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AGRICULTURAL POLICY AT THE END OF THE 20TH CENTURY

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Introduction

According to Paarlberg and Orden, the principal cause of the “radical policy change” embodied in the Federal Agricultural Improvement and Reform (FAIR) Act of 1996 was a Republican-controlled Congress and favorable farm commodity prices (p. 1305). If these factors were the primary causes of change, we would expect a return to a Democratic Congress and lower farm prices to also return higher loan rates, supply control, and payments coupled to commodity prices in grain and cotton programs. In addition, we would expect continuation of status quo sugar, peanut and tobacco programs.

This paper contends that commodity policy reforms will continue and deepen after the FAIR Act expires in year 2002 because the root cause of reform is a fundamental change in the intellectual paradigm underlying agricultural policy. Also, a case is made in this paper that the global food supply-demand balance has changed in a manner facilitating continued policy reform.

The next section, describing the paradigm shift, is followed by a section on future aggregate supply-demand balance for farm commodities. Analysis then turns to expected future directions of public policy for agriculture, including options to improve on current and expected policies.

Paradigm Shift

Elements of the new agricultural policy paradigm initially were presented in *Farm Policy Analysis* (Tweeten, 1989), but are contrasted with the old public policy paradigm for agriculture in a recent article by Carl Zulauf and myself in the *Review of Agricultural Economics*. The old and new paradigms are compared for central economic concepts, beliefs, political situation and policy prescriptions in Table 1.

Central Economic Concepts. The old paradigm viewed agriculture as being in chronic disequilibrium. Willard Cochrane’s treadmill theory holds that forces of science and industry continually impose irresistible technological advances in agriculture which cannot adjust rapidly enough to avoid persistent low returns, excess production capacity and excess farm labor resources (Table 1).

Table 1. Old and New Public Policy Paradigm for Agriculture.

OLD PARADIGM	NEW PARADIGM
<i>Central Economic Concepts</i>	
Economic disequilibrium	Approximate long-term economic equilibrium
• Excess production capacity	• Economic efficiency
• Excess labor	• Importance of off-farm income
• Low rates of return	
<i>Underlying Beliefs</i>	
Farm fundamentalism	Democratic capitalism
Agriculture as family-farm way of life	Agriculture as a successful family business
Market failure	Government failure
<i>Political Situation</i>	
Pivotal voting power at margin	Increased reliance on monetary contributions and direct contacts with members of Congress and the Executive Branch
<i>Policy Prescriptions</i>	
Agricultural Policy Emphasizing Commodity Programs	Public Policy for Agriculture Emphasizing Market Efficiency
• Supply control	• Removing market barriers
• Government payments tied to production base	• Providing public goods and internalizing externalities
• Stock adjustments	• Promoting economic equity with safety net
• Food security through government	• Food security through private sector

Source: Tweeten and Zulauf (1997).

In contrast, the new paradigm views agriculture as nearer long-term equilibrium (it is always in very short-term equilibrium but never fully reaches long-term equilibrium) and recognizes that commodity markets work. Markets promote economic efficiency to provide food and fiber at low cost to benefit consumers and international competitiveness. It is not that forces of change have stopped; rather, the new paradigm recognizes that commercial agriculture adjusts quickly enough to avoid chronic low returns on resources. Empirical evidence that reasonably well managed

commercial farms earn a return as high as their resources could earn elsewhere, with or without commodity programs, provides strong support for the new paradigm. Economists increasingly recognize that farm commodities are rival and exclusionary *market goods* rather than *public goods* requiring government intervention. The new paradigm recognizes the importance of off-farm incomes to provide economic vitality for seemingly inefficient small farms.

Underlying Beliefs. With less than one percent of the nation's population, commercial farmers (the principal beneficiaries of farm commodity programs) are not in a position to dictate farm policy without approval of nonfarmers. Under the old paradigm, commodity programs for farmers were sanctioned because large numbers of nonfarmers subscribed to *farm fundamentalism*: the belief that family farmers are an essential part of our heritage and, hence, must be preserved. The belief that agriculture should be a family-farm way of life and that market failure was widespread also motivated public favor for agriculture in the political arena (Table 1).

In contrast, the new paradigm places greater emphasis on democratic capitalism, apparent today in the conservative shift in public policy. Agriculture is viewed more as a business, in part because of the widespread press given to corporate farming, vertical coordination and factory farms. The collapse of socialist states, the many scandals plaguing American government office holders, and the almost nightly exposé of government mismanagement on television news and on news magazine shows have shifted the focus from market failure to government failure.

Political Situation. Under the old paradigm, farmers did not have to rely just on farm fundamentalism; they could count on impressive economic visibility and ballot numbers in many rural areas. In 1950, farming contributed 20 percent or more of total county earned income in more than 2,000 of the approximately 3,000 U.S. counties (U.S. Department of Agriculture, p. 10). Although farmers were a small percentage of voters, in elections often decided by margins of one percent or less, they exercised pivotal voting power under the old paradigm. By the late 1980s, only 556 counties depended on farming for 20 percent or more of earned income.

Loss of voting power and the intellectual foundation for supply controls and transfer payments to producers has forced producers to rely more heavily than before on raw political power to support commodity programs. Agriculture continues to wield substantial political power, but the farm population is too small in many states to be decisive in all but the closest elections. This situation, along with erosion of the family farm public image, is shifting commercial agriculture under the new paradigm to the political mode of conduct of businesses such as Cargill or ADM. Such firms, lacking votes, wield political influence through political contributions, paid lobbyists (to contract members of Congress and the Executive Branch), and paid advertisements to create a favorable public image.

Future Economic Climate for Policy

Before examining policy prescriptions, attention turns to food supply-demand and economic climate for agriculture at the end of the 21st Century and beyond. Historic global yield and area trends for crops provide the foundation to project the future supply of food. Livestock and livestock products receive less attention in this section because livestock output depends heavily on crop output and because data on livestock productivity trends are meager. Subsequent analysis also examines historic and prospective trends in population and income components of food demand, which are compared with supply projections.

Supply of Food. *Net* global area in crops has remained quite stable since 1960 and is not very sensitive to price. The stable net area hides considerable expansion of cropland by drainage, deforestation and irrigation offset by losses of cropland to desertification, development and other uses. Although future demand for land is not explicitly measured in subsequent analysis, readers can infer possible needs for additional cropland based on the imbalance between trends in expected demand for food and expected supply of food from yield gains alone. Emphasis is on cereals, although yield trends have been analyzed for other crops (see Tweeten 1997 for details on this and other analysis in this section).

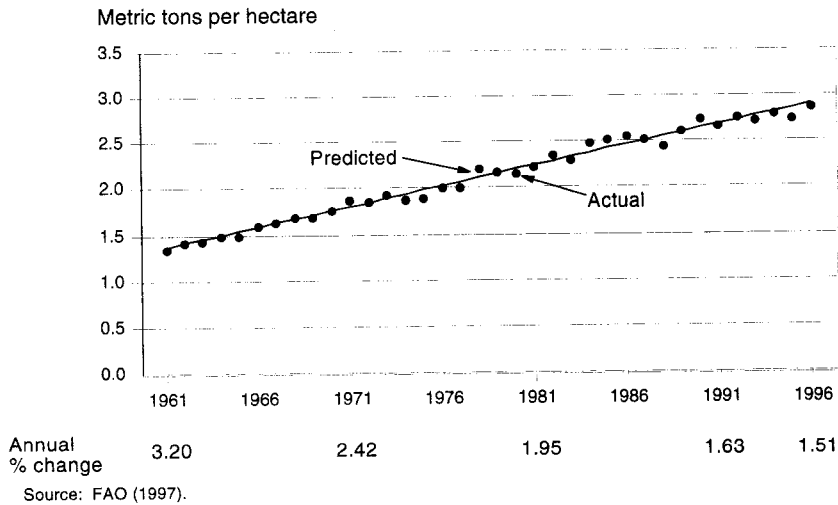
Cereals. Past cereal supply trends display notable characteristics:

- Almost all production expansion has been from yields in recent decades—global area in cereals was essentially the same in 1996 as in 1961.
- From 1961 to 1996, global cereal yields expanded around the straight line predicted by Thomas Malthus (Figure 1). The rate of gain averaged 44 kilograms per hectare per year.
- Clusters are apparent of approximately five years of flat yields followed by a sizable yield gain.
- The linear yield line implies declining percentage rates of yield growth. For example, the 3.2 percent trend growth rate for cereal yield in 1961 fell by half to 1.6 percent in 1991. If global population continued to grow at the 1.7 percent annual trend rate of 1991, the portents for world food security would be onerous indeed.

Other Crops. Yield graphs (not shown) for other crops also show linear trends apparent for cereals in Figure 1 (see Tweeten 1997 for graphs). Yield percentage gains for other crops are lower than for cereals. Like cereals, percentage rates of

yield increase were slowing although, unlike cereals, the rates of gain were not halved between 1961 and 1990.

Figure 1. World Yield for All Cereals, 1961-1996.



Livestock. Data comparable to those for crops in Table 2 are not available for livestock and livestock products. However, livestock offers only limited opportunities to expand productivity of agriculture. They require more resources per calorie of food than do crops. The Office of Technology Assessment (p. 18) projected the following growth rates in American animal production technology from 1982 to year 2000:

Annual growth (%)		Annual growth (%)	
Pounds beef per pound feed	0.2	Pounds pigmeat per pound feed	0.6
Pounds milk per pound feed	0.2	Pounds poultry meat per pound feed	2.0

If these rates are representative of world conditions, they provide little optimism that livestock productivity gains will improve food security. Nonetheless, livestock remain an excellent means to utilize land unsuited for crops, provide a buffer for consumption when crops fail, supply high quality protein and other nutrients, and are a favored food as income rises.

Table 2. World Crop Yield and Demand (Population and Income Per Capita) Trend Growth Rates by Selected Years.

Yield or demand	Historic				Projected					
	1961	1970	1980	1990	2000	2010	2020	2030	2040	2050
Supply (yield gain)	----- (Percent per Year) -----									
Crops ^a										
Cereals	3.20	2.48	1.99	1.66	1.42	1.25	1.11	1.00	0.91	0.83
Vegetables and melons	1.79	1.54	1.34	1.18	1.06	0.95	0.87	0.80	0.74	0.69
Pulses	1.01	0.93	0.85	0.78	0.72	0.68	0.63	0.60	0.56	0.53
Roots and tubers	0.82	0.77	0.71	0.66	0.62	0.59	0.55	0.52	0.50	0.47
Oilseeds	0.49	0.47	0.45	0.43	0.41	0.40	0.38	0.37	0.35	0.34
Total (weighted average)	2.78	2.18	1.77	1.49	1.28	1.14	1.01	0.92	0.84	0.77
Demand										
Population gain										
IIASA (Lutz <i>et al.</i>)	1.83	2.03	1.85	1.74	— ^b	1.47	1.13	0.87	0.67	0.51
UN (medium)	1.83	2.03	1.85	1.74	1.44	1.24	1.08	0.88	0.65	0.48
World Bank (Bos <i>et al.</i>)	1.83	2.03	1.85	1.74	1.47	1.28	1.09	0.91	0.68	0.57
Income effect gain	0.40	0.38	0.36	0.33	0.31	0.29	0.27	0.24	0.22	0.20
Total demand gain										
UN pop. plus income	2.23	2.41	2.21	2.07	1.75	1.53	1.35	1.12	0.87	0.68
Excess demand										
Demand less yield gain	c	c	c	c	0.47	0.39	0.34	0.20	0.03	-0.09
Price impact										
Price flexibility (3.0)	c	c	c	c	1.41	1.17	1.02	0.60	0.09	-0.27
times excess demand										

^a Extension of linear trend (see Tweeten 1997). Yields of livestock and other crops are assumed to increase at the weighted (by calories) average for the five crops shown.

^b Not predicted for year 2000.

^c Not included because depended on stocks, government diverted area, and other considerations not considered in this study.

Comment on Yields. In summary, global yield trends for crops and measures of livestock feeding efficiency provide a sobering picture for consumers. The hypothesis cannot be rejected that global yield trends from 1961 to 1996 are linear. In Table 2, projected yields are merely extensions of historic linear yield trends. Given that crop area is unlikely to expand without higher real prices for farm food ingredients, can the disappointing yield trends depicted in the previous paragraphs expand supply enough to meet the growing demand for food without higher real commodity prices?

Demand Trends. Demand for food is driven by two major components—population and income. Population growth is the more important of these two drivers.

Demographers are projecting a population trend turnaround: the world seems headed for zero population growth (ZPG) in the not too distant future after growing exponentially for at least two centuries. Table 3 shows the year and number of

Table 3. Total and Annual Food Demand Growth to ZPG from 1995.^a

Study	ZPG Population ^b (billion)	Years to ZPG ^b (Year[s])	Per capita food demand increasing: ^c					
			0.2%/year		0.3%/year		0.4%/year	
			Demand growth		Demand growth		Demand growth	
			Total	Annual	Total	Annual	Total	Annual
Mosher	7.0	35 (year 2030)	34	0.84	39	0.94	44	1.04
Avery	9.0	45 (year 2040)	76	1.26	84	1.36	92	1.46
IIASA (Lutz)	10.5	89 (year 2084)	124	0.91	144	1.01	167	1.11
UN (medium)	10.3	99 (year 2094)	124	0.82	147	0.92	173	1.02
World Bank (Bos et al.)	11.3	133 (year 2128)	163	0.73	201	0.83	243	0.93

Source: see text.

^a 1995 world population 5.6 billion.

^b When data from the source was incomplete, the ZPG population and year was projected using a quadratic equation fitted to available data.

^c See Tweeten 1997, Annex Table 1, for details.

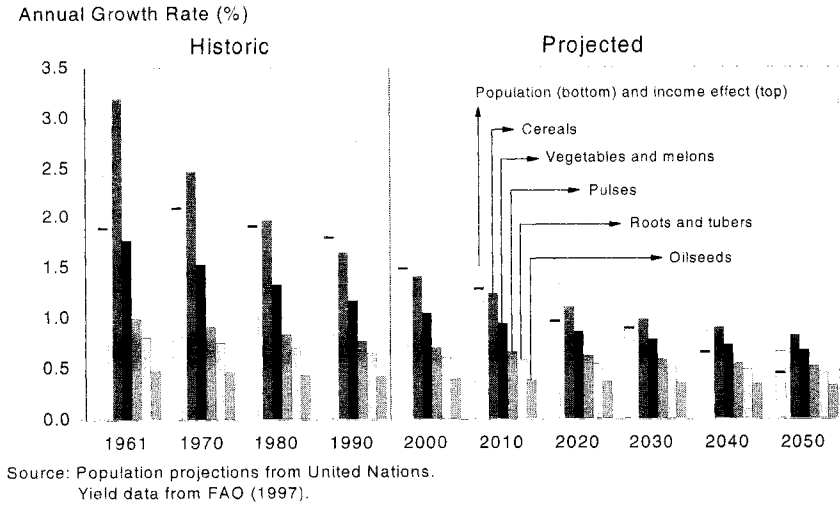
people when zero population growth is achieved as projected by the United Nations (UN medium), World Bank (by Bos et al.), International Institute for Applied Systems Analysis (IIASA by Lutz et al.), and by Steven Mosher (p. A-16) and Dennis Avery (p. 7). The five estimates for global ZPG range from year 2030 and 7 billion inhabitants by Mosher to year 2128 and 11 billion inhabitants by the World Bank.

Overall food demand depends on income as well as population. The most likely scenario is for global aggregate food demand to increase by 0.2 to 0.4 percent per capita annually on average due to rising incomes (Tweeten 1997). At a 0.3 percent rate, *per capita* food consumption gains by ZPG over the 1995 range from 10 percent (Mosher, president of the Population Research Institute) to 49 percent (Bos et al. for World Bank). Adding the impact of population growth to income, total demand for food is projected to increase from 39 percent (Mosher) to 201 percent (Bos et al.) from the 1995 level before ZPG is reached. The latter estimate implies that food production will have to triple from 1995 levels before reaching global ZPG.

At issue is whether expected demand increases will cause real commodity prices to rise—given the yield trend measured earlier. To address that issue, Table 2 and Figure 2 summarize global supply (yield) and food demand trends by decade to year 2050. Projected rates of yield gain are merely extensions of the linear yield trends from 1961 to 1996.¹ Population estimates in Figure 2 are medium UN projections. Per capita food demand increments from income are assumed to slow due to pricing pressures.

¹Population forecasts by Avery and Mosher are omitted from Table 2 and Figure 2 because they do not provide population estimates prior to ZPG.

Figure 2. Global Demand Growth Rates (from Income and Population) Contrasted with Crop Yield Gains.



Three supply/demand balance periods characterize data in Table 2 and Figure 2: first is prior to 1980, when cereal yield gains on average exceeded demand gains. Real commodity prices fell sharply and reserve capacity accumulated as diverted acres, storage stocks and subsidized exports. The trend reversed in the 1980s, but America had enough reserve capacity in commodity stocks and diverted acres to avoid increasing real food prices. Real commodity prices at the farm level were not much different in 1996 from a decade earlier, however.

Now that America's reserve capacity of diverted cropland, accumulated stocks and subsidized exports is spent, a second era, one of potential food insecurity, is apparent to 2030. On average, demand is projected to increase faster than yields. Without yield advances in excess of those anticipated, real prices for farm food ingredients are likely to rise to draw more land and other resources into food production.

A third period emerges after 2030. World demand is expected to increase 0.87 percent per year (medium UN population, 0.22 percent per capita demand growth) in 2040 and 0.68 percent per year in 2050, somewhat less than the projected annual cereal yield growth of 0.91 percent in 2040 and 0.83 percent in 2050 (Table 2).

The prospect of rising real farm and food prices is real, but warrants neither panic nor complacency. In year 2000, demand growth is likely to exceed all crop and livestock yield growth by 0.5 percent per year. A 0.5 percent global excess food demand growth would raise the real price of farm food ingredients 1.5 percent. The shortfall of yield growth below demand growth is less and, hence, price increments are less after year 2000.

Although real farm level food prices may rise in developed and developing countries on average for the next three decades, any increase is likely to be readily absorbed and, indeed, hardly noticed by consumers in developed countries. Americans, for example, on average spend only 2–3 percent of their income on farm food ingredients. Even a doubling (absurd) of farm food ingredient prices would reduce consumers' real income only 2 percent. However, rising real food prices are a hardship for low income families at home and abroad because they spend a much higher proportion of their income on food than does the average American family. Farmers benefit from price increases, but are cautioned against excessive bidding for land. Instability will continue to be the major economic problem for commercial farmers, and cyclical downturns in economic conditions could punish land market plungers.

Finally, it is important to note that distant predictions become especially unreliable. That unreliability could, of course, mean a more or less favorable food supply-demand balance than depicted in this analysis.

Policy Prescriptions

The review of economic concepts, beliefs and political situations in Table 1, coupled with projections of a generally tighter global future food supply-demand balance than in recent decades, helps to place future agricultural policy in perspective. Key issues are likely to be structural change, economic instability, environment, trade, research and rural development policy.

Structural Change. FAIR transition payments in conjunction with favorable farm prices and receipts in 1996 and 1997 provided sizable transitory income out of which farmers acquired machinery and other assets. While such preparation makes sense for a "rainy day," many operators found themselves holding excess machinery capacity and attendant debt. This happened at a time when machinery requirements per acre and per unit of output were being cut by conservation tillage, Roundup-Ready soybeans and other technologies. The consequence was substantial pressure for farm consolidation. Anticipating better future commodity and land prices for agriculture, many landowners preferred to rent out rather than sell their land. The result was increasing size and decreasing numbers of farms, an increase in the

proportion of rented land, and higher land rents and prices. One policy implication is that farm prosperity does not necessarily save the family farm.

Given a generally favorable economic climate, depicted in the previous section, for agriculture and the new paradigm recognizing that commercial farmers are capable of adjusting to emerging economic circumstances without incurring chronic low rates of return on their resources, continued “transitory” payments to farmers after 2002 are not justified on economic grounds. In contrast to tobacco, peanut and sugar programs, the grain and cotton programs were restructured because they must be competitive in export markets, had not made producers as dependent on them, and had depended on the Treasury rather than consumers for transfers. The public and policy makers are much more tolerant of opaque income transfers from consumers than transparent subsidies from taxpayers. Legislation in year 2002 likely will continue to reduce income transfers to grain and cotton producers.

As the interregional coalition or farm bloc of support for commodity programs under the old paradigm breaks down, the South will find political support for peanut, sugar and tobacco programs more difficult to sustain. The pressure will be keen to restructure these programs. A continued Pigouvian tax on tobacco and sugar is justified, however, to discourage currently excessive consumption, but proceeds of the tax appropriately would accrue to health providers rather than to producers. Structural adjustment could be especially painful for producers who have grown heavily dependent on these programs.

Milk marketing orders do not function well when the government no longer removes surpluses generated by blend pricing from the market. Reforms are underway, but the Northeast Dairy Compact does not appear to be an acceptable reform model because it restrains interstate commerce.

Economic Instability. According to Daryll Ray, “... if there was one thing analysts could agree on about the new farm bill, it was this: The bill will subject agriculture to increased price and income risk” (p. 89). He goes on to conclude that the impact of risk is “operators are unable to use their most efficient combinations of resources *post hoc* in order to produce the optimal mix of products in the short run” (p. 90).

Given the wide array of risk management institutions and strategies available to farmers and agribusiness today, with time it is conceivable that storage, forward pricing, insurance, diversification (including off-farm employment and investments), vertical coordination, leasing, liquidity and the like will enable farm operators to cope with risk so that it will pose no greater hardship under the FAIR Act than under previous commodity programs. As noted by D. Gale Johnson years ago, producers can find a more efficient resource level and mix to supply output under forward (fixed) commodity prices. However, such “efficiency” can be offset by an inefficient

product mix and level if prices are set at the wrong levels by central planners. Hence, forward pricing is best left to futures and options markets. The flexibility under FAIR to plant in response to emerging weather and market conditions has been welcomed by many producers. Though not a large or representative sample, the farmers I have talked to in Ohio say they do not favor a return to supply management even if farm prices fall.

For producers, I anticipate that year 2002 farm legislation will provide a safety net for grains and cotton with two principal features:

- Modest-level marketing loan with no government stock accumulation.
- Crop or revenue insurance provided through the private sector but with considerable government subsidy.

While this outcome seems likely, other options could further economic efficiency and equity. Farm operators are well aware that risk is endemic to farming. They are not welfare cases and can afford to pay for worthwhile risk management strategies. Insurance subsidies encourage uneconomic production in high risk areas, often on fragile lands better left in less environmentally-destructive uses. Publicly-supported crop insurance programs generate substantial waste and high administrative cost.

Despite the weak economic case for subsidized insurance, much political pressure will be placed on the government to address risks in agriculture. The challenge is to devise programs that are politically acceptable while reducing administrative, taxpayer and farm resource misallocation costs.

Carl Zulauf and I suggested an option patterned after the Net Income Stabilization Account (NISA) used in Canada. The program could be operated in conjunction with income tax collection to smooth net income of farmers from all sources. It would operate like an investment retirement account (IRA), with producers paying into the account (with modest government matching) in good years and drawing out in bad years. The program would have high target efficiency in stabilizing the “bottom line” for farm operators and net income from all sources, at low administrative cost. The program also has shortcomings such as lack of pooling of risk.

For consumers, especially in food-insecure developing countries, 2002 legislation is likely to continue the Food Security Commodity Reserve. That emergency food reserve, now including coarse as well as food grains, has been capped at 4 million tons for some years. Because Americans have sizable buffers even in the short run through private buffer stocks, exporting less, importing more, feeding less and slaughtering livestock, and haying or grazing Conservation Reserve Program (CRP) acres, it follows that the main beneficiary of the Security Reserve is less developed countries. If greater food security reserves are desired, an option is to

raise the Food Security Reserve above 4 million tons rather than return to the more costly and economically-intrusive former programs of acreage set asides or Commodity Credit Corporation stocks.

Environment. The FAIR Act extended the CRP at 36.4 million acres, but with greater emphasis than past programs on water quality and less emphasis on supply control. Dicks and Coombs estimate that only 18 million acres of U.S. cropland cannot be cropped with erosion below the soil regeneration tolerance rate of approximately 5 tons of soil loss annually per acre using “best management practices” including no-till (p. 55). A goal of CRP could be to enroll all such acres but, in the early 1990s, the CRP enrolled only 6 million of those acres. A second priority could be measures to improve water quality through, for example, filter strips.

A third priority is wildlife preservation. Given that the nation’s wildlife is generally in favorable condition and that four-fifths of the nation’s land is in range, forest and other uses more compatible with wildlife than is cropping, wildlife preservation does not appear to warrant the priority given to it in the new CRP. The wildlife priority causes reenrollment of land that was in the former CRP (because of wildlife established on such lands) rather than cost-effective targeting of soil erosion and water quality. Thus, instead of wildlife, a third priority could be to allow haying, grazing, recreation and other uses of CRP land consistent with soil conservation and water quality. Wildlife preservation could be achieved as a byproduct of soil conservation and water quality.

A phaseout of transition payments after year 2002 would pose difficult issues for environmental policy because the major incentives for participation in commodity programs and the attendant required Conservation Compliance (CC) program would be lost. CC has helped to protect the environment and is generally well received by participating farmers. Those farmers account for a high proportion of the nation’s cropland. A strong case can be made to continue Conservation Compliance. The chief issue is whether to make it voluntary or mandatory.

The best case for a voluntary program is that it gives freedom for producers to participate or not participate—a tradition tracing to the very origins of conservation policy in agriculture. I expect a major political initiative to maintain transition payments after year 2002 in the name of “green payments” to induce Conservation Compliance. A problem is that such payments likely would be distributed proportional to past payments rather than targeting environmental problems.

An alternative is to require Conservation Compliance on all cropland. The case for requiring CC is as follows:

- Requiring CC reduces “taking.” Off-site costs of soil erosion may average twice the on-site costs. An operator who allows erosion is “taking” from others by depositing sediment and chemicals in rivers, urban reservoirs and on “downstream” land. A mandatory CC would attempt to stop the producer from inappropriate behavior—taking from others.
- Modern best management practices, such as no-till or conservation tillage, allow much land formerly classified as highly erodible to be cropped at erosion rates below tolerance levels without loss of output or profit.
- The “stick” of CC is necessary to push the 18 million acres of cropland that cannot be cropped at erosion rates below tolerance levels into the CRP where farmers can be compensated for “taking.”
- Federal budgets are too tight and alternative budget priorities too pressing to afford green payments distributed cost-ineffectively.
- Requiring compliance aligns government environmental procedures in agriculture with those in other industries.

International Trade Policy. The Uruguay Round provided reforms such as tariffication of nontariff barriers, but the task of trade liberalization awaits tariff reduction under the new round of multilateral trade negotiations slated to begin in 1999 under the auspices of the World Trade Organization. However, prospects at this writing appear dim for significant trade liberalization.

Several impediments retard movement to freer trade. One is that Americans are fatigued from outsourcing, downsizing, mergers, acquisitions, reengineering, reinventing and a host of other changes in recent years. Many want a breather from change. A second factor is that environmental, sanitary and phytosanitary concerns have taken new life in the face of real or imagined fears of mad cow disease and bioengineered crops and livestock. Populists, environmentalists and autarkists have exploited these public fears to promote protectionism.

Despite Congress’ lack of enthusiasm, potential openings to freer trade are promising. The U.S. and other Western Hemisphere participants made an unofficial commitment to a Free Trade Area of the Americas (FTAA) by 2005. The 18 nations in the Asia-Pacific Economic Cooperation (APEC) forum pledged themselves to free trade by year 2010 for developed country members such as Australia, the U.S. and Japan, and by year 2020 for developing country members such as China, Indonesia and the Philippines. As with eight rounds of multilateral negotiations under the General Agreement on Tariffs and Trade, the FTAA and APEC implementation is

likely to founder over agriculture—prospects are much brighter for agreements covering nonagricultural commodities. Without special and early negotiations on agriculture, where the U.S. stands to gain through its strong comparative advantage, farm commodities seem destined to be left out of the FTAA and APEC.

Large gains in national and world income await freer trade; at issue is how to capture them given formidable problems listed above. Prospects are bright for further unilateral liberalization, as is apparent in agricultural policy legislation from New Zealand to the United States and the European Union. Much past protectionism has been the result of commodity program interventions in agriculture which governments around the world unilaterally are finding too costly and inequitable to justify maintaining. Governments liberalized before the Uruguay Round Agreement because protecting their domestic agriculture became too expensive. Commodity programs continue to provide openings for further unilateral trade liberalization.

Agricultural Research and Extension. Several observations influence our thinking about agricultural research policy:

- After growing 3-4 percent annually from 1960 to 1980, yearly growth of U.S. public agricultural research spending has slowed to less than 1 percent since that time (U.S. Department of Agriculture, p. 67).
- Growth in public funding since 1980 has been from state sources; federal funds stagnated.
- Public funding of agricultural research per unit of farm output has fallen approximately 1 percent per year since 1980.
- The share of public agricultural research outlays designed to reduce crop and livestock production costs and protect from diseases and pests fell from 57 percent in 1982 to 54 percent in 1992 (U.S. Department of Agriculture, p. 70). While the proportion of production research fell, the proportion of public agricultural research outlays for natural resources and the environment increased from 21 percent in 1982 to 25 percent in 1992. The latter outlays are useful, but they have come at the expense of production research to raise yields. The earlier supply-demand projections indicate that neglect of low cost sources of future output through research and extension could be a costly oversight.
- Lethargic public funding has been offset, fortunately, by private outlays for agricultural research which have doubled since 1960 and are larger than public outlays.

The best guess is that federal funding of agricultural research and extension will follow its past trajectory, but future food supply-demand prospects make the case for greater overall spending on research and extension. A case can be made for a greater share of research funding by the federal government. To see why, divide public research into four broad categories:

- Basic research, defined as having no immediate application.
- Applied research on national problems such as global warming.
- Applied research on regional problems.
- Applied research on local and state problems.

States can be expected to fund applied research where benefits are realized within the state—the fourth category. But, relatively little research can qualify for that category—a sizable share of public research benefits spill across state lines to help producers and consumers elsewhere. In time, a large share of agricultural applied and basic research benefits accrue to consumers across the nation and the world. Because states cannot recoup their cost of research despite favorable national benefits relative to costs, states underinvest.

To illustrate how spillovers affect state incentives and discourage state funding, consider a typical discounted national benefit-cost ratio on agricultural research of 5:1; that is, \$5.00 of benefits for each \$1.00 of research investment. An average state, however, has only 2 percent of the nation's consumption and population, hence, it receives only about 2 percent of the benefits under the first two categories above. Thus, on average, a state experiences an uneconomic benefit-cost ratio of only 10 cents ($\$5.00 \times 2$ percent) on each unsupplemented dollar it spends on socially-beneficial research under the first and second categories.

Due to spillovers, the third category, as well as the first and second categories above, warrant considerable federal funding. Because of the importance of recognizing and addressing problems and opportunities unique to state and regional circumstances, research on the first three categories often is best performed by states using Hatch Act funds or other “revenue sharing” from the federal government to compensate for spillovers. Basic research is especially important to fund publicly because lack of ability to recoup benefits discourages private initiative. While the strongest case can be made for more federal funding of basic research, even much of that research may best be performed at land grant universities where closeness to issues, talents and facilities provide a comparative advantage.

Rural Development. Rural development is unlikely to become a priority for the federal government. Reasons include:

- Revived population growth in rural areas (U.S. Department of Agriculture, p. 13).
- Concerns motivated by global food supply-demand projections for preservation of farmland from urban or rural development.
- An absence of a solid intellectual and political base to commit federal funds to promote rural place prosperity.

Rhetoric notwithstanding, the federal government invests comparatively little in rural development. The FAIR Act established a \$300 million Fund for Rural America to promote research and socioeconomic progress in rural areas—modest funding compared to commodity programs. Only 2 percent of public agricultural research expenditures address rural development (U.S. Department of Agriculture, p. 70).

Although *explicit* rural development programs are likely to continue to receive little funding, *implicit* “rural development” programs are likely to receive major federal assistance. These programs include favored tax treatment for mortgage interest, municipal bonds and capital gains. Such programs, along with federal subsidies to postal services, housing, and utilities such as electricity and water systems in rural areas, encourage urban sprawl into the country. Failure to fully include the externality or scarcity costs of greenhouse gas emissions, traffic congestion, dependence on foreign oil, and depletion of finite fossil fuel stocks in energy prices also encourages sprawl into the country. Worthy issues such as welfare reform, greater funding of common schools to compensate for larger spillover of education across state lines, and extension’s effort to help rural areas get the most out of their resources may receive more attention from federal policymakers as interest wanes in farm commodity programs.

Conclusions

Agricultural policy reform embodied in the FAIR Act of 1996 represents a fundamental and likely lasting redirection of farm policy because directions conform to the agricultural paradigm shift. The intellectual base for traditional commodity programs has collapsed—agriculture is no longer a chronic low-return industry warranting income transfers from taxpayers or consumers. Educators can shift their focus from the technological treadmill and fixed asset theories of farm problems. Agriculture has not been on a technological treadmill running in place. A more appropriate metaphor is a technological distance runner who has covered an impressive number of miles to arrive at a preferred destination.

In an agriculture nearer long-term economic equilibrium, income per capita of people in agriculture will be near income per capita (return on resources) of nonfarmers. So, while agriculture in the past would not support sound national growth policies because it had to protect its own policy distortions, in the future it can be a more nearly unequivocal supporter of prudent national public policies—including policies for agriculture.

Sound public policy under the new policy paradigm emphasizes supplying public goods and correcting externalities. That means continued public support for environmental programs, basic research, education and information systems for economic efficiency. Equity is a more subjective issue, but support probably will continue for a minimum safety net of marketing loans, revenue or income insurance, and an emergency food reserve.

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