not add to 100.0 due to rounding

SOURCE: Richard Fallert, Tom McGuckin, Carolyn Betts and Gary Bruner, BST and the Dairy Industry: A National, Regional and Farm-Level Analysis, USDA, Economic Research Service, Agricultural Economic Report No. 579, October 1987, pp. 101-102.

Results From Recent Farm Level Surveys

The recent financial stress in the traditional dairy regions combined with the potential reconfiguration of those dairy industries have led to requests for help from the regions' Land Grant institutions. As a result of this pressure, a group of agricultural economists met at the 1987 annual meeting of the American Agricultural Economics Association and agreed to conduct a joint survey of the Northern Dairy Farm Sector. States committing to develop a common questionnaire or to provide data from existing sources included: New York, Pennsylvania, Ohio, Michigan, Indiana, Wisconsin, Minnesota, and Missouri. Most of the surveys were sent last spring and the data is now being tabulated for an anticipated regional publication describing the U.S. Northern Dairy Farm Industry.

The survey was designed to provide a snapshot of the dairy farming systems used by dairy producers in the traditional dairy areas. In addition to background and demographic information, information on capital ownership, labor use, land use, the investment in and use of facilities, management practices, and financial characteristics were all examined. Data from Michigan and Minnesota have been tabulated, checked for consistency, and initially distributed to dairy industries within these two states. Table 6, 7, and 8 present some results from the Northern Dairy Farm Survey for these two states.

Table 6 shows the distribution of the dairy farms by herd size. In 1987 only 24.8 percent and 5.4 percent of the Michigan and Minnesota dairy farms, respectively, had more than 100 cows. In Michigan, however, those 25 percent of the farms controlled nearly 55 percent of the milk supply. The comparable figure for Minnesota was only 15.2 percent. If the USDA simulation is correct there can be a significant structural shift in both dairy industries with Minnesota perhaps taking a proportionately greater adjustment.

In a related question on the survey, producers were asked to give their intended dairy herd size by the 1993. In Michigan the respondents indicated that they intended to have an average herd size of 96, an increase of 22 cows. In Minnesota, the responding firms indicated their average planned herd size was 52 only two higher than 1987 herds. Both results in Table 6 and these further results reinforce the conclusions of the ERS study. They also indicate that probable adjustments will vary greatly across the Northern dairy production tier.

Table 7 presents the same data set by average production per cow. Both states show similar results in that around 28 to 29 percent of the herds in each state averaged over 16,000 pounds. Those herds accounted for proportionately larger volume of the milk produced in those states. According to the survey results, approximately 40 percent of the milk volume in these two Lake States are produced on farms with average productivity approaching that of Pacific region producers.

Two implications are drawn from these results. First, there is a nucleus of fairly innovative and highly productive herds in the traditional dairy regions. Second, there is substantial room for improvement in those regions.

Table 6. Herd Size and Milk Volume for Michigan and Minnesota Dairy Farms, 1987.

Herd Size	Number of Farms Reporting		Percent of Total Farms Reporting		Percent of Milk Volume[1]	
	MI	MN	MI	MN	MI	MN
Less than 30	74.4	50.6	16.2	16.8	3.4	5.5
30-49	131	346	26.3	40.0	12.2	29.5
50-74	107	261	21.4	30.2	17.3	35.9
75-99	56	66	11.2	7.6	12.3	14.0
100-124	51	28	10.2	3.2	15.1	7.8
125-149	28	6	5.6	.7	11.0	1.4
150-199	16	6	3.2	.7	7.5	2.1
200-299	24	6	4.8	.7	15.8	3.0
300 and up	5	1	1.0	.1	5.4	.9
Total	499	865	100.0	100.0	100.0	100.0
Average Herd Size	74.4	50.6				

[1] Calculated for farms reporting both herd size and milk volume.

SOURCE: Preliminary results from Michigan and Minnesota surveys conducted as part of the Northern Dairy Farm Survey, 1987.

Table 7. Average Production Per Cow and Milk Volume for Dairy Herds in Michigan and Minnesota, 1987.

Average Production Per Cow per Year (lbs)	Number of Farms Reporting		Percent of Total Farms Reporting		Percent of Milk Volume[1]	
	MI	MN	MI	MN	MI	MN
Less than 10000	72	81	15.2	11.0	5.9	4.8
10000-12999	106	192	22.4	26.0	14.4	19.2
13000-15999	157	265	33.2	36.0	36.8	37.5
16000-18999	115	162	24.3	22.0	36.6	29.6
19000-21999	21	40	4.4	5.0	6.0	8.1
22000-24999	2	4	.4	1.0	.3	.7
Total	473	744	100.0	100.0	100.0	100.0
Average Production per Cow	14,513	14,027				

[1] Calculated for farms reporting both herd size and milk volume.

SOURCE: Preliminary results from Michigan and Minnesota surveys conducted as part of the Northern Dairy Farm Survey, 1987.

Table 8. Distribution of Michigan and Minnesota Debt/Asset Ratio and Milk Volume, 1987.

Debt/Asset Ratio	Number of Farms Reporting		Percent of Total Farms Reporting		Percent of Milk Volume[1]	
	MI	MN	MI	MN	MI	MN
0	91	168	18.9	20.1	13.6	12.5
1-19	84	111	17.4	13.3	19.6	12.3
20-39	81	128	16.8	15.3	15.7	17.2
40-69	114	187	23.7	22.4	27.8	24.2
70-100	98	179	20.3	21.5	21.5	22.3
100	14	61	2.9	7.3	1.8	6.5
Total	482	834	100.0	100.0	100.0	100.0

[1] Calculated for farm reporting both herd size and milk volume.

SOURCE: Preliminary results from Michigan and Minnesota surveys conducted as part of the Northern Dairy Farm Survey.

Table 8 has perhaps the most disheartening findings from the Michigan and Minnesota surveys. The debt-to-asset ratio position of dairy farms in these states as reported on the survey are consistent with recent USDA reports. In 1987 in Michigan approximately 23 percent of the farms producing 23 percent of the milk volume in the state were operating with debt-to-asset ratios of greater than 70 percent; the level generally recognized as an extremely precarious financial position. The numbers from Minnesota were even more grim. Farms responding to the survey indicated that about 29 percent of the farms accounting for 29 percent of the milk volume were in severe financial condition. Preliminary analysis with the Michigan data indicate that the highly leveraged firms are about equally represented in all herd sizes but had lower average productivity levels. Results from the other states will need to be analyzed.

These data are for the year 1987. Early 1988 saw the lowest milk prices in 10 years and the drought produced some of the highest feed costs in recent memory. These two factors are combining to lead to the shortening of milk supply and the higher prices reported earlier. Irrespective of the final outcome as to the proportionate share of the U.S. dairy industry controlled by the traditional dairy region, the changes in the number of farms, the number of dairy animals, and the size distribution of those surviving will cause major economic and social disruption. More primary farm level survey data are forthcoming as survey results from other states are processed.

INDUSTRY RESPONSE AND SELECTED IMPLICATIONS

The analysis presented above seems to suggest that although the regional production adjustments to date have taken place in areas other than the traditional dairy regions, adjustments are coming to the Northeast and Lake States areas. One can argue that the evolution to fewer farms and larger farms is but a continuation of the long-term historic capacity adjustment. But given the hiatus taken between 1979 and 1985 from the gradual and systematic year by year industry adjustment, the forthcoming adjustments will seem extreme.

The dairy sectors in the traditional dairying regions appear to be at a crucial point in their structural evolution. The analysis indicates they will probably not loose their dominance in the dairy sector. However, they will be less dominant than they were in the previous decades. The character of the industry will change. If the models are correct, the traditional dairy regions will loose approximately a million dairy cows and over 25,000 dairy farms within the next decade. Those losses will account for approximately 90 percent of the anticipated capacity adjustment within the industry. The traditional dairy areas can only maintain their predominance in total U.S. milk production through a major commitment to change.

Response Patterns

The industry response to date contains both firm level (micro) and industry level (macro) elements. The micro or farm level strategies are best summed up as "better before bigger" (U.S. Dept. of Agriculture, 1987). These are obvious recommendations which may, however, be very difficult to achieve.

Getting better may require significant changes in traditional dairy operations. The capital structure of Northern dairy farms locks them into rigid scales of operation. The combinations of milking, feeding, housing, and waste handling facilities often precludes farmers from making the nonmarginal management changes needed to move toward greater profitability. Major capital restructuring is currently being constrained by both lenders and producer attitudes.

Many agricultural lenders have been burned by dairy loans in the 1980's. Constant talk of the excess dairy surplus, the exaggerated claims for bST and the reported low returns to management (Table 4 and 5) all have made capital markets leary of major commitments to new dairy capacity in the traditional dairy regions.

The efficient producers having survived the turmoil of the 1980's are having difficulty finding the drive and desire to undergo major operational restructuring. Many of these dairy producers have their current operations running as efficiently as possible within the constraints imposed by their current situation. The next step requires reconfiguring management, labor, capital, and perhaps enterprise mix.

Also, much of dairying in the traditional regions has had its foundation on the availability of sufficient amounts of relatively inexpensive family labor. A significant reduction in family labor availability will put severe management and perhaps financial stress on dairying in Northeast and Lake States regions. Fewer farms, smaller families and low returns are putting intense labor pressure on Northern dairy farms. The tight off-farm labor market and relatively high area wage levels imply that getting "bigger" is very difficult. The availability of relatively inexpensive labor to the West-Southwest dairy producer has in the past allowed those producers to negate the advantages historically given to Northeast and Upper Midwest producers by the relatively inexpensive family labor. The recent changes to immigration laws and a general tightening of the labor market have influenced the labor costs in these emerging dairy production regions, also. However, their larger average size makes labor cost management easier.

The micro-firm level response or getting "better before bigger" often may come to mean getting bigger. The recent industry experience combined with capital and labor market constraints suggest that the traditional dairy industry is currently frozen in place.

The dairy industry has mastered and uses the art of political influence. More importantly, the industry generally accepts the legitimacy of political-economic solutions to industry-wide problems. If there are macro-economic constraints to solutions to industry problems, they are considered legimate targets for change.

Also, the dairy industry is the leading agricultural industry in the states of Vermont, New York, Pennsylvania, Michigan, Wisconsin and Minnesota. Threats to the perceived vitality of the dairy industries within these states are viewed as threats to the economic and rural development of the respective state economies. Because of the financial stress and the structural change currently underway Wisconsin, New York, Michigan, and Minnesota all have formal state-wide coordinated efforts to help maintain the future vitality of the dairy industries within those states.

Most often these activities involved coalitions of industry leaders, state governments, and university personnel designing plans and institutions to deal with the competitiveness of dairy industries within the region. Most of these initiatives involve recommendations to alter state laws, regulations, etc. The recent Wisconsin Dairy Task Force 1995 made 75 recommendations of which over 60 dealt with macro issues which were perceived to be hindering the growth of the Wisconsin dairy industry (U.S. Dept. of Agriculture, 1987).

The Land Grant universities in the traditional dairy regions are also viewed as part of macro-economic institutional sets responsible for the industry's future. The Northern U.S. dairy farm survey cited above is a response to industry macro initiatives. In those Land Grant universities where the preponderance of Experiment Station funding comes from state tax revenue, Experiment Station Directors and researchers are being called upon to deliver applied research and information designed to help the state's industries respond to competitive challenges from other regions. These pressures are coming at times when in many Experiment Stations the concept of state-specific, applied research programming has all but been forgotten, or worse, judged illegitimate.

The sum in substance of all of these macro-economic activities is an attempt to channel the inevitable longer term capacity adjustment in ways which are least harmful and disruptive to the regions' critical dairy industries.

Conscious political-economic interaction such as discussed above has the potential of altering results of economics, and the timing of long-term economic trends. Rarely, however, do these efforts stop or reverse economic fundamentals. However, the willingness and the ability of the dairy industry to attempt to direct the flow of economic consequences means that micro-level analysis and predictions often miss timing and turning points in the dairy industry.

Selected Implications

If the margin data presented in Tables 4 and 5 are reasonably accurate, one solution to altering the flow of capacity adjustment in the dairy industry involves changing the prices received by dairy farmers in the region. Dairy industry prices are directly influenced by the price support program and the Federal Milk Marketing Order (FMMO) programs. As states and regions grapple with these impending structural adjustments, proposals will be put forth to alter dairy industry pricing institutions. Recent proposals to regionalize the price support program and to dramatically alter FMMO regulations have their genesis in regional attempts by the Northeast and the Upper Midwest to mitigate the consequences of capacity adjustment.

The dairy industry has generated its macro-economic adjustment capabilities through unified action within the political arena. Various proposals designed to gain strategic advantage or to eliminate other region's perceived and/or actual advantages contain in them the seeds of discord which can lead to the demise of dairy industry unity. The outcome of a political free-for-all within the dairy industry is unpredictable. However, the preeminence of the California and Texas Congressional delegations implies that the traditional dairy regions have much to lose from this possibility.

The paper circulated summarizing the results of policy modeling efforts within the agricultural economics profession appears to have one point of unified agreement (Baker, et al.). It is that the U.S. dairy industry would incur significant losses in cash receipts, lower prices, and further structural adjustment with the advent of open international dairy trade. Given that world dairy trade rarely exceeds five percent of world production and that all domestic world dairy industries are protected industries, there is very little demand among them (with the exception of New Zealand) for free international trade. Calls for loosened dairy trading patterns mostly come from other agricultural sectors wanting to trade-off dairy's protection for their own perceived international trading advantages.

Dairy industry trade protection is directly linked to the operation of the domestic price support program. The current dairy price support program could not survive without the quota protections granted by Section 22. Although regional responses to adjustment to excess capacity in the dairy industry have the potential for dividing the U.S. dairy industry, nothing would bring on a united front faster than serious attempts to impose freer trade on the dairy industry. A united U.S. dairy industry is a political force with few peers. Additional structural adjustment in the traditional dairy regions caused by a freeing of international dairy trade is not likely.

SUMMARY AND CONCLUSIONS

The U.S. dairy industry historically dealt with excess capacity through the gradual elimination of large numbers of dairy farms, a reduction in the number of dairy cows, increases in the average size of dairy farms. That structural adjustment process continued even under the operation of the dairy price support program until exogenous shocks from feed grain markets and government policies significantly altered the rates of return to the dairy sector. The dairy industry's ability and willingness to use political economy to alter or attempt to alter the flow of economic events resulted in price support legislation in 1977 which resulted in a significant increase in excess capacity within the industry. After a period of frequent and drastic dairy policy and price support changes and a period of rapid growth in dairy demand, it appears that the dairy industry is back on its long-term trend line for excess capacity adjustment.

The analysis provided in the paper indicates, however, that the potential exists for a regional bias in the capacity adjustment process against the traditional Northeast and Great Lakes dairy regions. The magnitude of this bias, while not significantly greater than historical trends, does have the potential of unleasing a variety of attempts to alter long-term structural evolution. The dairy industry will probably muddle through and come to grips with these fundamental economic forces.

The dairy industry is, however, a livestock industry dependent upon external shocks generated by the feed grain industry. Should feed grain policy and its allied initiatives toward changed agricultural trading patterns cause significant impacts on the dairy sector, the gradual return to historic rates of adjustment can be derailed. The potential political economic solutions such as mandatory supply control, regionalized dairy price support policy, cost of production price indexing, etc. are all in the realm of possibility.

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CHAPTER 9. REGIONAL ADJUSTMENT ISSUES: DISCUSSION

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INTRODUCTION

First, I wish to thank the authors of the regional papers for preparing high-quality papers and getting copies to me before this meeting. That made my job much easier.

It is useful in the context of this symposium to distinguish between two sets of forces that could force agriculture to adjust in the future. The first is real and the second is hypothetical. The first set contains long run forces such as continually improving efficiency and changes in price ratios among outputs, among inputs, and between inputs and outputs. These have been major forces shaping American agriculture for many years. They will continue to cause disequilibrium in agriculture and force adjustment in the future.

The second set of forces relate to potential changes in U.S. agricultural policy that would be consistent with the U.S. position in GATT for liberalizing trade. This symposium has assumed a dismantling of the various commodity programs. My understanding is that this second set of forces is the primary focus of the symposium, but both sets need to be considered. The authors of the regional papers discuss both sets, although some do not explicitly distinguish between the two. It helps to view the second set in light of the first and raise the question, "Would trade liberalization force adjustments on agriculture that would differ noticeably in form or magnitude from what likely would happen anyway?"

The five regional papers discuss many topics that are important for individual regions. Most of those topics will not be repeated here. My objective is to draw some general conclusions from the five papers pertaining to expected future adjustments in response to the two sets of forces discussed above. I start by reviewing some of the long run forces and adjustments that have already taken place.

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[1]Thanks to Carol Stillwagon for constructing the graphs.

LONG RUN FORCES AND ADJUSTMENTS

Considerable adjustment has taken place in American agriculture since World War II as was discussed in detail by Hallberg (in this proceedings). I will just highlight in a few figures some of the major changes since 1949.

* One primary force behind change is the continual increase in output per unit of input (figure 1). New technology and improved human capital play important roles. This trend appears to be continuing throughout the 1980s.

* A second primary force is the long run decline in output prices relative to input prices (figure 2). This ratio has leveled off in the 1980s.

* In spite of the long run price squeeze, output has gradually increased (figure 3). In the 1980s, however, it is leveling off and becoming more variable. If output is used as a measure of size of the agricultural sector, one can say that the sector has grown since 1950.

* There has been a long run gradual decline in aggregate input use, except for a temporary rise in the late 1970s (figure 4). The rate of decline increased in the 1980s. Measured in terms of total inputs, the agricultural sector has been shrinking.

* Labor use has declined sharply (figure 5). The opportunity cost of labor use in nonagricultural employment has gone up and technology has allowed other inputs to substitute for labor. Though the decline nearly halted in the 1970s and early 1980s, the rate of decline has picked up more recently.

* There has been a marginal reduction in land used for agricultural purposes (figure 6). Changes are mainly due to farm programs.

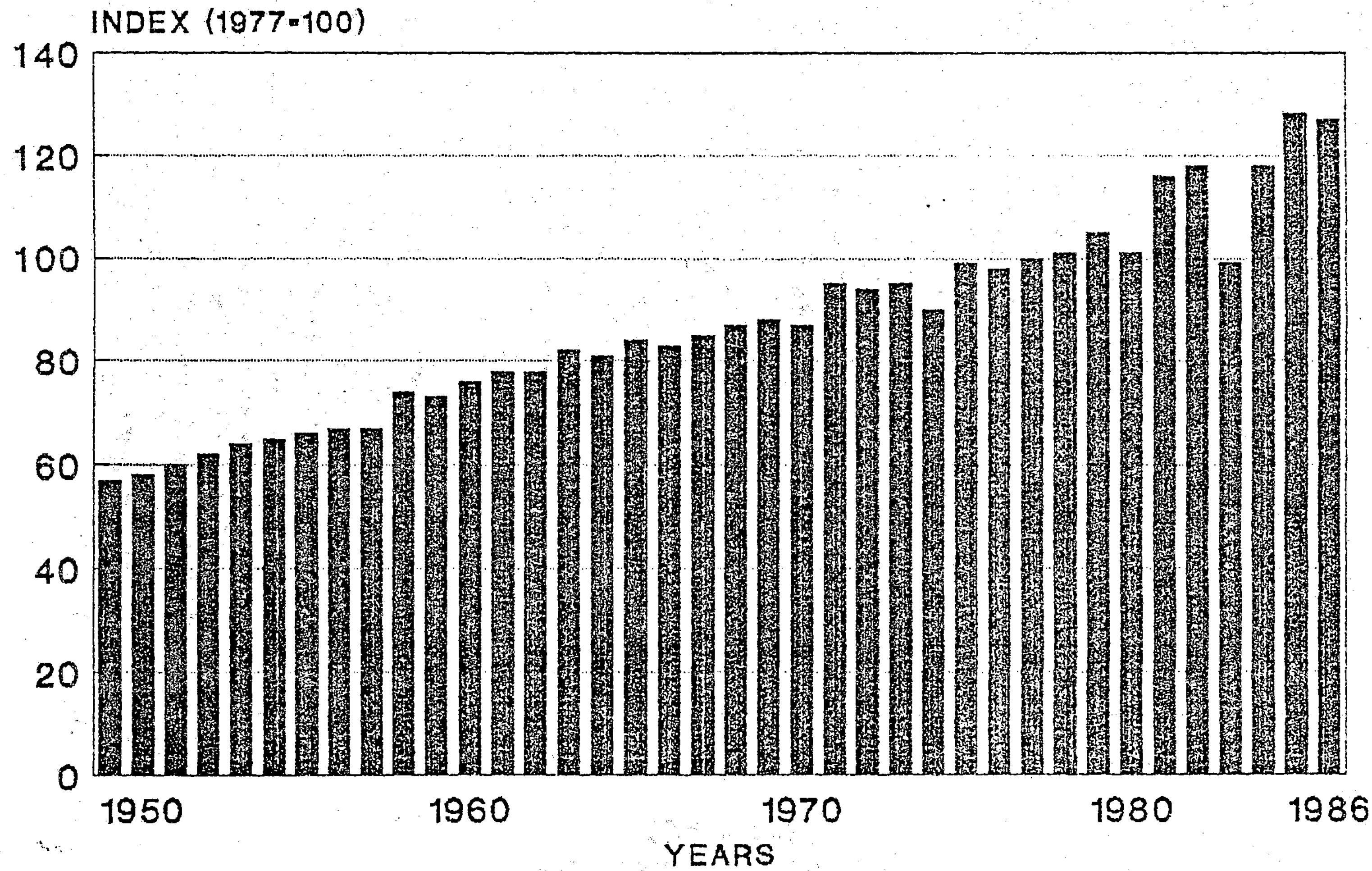
* Major growth took place in machinery investment until the early 1980s, and then a sharp decline occurred (figure 7). The stock of machinery appears to be wearing out during the 1980s.

* There has been a dramatic increase in the use of chemicals (figure 8). But there has been a major turn-around in the 1980s.

* The trend in feed and seed use is similar to chemicals, though the rise was less dramatic (figure 9).

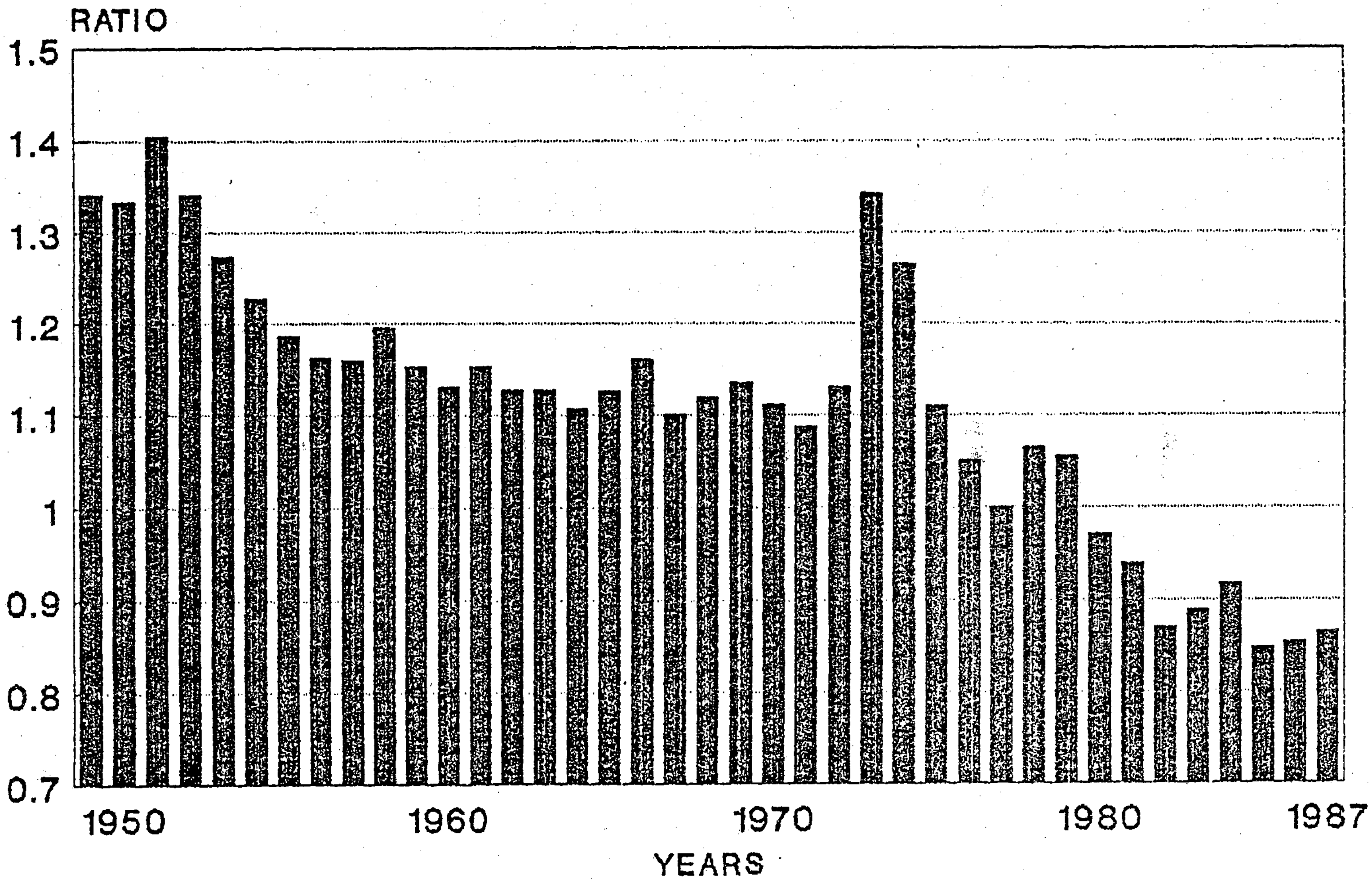
* There has been a marked decline in the "fixed" inputs (identified as "nonpurchased" on the graph) and a growth of purchased inputs in the total input mix (figure 10). This change has implications about the ability of the agricultural sector to adjust, and will be discussed further in the research issues section of my comments.

Figure 1. FARM OUTPUT PER UNIT OF TOTAL INPUT
1949-1986



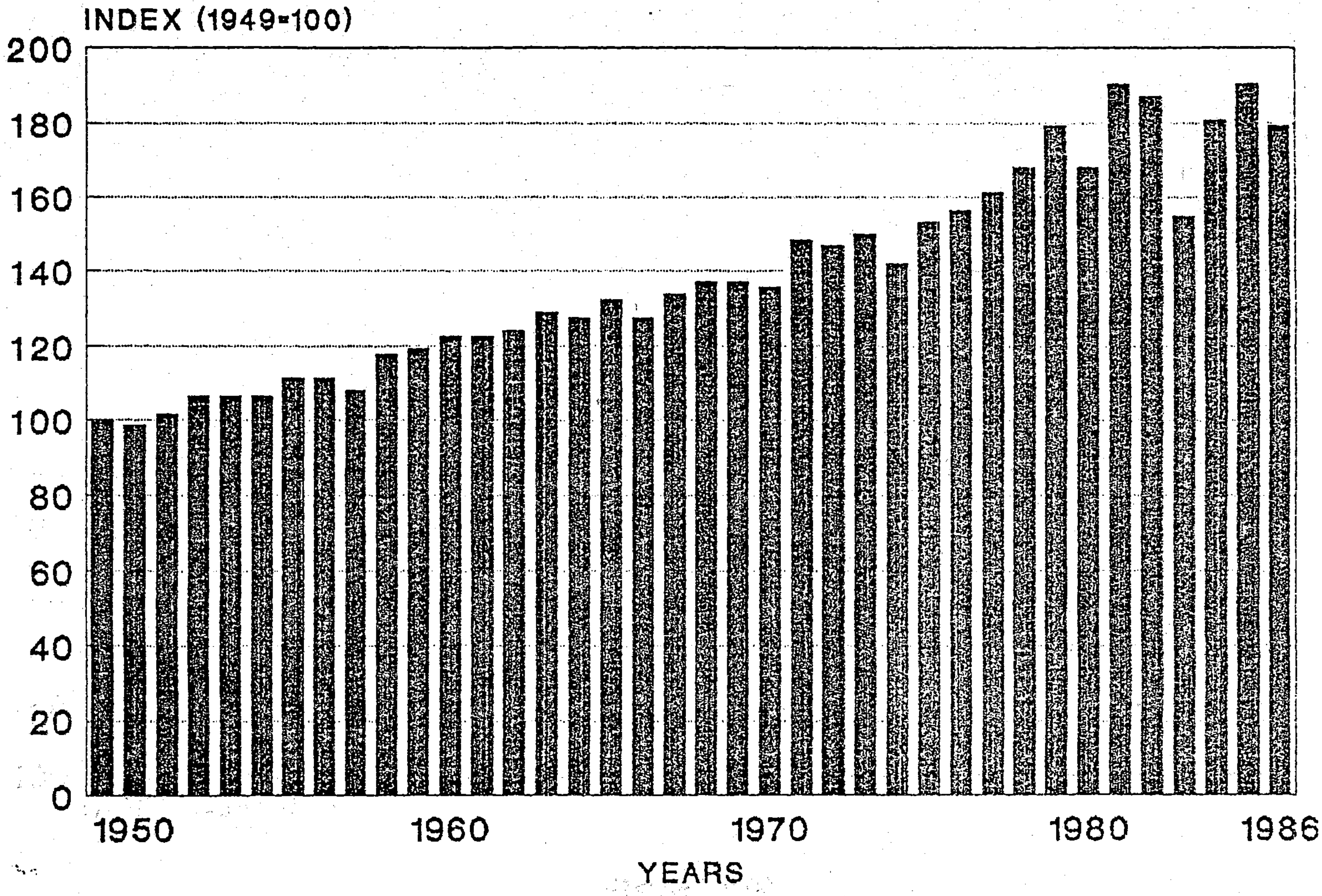
Source: ERS

Figure 2. PRICES RECEIVED / PRICES PAID
ALL FARM PRODUCTS
1949-1987



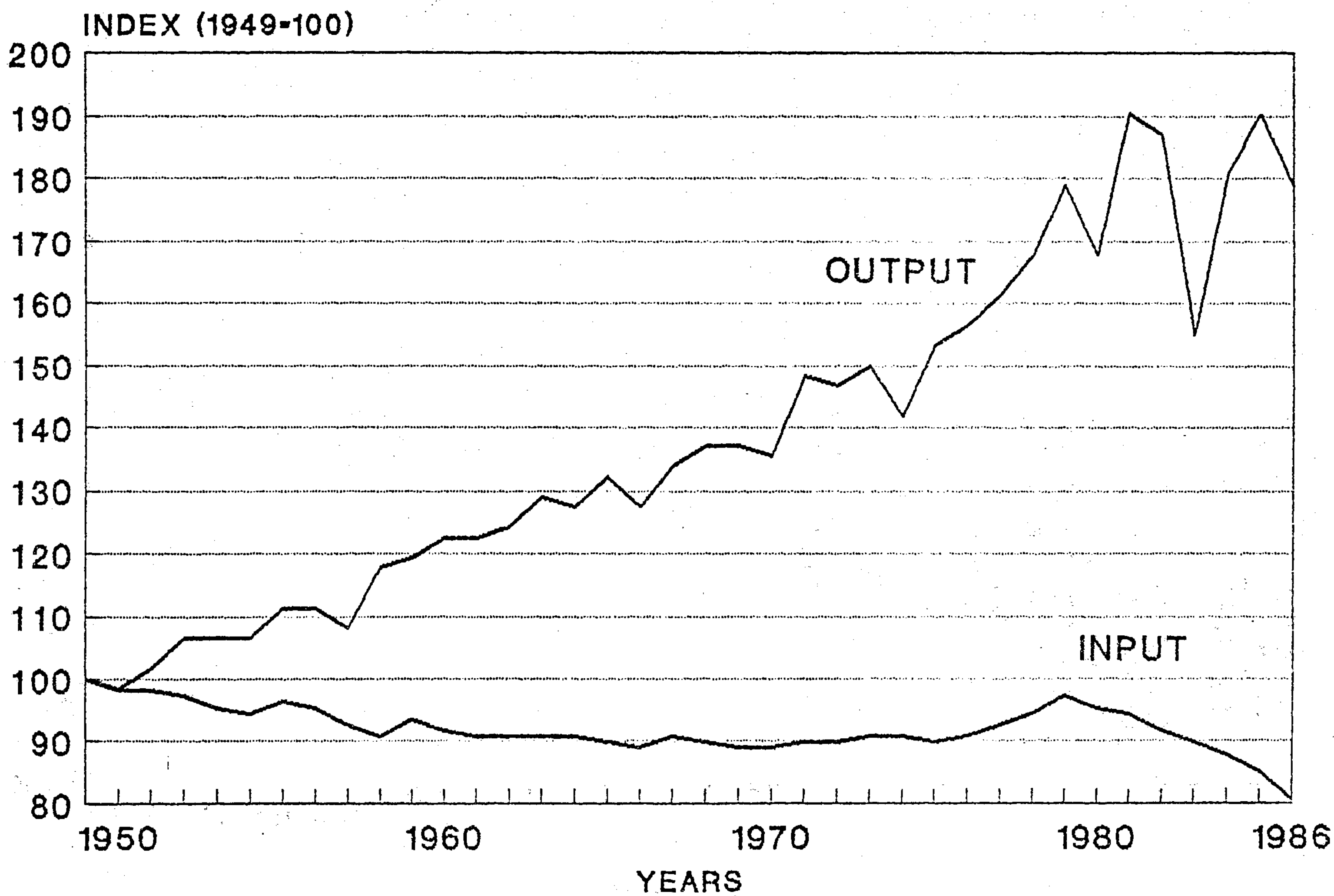
Source: ERS

Figure 3. OUTPUT INDEX
1949-1986



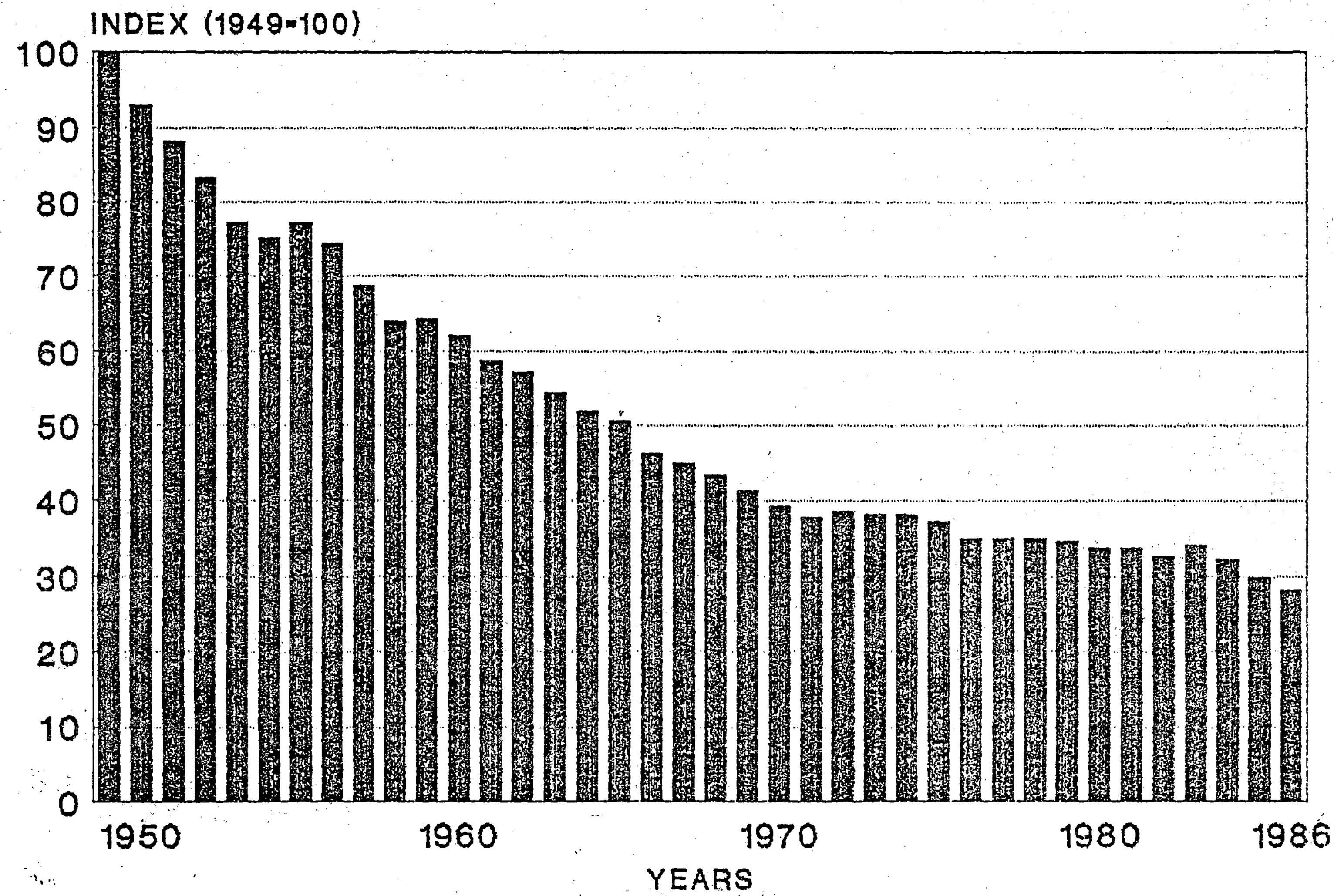
Source: ERS

Figure 4. INDICES OF OUTPUT AND INPUT
1949-1986



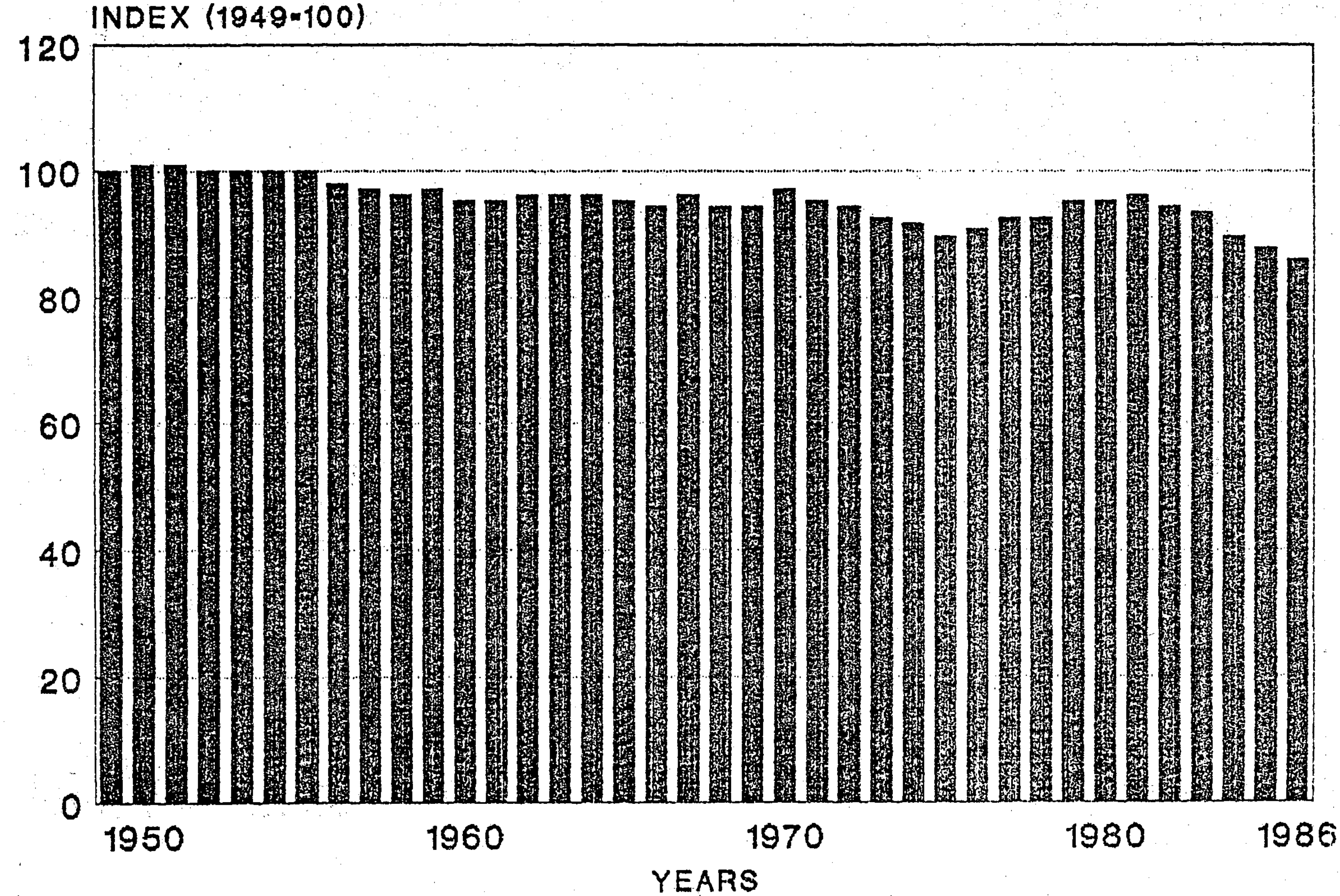
Source: ERS

Figure 5. FARM LABOR INPUT INDEX
1949-1986



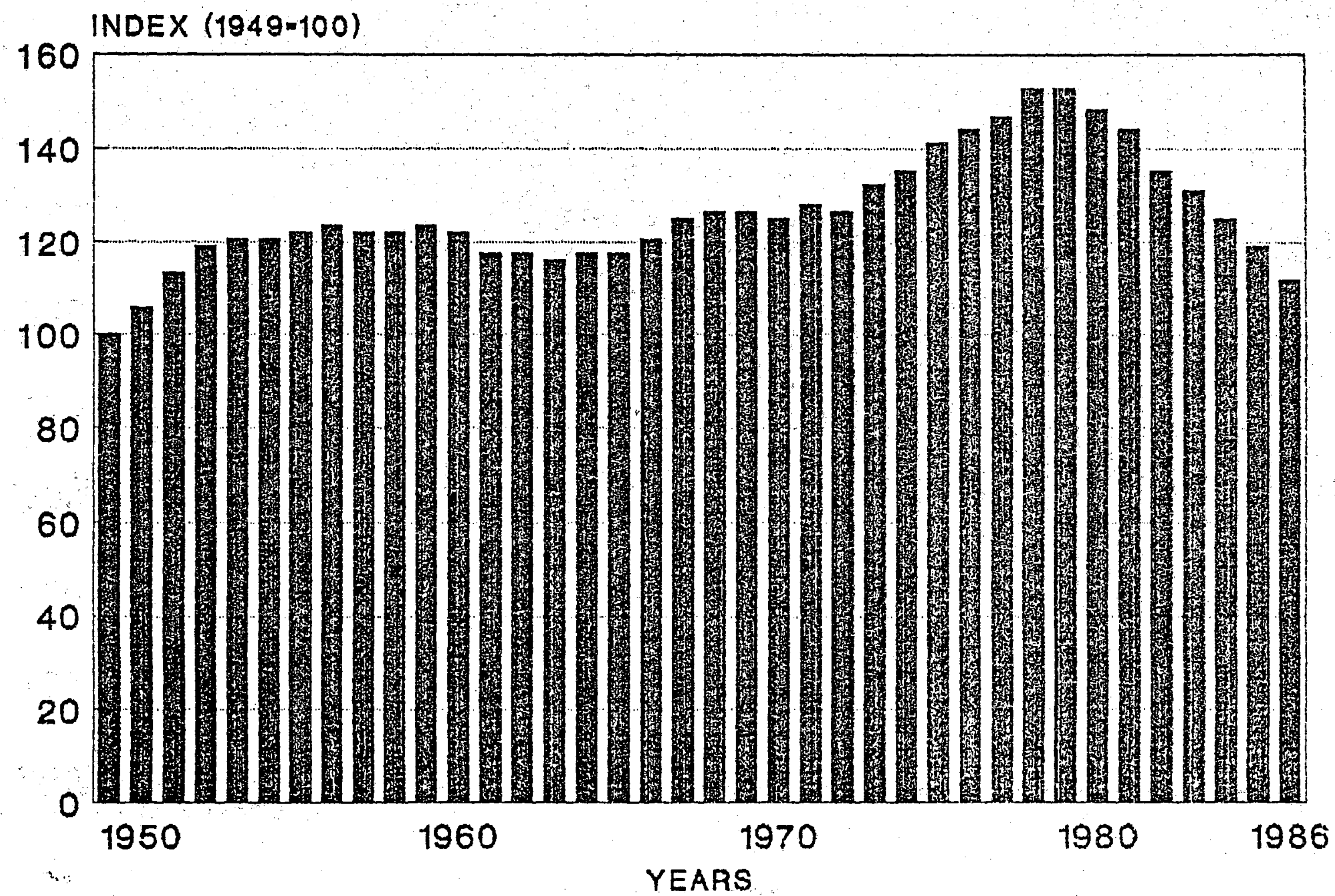
Source: ERS

Figure 6. FARM LAND INPUT INDEX
1949-1986



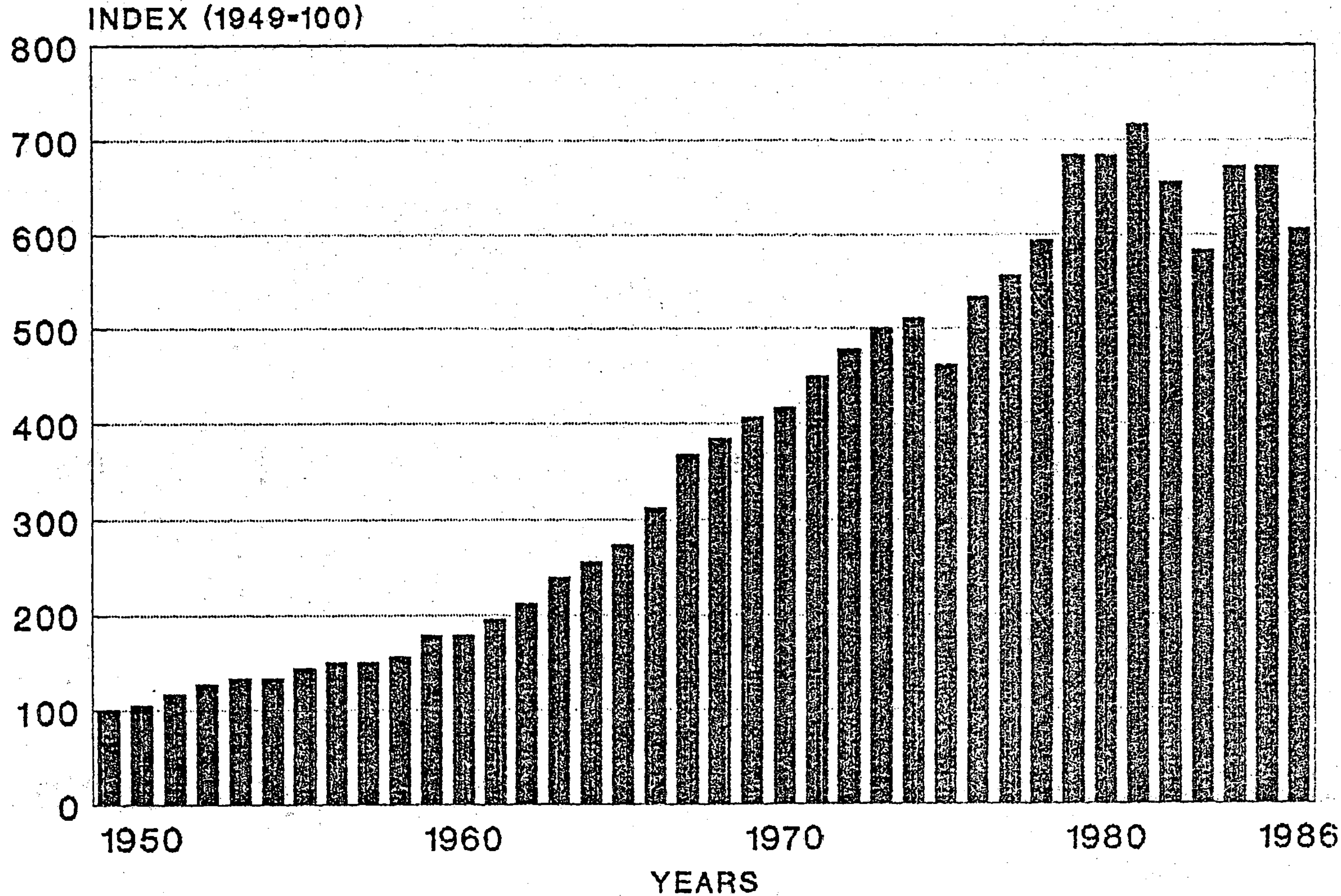
Source: ERS

Figure 7. FARM MACHINERY INDEX
1949-1986



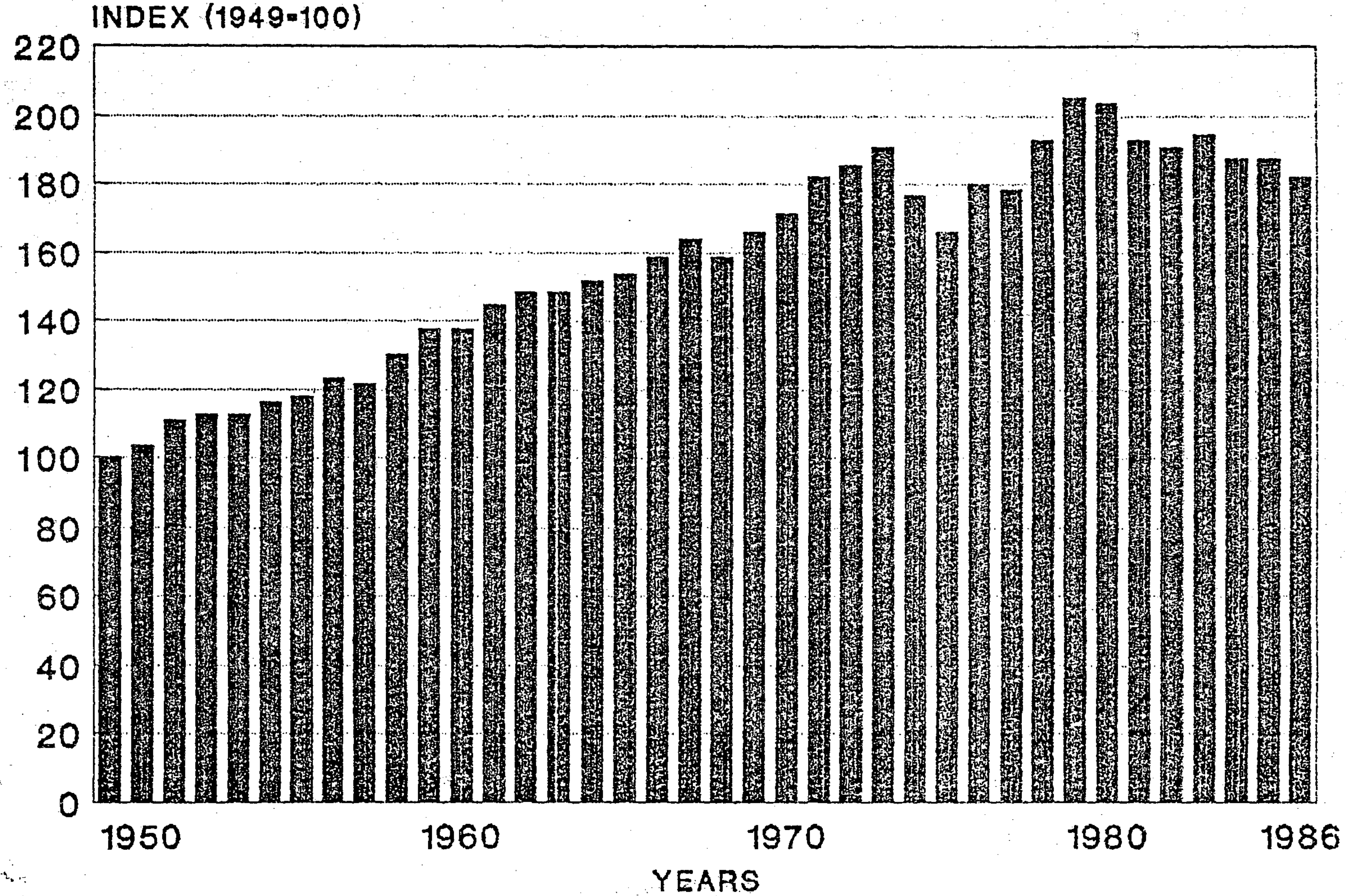
Source: ERS

Figure 8. AGRICULTURAL CHEMICALS INDEX
1949-1986



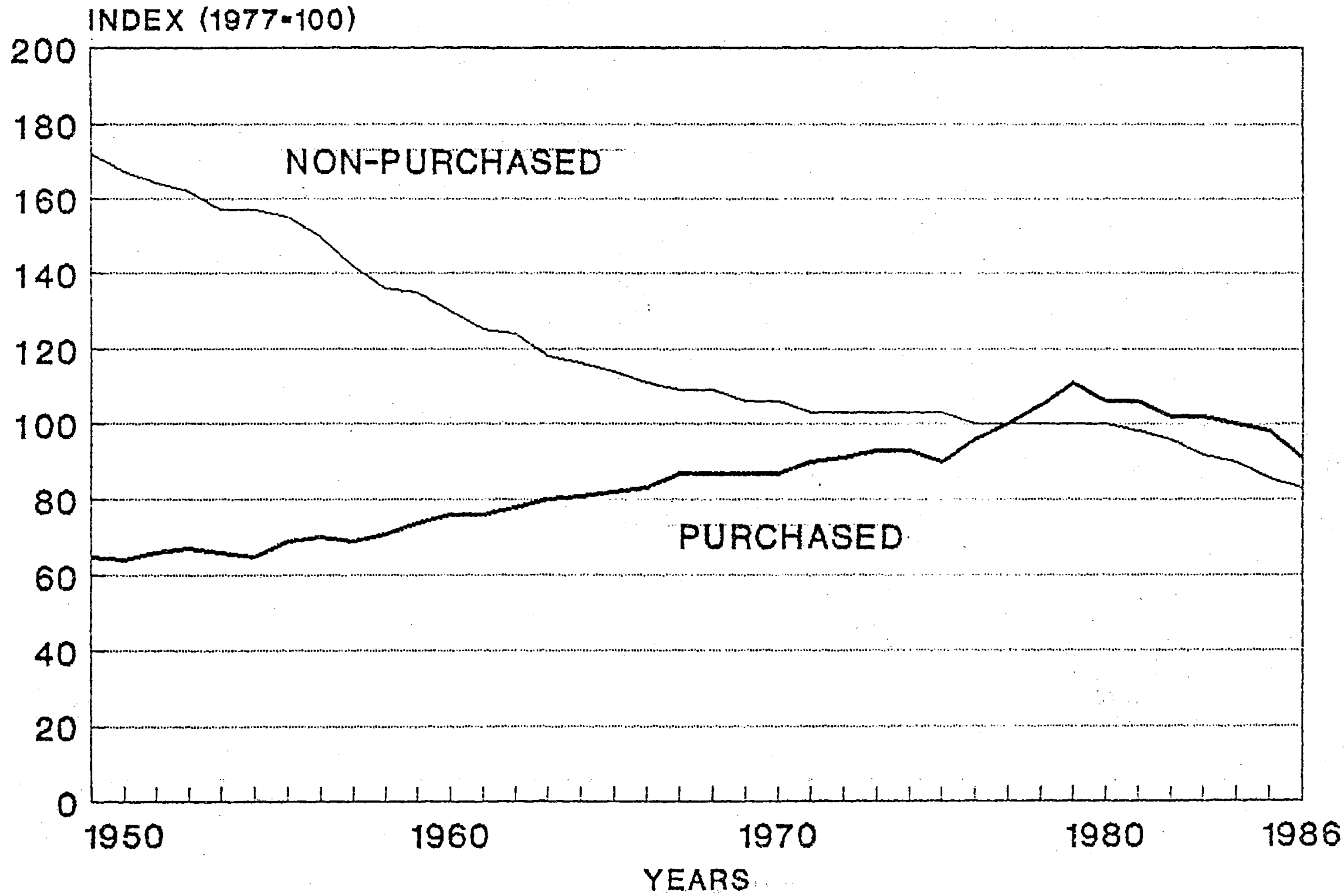
Source: ERS

Figure 9. FEED AND SEED INDEX
1949-1986



Source: ERS

Figure 10. INDICES OF TOTAL INPUT
1949-1986



Source: ERS

Summarizing the graphs, they show major adjustment by the agricultural sector as a whole over the past 38 years. The most striking is the decline of the farm labor force and the growth in chemical use. There is also evidence in the 1980s of changes in the long run adjustment picture. Output is leveling off and becoming more variable while total inputs are dropping more rapidly. The capital stock appears to be shrinking. What about the next ten years or so? Will they show adjustment like the last 38 years, or more like the adjustment of the recent past? I'll look to the regional papers for answers to this question.

Though many special regional issues are discussed, these papers generally portray an agricultural sector that is nearly fully adjusted to the disequilibrating long run forces that have influenced agriculture up to now. Thus if we take current farm programs as given, little excess capacity exists. Changes should continue to occur as the long run forces listed above continue to push agriculture out of equilibrium, but the rate of change is expected to be slower in the future than in the past -- more like that of the 1980s than the 1950s to 1970s.

In the dairy regions, labor should continue to leave and there will be fewer and larger (i.e., more dairy cows) farms. The interesting dynamics of adjustment likely will be the shifts in dairy production among regions.

Labor in the Corn Belt should continue to leave agriculture but at a diminishing rate. There is some excess capacity in the Corn Belt represented by the land withheld from production. Chemical use is now about optimum per acre, and changes would be a function of the area planted to crops.

The Plains and Mountain States will continue to adjust to long run forces as in the past. Plains agriculture tends to contain a higher share of the nation's marginal land resources and thus has to make larger adjustments to shocks to the agricultural sector. Labor adjustments should continue. That will be a difficult problem because of the scarcity of off-farm employment in the two regions.

Longer run resource adjustment in Southwest agriculture was discussed assuming a fall in output prices. Labor would be expected to continue to leave agriculture, but land and fertilizer adjustment would be minor because of the very inelastic supply of land in the region--especially because marginal land already has been removed from production by the Conservation Reserve Program.

ADJUSTMENT TO REDUCED, DECOUPLED, OR ELIMINATED FARM PROGRAMS

In addition to the future adjustments needed in response to the above long run forces, this symposium is interested in the regional adjustments implied by reduced, decoupled, or complete removal of farm programs. The background paper by Baker, Hallberg and Blandford (1989) provides a summary of what the world models estimate as the changes in prices and quantities due to either a unilateral elimination of U.S. farm programs, or a multilateral dismantling. Before discussing what the regional papers say about adjustments to these forces, I would like to give my own reaction to the background paper.

The global and national model results reviewed by Baker, et. al. (1989), give quite a range of results. After taking account of the different base periods, different procedures and different assumptions, they seem to be saying that elimination of U.S. farm programs would have a big negative impact on farm income and returns to primary resources (especially resources invested in the production of "program" commodities), but the aggregate impact on farm output would be relatively small. The small impact on output is the net result of expansion of production on land formerly withheld from production, being offset by the reduction in production due to less use of cash inputs on other cropland.

The regional papers tend to agree with this general assessment, even though a number of other significant local or regional adjustment issues are discussed. Model results for different sections of the South show small production adjustments to the removal of farm programs, but they also show some increases in farm income. White pointed out in discussing these results, however, that the base year for this analysis was 1982; a year with relatively low production control and program payments. If the base year had been any year between 1984 to 1987, the model likely would show farm incomes decreasing with the removal of farm programs.

Miller does not expect much adjustment in output to occur in the Plains if farm programs were terminated. He emphasizes, however, that removal of program payments would have a major impact on farmers and rural communities.

Sundquist expects some increase in crop production with the removal of farm programs, but he agrees that farm income and land prices would significantly decrease. Ray expects that little change would occur in grain production in the Southwest, with removal of farm programs, but less peanuts and cotton would be harvested.

Hamm figures that the trade liberalization issue is strictly academic in the dairy areas because the powerful dairy lobbies would not let it occur. Thus he did not attempt to estimate the impact of removing dairy price supports and border protection.

One can draw several generalizations from the above discussion. One is that those components of agriculture and agribusiness that make their living supplying inputs or handling output, would not be greatly affected by trade liberalization. The regional papers point out, however, that there could be many local exceptions to this generalization.

A second generalization is that those who own the primary resources, those who depend on farming for a living, and those who depend on farmers' personal expenditures in the local community would be hard hit. Rural schools and other services supported by land-based taxes would also be hard hit by the fall in land prices that likely would accompany the removal or decoupling of farm programs. Supposedly, decoupled payments (i.e., payments tied to people rather than to land or output) would reduce the impact on producers and on the community of the income lost by removing the programs. Decoupled payments would not stop the fall in land prices, however, and owners of land would still loose wealth.

RESEARCH NEEDS

One could develop a long research agenda to address the adjustment problems and policy needs associated with the topic of this symposium. That list would include analyses of decoupling; the linkages between trade, production and resource degradation; implications for funding rural school systems and other community services of a significant (further) drop in land values; and many other topics. I wish to add two topics to the list.

First, a comparison of how the agricultural sectors are adjusting in some of the major developed economies might help us better understand our own policy choices and adjustment needs. Alternative futures for U.S. agricultural policy and adjustment might be better understood by looking more closely at adjustments (or lack thereof) taking place, for example, in New Zealand, Australia, and the EC. The object of this comparison would be to draw implications for future policy choices and adjustment in the United States. The case study approach may have more of an impact on policymakers and opinionmakers than do model results from U.S. studies.

In the EC, high levels of protection have been in place for many years and distortions in the rural economy and the associated environmental problems are becoming quite apparent. Their experience could provide insights into problems the U.S. might face if support levels for agriculture remained high or were increased. In Australia, broadacre agriculture (i.e., their extensive beef, sheep and wheat enterprises) receives very little government protection in a very risky environment. Yet in this environment farmers survive and earn competitive rates of return on their labor and investment. Lessons might be learned about how similar parts of United States agriculture could evolve if faced with little support from farm programs. And New Zealand provides a case study of the impact on farms and rural communities of removing protection. During the 1980s their farmers have gone from receiving substantial government support to no support. What is this doing to their rural communities? How high is the adjustment cost? New Zealand's experience might indicate what U.S. agriculture could go through if support were removed.

A second research topic is the longer run elasticity of supply of U.S. agricultural sector as a whole. Even though this topic is as old as the agricultural economics profession, I emphasize this topic because there now exists a big divergence of opinion on the size of that elasticity. Micro-analysis and conventional wisdom tells us that it is low. Land is limited.

There are biological limits on the rate of increase of large animals. Optimum chemical use per acre apparently is not very sensitive to changes in the input/output price ratio. Comments in several of the regional adjustment papers supported this view. Recent aggregate analysis, on the other hand, suggest that the longer run elasticity of supply is quite large -- at least 1.0 or higher. The most recent example is the work of Ball.[2] Further, aggregate data suggest that the elasticity of supply is increasing over time because purchased inputs now account for a much larger share of total agricultural inputs than in the past. Land and operator labor (usually considered the "fixed" factors of production) have diminished in the mix of farm inputs. Which view of agricultural production is more accurate?

If agriculture in fact has a significantly higher elasticity of supply than perceived, then that has several important policy implications: Price distortions have a larger impact on resource use and production; the welfare costs of distortions are larger; there is less need to worry about food shortages because production could increase more in the face of higher farm prices. And it implies that agricultural resources do in fact exhibit substantial adjustment in response to changes in input and product prices. Higher supply elasticities tell us little, however, about the human costs of adjustment.

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[2]See the technical papers by Ball (1988 and 1989), and by Vasavada and Ball (1988).

CHAPTER 10. COMMODITY POLICY AND RESOURCE ALLOCATION

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INTRODUCTION

We have been asked to address the question: "Does commodity policy impede resource adjustment?" We look at the issues, provide some evidence, and conclude that the answer is "yes." But, then we move beyond this question and look at the issues in a much broader context. We compare agriculture to other sectors of the economy and farm commodity programs with government programs applying to other sectors. This broader view provides useful perspective on and implications for agricultural sector programs.

What Have Been the General Effects of Farm Programs?

The United States has a long history of programs that affect resource allocation in the agricultural sector. One means of guaging the impacts of these programs is to compare what actually happened in the farm sector with what might have happened in a free market. Results of many studies covering the 1955-1972 period indicate that in the absence of farm programs, prices received by farmers would have been between 10 and 25 percent lower and that aggregate net farm income would likely have been 20 to 60 percent lower (Heady and Tweeten; Nelson and Cochrane; Ray and Heady; Tyner and Tweeten).

Many recent studies have focused on uni- or multilateral trade liberalization that presumes that the U.S. eliminates trade and production distorting domestic farm programs (Robinson, et al; Hertel and Tsigas; Hertel; Hickenbotham and House). Results of these recent studies generally corroborate those before.

Have U.S. Farm Price and Income Support Programs Impeded Resource Adjustment?

Long run impacts on resource use and values

A general conclusion from published research is that, over the long term, a combination of price and income support programs, tax policies, credit policies, and changing technology have led to an increased allocation of labor and capital to the production of agricultural commodities (Cochrane and Ryan; Floyd; Heady and Tweeten; Reinsel and Krenz). The extra labor and capital, combined with a relatively fixed land area, have boosted returns to land relative to returns to labor and other inputs. Higher land returns take the form of higher rents and higher land values as the expectations of higher rents are capitalized into land prices. Labor earnings have increased modestly, if at all, because labor supply is more elastic than that of land and capital has proven to be a ready substitute for labor.

Research by Tyner and Tweeten and by Hertel and Tsigas (Table 1) implies that during the period 1952-1961, commodity programs hindered the use of capital in U.S. agriculture by 17 percent, while programs in the mid-1980's encouraged 14 percent more capital use in the U.S. farm sector. Also, evidence suggests that commodity programs retained more labor in agriculture than a free market situation would have.

Featherstone and Baker recently estimated that cash rents and land prices would be about 13 percent lower and more variable under a free market alternative than under the 1985 commodity programs. They found that cash rents and land prices could fall up to 59 percent and 38 percent, respectively, under a market alternative with adverse world supply/demand conditions.

FAA 1981 and FSA 1985 excess capacity maintenance

If stabilization and income enhancement measures are simultaneously and continuously pursued, then productive capacity is not just maintained, but maintained at a level that results in excessive stock accumulations and/or the need for acreage diversion programs.

The package of farm programs in use during the eighties, particularly as they relate to target prices and deficiency payments, appears to have encouraged capacity expansion beyond that which the market would have generated. They also appear to have discouraged the downward adjustment which market forces would have caused when farm income declined in the early eighties.

POLICIES IMPEDING RESOURCE ADJUSTMENT: THE PAYOFF FOR SOCIETY

We have presented empirical estimates of how much policy impedes or distorts resource adjustment. But this suggests only the effect on market efficiency, whereas real policies are judged more broadly in terms of their advantages and disadvantages, their costs and benefits. We next look to these advantages and disadvantages, first in terms of society as a whole and then in terms of individual farmers.

Advantages

The key advantages of impeding adjustment are promotion of U.S. food security and strategic policy objectives. Maintaining a productive capacity in a primary industry assures secure supplies in case of conflict or other market disruptions. For example, the National Wool Act of 1954 (still in effect) states that wool is an essential commodity not produced in the United States in sufficient quantities and grades to meet domestic needs. In 1954, memory of the Korean War was fresh in the public mind. Assuring the supply of wool for military uniforms was one reason for supporting a domestic wool industry. Hence Congress stated in the Act that its objectives were national security, promotion of the general economic welfare, and continued domestic production of wool by means of price supports. Proponents argue that this action ensures a viable domestic wool industry. Similar arguments have also been used for sugar.[1]

Table 1. Long Run Resource Levels in the Agricultural Sector Without Government Programs.

	Land	Labor	Capital
	-- percent of 1984 base --		
Farm sectors	1/	94.5	86.1
Dairy	82.9	78.6	76.5
Poultry	101.3	99.2	94.9
Red meats	100.9	97.7	95.6
Cotton	109.1	89.6	86.3
Foodgrains	121.1	87.8	79.6
Feedgrains	103.7	89.4	72.5
Sugar crops	100.0	29.4	2.1
Oilseeds	102.3	101.0	78.0
Other crops	105.7	99.9	85.2
Processed food sectors	100.0	95.6	86.9
Other sectors	NA	NA	NA
Agricultural inputs	100.0	98.5	2/
Other services	100.0	2/	100.7
Other manufacturing	100.0	100.8	101.7

1/ All set-aside acreage was assumed to enter production. Ninety (87, 40) percent of foodgrain (feedgrain, cotton) set-aside enters foodgrain (feedgrain, cotton) production.
2/ Less than 0.05.

Source: Hertel and Tsigas

[1] The United States often rejects these infant industry/national security/food security-type arguments when put forward by other countries. For example, in seeking increased U.S. access to Japanese and Korean markets, U.S. officials have criticized policies which protect Japanese and Korean agricultural producers from foreign competition.

Excess food production capacity might be used to support strategic U.S. policy objectives in foreign policy, business, humanitarian, and other areas. Foreign policy objectives might be furthered through food donations made possible by extra capacity. Business opportunities might be made possible by extra capacity which enables U.S. agriculture to quickly respond in times of demand expansion. And extra capacity might serve as world food insurance.

The security and strategic advantages are questioned by many. Given the current size of U.S. production capacity relative to U.S. domestic demand, and the general efficiency of the sector, ordinary market forces would seem to assure U.S. food security without policy intervention. Strategic policy objectives can be better satisfied in ways other than maintaining extra production capacity. Business strategy is best funded by private capital rather than public monies. Supplies for world food needs would be better handled by bufferstocks rather than maintenance of excess capacity.

Disadvantages

Excess resources in a sector impose efficiency losses, costs to other sectors and net social welfare loss. In 1986, total social losses due to six major agricultural income support programs were estimated to be $6 to $7 billion annually (Table 2).

Impeding resource adjustment arbitrarily inflates input costs. For example, policies that restrict land use but stimulate production increase the demand for yield-enhancing inputs. The increased demand for such inputs may bid up their prices to artificially high levels. Further, the prices of raw materials used in to produce agricultural inputs (e.g. nitrogen is used to produce fertilizer) would also be inflated, which would affect production costs in other sectors.

POLICIES IMPEDING RESOURCE ADJUSTMENT: THE PAYOFF FOR PRODUCERS

Net social benefit is as far as one usually goes in applying welfare analysis to evaluate whether a policy should or should not be pursued. If the net benefits reaped by a targeted group, say farmers, are outweighed by net social costs to other members of society, then the policy is not justified. But when agricultural policy is made in the U.S., welfare of individual commodity producers is given a far greater weight than their numbers in the population would suggest.

Advantages

The benefits of impeding agricultural adjustment flow to those producers and businesspeople whose incomes are boosted by subsidy programs.

Producer gains during the early 1980's averaged $10-$12 billion per year, and in 1986 direct payments and loans exceeded $25 billion. Beyond direct financial gains is the value of not having to adjust one's business operation in response to price and other market signals.

It seems obvious that any individual or businessperson only benefits from accepting government subsidies. But there are costs too. Since the costs are not always obvious, we suggest a variety of ways subsidies might injure recipients.

Table 2. Losses and Gains From Income-Support Programs (Annual Costs).1/

Commodity	Consumer loss	Taxpayer 2/ cost	Producer gain	Total loss
		-- billion	dollars --	
Sugar	2.5 to 2.9	0.	1.9	0.9 to 1.1
Milk	1.7 to 3.7	1.9	1.8 to 3.9	1.7 to 1.8
Wheat	.1	3.2	2.1	1.2
Corn	.5 to .6	3.0 to 4.1	2.1 to 2.5	1.5 to 2.1
Cotton	3/	1.5	1.1	.4
Rice	.1	.7	.6	.2
Total	4.9 to 7.4	10.3 to 11.4	9.6 to 12.1	5.9 to 6.8

1/ Estimates are not adjusted for program changes contained in the Food Security Act of 1985.
2/ Includes CCC expenses after cost recovery.
3/ Less than $50 million.

Source: Council of Economic Advisors, "Economic Report of the President," February 1986, p. 156.

Disadvantages: The Paradoxes of Agricultural Policy

It is useful to distinguish between the benefits and the incidence of public policies. The benefits of commodity programs have clearly defined points of impact and are easy to measure. But the incidence, or "change in the distribution of income available for private use,... may differ greatly from the way in which the initial... outlays are placed" (Musgrave, pp.205-7). In other words, it is easy to calculate the dollar value of agricultural subsidies, but this may not be exactly what farmers end up with.

Producers don't receive all of the benefits of commodity programs

Subsidies are tied to eligible acreage and often require land diversion, both of which inflate land prices. Subsidies on production cause increases in input use which inflates input prices. Producer costs rise until producers lose the subsidy value to asset owners and input suppliers. In the mean time, subsidy-induced overproduction causes commodity prices to fall below production costs. This further places producers in a cost-price squeeze.

Support can adversely affect domestic producers while benefitting foreign producers

Subsidy programs remove or distort market incentives which keep domestic producers competitive on the world market. One example is acreage reduction programs which withhold land from production. Idling land boosts crop production costs (both from inflating land costs and stimulating more intensive nonland input use). Inflating U.S. production costs makes the U.S. less competitive by encouraging higher cost competitors to enter or expand production, and by possibly making the U.S. the high cost producer.

Loan programs can cause similar problems by supporting world prices. If loan rates are set too high then there is less incentive for U.S. producers to cut costs and be efficient. This provides a cost of production umbrella of protection to foreign producers. Foreign producers benefit both by reaping economic profits while world prices are held above long run competitive equilibrium/free market levels, and facing reduced risks due to assurance of U.S. loan program protection.[2]

Programs to reduce farming risk may actually increase it

Featherstone, et. al., demonstrated that farm policies increase financial leverage enough to increase the probability of farmers having negative returns on equity. The argument is that if producers think there is a safety net, there is a tendency to financially overextend themselves. This conclusion is supported by Gabriel and Baker, Collins, and Robison and Barry. The real risk to financially overextended commodity producers is from government support levels being changed rather than maintained at a constant level.

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[2] These effects can apply to any supported or protected U.S. commodity. With tobacco, for example, research indicates that loss of U.S. competitiveness in the world market in the main is due to the tobacco program (Sharples and Sullivan, p. 20). The tobacco program boosted grower incomes for many years, but led to declining income for tobacco growers in the 1980's (Carraro, p. 61).

Policies that impede adjustment can be detrimental to those "protected"

Disturbances in agricultural commodity markets are often large. Several forces amplify these disturbances.[3] Agricultural policy in a market economy can inhibit, but probably cannot prevent adjustments (to agricultural market disturbances) over the long run. As a rule, adjustment costs are greater for an adjusting sector, the more other sectors fail to adjust. When an inevitable adjustment occurs in agriculture, it will be all the more severe for agricultural operators and institutions, because other sectors will not adjust, having already adjusted to the external forces.

Subsidies may damage work incentives

Public assistance programs have long been viewed as potentially harmful, insofar as they damage recipients' work incentives. Guilder summarizes this view: "...welfare beyond a minimal level becomes deeply problematic. The fact is that it is extremely difficult to transfer value to people in a way that actually helps them. Excessive welfare hurts its recipients, demoralizing them or reducing them to an addictive dependency that can ruin their lives" (Guilder, p.33). There are no clear guidelines as to where a safety net ends and where excessive subsidies begin.

For several reasons, agricultural subsidy programs have not been criticized in this regard as have public assistance programs. Farmers are viewed as hardworking; the programs are viewed as directed at stabilization, conservation, and other objectives in addition to income support; and most agricultural transfers are given in exchange for something (e.g., commodities are forfeited in exchange for nonrecourse loans, acreage is devoted to conserving use in exchange for deficiency payments, etc.) However, a significant portion of most agricultural transfers is a subsidy. And even an agricultural subsidy, if large enough, and if received over a long enough time period, has potential to disrupt personal and business incentives enough to make the recipients dependent on the subsidy.

Farmer opposition to subsidies

Many farmers oppose government subsidies even though it appears to be in their best interest to obtain the transfers. Like all good business people, farmers won't turn government subsidies away, but there is

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[3] Some nonagricultural sectors experience less price variability than agriculture. Because agricultural commodity prices are flexible, while other prices tend to be fixed in short run, monetary and other macro shocks tend to be absorbed in commodity market prices (Council of Economic Advisors, 1987). In international markets governments intervene in many countries to protect their producers and consumers from price and quantity adjustments. This means that disturbances have to be absorbed in narrower, more flexible markets such as in the U.S. (Miller, et al).

surprisingly strong feeling among farmers that government transfers to agriculture have gotten out of control.

Why is there any support among farmers for reducing or removing subsidies? Is it selfless devotion to the common good? More likely, many farmers believe that they can do well, perhaps better on their own. Plus, there is a real loss of freedom and independence, and an intangible, yet nonetheless disagreeable, feeling about receiving subsidies. Friedman summarizes this notion: when an entity or government spends other peoples money on any group, it "puts some people in a position to decide what is good for other people. The effect is to instill in the [givers] a feeling of almost God-like power; in the [recipients] a feeling of childlike dependence." (Friedman and Friedman, p. 109)

WHAT IS THE RATIONALE FOR AGRICULTURAL SUBSIDIES?

Economic shocks and adjustments occur in all sectors. Adjustments in any sector often involve structural changes in the way people earn their living and lead their lives. So, why has agriculture long been the focus of special attention?

The Rationale for Agricultural Sector Intervention

U.S. policy has traditionally operated at the macroeconomic level, using economywide monetary and fiscal policy measures to correct supply/demand imbalances in accordance with cyclical stabilization objectives. Agriculture, along with defense and transportation industries, represent the few examples where U.S. policy is operated explicitly at the sectoral level.

Two reasons given for agriculture sector specific intervention are that agricultural policy must address many special objectives and that farmers are economically disadvantaged and need special protections.

Many objectives for agricultural sector-specific policy

The stated purposes of U.S. farm policy legislation include providing price and income protection for farmers, assuring consumers an abundance of food and fiber at reasonable prices, continuing food assistance to low-income households, encouraging conservation, and other objectives. One reason for sectoral intervention might be the multitude of objectives which are imbued in food and agricultural policy (Table 3). Economy-wide policy may be too blunt an instrument to address so many diverse objectives.

Farmers are perceived as economically-disadvantaged

Justification for government intervention in the domestic agricultural sector includes perceptions that farmers are an economically hard-pressed group, that a principal reason for this is their relatively disadvantaged position in the marketplace, and--in the absence of government intervention--there would be intolerable instability in commodity markets, adversely affecting both farmers and consumers.

In part, farmers' perceived disadvantages compared with other participants in the economy stem from agriculture's organizational and biological characteristics. A large number of farms produce relatively homogeneous commodities and each farm accounts for a very small part of total production. Production tends to be variable because of weather, which causes wide swings in farm prices and income. Also, continued technological advances in agriculture have resulted in fewer resources being needed to supply the market.

SIMILARITY OF AGRICULTURE AND OTHER SECTORS

There is no doubt that the organizational and biological characteristics discussed above are true of the agricultural sector. Even so, there is room for doubt as to whether these characteristics are truly unique or justify government intervention. In large measure the agricultural sector is like other sectors of the economy.

Variability is Not Unique to Agriculture

Variability in returns is not in itself a market failure (which might justify government intervention). Variable returns occur in other sectors. The steel industry, the auto industry, textile manufacturing, oil and gas exploration, aerospace, government contracting, and many others are subject to market disruptions. Nor is agriculture the only industry where the variability is due in part to the forces of nature. Fishermen and watermen are equally dependent on the vagaries of nature and environmental degradation, but do not have the benefits of price and income supports. Many other industries and businesses are subject to unpredictable business cycles, labor strikes and even costly takeover battles.

Table 3. The Many Objectives Of Agricultural Sector Policy.[4]

Assure adequate supply of food
Reasonably priced food
Safe, wholesome, and nutritious food
Access to food by all segments of the population
Competitive market for farm products
Fair market practices
Consumer information
Efficient use of resources
Conservation of resources
Environmental quality
Resilience to economic and natural disturbances
Consistency with other national economic goals and policies
Equitable distribution of returns and economic power
Preserve family farming as a way of life
Adequate producer income and returns
Reduction of producer risk and uncertainty

Atomistic Production is Not Unique to Agriculture

The atomistic production organization of farming is not unique either. Goods and service retailing, for example, also tends to be characterized by many operators providing relatively homogeneous products. Retailing is subject to forces similar to those facing farming. Fifty years ago, corner grocery stores were ubiquitous. Now, the family grocery store is rare and food retailing is more concentrated in supermarkets. But the retailing industry has adapted and adjusted to changing conditions. Today there are retailers selling products which did not exist fifty years ago (like corner video rental and quick print stores).

Markets Can Work as in Other Sectors

The entrepreneurial function of a market-oriented economy is to allocate the resources, take the risks, and receive the profits. Profits are regulated by free entry into and exit from the industry. A low or negative return on the investment is the market's way of telling the entrepreneur to seek an alternative means of making a living. In many economic sectors dominated by small business or even family enterprise, and in many agricultural (nonprogram) commodity subsectors, markets function quite well.

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[4]These objectives are mostly, but not entirely, from Lee, pp. 141-5.

Key Difference Between Agriculture and Other Sectors: Policy

When adjustments and shocks occur in agriculture there is a very real human cost, but no more so than for individuals in other industries. However, farmers typically receive very favorable treatment in the press, and the Government seems particularly attuned to the conditions and needs of farmers, as compared with, say, urban service sector owners/employees. With every calamity the Secretary of Agriculture and other top officials exhort creditors, input suppliers and other business people and commodity program administrators to "exercise extreme forbearance" in the case of hard-hit agricultural operators. There are even court injunctions against FmHA foreclosing on overdue loans which have a low probability of ever being repaid.

The situation in agriculture is different from the practice applied in other industries of relying on, for example, unemployment insurance which is designed as a safety net for workers while they adjust from losing their job in a contracting business to finding a job in a stronger or expanding business. Are we to infer that the way of life and well-being of blue-collar workers or small business owners are less important to society than are farmers? Few would suggest that, say, steelworkers are not just as proud of their profession and their contribution to society, and that they do not suffer just as much emotional turmoil if they loose their jobs and homes.

SIMILARITY OF AGRICULTURAL AND ECONOMYWIDE TRANSFER PROGRAMS

The agriculture sector is not the only sector where government programs seek to provide people with a "fair" return for their labor and to support them in time of need. For example, the nationwide minimum wage, Social Security, medicare, medicaid, unemployment insurance, public assistance, special tax credits and deductions, oil depletion allowance, and other programs support individuals in all sectors of the economy.

Similar Origins

As we have seen, the business risks, production organization and entrepreneurial functions of the agricultural sector are not unlike those in many other sectors. Similar also is the commitment of the Government to protect individuals and businesses. This suggests that the rationale for government programs in agriculture is more similar to that for programs in other sectors than is at first apparent. The origins of these programs support this notion.

In 1933 when Franklin Roosevelt took office, the United States was in the middle of a depression. The populace in agriculture and in other sectors wanted an end to the misery; this was provided by New Deal policy. Beyond addressing the depression, the New Deal resulted in permanent changes in the Federal Budget. The size of the Budget relative to private spending grew remarkably, with the increases mainly directed at social programs.

The first attempts to control agricultural surpluses through production controls were authorized and put into place under the Agricultural Adjustment Act of 1933. The processor taxes and producer control sections of the 1933 Act were declared unconstitutional in 1936. The Agricultural Adjustment Act of 1938 and the Agricultural Act of 1949 continue to be the basis for most commodity programs.

Trends in Federal Agricultural and Social Program Spending

Federal government spending (excepting wartime) was 3 percent or less of national income from the founding of the Republic until 1929. In the 1930's it rose to 13 percent of national income (Friedman and Friedman, p. 82) Since World War II, Federal spending has risen from 16 percent of national income in 1951 to 29 percent in the 1980's (Figure 1). Between the 1950's and the 1980's, social program spending rose from 4 percent of national income to 16 percent.

While the share of national income spent on social programs has risen, agricultural spending appears to have remained a steady, low percentage of national income since the 1930s. Expenditures per person tell a different story, however (Figure 2). Over this period national income has been rising while the population actively engaged in agriculture has steadily declined. Since 1940, agricultural spending per person engaged in farming has usually been somewhat more than U.S. social program expenditures per capita, but followed the trend. In the late 70's agricultural spending per capita broke with the social spending trend and began to rise at a much faster rate. From 1986-1988 social program spending per capita was $1760, while agricultural spending per person engaged in farming was $4547.[5]

Trends in Government Spending Philosophy: Public Goods versus Equality of Outcome

But a philosophical change began with the New Deal that was more fundamental than fiscal policy. The New Deal planners invested government with the responsibility "to protect individuals from the vicissitudes of fortune and to control the operation of the economy in the 'general interest'." (Friedman and Friedman, p. 83) Milton Friedman has noted an evolution in the philosophy of what role the government should play: from

[5] In 1978 the definition of a farm was changed from operations with at least $250 in sales per year to include only those with at least $1000 in sales per year. This reduced the reported number of "persons actively engaged in farming" and means the agricultural spending line in Figure 2 is somewhat higher after 1978 than if the series had not changed. If the older series were still in use, the 1986-1988 agricultural spending per person in farming would be about $3751, still twice social spending per capita.

Figure 1. U.S. Budget Outlays by Category as a Percent of U.S. National Income

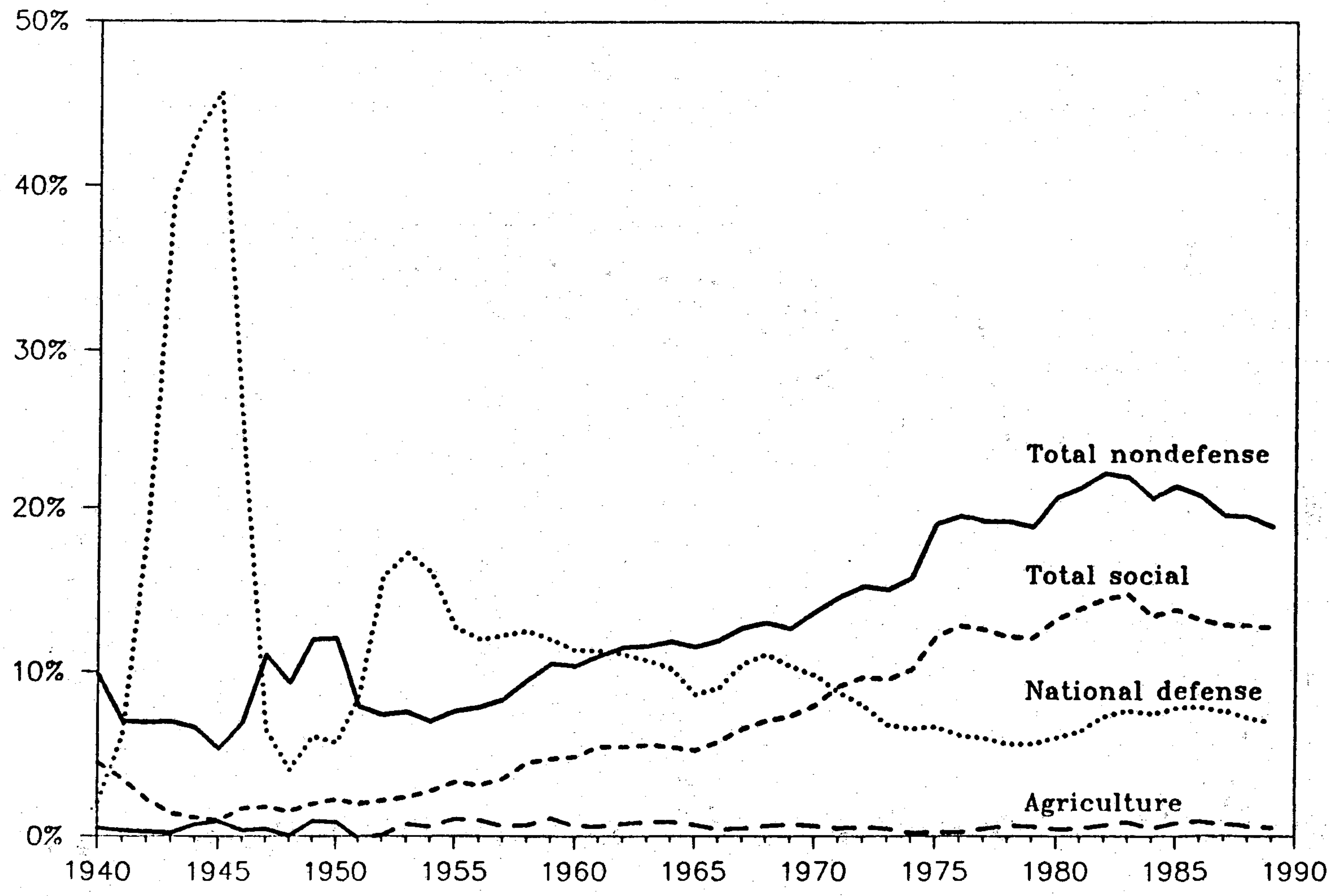
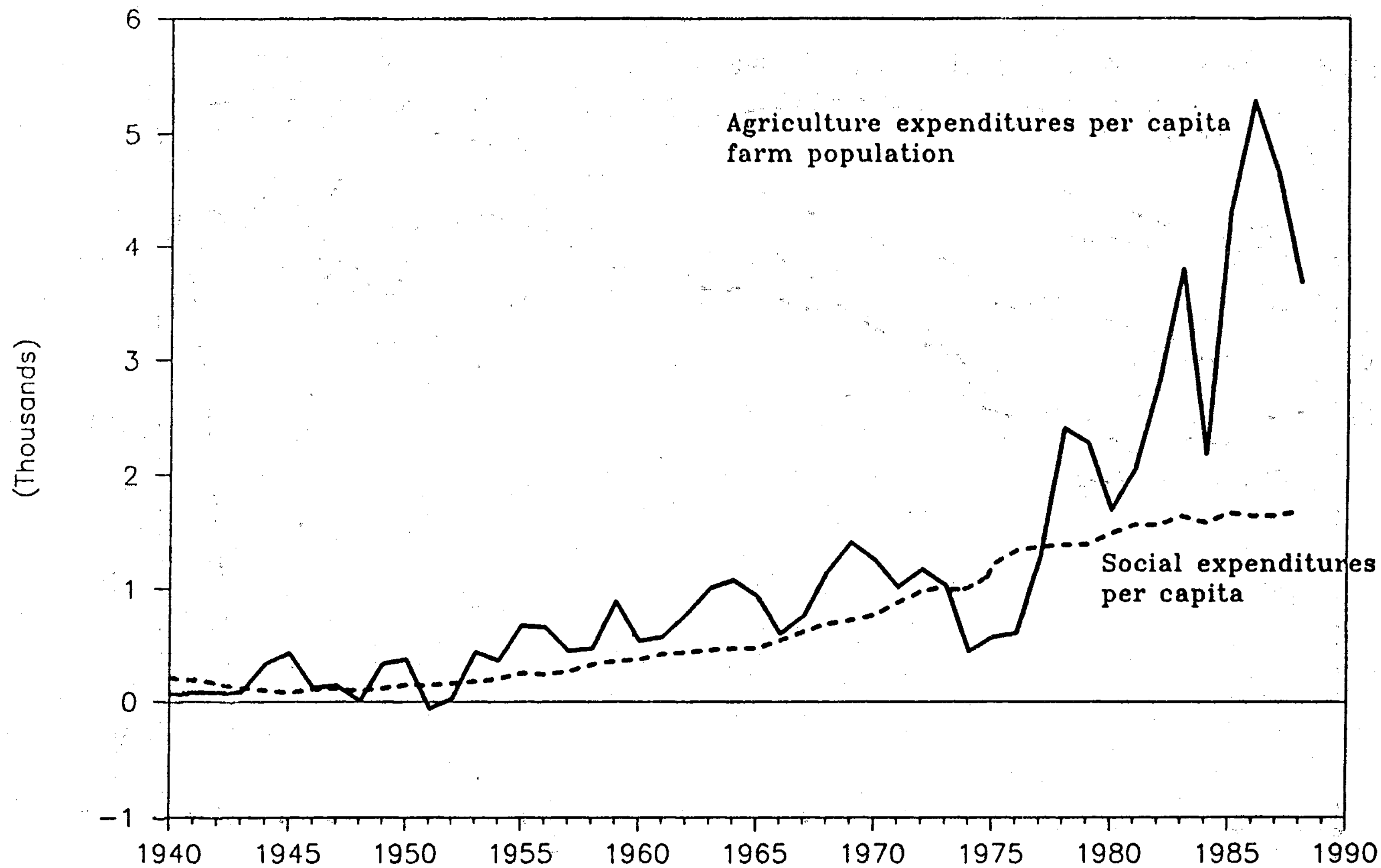


Figure 2. Expenditures per capita, 1982 Dollars
Total Social and Farm Sector



providing "equality of opportunity," (i.e. no one should be prevented by arbitrary obstacles from using his capacities to pursue his own objectives) increasingly to providing "equality of outcome." That is, everyone should have the same level of living and be protected from misfortune. Friedman and Friedman (p. 119-20) attributes much of the growth in government spending since the New Deal to promotion of the equality of outcome philosophy.

Though equality of outcome is not the dominant philosophy in the United States, it has increasingly been incorporated into public policy since the New Deal days. Harold Breimeyer recently wrote about the government philosophy of "privatization of profit and socialization of risk" (Choices). The government steps in to bear the risks, while leaving rewards to accrue to private enterprise. Breimeyer observes how this philosophy is exhibited in many government activities: the Farm Credit System bailout (Agricultural Credit Act of 1987), farm commodity programs, FmHA funding, government insurance of deposits in banks and savings and loans through FDIC and FSLIC, and so on. Such privatization/socialization policies promote equality of outcome; they seek to guarantee a level of living and protection from misfortune.

Clearly, not all objectives or programs of U.S. agricultural policy are motivated to assure equality of outcome. Many objectives derive from the "public good" rationale--government intervention to provide something which society values, but which would not be provided by the market system alone. It is clear that both types of rationale exist and both motivate transfers to agriculture. The objectives of farm policy which we discussed earlier can be roughly separated into those whose rationale is mostly equality of outcome and those whose rationale is mostly to provide a public good (Table 4). The rationales overlap for some objectives, but the notion is compelling that assuring "safe, wholesome, and nutritious food" is mostly public good while assuring "adequate agricultural producer income and returns" is mostly something else. We do not attempt to separate individual farm programs or expenditures into these two classes.

Table 4. Public Good Versus Equality Of Outcome Objectives.

Mostly public good rationale
Assure adequate supply of food
Reasonably priced food
Safe, wholesome, and nutritious food
Access to food by all segments of the population
Competitive market for farm products
Fair market practices
Consumer information
Efficient use of resources
Conservation of resources
Environmental quality
Resilience to economic and natural disturbances
Consistency with other national economic goals and policies
Mostly equality of outcome rationale
Equitable distribution of returns and economic power
Preserve family farming as a way of life
Adequate producer income and returns
Reduction of producer risk and uncertainty

Growing Awareness of Deficiencies in Equality of Outcome Public Programs

Public programs yield many benefits, but they are also subject to potential problems: inefficiency, inequity, reaching the wrong people, unintended consequences, promotion of private rather than public interest, and so on. Equality of outcome programs may have good motives, but they are particularly susceptible to problems since they supplant market forces which provide economic agents the incentives to be productive and efficient. For example, providing a public good augments or creates a market demand for items such as defense equipment. Producers have incentives (assuming a competitive market) to minimize costs, price products competitively, and maximize profits. On the other hand, providing a subsidy creates incentives to qualify for the subsidy and may divert productive resources into unproductive uses merely to qualify for the subsidy.

Whether their focus is economy-wide or on the agriculture sector, equality of outcome programs exhibit many of the same inequity, inefficiency and expense problems. We next describe these similarities in some detail, not to offer excuses for agricultural program weaknesses, but rather to promote a broader perspective in examination of agricultural policy. We first need to provide some background on economy-wide programs.

Economy-wide programs. The three largest Federal program areas which contain large elements of equality of outcome are Social Security, Medicare and public assistance. These economy-wide programs accounted for over 41 percent of Federal budget outlays in fiscal year 1989 (Economic Report of the President, 1988, p. 339).

The Social Security program was created to assure that all working citizens have an adequate retirement income.

> The program is inequitable because many wealthy retirees are receiving many times what they and their employers have paid in, plus interest, while it is heavily financed by taxes paid by low- and middle-income workers. In addition, it redistributes the benefits from low- and middle-income two-earner couples to wealthy one-earner couples. It is inefficient in that it does not target benefits as well as it should to those who need them the most. Moreover, it impairs incentives to continue to work in old age and to save for retirement (Boskin, p.62).

Both Social Security and Medicare are financially insolvent in the long run. "...at the beginning of the 1980s [Social Security] had an enormous long-term [over the next 75 years] deficit of $1.8 trillion... an even larger deficit was projected in [Medicare.]" The 1983 amendments to the Social Security and Medicare programs addressed only short-run funding problems and will be sufficient only to keep the systems solvent into the 1990's, barring major recession (Boskin, p. 126).

Public assistance programs mushroomed in the 1960's and 1970's with the advent of the War on Poverty. While the programs provided a much-needed safety net to many they have also been roundly criticized: "Public assistance rolls mount despite growing employment." (Friedman and Friedman, p. 87) Administrative reforms in the 1980s aimed at reducing abuse of the system. In addition, belief that too much of the funds were going to middle- and lower-middle income families as opposed to the low-income poor led to tightening of eligibility standards (Boskin, p.208). The system is still criticized as creating disincentives to work, and attempts to reduce the disincentives continue.

<u>Agricultural programs.</u> In agriculture, the public good objectives of policy have been well met by farm programs. The United States has had an adequate supply of reasonably priced food. Continuous efforts are made to ensure access to market information and competitive markets. Federal government monitoring and regulation of environmental and food safety is also quite successful.

The equality of outcome objectives, though, are cause for continuing and increasing concern. Agricultural programs are inefficient. It has been estimated that to raise net farm income by $1, $4.25 must be spent on agricultural programs (Economic Report of President, 1986, p. 155). Much of the farm subsidies are ultimately captured by asset owners, input suppliers, and foreign consumers (in the case of export subsidies).

As to program equity, it has long been noted that the majority of farm program benefits go to the largest, most wealthy producers. In 1986, about 93 percent of direct government payments went to farms having gross sales of $20,000 or more. The net worth of those farms averaged $550,348, and their incomes were also above nonfarm averages (Collins and Vertrees). In 1986 only 22 percent of direct payments went to those farmers in severe financial distress. While farms with annual sales in excess of $250,000 represent 4 percent of all U.S. farms, they received 25 percent of the total amount of Federal payments (Office of Management and Budget). This results from the programs attempting to support incomes indirectly based on volume of production, rather than--say--direct income supplement payments based on needs.

Another inequity of farm program is that they redistribute income from lower income taxpayers to higher income subsidy recipients. In 1987, for example, median family income was $30,853 (Economic Report of the President, 1989, p. 252). For the average farm operator in 1987, net cash income was $57,060 and total cash income (includes off-farm income) was $103,829 (USDA, p. 13).

An explosive growth of expenditures made agriculture one of the fastest growing components of the Federal budget in the 1980s. Commodity price support payments grew from $4 billion in 1981 to $12.5 billion in 1988; even after adjusting for inflation, there was a threefold increase. From 1986 through 1990, Federal outlays to agriculture are expected to exceed $130 billion.

Though most agricultural programs are not intended to be self-financed (as is Social Security), when elements of agricultural programs are set up to be self-financed, Congress sometimes retreats and covers the cost with public funds. Examples include the tobacco program (Carraro) and the recurring disaster assistance programs provided after repeated exhortations for producers to self-insure themselves with crop insurance.

Falling Short of Objectives Leads to Pressure Not for Elimination, but Expansion

A characteristic of many public programs is that when they fall short of their objectives, ..."the pressure to expand them grows. Failures are attributed to the miserliness of Congress in appropriating funds, and so are met with a cry for still bigger programs." (Friedman and Friedman, p. 88) Rarely is there much support for eliminating or trimming a program. In agriculture this is also true. Even with record farm income levels in the late 1980s, the pressure to expand and extend farm income support and stabilization continues.

DECOUPLING: POTENTIAL SOLUTIONS, POTENTIAL PROBLEMS

A currently popular policy prescription is decoupled farm program payments. Decoupling would seem to address many of the concerns we have raised, but decoupling is not without problems of its own.

A common complaint of U.S. commodity programs is that benefits are dependent on the level of production. It has been argued that if farmers were allowed to plant according to their perception of market needs instead of government program regulations, a better balance of production and resource allocation could be obtained.

Decoupling in its various forms attempts to achieve protection of farm income, more efficient production, and improved export competitiveness (Collins and Vertrees). A key component of decoupling proposals is that producers receive a transitional income support payment regardless of what commodities they plant. The transition payments would be phased out over a 5 to 10 year period. The payments would not depend on market prices. In addition, no acreage limitation programs would be in effect. The key is that farmers would be allowed to plant any combination of feed grains, wheat, oilseeds, cotton and rice, or none at all.

Decoupling, on its surface, has many desirable features. However--as Korves points out--for decoupling to gain widespread acceptance, a huge philosophical issue must be dealt with: Why would farmers be receiving payments? In the past, farmers have received payments for "doing something," such as setting a portion of their land aside, or because prices, and thus incomes, were temporarily low. Under decoupling, farmers would not have to idle land, conserve soil or store grain. Payments would be made regardless of how much is planted, what is planted, or even if anything is planted at all--regardless of what happens to market prices. The often stated concern is that decoupling would be perceived as welfare.

Finally, a decoupled subsidy program could have disadvantages more serious than an image problem. It might inflict on farmers some of the dependency and loss of incentive problems for which poverty/welfare programs have been criticized.

CONCLUSIONS

As a society we have not yet reconciled the need for safety nets with the need to preserve incentives of the price system. This will require policy which identifies its objectives clearly, acts directly to meet human needs, and questions the wisdom of believing that problems can be solved solely by increased funding.

Public policy must be made recognizing that moral hazard and rent-seeking behavior are real problems. Individuals and business must be responsible for the consequences of their actions. Otherwise, policy will play havoc with incentives which make the market system efficient and productive, and Americans will have to give up the growth in economic and social benefits to which they have become accustomed over the past 200 years.

For agriculture there are several lessons from experience with equality of outcome policy. First, we need to be aware of the public good objectives for agriculture and support them with farm policy. We need to beware of objectives and programs for which equality of outcome plays a large part in the rationale. They may have noble objectives, but can yield bad policy. They distort incentives, and are subject to a vicious cycle of program failure, calls for more spending and protection of weak sectors/businesses, further failure, and so on. Any safety net subsidy should be small enough such that the "problem" is not made more attractive than the "solution."

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CHAPTER 11. CONSERVATION RESERVE AND CONSERVATION COMPLIANCE PROGRAMS: IMPLICATIONS FOR RESOURCE ADJUSTMENT

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INTRODUCTION

During the formation of the Food Security Act of 1985, an alliance was formed between farm interest groups and environmental groups to support new provisions in the legislation under the conservation title (Title XII). The two most important elements of this title are the conservation acreage reserve program and the conservation compliance program.

This paper explores the impacts of these programs on resource adjustment. The conservation reserve program (CRP) has impacts on land use and commodity markets as well as on the environment. Similarly, the conservation compliance (CC) provisions of the 1985 Act will influence land use, input use, tillage practices, and production costs.

This paper reviews the impacts of these conservation programs on resource adjustment by comparing a baseline projection or reference run to an alternative scenario. In the case of the conservation reserve program, a multi-market commodity model (CARD/FAPRI 1989) is used to generate a baseline projection and to evaluate the impacts of increasing the amount of land in the conservation reserve program. In the case of the conservation compliance program, the CARD Agricultural Resources Interregional Modeling System (English et al.) is used to generate a baseline without the program and then to evaluate the impacts of imposing the conservation compliance provisions.

CONSERVATION RESERVE PROGRAM

In the Food Security Act of 1985 Congress mandated the Secretary of Agriculture to carry out the CRP on highly erodible cropland and remove a total of 40 to 45 million acres over the five years of the program. Although the focus of the legislative language is on conservation and improvement of soil and water resources, this program also has become part of the total supply management strategy of the government.

When there is an announced sign-up period to participate in the program, farmers place bids with the government indicating the rental rate at which they would put cropland into the CRP. If a bid is accepted, the farmer signs a ten-year contract to keep the land out of production and the government provides 50 percent of the cost of establishing a cover crop on the CRP land. Lowest bids are accepted first within each area, and not more than 25 percent of the land in a single county can be enrolled in the program without special approval.

During the first six sign-ups from March 1986 to August 1988, 25.5 million acres were enrolled. Approximately 60 percent of the enrollment up to this time was from the Plains and Mountain States (Figure 1). Nearly a third of the land enrolled by 1988 came out of the wheat base (Figure 2).

FAPRI Baseline Projections

Recent FAPRI projections for United States and world agriculture assume that 40 million acres will be enrolled in the program by 1990/91. It remains to be seen whether program managers can induce this amount of land into the reserve, but this is the minimum acreage for the CRP that has been targeted by the 1985 Act.

To estimate the regional and commodity distribution of future enrollment, rules were established to estimate future sign-up for the CRP. The proportion of new enrollment coming from any state is varied with the state's proportion of eligible highly erodible cropland that has not yet enrolled and with the state's proportion of current CRP enrollment. It is also assumed that the distribution of enrollment by crop within each state remains the same as it has been in the past. Because the future enrollment is likely to include a higher quality of land than in the past, it is assumed that the government will have to raise the acceptable rental rate by an average of 25 percent on future sign-ups in order to achieve the 40 million acre target.

The results of these assumptions is that future enrollment depends more heavily on sign-up in the Corn Belt and less heavily on the Mountain and Northern Plain States (Figure 3). By implication a relatively larger share of the new enrollment would out of corn and soybean area and relatively less out of wheat area.

An important aggregate effect of the expansion of the CRP is that a larger proportion of idle acreage in the future will be in long-term programs and a smaller portion in annual acreage reduction programs (Figure 4). In crop years 1987/88 and 1988/89, the CRP accounted for only one-fourth to one-third of total idled acreage. From 1990 onward, it is expected that the CRP will account for two-thirds or more of the idled acreage in the U.S. This would make it more difficult in the future to adjust the acreage reduction programs quickly in the event of a drought, such as occurred when the acreage reduction program rates were drastically reduced for 1989. Generally, this would lead to a production environment in which the excess production capacity is more insulated from the market and there is greater potential for market strength and price variability. In spite of the continued idling of relatively large areas of land, the real commodity prices in the FAPRI projections are flat or declining slightly over the next decade.

Figure 1: **Spring 1988 CRP Enrollment**
25.53 Million Acres

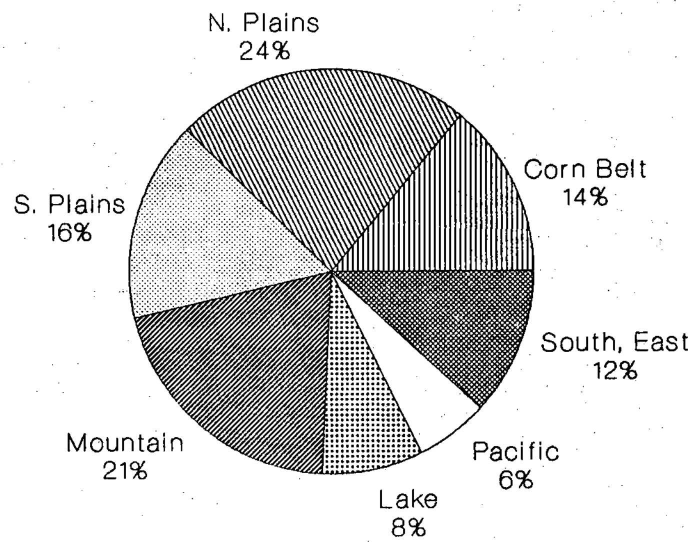


Figure 2: **CRP Enrollment by Crop**
1990/91 Total: 40 Million Acres

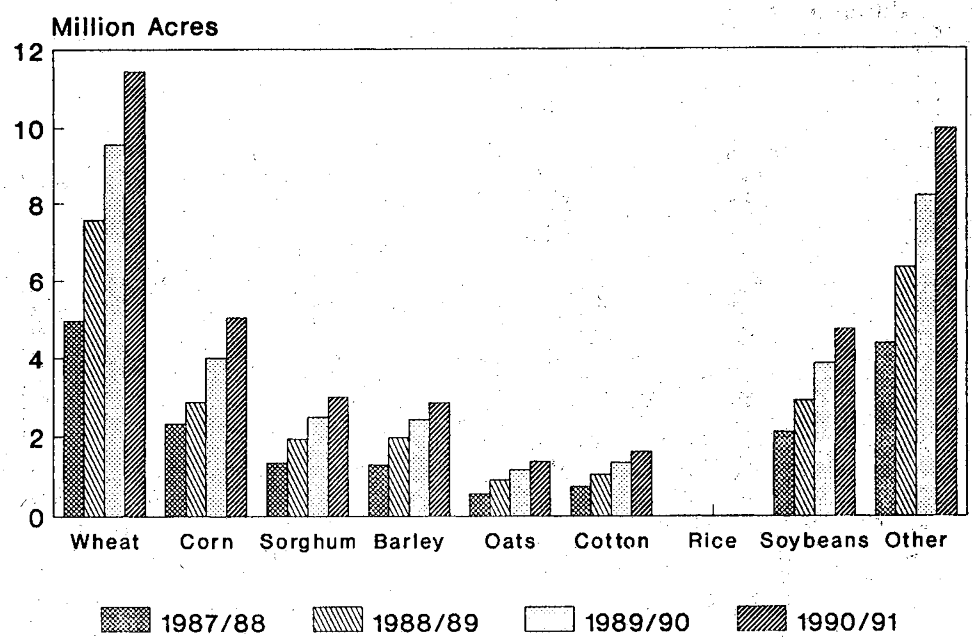


Figure 3: **Future CRP Enrollment**
14.47 Million Acres

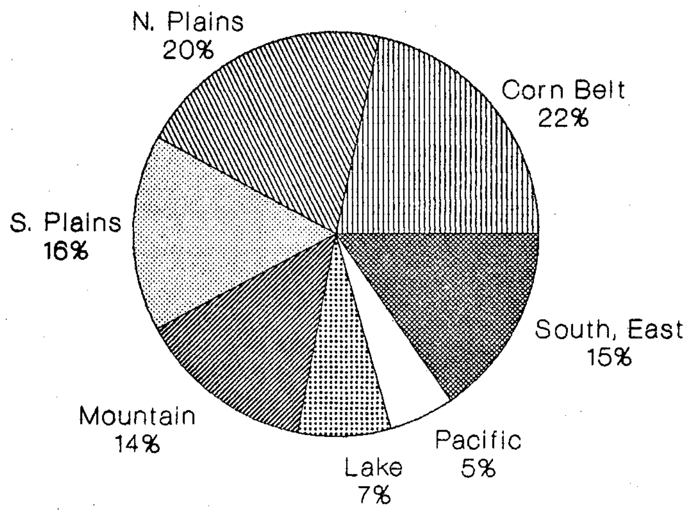
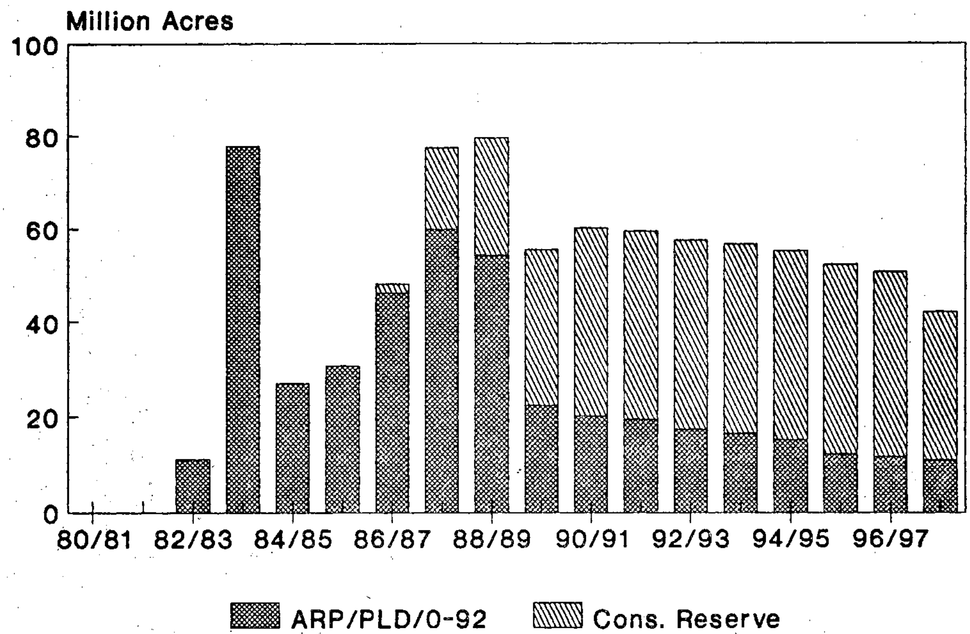


Figure 4: **Acreage Idled by Gov't Programs**
15 Principal Crops



Impacts of a CRP Expansion

Both environmental and farm interest groups and the Congress are generally pleased with the way the CRP has worked. Some proposals have already been made for an expansion of the CRP in future legislation. The potential effects of such an expansion are evaluated by increasing the CRP by an additional 20 million acres over the period of 1989/90 to 1991/92. The impact of this change in the level of CRP provides some insights into the impact of the current CRP program on land use and commodity markets.

Of the total 20 million acre expansion in the CRP, 15 million acres are estimated to come out of the eight major program crops (Figure 5). Planted area in these crops declines by about six million acres in the long run. One reason for the diluted effect of the increased CRP on planted acreage is that the annual acreage reduction programs nearly disappear as prices increase and participation rates decline. The net effect of these adjustments is that total acreage planted and idled for the major program crops increases by more than three million acres (Figure 6).

The consequence of lower plantings and production is lower stocks and higher commodity prices. Crop prices increase by about 10 percent in the long run (Figure 7). Corn and soybean prices increase proportionally more than other commodities, because a high proportion of the increase in CRP acreage occurs in the Corn Belt rather than the Great Plains. After a delay of approximately two years, the index of livestock prices begins to increase and eventually exceeds the baseline by about 4 percent as a consequence of the higher feed grain prices (Figure 8).

Although deficiency payments decrease as a consequence of higher crop prices, these savings are approximately offset by increases in the cost of the CRP. The net effect is a relatively small estimated impact on the cost of government programs including the CRP (Figure 9).

For similar reasons, government payments to farmers don't change substantially, since lower deficiency payments are offset by higher payments for CRP acreage. However, receipts from livestock and crop marketings increase as a consequence of higher market prices. The net effect on income is, therefore, a net increase of three to six billion dollars annually over the years following the implementation of CRP expansion (Figure 10).

It is important to note that this scenario was evaluated off a pre-drought baseline in which there were larger stocks available to buffer the tighter markets that result from the increase in the CRP acreage. Given a post-drought baseline, it is to be expected that the increased CRP would result in even tighter market conditions and certainly in more potential for price volatility.

Figure 5: **Change in Area Planted for 8 Major Crops**
(CRP - Base)

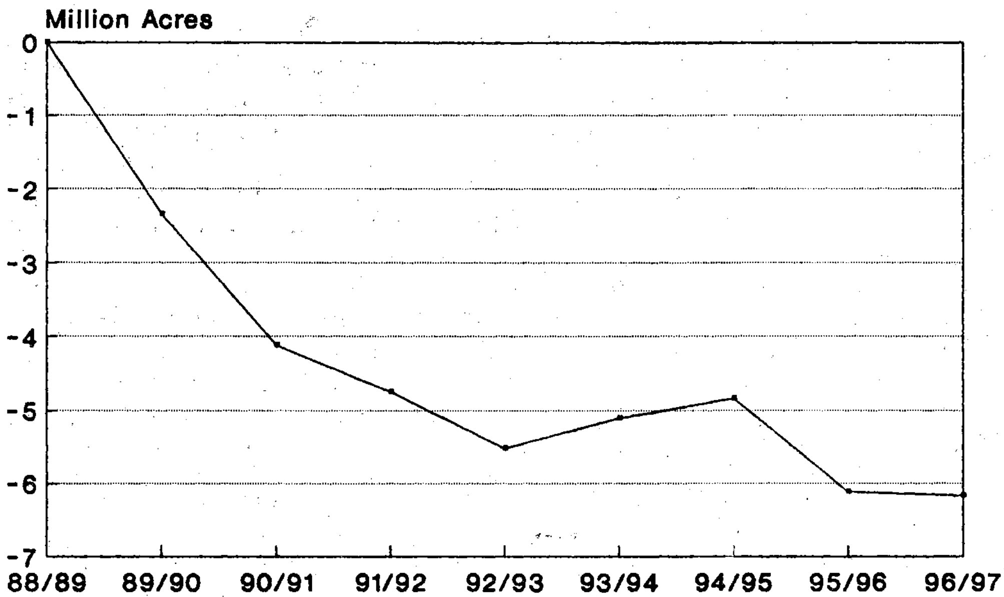


Figure 6: **Change in Total Area Planted and Idled for 8 Major Crops**
(CRP - Base)

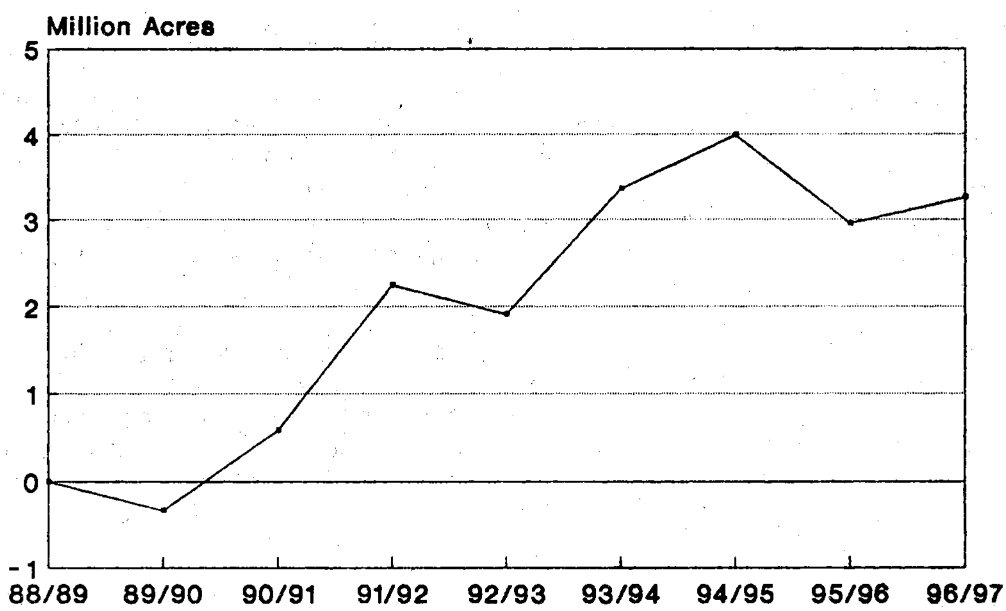


Figure 7: Percent Change in Price Index for 8 Major Crops
(CRP/Base)

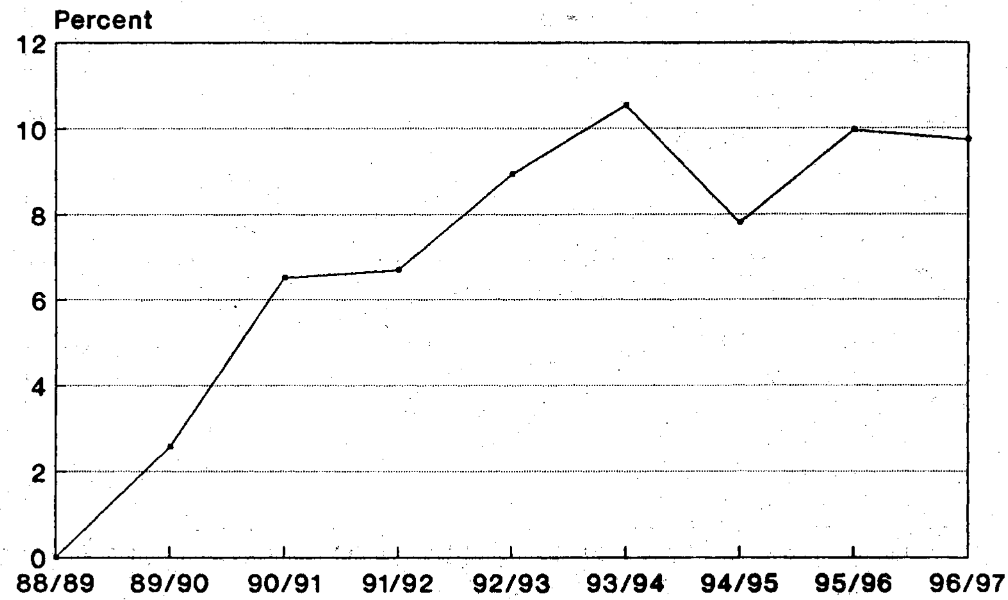


Figure 8: Percent Change in Price Index for 5 Livestock Products
(CRP/Base)

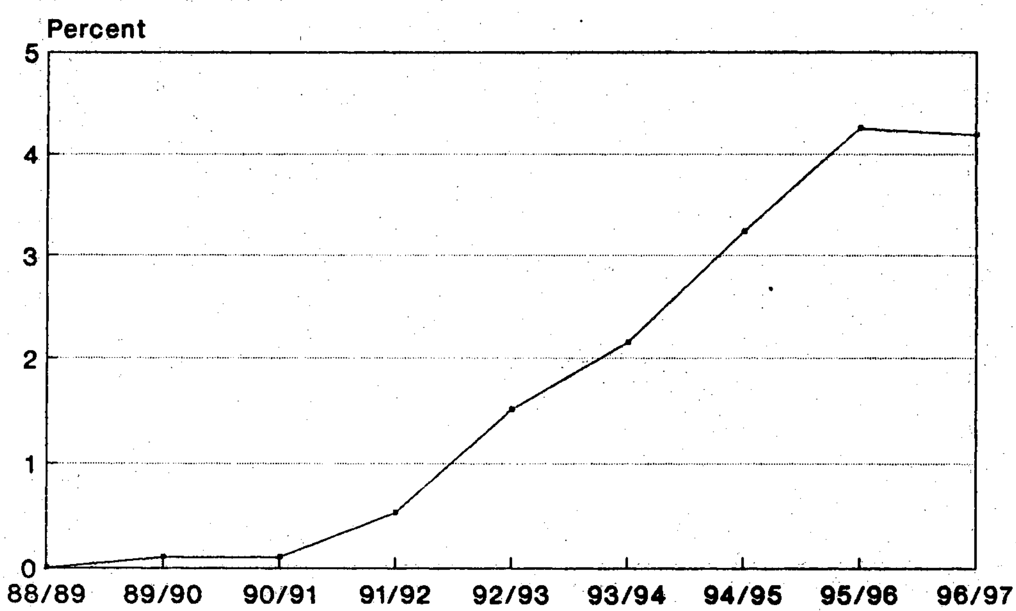


Figure 9: Change in Total Government Costs
(CRP - Base)

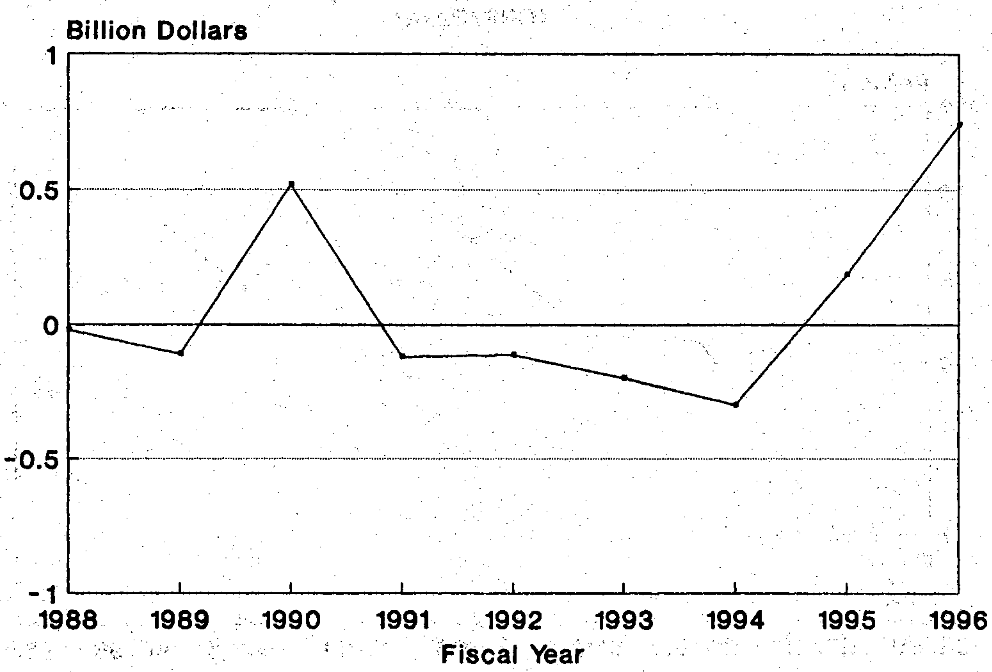
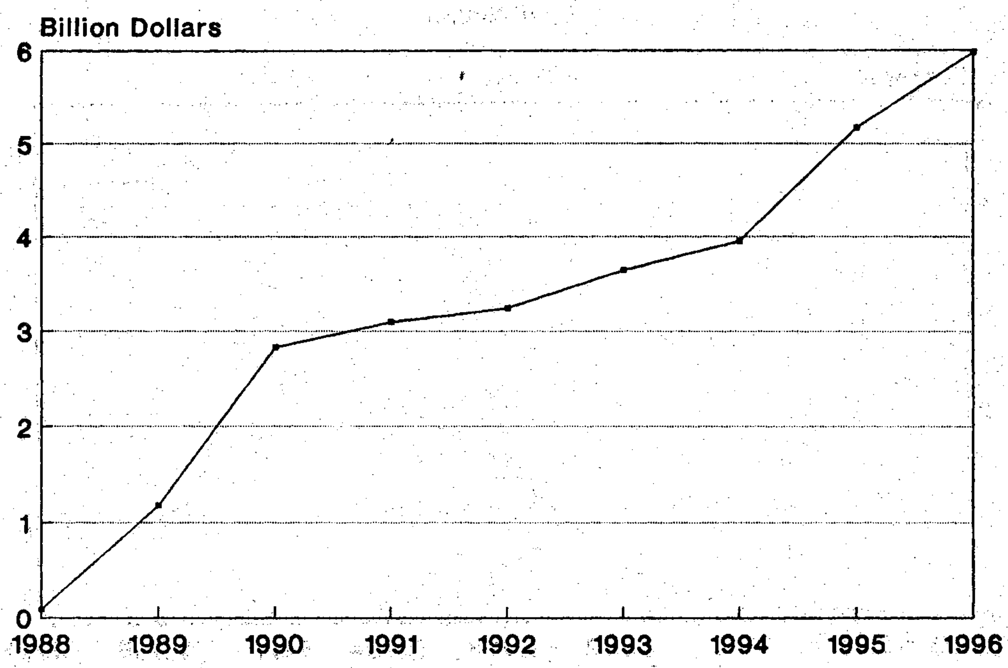


Figure 10: Change in Net Farm Income
(CRP - Base)



CONSERVATION COMPLIANCE PROGRAM

In addition to programs for the complete removal of highly erodible cropland from production, the 1985 Food Security Act includes Conservation Compliance (CC). CC discourages production of crops on highly erodible cropland if the land is not adequately protected from soil erosion. Production on highly erodible cropland without a locally approved soil conservation plan may prevent the operator from receiving agricultural commodity program benefits. With the assistance of Soil Conservation Service (SCS) guidelines and personnel, annual conservation plans must be developed by 1990 and implemented fully by 1995. Without this compliance, a farmer is ineligible for commodity program benefits.

Conservation planning entails implementation of resource management systems. A resource management system is a combination of conservation and management practices that are conditioned on the primary use of the land and will protect, restore, and improve the soil resource base by meeting acceptable soil loss rates or water quality standards (USDA, 1987). Conservation treatment systems implemented on the farm soil resource base are designed to control the greater of the erosive forces (water or wind) so that estimated erosion does not exceed a designated soil loss tolerance level for the dominant farm soil. Conservation systems are erosion control components of resource management systems and are the minimum standard for compliance with the 1985 FSA (cross-compliance) provisions linking conservation to farm commodity program benefits.

ARIMS Assumptions and Conservation Compliance Scenarios

ARIMS is a large-scale national linear programming model and several supporting data sets and models (English et al., 1987). This set of models simulates economic activity in seven sectors of U.S. agriculture: crop production, livestock production, pasture/range production, irrigation requirement and costs, land availability, final and intermediate commodity transportation, and demand. Exogenous national and export demand projections are from FAPRI (1988) commodity market models. The ARIMS finds the least-cost method of producing for a specified set of demands, given technology and land base availability.

The policy analysis involves comparing the long-run equilibria for different sets of conservation compliance policy conditions. These are final or equilibrium outcomes. No attempt is made to describe the path from the baseline situation to the solution of the model given all of the alternative policy scenarios.

The baseline to which other alternatives are compared, simulates current farm policy continuing through 1990. A 45 million acre conservation reserve is taken out of the cropland base by 1990 for all scenarios. Crop acreage change constraints and upper bounds on adoption of conservation practices are included in the baseline and all CC scenarios. The crop acreage constraints reflect the distortion from the competitive least-cost solution which occur mainly due to commodity programs. These constraints are set to require at least 80 percent of the 1985-86 average crop acres by producing region. Tillage constraints reflect likely adoption rates by 1990. These restrictions are rationalized on the basis of institutional factors that affect the adoption decisions not being modeled.

There are two erosion restriction scenarios in this analysis. Baseline assumptions are maintained, however, the CC scenarios evaluate a 10-ton per acre soil loss restriction and a 5-ton per acre soil loss restriction. These erosion restrictions reflect the CC rules of the 1985 Food Security Act. For this study it is assumed that the erosion restrictions are mandatory for all land uses generating excessive erosion levels. The model can choose the crop-practice-land type combination to meet the mandatory erosion restriction while satisfying other constraints and demands for commodities.

It is important to note that ARIMS is formulated to use land resources in eight land groups based on capability class. As a result, the model may choose to idle some less productive, more erosive land groups, and concentrate production activities on more productive land. This would imply that ARIMS may find optimal solutions that are more efficient than empirically observed production practices, or production patterns that are not necessarily available in reality.

Impacts of Conservation Compliance

The conservation titles of the 1985 FSA formulate land use policies that influence resource adjustments with respect to how producers use available capacity and how intensively they use the land resource unit. Conservation compliance rules imply adjustments in which land is used considering potential erosiveness and also what technologies and practices are used in producing on the land. Where the CRP takes land out of production the adjustment is clear and straight-forward for the producer. Conservation compliance decisions, however, mean producers must adjust cropping patterns and technologies, and evaluate available input substitutions along with applying the management skills needed to protect soil resources as well as maintain crop performance. The implication is that resource adjustments associated with conservation compliance can be protracted and may be costly.

Erosion restrictions imposed on the model formulation reduced per acre soil erosion in both scenarios compared to the baseline. For the nation as a whole, soil loss averaged 7.4 tons per acre in the baseline. Erosion rates were reduced by 32 and 45 percent respectively for the 10-ton and 5-ton restricted scenario (Figure 11). Regional impacts of soil loss restrictions indicated that in regions where per acre soil losses associated with wind and water action was highest, erosion reductions were greatest. Soil erosion from water action (sheet and rill) was greatest in the Southeast, while wind erosion was the primary concern in the Plains and Mountain States.

Acres of cropland in production of all crops increased in both conservation compliance scenarios compared to the baseline (Figure 12). Expanded use of cropland in the 10-ton scenario amounted to 0.5 percent above the baseline, which is 1.5 million acres. For the 5-ton scenario, expanded use of cropland was 0.3 percent or approximately 1.0 million acres. The additional land in production came from a mix of available capacity in potential cropland, highly erodible land going into idle land categories, and less erodible land coming out of idle land categories. The use of double cropping increased in the 5-ton scenario as a practice to control erosion.

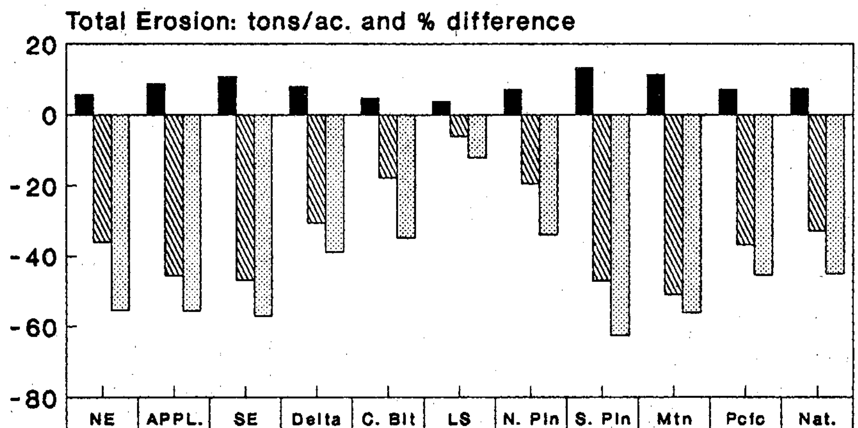
Total costs were greater in meeting erosion restrictions while still satisfying national commodity demand. Total costs include crop costs, livestock costs, transportation and land improvement costs. Compared to the baseline, total costs were 2.2 percent higher for the 10-ton scenario and 3.9 percent higher for the 5-ton scenario (Figure 13). Increases in the crop production costs were somewhat greater still, at 3.3 percent for the 10-ton scenario and 6.1 percent for the 5-ton restriction level. These higher production costs were in part attributable to the higher costs of applying conservation treatments relative to conventional cropping methods. Some of the increase was due to production on expanded acreage.

Estimates indicate that with the imposition of conservation compliance there would be some increase in the level of applied inputs. National estimates for fertilizer applications show nitrogen fertilizer increased approximately 5.6 percent in the 5-ton scenario (Figure 14). This can be attributed to both more intensive application levels and more intensive annual use of crop acres by double cropping. Overall, application rates of pounds of nitrogen per acre increased approximately 5.2 percent. In the Corn Belt and Northern Plains, the percentage increase was slightly greater than national levels. Conservation practices typically show a substitution of pesticide inputs for machinery and labor inputs in production.

Conservation treatments employed to meet erosion restrictions required shifts to alternative cropping practices. National estimates for the use of conservation practices shown in Figure 15 indicate that while straight row practices are normally the dominant cropping method, there was a shift of 25 to 50 million acres toward contour and strip cropping systems. The use of strip cropping patterns was the dominant strategy used to meet erosion limits and is shown in Figure 15 as a 39 million acre increase in this practice. These conservation practices are sometimes used in combination with soil saving tillage practices. Given limits on allowable erosion, less fall plowing and a higher use of spring plowing and conservation tillage methods is indicated (Figure 16). For both erosion restriction scenarios, however, there was a lower use of zero tillage methods. The zero tillage practice is at some disadvantage compared to other conservation systems because of higher costs of applied inputs and the difficulty in achieving high yields because of limited seed bed preparation.

Figure 11: Total soil Loss Per Acre

Conservation Compliance Scenarios



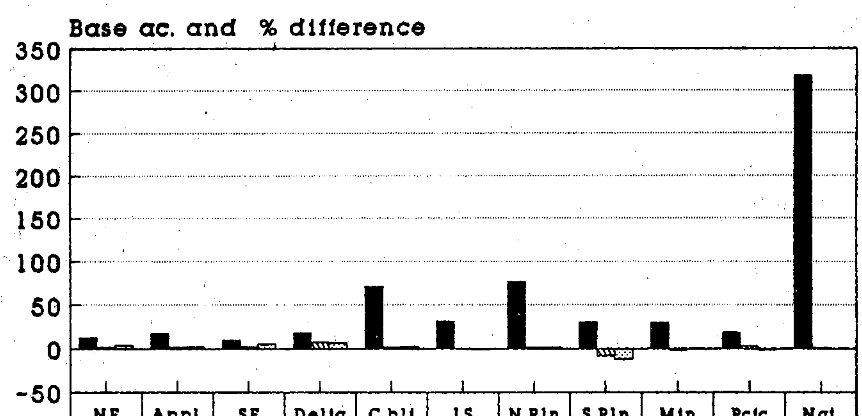
	NE	APPL.	SE	Delta	C. Blt	LS	N. Pln	S. Pln	Mtn	Pcfc	Nat.
Base tons/ac.	5.5	8.7	10.7	8	4.7	3.8	7.1	13.3	11.2	7	7.4
10-ton %	-36.1	-45.5	-46.9	-30.5	-17.8	-6.1	-19.5	-47.1	-51	-36.7	-32.8
5-ton %	-55.4	-55.6	-57	-38.8	-34.7	-12.2	-33.9	-62.5	-56.1	-45.3	-45.1

USDA Production Regions

Base tons/ac. 10-ton % 5-ton %

Figure 12: Land in Production

Conservation Compliance Scenarios



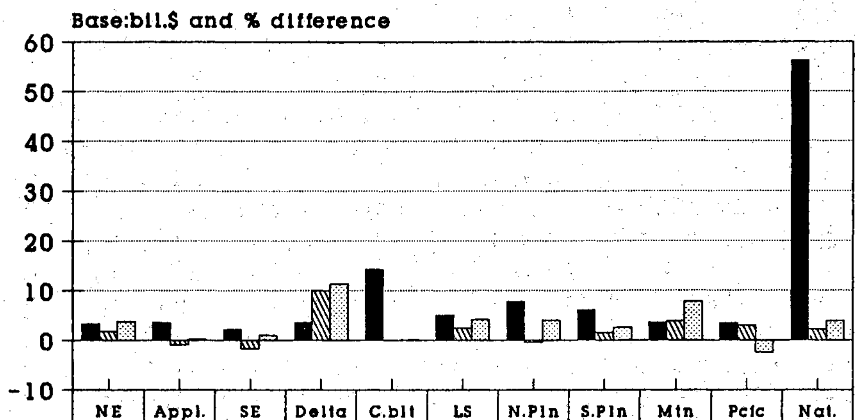
	NE	Appl.	SE	Delta	C.blt	LS	N.Pln	S.Pln	Mtn	Pcfc	Nat.
Base :mil. ac.	13	17.1	10.1	18.2	71.5	31.3	76.8	30.7	30.4	19.1	318.1
10-ton %	1.6	1.6	2.1	7.9	1.3	0.2	1.2	-8.1	-1.6	3.1	0.5
5-ton %	4.1	2.5	5.2	6.6	2	-0.6	1.2	-12.1	0	-1.1	0.3

USDA Production regions

Base :mil. ac. 10-ton % 5-ton %

Figure 13: Total Production Costs

Conservation Compliance Scenarios



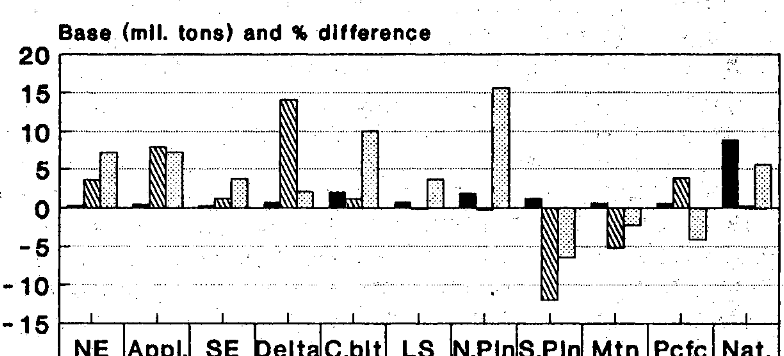
	NE	Appl.	SE	Delta	C.blt	LS	N.Pln	S.Pln	Mtn	Pcfc	Nat.
Base:billion $	3.3	3.6	2.2	3.6	14.3	5	7.8	6	3.6	3.4	56.2
10-ton %	1.8	-1	-1.8	9.9	0	2.4	-0.5	1.5	3.8	2.9	2.2
5-ton %	3.7	0.2	1	11.3	0.1	4.1	4	2.5	7.8	-2.5	3.9

USDA Production Regions

Base:billion $ 10-ton % 5-ton %

Figure 14: Nitrogen Fert. use

Conservation Compliance Scenarios



	NE	Appl.	SE	Delta	C.blt	LS	N.Pln	S.Pln	Mtn	Pcfc	Nat.
Base (mil. tons)	0.27	0.43	0.32	0.69	2	0.74	1.9	1.2	0.64	0.61	8.9
10-ton %	3.6	8	1.2	14.1	1.1	-0.1	-0.3	-11.9	-5.2	3.9	0.2
5-ton %	7.2	7.3	3.8	2.1	10.1	3.7	15.6	-6.4	-2.3	-4.1	5.6

USDA Production Regions

Base (mil. tons) 10-ton % 5-ton %

RESOURCE ADJUSTMENT IMPLICATIONS

The results of the analysis indicate that both the CRP and the CC provisions in the Food Security Act of 1985 have resource adjustment implications. Because of the bidding system used to implement the CRP and the emphasis on idling erodible crop land, land idled in the CRP comes more heavily from certain regions of the country (Plains States) and more heavily from certain crops (wheat). This differs from the annual acreage reduction programs which are based on a certain percentage of participants' base acres regardless of where in the country it is located. Insofar as the CRP reduces production and strengthens prices, it also can have the effect of increasing the intensity of input use in the remaining planted area. It is also a desire of policymakers that the long run nature of the CRP leads to these CRP lands being removed from production permanently. To encourage this result, producers are encouraged to take steps that would move the land permanently into other uses, such as tree crops or wildlife habitats. A permanent shift in the land use pattern does not yet appear to be making significant progress under the CRP.

The conservation compliance provisions are still at a relatively early stage of implementation. If the relative benefits of commodity programs continue to decline and the conservation compliance plans mandated by the government appear to be too costly, producers may simply decide not to participate in government programs and thus avoid the conservation compliance provisions. The results of the analysis indicate that conservation compliance clearly influences cropping patterns and choice of technologies as well as rates of soil erosion. While production cost increases of 2 to 4 percent seem relatively small, the percentage decline in net farm income could be more than twice as large.

The impact of the conservation compliance will, of course come to depend on how many producers continue as participants in government programs. It will also depend ultimately on how the provisions are implemented and enforced, which is still in the process of evolving. It is unlikely that in its current form, conservation compliance provisions will have as an important impact on resource adjustment as does the CRP. However, other more stringent provisions could be adopted in the future as a consequence of political pressures from environmental interests. As indicated in the analysis, a widespread program of this type would be expected to influence cropping patterns, tillage practices, and the profitability of production in different areas of the country.

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CHAPTER 12. PROGRAMS TO SUPPORT A POLICY OF ADJUSTMENT ASSISTANCE

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Henry A. Wallace, speaking to the American Farm Economics Association on Dec. 28, 1922, captured the essence of the agricultural adjustment problem when he said:

> "I clearly recognize that in the long run every economic evil creates its own cure. If prices of farm products continue sufficiently long enough below cost of production, there will eventually be forced into bankruptcy enough farmers so that there will be no longer a disastrous surplus. At the same time there will be readjustments of land values, wages, etc., which will lower the production costs. Economic affairs always work themselves out if you leave them alone. However, it is equally certain that they will work themselves out even though you tamper with them. The disadvantage of tampering is that those who do the tampering are likely to be reviled by about half the population."

Wallace's statement remains as true in 1989 as in 1922, yet we are looking for new ways of tampering with the market. Why is it that agricultural adjustment has been a topic of discussion for 67 years? Why haven't we found the solution? What are we adjusting from? What are we adjusting to?

To address these implicit questions suggested by the title, I have divided the paper into major sections concerning where we are, how we got here, what we might expect to achieve by adjustment, how adjustment might be achieved, and what we might need do after we get there. Let us first consider where we are with respect to intervention in agricultural markets.

WHERE ARE WE?

Agricultural commodity programs have never been directed at resource adjustment. Rather they have, since 1929, been most consistent in their attempt to support incomes of commercial producers of certain specific commodities. Over their 60 year history, they have provided varying price floors for program commodities and these floors have resulted in more production than could be sold at the support price. The excess was stored under nonrecourse loans. To offset the extra production, output control programs were instituted, usually through acreage reduction. When prices were allowed to approach market levels direct income payments under various names are used to support income and encourage participation in acreage reduction programs.

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[1]The views expressed in this paper are entirely those of Mr. Reinsel and do not necessarily represent the view of the Economic Research Service.

The net result of the programs is that incomes and asset values are higher than they would be in the absence of the programs. And, more resources are committed to the production of the supported commodities than would be used in the absence of the programs. However, despite the programs, real prices of commodities have continued their long-term downward trend.

From 1860 until 1989, wheat prices experienced 4 major shocks that caused major short run upward spikes in prices (Figure 1). These were the Civil War, World War I, World War II and the Russian Grain Deal of 1982. These shocks plus the radical upward adjustment in nominal price supports from 1933 to 1949 and again from 1973 to 1982 obscured the underlying conditions in the market. That is, output was increasing faster than domestic consumption and exports. The impact of rapidly changing technology and a huge expansion in acreage and production, pressing against a declining demand in the 1920's, signaled the need for fewer resources, but as the market was functioning to cause resources to leave, we found a way to prevent the price signal from being recognized.

The inability of the commodity price support programs to deal with the underlying issues of excess capacity becomes clearer when we observe the direction of real prices (Figure 2). Viewed over a perspective of 120 years the impact of market forces is dramatic. The effect of expansionary agricultural development policy that made land readily available, that provided cheap power for production and transport, and the changes in varieties and fertilization overwhelmed the growth in demand. In spite of the income support programs, resource adjustment occurred. As real prices of agricultural commodities and real income to the sector have trended downward, over 4 million farmers have disappeared and most of their assets, except their land, have gone with them. New land has been developed, farms have become larger, new technology has been introduced and output has grown at 2 to 3 percent per year while consumption has lagged at 1.5 to 2.0 percent. Tax laws, including investment credit and accelerated depreciation, which subsidized investment in machinery and equipment resulted in the rapid development of irrigation in the plains. Water subsidies resulted in the development of California, Washington and Arizona. Output in the late 1980's continues to exceed consumption because support levels are above the long-run free market price level.

Although protection against price variability has often been cited as a major objective of programs, no consistent policy relative to price variability has been legislated by Congress or developed by farm groups or the several Administrations since the 1930's. Prices have merely been truncated on the lower end of the distribution by the nonrecourse loan rate.

The evidence available suggests that (1) the cost of the programs has been higher than some thought desirable, (2) the benefits of the programs go to producers with large farms, and, (3) programs support income, but do little to lessen price variability or provide for stable budget cost.

HOW DID WE GET HERE?

In the 1920's, U.S. agriculture underwent a rapid decline in demand for exports. At the same time, tractors, trucks and autos were replacing horses and the demand for horse feed declined sharply while the supply of commodities reaching the market expanded. The combined effect was a sharp decline in real prices which placed agriculture at a significant disadvantage relative to the nonfarm sector. Rather than let prices cause resources to adjust, farmers sought aid from the Federal government to offset a perceived inequity.

Although forewarned by Wallace about tampering, the first serious attempts at manipulating the market were developed by George Peek who sought a policy of equality for agriculture. During the 1920's, Peek put together and led the fight for an export dumping scheme that was to become the McNary-Haugen Bills. Introduced 5 times in Congress, and passed twice, the bills failed in securing enough votes to overcome Presidential vetoes on the fourth and fifth attempts.

As a compromise solution to market problems, Congress created the Federal Farm Board in 1929 to assist in the marketing of grain. However, the $500 million appropriation for grain purchases was not sufficient to induce price stability and, with inadequate financing, the Board was declared a failure.

The Agricultural Adjustment Act of 1933 was to be a self-financing program of price enhancement through supply control. However, the processor taxes, which were to make it self-financing, and the acreage reduction contracts, which were to control supply, were declared unconstitutional in the case of The U.S. vs Butler, often referred to as the Hoosac Mills decision.

Within two months after the Supreme Court decision, Congress converted the short-term program of the 1933 Act into a permanent program by passing the Soil Conservation and Domestic Allotment Act of 1936. Supply control (which the managers of the program viewed as resource adjustment) was now to be carried out under the guise of soil conservation and payments were to come from the Treasury rather than through new taxes. Conservation was to be used as a device to cut production and transfer income to farmers, however the 1936 Act had no real teeth and no real incentive in the supply control effort.

The first true agricultural resource adjustment program was the Resettlement Administration which was created by Executive Order No. 7027 on May 1 1935. The agency attempted to move producers out of marginal areas, such as the cut over areas of the Lake States and the mountain tops of Appalachia, to more productive farms or nonfarm jobs. Cooperative "Greenbelt" towns were created to assist the rural and urban migrants in finding low cost housing in urban areas. Lead by Rexford Tugwell, the Resettlement Administration moved into uncharted water by facing the resource adjustment problem head on. Excess resources were to be moved out of agriculture. However, the Agency's social planning activity, cooperative farming ventures and lack of legitimization by Congress caused it to be reorganized in 1937 into the Farm Security Administration (FSA) who's mandate arose out of concern for the landless tenant. Moving in the opposite philosophical direction from the Resettlement Administration the FSA, which had the primary aim of keeping tenants and low resource producers on the farm, brought the family farm to the center of the policy debate. However, the concern was to help the farm family secure sufficient resources to make a decent living from farming. The thrust of the program was to see that farms were large enough to support a family. (Today the objective seems to be to keep farms small enough not to be a corporation).

The goal transformation process which began in 1937 was completed in 1948 when the Farm Security Administration, minus any cooperative ventures, became the Farmers Home Administration which had the clear mission of retaining marginal producers in agriculture.

The second, but most successful resource adjustment program of the 1930's, the Tennessee Valley Authority (TVA), still exists, but with a greatly altered agenda when compared with its origins. As envisioned and operated it transcended power development, flood control, fertilizer production, soil erosion, reforestation, resettlement of people from marginal farms and the development of industry. It continues as a major force in the Valley, but its resource adjustment role has been sharply restricted.

All vestiges of true resource adjustment in agricultural commodity legislation disappeared with the Agricultural Adjustment Act of 1938 which legitimized the concept of parity for agriculture, formalized the nonrecourse loan and permanently institutionalized the objective of raising income through supply control. Since the 1920's, support for raising the share of income going to agriculture had rested on the premise that agriculture was disadvantaged relative to other sectors of the economy. To offset this disadvantage, income was to be transferred to producers of specific commodities through supported prices and direct payments for acreage reduction. Price supports at parity levels caused production to be greater than consumption.

The case for decoupling from fixed high prices, while still supporting farm income, was first made in the late 1940's by Secretary Charles F. Brannan. Known as the Brannan plan, his proposal was to allow prices to be set by the market and to make up the difference between the support level and the market price through direct compensatory payments. He also proposed a limit on the amount of the crop that would be eligible for payments. The plan encountered strong opposition because of the possible high cost of the direct payments and the prospect for sharply declining prices. An important and perhaps fundamental issue in the debate was over the issue of welfare payments to farmers. Direct payments as proposed by Brannan gave the appearance of welfare and the farmers preferred to avoid this by having the transfer come through higher prices.

Congress did not believe that free market prices and supplementary income payments would provide adequate farm income at a reasonable cost to the treasury. Fear of falling prices, after the removal of World War II price supports, resulted in the passage of the Agricultural Act of 1949, which kept price high while only modestly restricting acreage, thus allowing stocks to accumulate. Income was supported through the parity level of the nonrecourse loan. Price support, coupled with supply control, was to remain the basic farm policy.

Resource adjustment in the form of land retirement appeared as the Soil Bank-- Conservation Reserve and Acreage Reserve--during the 1950's and 1960's. The programs permitted the retirement of excess resources over a ten year period and some land left production permanently. Although Secretary Orville Freeman wanted to put a mandatory supply control program in place in the early 1960's, he did a 180 degree turn when the supply control referendum failed. As a result, he moved to a very market oriented loan program with prices supported by acreage reduction programs and income supported by direct payments to producers. A bid program for land retirement reduced the cost of the program. However, the volatile economics of the 1970's called new resources into production, driving prices for commodities well above support levels.

Agriculture programs from 1938 to 1985, by one means or another, attempted to establish a floor price for program commodities to address what was perceived to be a low income problem for the sector as a whole. A defense of the floor price was conducted by acquiring stocks and limiting production or marketings. However, a persistent problem remained. That is, it was exceedingly difficult, if not impossible, for policymakers to establish a floor price to both protect income and allow the long-run market price to exceed the floor to clear stocks from farmer and Government held reserves. This is not surprising because, to support income through price supports, demand must be inelastic and support prices must be higher than the long run average free market price. The inelasticity of demand has been a major source of problems in setting program parameters, because an implicit assumption of the programs has been that production variability would be sufficient to empty out the storage. However, this cannot occur unless supply (production) is somehow restricted. Thus, although the legislators and the program managers assumed the problem to be a low income problem, they relied on variability to extract them from the long run excess capacity problem, which they had, in part, created by the supply control effort. For most of the historical period, long run prices appeared to be below the floor price. As a result, stocks accumulated in Government ownership as nonrecourse loans were forfeited.

The focus on price as the trigger variable to initiate a Government action prevented the price from serving as a true signal for production in future periods. That is, current year prices were not a sound basis for forming expectations concerning future prices. Also, market allocation of the current year's crop was distorted because the distribution of expected price was truncated on the lower end and the expected price faced by the producer was necessarily higher than the price floor.

In an effort to move toward market pricing, Secretary John Block developed a proposal called the Agricultural Adjustment Act of 1981, in which programs were to be phased out quickly. This proposal was, for all practical purposes, ignored by Congress which passed one of the most tightly restrictive programs on record. With legislated loan rates and target prices moving upward at 9 percent per year over the life of the Act, producers thought they knew what to expect in the way of income for the next 4 years. The more they produced the higher their income. Production soared and stocks accumulated rapidly.

Emergency action by Congress and the Administration to cut the cost of programs and the buildup of stocks resulted in freezing loan rates. Loan rates were then reduced in subsequent years. Farmer expectations concerning income from the program changed rapidly in 1982 and 1983. With lower income expectations, land values declined, highly leveraged farmers experiencing lower incomes could not make their payments, and banks saw their security disappear as the real estate market began to collapse.

In contrast to the 1981 program, the 1985 Act recognized the fundamental problem of high fixed loan rates. The Act provided the flexibility to rapidly adjust loan rates downward, while supporting income through deficiency payments. However, the cost of supporting incomes of producers was transferred from consumers to tax payers by the reduction in loan rates and the rise in direct payments.

WHAT MIGHT ADJUSTMENT ACHIEVE?

At present, there seems to be a continuing belief by many policy analysts that a market oriented agriculture would be desirable if market orientation can be achieved without too much of a shock to producers and to the rural communities that support producers. However, there also seems to be agreement that a market oriented agriculture does not mean a total withdrawal of Government from commodity markets. What has not been established is the economic rationale for continued involvement of the Federal Government. Without a rationale the nature of that involvement has not been developed.

If adjustment is to occur its intent might be (1) to move resources out of the sector to bring the market in line with the long-run price trend while preventing the effects of current excess capacity from inducing excessive price declines. However, adjustment to long-run prices is made difficult by weather induced yield variability and programs are required to reduce the impact of yield variability on the market and to facilitate long-run price discovery. Also, because of structural excess capacity, the exit of resources from production as a response to long-run prices will not necessarily result in an improvement in income for the sector or for producers.

Moving toward the free market from a position of program induced excess capacity requires more than the abandonment of programs or the simple modification of existing programs. Choosing to allow real earnings to fall to the point where a large number of resources are forced out of the sector is a painful solution that has been unpalatable to even the most dedicated free market politician. Expanding demand at a rate fast enough to keep prices from falling appears to be an economic impossibility. Thus, the most feasible solution appears to be programs to induce resource exit and diversion along with a quantity stabilization program.

There are differing points of view as to how farm policy should be accomplished but there is little difference over whether or not there should be a farm policy. The basis for a future farm policy appears to be linked to widely held if somewhat ambiguous beliefs and the issues associated with them.

First, there seems to be a societal belief and general consensus that farmers should receive some degree of protection from the random force of weather. Weather is more of a factor in the production process in agriculture than in any other sector of the economy. It is beyond the control of individuals and the government. Input from weather is a factor in the market, but, it is non-economic because nothing was expended to bring about the change.

Secondly, there appears to be a societal need to hold some level of stocks against the possibility of a shortage of production. However, the private stockholding function is basically to balance production with consumption over the year, not to carry more than pipeline stocks from one year to the next. This suggests a potential need for a government stock management program. Neither the Government nor the farmer can correctly anticipate or forecast the outcome of a specific crop at planting time except by chance. Therefore, programs should be designed to be reactive to crop output instead of based on anticipated crop output.

Third, commodity prices have been supported above market clearing levels in the majority of years since the 1930's. Thus, the sector currently employs excess resources in the production of price supported commodities. It is the general desire of society that resources should be used as efficiently as possible. Thus, programs should encourage a more efficient resource mix and exit of resources from the sector.

HOW CAN ADJUSTMENT BE FACILITATED?

Currently, policymakers are searching for program alternatives that will reduce the cost of programs to the taxpayer while preventing the collapse of the farm sector. At the beginning of 1989, the search continues for ways to rationalize agriculture with the free market where resources will, presumably, respond to market prices.

The arguments concerning adjustment policy generally are focused on the desirability of providing for a market orientation and/or market equilibrium in agriculture on the one hand and maintaining some level of support for commercial producers of agricultural commodities on the other. There has not yet been agreement on the meaning of market orientation and the level of and distribution of support has not been established. It is unclear whether the orientation is to be with the competitive norm (the economists standard for measuring market performance) or with the free market, yet it seems that some programs will be needed to buffer producers from the full shock of changes in policy.

MARKET SIGNALS FROM COMPETITIVE MARKET

Most often it is argued that competitive markets will provide the correct signals to producers and consumers about how much to produce and how much to consume. The type of signal to be sent is seldom specified but most infer that prices are the appropriate mechanism to provide the signal. In a free and competitive market, where no buyer or seller is large enough to affect the market price and where everyone has equal and perfect information, output will be allocated among consumers efficiently by the changing market price signals (Figure 3). In Figure 3 the firms adjust in and out with no resource adjustment problems and as demand shifts the market price adjusts to equilibrate the quantity supplied and the quantity demanded. That is, it provides the signal that adjustments must be made. However, this theoretical framework assumes perfect knowledge and instantaneous adjustment to equilibrium which is simultaneous for long-run and short-run positions, i.e., there is no short run. Capital, labor and current expenditures adjust so that no excess resources are used in production. However, two fundamental problems in agricultural markets result in the inability of agriculture to arrive at a long-run economic equilibrium. The first is yield variability. The second is structural excess capacity.

Yield Variability Problems

The market for farm commodities has several features that depart from the rigid assumptions of the perfect market. Specifically, knowledge is imperfect; production and consumption do not adjust simultaneously; production is stochastic and, to the extent that it is affected by weather, random and normally distributed; and, there is not a fixed relationship between units of input and units of output. Although producers can plan for an expected output and, given sufficient experience, estimate how that output might vary, they have no basis for determining how much, or in what direction, output will vary in any one year until after harvest. Producers' planting decisions are based on an expected price and an expected set of cost relationships that would permit them, under expected conditions, to earn a return over variable cost sufficient to cover some or all of fixed cost. However, because of the random nature of yield variability, it would be coincidence if expected cost and actual cost or expected price and actual price coincided.

The quantity shock that occurs because of yield and weather variability is not a trivial condition. If no other changes occurred, weather would disrupt the market by bringing about a mismatch between expected and actual outcomes for yields, costs and prices. As a result, it often takes several production periods to determine the existence of fundamental market changes, that is, shifts in demand or shifts in supply caused by economic forces. Price signals relative to future production are distorted by the noneconomic yield shocks as the price allocates the actual production with demand rather than allocating what producers expected to supply.

Implication for Stocks Programs

Before the harvest, uncertainty about output for the season creates uncertainty about the level of stocks to carry into the next period. There is no optimal stock level for any particular year. Output for the coming season is a random variable so the optimal stock level is also a random variable. Programs to address the problem of quantity variability must, therefore, be designed to be reactive to output rather than anticipatory. Adding to or releasing from buffer stocks in response to changes in yield would stabilize the major source of food price variance in a closed system.

Under conditions when long-term supply and demand are in balance, the smoothing effect of a reactive policy to acquire positive increments to trend yield and store them until they could be disposed of in periods of low yields would result in stability of supply for the domestic and export markets. Such a stocks management program would minimize the impact of domestic weather variation on commodity prices. For example: a program could be developed to offer to purchase a quantity of output equal to the amount by which actual yield exceeds a moving trend projected yield times the planted acres. Purchases would be made at 85 to 90 percent of a five-year moving average price. Stocks acquired in this manner would be available for sale at 110 to 115 percent of the season average price at any time. Thus during periods of short yields stocks would be called back to the market by higher prices. By limiting the quantity acquired by the government to the positive yield deviation, or less, all other factors would be reflected in the market including demand and supply shifts as a result of technology or changes in macro or policy variables. If operated worldwide, such a program would provide reasonably stable food supply and prices. Theoretically, a buffer stock managed by a yield rule would stabilize prices with minimal interference with the market's allocative function. Prices would be free to respond to changes in demand [and changes in supply] and the allocative signals so generated would not be clouded by the noises of price changes in response to production variances occasioned by weather vagaries.

Worldwide rationality on stockholding policy implies that all producing countries would store the positive deviations from trend yield and dispose of them during periods of negative deviations. Storing more than the positive deviations from trend would require that in some year the market would have less available than had been planned for by producers or expected by consumers. Storing less than the positive deviations increases the probability of incurring a shortfall in stocks, because the positive increment from yield has not been stored but consumed. Thus, future consumption must be reduced below what it could have been if stocks had been retained.

If policy is changed, from supporting prices and thus encouraging excess production, to free market pricing, then the appropriate response to changes in export demand would be to allow the market to clear. However, the U.S. would stand ready to buy or sell the additions to or shortfalls from a moving trend yield on whatever acreage was planted at some percentage of a moving average market price. Under such conditions the U.S. would not export it's domestic weather induced quantity variability.

Heterogeneity Problems

The second major problem of the free market is structurally induced excess capacity which results from heterogeneity in the costs of production and marketing. Structural excess capacity induces disequilibrium and loss of resources from the sector regardless of the form of policy. In Figure 4 we see a cumulative distribution of wheat production for the quantity expected to be produced at varying levels of variable cost for 1986. The vertical line at 2.1 billion bushels is the actual 1986 production. The horizonal line at $2.44 is the season average price in 1986/87. The line at $3.69 is the season average price in 1981/82. The crosses show domestic use in other years and the diamonds on the right show production. The ragged line shows the quantity of wheat that would have been expected to be produced at varying price levels. That is, at $2.35 per bushel the U.S. would have expected to produce 2.3 billion bushels of wheat. In the absence of target prices and deficiency payments any price level less than $4.10 would be expected to drive some firms out of production while others continue to earn returns in excess of their production cost. The assets of the exiting firms would likely be recombined with those of the more profitable firms and production would likely expand or cost decline, or both, because of the efficiency of the acquiring firm. With no change in demand, price would likely decline and additional firms would be forced to exit. Continuing consolidation of assets would occur until a homogeneity of sorts was achieved or an oligopoly was developed which permitted some control of output. In such a structure, the least competitive firm would remain in production through allocation of market shares.

Implications for Programs

The fundamental issue with respect to structural excess capacity is whether to provide positive assistance to the structural change process or allow the market disequilibrium to cause the slow exit of resources. Without a positive adjustment program the adjustment process is likely to be extended and painful because of the fixity of resources in agricultural production. That is, the resources have few alternative employment opportunities.

A positive program that increased the freedom with which resources could leave the sector might bring about increased returns for the remaining resources while improving resource efficiency. As an example, a resource buy-out or lease-out program could provide a retraining or retirement fund that would facilitate the movement of farmers from farms and others from rural areas. A program that leased land on a bid basis for 5 to 15 years might bring about the retirement of land and the producer or assist the producer in finding a nonfarm occupation. In areas where more than 10 percent of the producers chose the lease-out program, an adjustment impact program could be developed that would buy-out or buy-down the assets of impacted firms and offer increased aid to those unemployed in the impacted area.

Noneconomic Objectives

An adjustment program must recognize that many goals of society are not economic and insure that these goals are not overlooked, while minimizing the potential conflict with market oriented programs. For example, a humanitarian goal of society is that no one starves regardless of their ability to purchase food. Achieving a goal of feeding everyone, means that output must be greater than the free market would be expected to provide, because those starving are not part of the effective demand. One method of providing this aid is to shift demand by transferring income to the disadvantaged through food stamps or other direct income transfers. Alternatively, supply may be shifted by making commodities available to certain segments of society at subsidized prices or by donations.

SUMMARY

The concept of agricultural adjustment as formulated in the 1920's and 1930's and the management of agricultural commodity programs over the past 60 years has been reviewed to show how agricultural adjustment has shifted in meaning, from adjusting production, to moving resources out of the sector and back to adjusting production.

Two factors that are present in the free market, structural excess capacity and a high degree of variation in commodity output due to weather provide a rationale for not choosing to move completely to the free market. However, if policy is to be market oriented policy in the future so that resources are to adjust, prices must move freely. Thus, price triggers cannot be used to implement program action. Quantity based triggers are required as the device to initiating action. Resource adjustment programs,as contrasted with varibility programs, must avoid both quantity and price triggers and operate directly to facilitate the movement of resources out of production and perhaps out of the sector through buy-outs, leasing or incentives to relocate.

Stability programs should be directed at the weather induced yield variability. To remove noneconomic shocks from the market, only the yield increment due to weather should be part of the government storage scheme.

Humanitarian motives may require that we induce either a greater supply than the market would produce or subsidize demand for those in danger of having insufficient to eat.

Regardless of the policy path chosen, market forces are likely to result in a continued exodus of resources from the sector as real prices decline.

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CHAPTER 13. SURPLUS CAPACITY AND RESOURCE ADJUSTMENTS IN AMERICAN AGRICULTURE: A SUMMARY VIEW

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An overall summary of the papers contained in this proceedings, taking great liberties, might go like this:

- o aggregate excess capacity may not be that large currently
- o adjustments will continue to occur in response to prices and off-farm opportunities, just as in the past
- o policy has not been aimed at resource adjustment but rather at slowing adjustment
- o programs that impede adjustment lower profit potential for those remaining in agriculture

Obviously such a summary glosses over many of the nuances detailed in the excellent set of papers contained in this proceedings. But I think the summary points do provide a basis for thinking about what has been said and some point that may need further exploration and research.

A BRIEF SUMMARY

The papers elaborate on the point that current excess capacity may not be that great in terms of total production and aggregate demand. Tweeten argues that excess capacity is attributable to government involvement. The Economic Community's (EC) declining involvement of government is due to supply reducing policies as well as growth in demand related to increased income in other countries. Trends in supply and demand growth imply that real farm prices will continue to decline since the U.S. policy is currently to increase productivity. If demand increases do not keep pace with supply increases, there will be a need for policy adjustments to accompany productivity increasing policy.

Sutton, Young and Alt also make the point that production factor over-investment has occurred in agriculture due to government policies which encourage more resources to be used than would otherwise be the case. Those policies also enable existing owners to finance expansion and alter combinations of factors used to achieve economies of scale in their operations. Policy reforms that lower producer prices and eliminate set aside requirements create impacts on production capacity that require empirical estimation.

Low opportunity costs of land outside of agriculture may result in more land using, capital saving technology being adopted. That leads me to raise a question about the implications of the current thrust on low-input sustainable agriculture, and the need for further research on its potential effects both nationally and regionally.

Hallberg makes the point that farm families do adjust labor resources in response to changes in the farm income level, although there are impediments to resource adjustment in the short run. These impediments exist both from within and from outside of agriculture. The most important barriers to adjustment may be those imposed by outside forces. For example, government policy, economic opportunity and educational opportunity among others are forces from outside agriculture that have much to say about opportunities for adjustment.

The series of papers on regional adjustment issues indicate there is a need to analyze relative excess capacity regionally and by commodities. In particular, decoupling and trade liberalization may have impacts which vary a great deal by region or subregion, and by commodity or even varieties. For example, wheat for various uses is supplied by different varieties and qualities, i.e., all wheat is not suitable for all uses.

Further, impact analyses cannot focus on production implications alone, but also need to pay attention to economic development and opportunity implications from changes in policy. This is particularly true given the relatively low opportunity cost outside of agriculture for land and labor in sparsely populated areas. As Miller pointed out, this may well imply need for adjustment assistance, perhaps longer term in some areas than in others.

The regional adjustment issues suggest to me that we need not only research results that give us the capability of saying something about regional, subregional, state and commodity implications, but we need to mount an Extension public policy education program incorporating those research results. Otherwise producers, agribusinesses and policymakers will not understand the implications of various policy alternatives for their particular geographic area and commodity.

The point was made by House and Langley, as well as by Reinsel, that policy has not been aimed at resource adjustment, but rather at slowing adjustment. Resource adjustment programs need to be structured to not conflict with market driven adjustments that need to continue if excess capacity in agriculture is to be eliminated.

Since commodity programs are not directed to resource adjustment but rather at providing price floors for specific commodities, they result in more production than can be sold at the support price. Policies have then been instituted to control output. However, adjustment has continued with a downward drift in real prices as was also indicated earlier by Tweeten. Reinsel points out that the inability of agriculture to arrive at a long-run equilibrium revolves around two factors -- yield variability and structural excess capacity. The fundamental issue with respect to structural excess capacity is whether programs should be used to facilitate the structural change process or allow market disequilibrium to force a slow exit of resources from agriculture. Any adjustment program would need to take account of the many societal goals which are not economic while minimizing the potential conflict with market-oriented programs.

House and Langley remind us that producers are not the recipients of all program benefits from commodity programs, nor do they bear all the costs. Noting that programs to impede resource adjustment out of the industry lower the profit potential for those remaining, they indicate that a policy to impede adjustment can in fact hurt those it is intended to protect since it really distorts incentives. Lester Thurow, in a speech to the Social Science Agricultural Agenda Project Phase II Workshop (p. 203) argued that transition costs are now being levied on those staying in agriculture through declines in their net worth rather than the transition cost being borne by those leaving the farm economy.

This raises a question about whether those are acceptable outcomes or policy changes are needed to shift the incidence of transition costs. An equity issue is involved. Do you want the costs of the agricultural programs to be borne by farmers, by those exiting farming, by the taxpayer, or by the consumer? Certainly there are rationales that support continuation of farm programs. A public good rationale and a goal of equality of income for individual farmers are frequently cited for farm programs.

There are possible prescriptions for facilitating resource adjustment in agriculture, but a real question remains whether marginal adjustments of current law can do the job desired. As House and Langley argue, if transition assistance were to be provided it should clearly be of a temporary nature so that it is used to facilitate adjustment as opposed to facilitating staying in agriculture a bit longer. And steps must be taken to assure that any subsidy is small enough that suffering a problem to attain the assistance is not more attractive than reaching the end solution.

FURTHER RESEARCH NEEDS

I conclude from the preceding papers that there are a number of points needing further research and exploration.

Environmental Policy

Environmental policy issues including groundwater contamination, as well as food safety and health issues including chemical residues, will play a more important role in agricultural policy and food system decisions in the foreseeable future. This will be true not only in the U.S., but in the EEC countries, Australia, Canada and Japan as well. These issues may be less of a factor in the newly industrializing country and third world counties except to the extent exports to countries concerned about food residues may drive concerns in the latter two categories.

What are the implications of environmental concerns and food safety and health concerns relative to U.S. excess capacity? Research is needed on any changes in trends in chemical/labor/machinery inputs for production purposes. Hallberg's numbers indicate the possibility of some downturn in the last couple of years, but that could be partially drought related in 1988. Certainly some of that downturn has been cost driven as farmers seek to assure profitability in the face of lower crop prices. Will the direction of substitution or the relative changes in substitution differ if the concerns are environmentally driven? Might low input sustainable agriculture (LISA) be more land extensive? According to Schaller (p. 9), it will be more management intensive.

The research challenge is to determine whether analyses based on past relationships are likely to remain valid if we get somewhat rapid shifts in relationships either through the regulatory process or voluntarily in order to head off regulation of agriculture. This concern may be particularly relevent in the transition period, assuming that farmers will be able to adjust fairly rapidly to any changes in availability of chemicals for use in agriculture. They have shown remarkable ability to adjust in the past to technological change.

Are we doing enough research on management as a major factor in the production process? Especially to the extent that shifts away from commodities for which excess capacity exists imply producing less familiar commodities, management requirements may change. If non-farm uses of agricultural resources such as for hunting occur, is there adequate management capacity to make such transitions?

The reseach needs implied by the discussion calls for a more interdisciplinary systems approach to research with economists playing a lead, integrating role.

Comparative Advantage

Do we really understand in which commodities the U.S. has a comparative advantage? The question becomes more important as trade liberalization and decoupling evolve. Are there policy adjustments or managerial changes which can create or increase comparative advantage?

Government Intervention

Since it has been argued that excess capacity is a function of government intervention in markets, we must recognize that we measure excess capacity with an emphasis on prices and adjustments driven by relative prices. An efficiency concept is used to determine whether or not excess capacity exists. However, agricultural policy has a number of objectives, both efficiency and equity based.

Assuming the desirability of some transition policy to ease adjustment burdens for those that need to exit agriculture, equity criteria need to be considered. Do we adequately understand the potential interrelationships between efficiency and equity concerns in dealing with excess capacity and transition out of agriculture to reduce it?

Distributional Impacts

Do we understand the likely farm sector and rural economic structural effects by regions, subregions and commodities deriving from both efficiency and equity concerns related to adjustment alternatives? What differences in potential impact are there between exit annuity and other "decoupling" approaches?

There is need to carefully analyze the distributional impacts of any transition policies. Commodity policy has been subject to criticism related to the distribution of benefits versus the perceived need of individual farmers. This issue relates back to the efficiency/equity interrelationships. But there is also need to analyze rural economic development impacts of any transition policies.

Researchers who may face vested interests of commodity producers within a state may be better off to work regionally in conducting impact analyses of policy changes. However, analyses need to focus on both subregional and state impacts, as well as on commodity and subcommodity impacts.

Internationalization

Increasing internationalization of agricultural and food firms is currently underway. Will this phenomena which appears to be accelerating alter the location of excess capacity? The ability of multinational firms to relocate processing capacity may create increased excess production capacity within the U.S. The regulatory environment may allow faster adoption of new technology outside the U.S. in some cases. The question that needs to be addressed is whether a fundamental change is underway that may alter the U.S. competitive position and excess capacity.

CONCLUSION

In conclusion, while excess capacity may be declining in U.S. agriculture there are significant research challenges as we continue to seek policies that may help achieve long-run equilibrium in agriculture. Macroeconomic, environmental, and international trade policies must all be given increased research attention relative to their implications regarding excess capacity in agriculture. Will these various policies differ in the future from the past in terms of their implications for agriculture?

Research is needed to guide policymakers in designing policies that assist in needed adjustment, do not impede needed adjustment and minimize undesirable effects of policies involving adjustment.

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