POLICY ALTERNATIVES TO MANAGE SUPPLY: MANAGEMENT OF OUR PRODUCTIVE CAPACITY

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First, one can reasonably expect the total demand for U.S. agricultural products to grow in real amounts of 3 percent or more per year during the 1980s. And, the volatile export sector could impose fluctuations of as much as 10-15 percent per year on that trend. One can probably expect the strongest continuing export demand pressures to come for feed grains and oilseeds, particularly soybeans. This strong demand can, in turn, be expected to result, on average, in slightly increasing real prices for farm products.

Second, the supply side of agriculture is also subject to major fluctuations and the 1981 grain crop is a good example. Recent projections set the 1981 feed grain crop at 19 percent, the wheat crop at 16 percent and the soybean crop 11 percent, respectively over 1980 levels. And, 1980 was a year when existing production capacity was utilized rather fully.

Third, I do not believe agricultural structure impacts agricultural production capacity significantly at least not for the 1980s. Most production entering commercial markets now comes from farm operating units which are well mechanized and use modern production practices. Thus, near term changes in structure will not translate into any major changes in production capacity or in the management of that capacity.

However, it is important for us to quit using "Census of Agriculture" definitions of farms when referring to technology use, per unit production costs and supply response. A much more relevant concept is that of the "operating units" on which farm production technology is actually applied. Recent surveys indicate, for example, that operating units in the Cornbelt now average well over 500 acres and operating units in the Wheatbelt are much larger.

Fourth, as the practitioners of U.S. agricultural policy in the 1950s and 1960s became well aware, a good deal of flexibility exists as to how the agricultural production capacity in the U.S. gets used. Thus, one cannot "manage" a single resource or a single commodity without impacting on the use of other resources or on the production of other products. For this reason, earlier period supply management programs proceeded to acquire a so-called "cross compliance" feature. But, even that device was only partially effective in curbing unwanted shifts by farmers in resource use and production. For simplicity of discussion it is necessary to minimize the treatment of these complex interrelationships between resources and products and within both groups. But, they should not be forgotten!

Fifth, it is realistic to assume that most decisions regarding the management of agricultural resources in the 1980s will be made in a relatively free market environment. In other words, management decisions will be made by investors and producers (often, but not always, the same persons) responding to price incentives and personal preferences. This is not to suggest that governmental policy will not play a key role in the development of these incentives. But, that role will most likely be one of facilitating, inducing, and encouraging rather than one of specifying and regulating.

Finally, without elaborating on the basis for this conclusion, the comparative advantage of U.S. agriculture currently lies in the extensive production of energy products to substitute for petroleum-based liquid fuels. This situation isn't likely to change greatly during the 1980s. Thus, I see little merit in targeting large quantities of our agricultural resources to the production of liquid fuels.

This is not to suggest that the energy topic is not an important one. Moreover, I am personally optimistic that, in addition to increased energy conservation, we will see some significant use of agricultural waste products for energy production such as the use of corncobs for drying grain, etc. Also, some limited use of vegetable oils as a diesel fuel substitute is probably a strong likelihood as is some modest use of grain in the production of ethanol. My major point is, however, that most agricultural resources will probably continue to have a comparative advantage in the production of food, not fuel, and should be managed with that objective in mind.

Production Capacity Defined

Production capacity for purposes of my discussion is the capability at a given time, to produce agricultural products given "reasonable financial incentives" to do so. And, despite the pressure on prices from the large 1981 crop, it looks as if incentives in the form of increasing real prices for grains and oilseeds are likely to obtain in the 1980s. The situation would be dramatically different, however, if we were, other things the same, considering production capacity with near-term prices of $15 for soybeans, $10 for wheat and $7.50 for corn. Such incentives would draw into production resources which we didn't even know existed!

Future real price increases for livestock products are, however, somewhat less likely than for grains and, among livestock products, only the production capacity for poultry seems likely to be pressed by effective demand in the 1980s. Production of livestock products will continue to be mainly for domestic consumption in the 1980s and will not, in general, be competitive with grain and oilseeds for production resources.

Key Components of Production Capacity

Agricultural productive capacity for the 1980s can be thought of as generated by three components:

(1) the stock of production resources represented by land and water resources, human capital, nitrogen fertilizer manufacturing plant capacity, other durable assets (e.g., irrigation wells, combines, etc.) Some are natural resources, but not all are. Some can be augmented for the 1980s, others cannot.

(2) the flow (or set of flows) of production services which can be derived from available resource stocks within a given time period and

(3) the technological capability (or set of capabilities) to transform production services into agricultural products.

The rate at which production services are converted into products is, as previously mentioned, highly influenced by (a) the financial incentives available to entrepreneurs to make the conversion(s) and (b) the constraints which prevent them from proceeding with these conversions. Such constraints can range all the way from legal regulations on pesticide use, to internal or external capital rationing, to lack of information, etc.

Generally speaking, we can limit major considerations about production capacity to three categories: (1) stocks of land and water resources; (2) expected new net resources; and (3) expected technological capabilities (resource-product transformation rates).

Production Capacity in the 1980s

Land: In 1949 U.S. farmers used an all-time-high of 387 million acres of cropland for crops (Table 1). This included 352 million acres of cropland harvested, 9 million acres of crop failure and 26 million acres summer fallow. In the 1960s cropland used for crops dropped by about 50 million acres as farm program constraints and low commodity prices reduced harvested acreage dramatically. By 1977, increased demand and removal of acreage constraints pushed cropland used for crops back up to 377 million acres, it's highest level in over 20 years. In addition, there was probably about 20 million acres of cropland standing idle or in soil conserving uses and 16 million acres or so in short-term rotation pasture. If one adds these acres to those used for crops one obtains a cropland base of about 413 million acres.

Table 1 — Cropland Used for Crops (Selected Years)

	Cropland Harvested	Crop Failure	Summer Fallow	Total
	---------- millions of acres ----------			
1949	352	9	26	387
1960s	295	7	35	337
1977	338*	9	30	377

*of which 6 million acres was double cropped for an effective harvested acreage of 344 million.

In 1981, farmers appear to have added still another 18 million acres or so of planted acres above 1977 levels with about two-thirds of this added planted acreage located in the Wheatbelt. Thus, the additional cropland acreage available for cultivated crops is probably now down to 20 million acres or less and much of this acreage needs to remain in summer fallow and rotation pasture.

In the near-term, at least, some modest cutback in planted acreage in the Wheatbelt appears both warranted and likely. Though another 50 million acres or so of land used only for pasture is also classified as potential cropland, most of this is probably best left in permanent pasture. In any event, it represents only a very modest addition to the production capacity for harvested crops.

There is some additional acreage which has the potential of being converted to cropland as far as its use capability is concerned. This acreage is variously estimated at 40 to 70 million acres. Much of it would require substantial investments for clearing, drainage and/or irrigation. This potential cropland has remained unconverted during historical periods of high commodity prices. Though sustained high prices would undoubtedly induce conversion of some of it to cropland (maybe 10 to 20 million acres), much of this land is probably controlled by entities which are not very responsive to commodity price inducements. For other acres, the cost of conversion is excessively high.

In sum, cropland used for crops in 1981 is probably within 5 percent or so of its capacity for the late 1980s. The major potential for increased production capacity in the 1980s is not via the use of more cropland but, rather, it is via the manner in which the existing cropland base is put to use, i.e., the production technology employed. Moreover, there is little likelihood of any significant conversion of new or existing cropland to use for extensive livestock production.

Water: The role of water in agricultural production can be visualized under the broader heading of soil moisture modification with three components: irrigation, drainage, and weather modification.

Weather modification technology is advancing some but will have essentially no application to commercial farming in the 1980s. Recent technology in land drainage, mainly the installation of small diameter plastic tubing using plows with laser controlled leveling devices, has resulted in labor efficient, long lasting and economical ($300 plus per acre) drainage technology. Wet soils are concentrated in the North Central Region of the U.S. and most will be effectively drained with available technology by the mid-to-late 1980s. Even now, most of the potential gain in production capacity from land drainage has already been realized and future installations will result mainly in improved timeliness of field operations and reduced production costs.

Irrigation is the moisture modification technology with greatest potential for increasing agricultural production capacity. About 60 million acres of cropland were irrigated in 1980. Of this, irrigated corn acreage totalled about 11.5 million acres. And, sprinkler irrigation of corn using on-farm-pumped-water was the most rapidly growing component of irrigated agriculture.

Adoption of irrigation technology for use in grain production has resulted in major increases in the demand for water, for fossil source energy and for nitrogen fertilizer. In 1975, 77 percent of the consumption of water withdrawals in the U.S. were for agriculture, and 23 percent was for all other purposes. The latter percentage was up from 10 percent in 1955 and 15 percent in 1965.

Nonagricultural water use is probably now in the 26-28 percent of-total-use range and rising. Both a declining water table in underground aquifers and increased competition from non-agricultural water uses have made competition for water supplies intense in the arid areas of the West and Southern Plains. In the latter area, for example, nonagricultural water use is projected to increase by 50 percent or more by the year 2000 while agricultural use declines by 4 percent.

Though such projections are probably reasonable for arid and semi-arid agriculture, they may underestimate the future of irrigation in more humid areas (east of the Great Plains) where the recharge capability of both surface and subsurface water supplies is greatest. Future energy-crop price ratios will be an important determinant of whether or not investments of $500 to $600 or more in irrigation technology are made by farmers. It is energy costs for pumping and water distribution which constitute the major operating costs for irrigation.

In my judgement, increased irrigation in the Northern Plains, Lake States, Cornbelt, and Southern Regions during the 1980s will more than off-set the decline in acreage in the Southern Plains due to declining water tables.

In sum, though moisture control via irrigation and drainage will likely increase aggregate production capacity some during the 1980s, this increase will be small, probably not exceeding 0.5 percent per year for the decade as a whole.

Technological Capability: Space permits only a brief discussion of a very complex topic. My objective is to assess briefly the current situation for agricultural production technology and to project it informally through the 1980s. In addition to assessing the more "established" technologies such as plant breeding, plant nutrition, pest control, mechanization, moisture modification, etc., it is useful also to evaluate the potential contribution to production capacity of a set of emerging biotechnologies including genetic engineering, cell tissue culture, biological nitrogen fixation, photosynthetic enhancement and plant growth regulators.

Recently, a general concern has been expressed over the leveling off of agricultural productivity. In our analysis we find evidence of (1) a significant recent reduction in the annual rate of yield increase for corn associated with the leveling off of nitrogen inputs, but (2) no significant narrowing of the differential between experimental yield levels and those being realized, on average, by farmers. In addition to the nitrogen response phenomenon for corn other modest reductions in the rate of overall productivity gain are most likely associated with:

(1) the completion (or near completion) of the mechanization of U.S. agriculture and the attendant reduction to a very low level of labor inputs in farm production. Thus, in recent years there have been only limited opportunities for productivity gains via annual reductions in total labor inputs, and

(2) the shift from a land and labor intensive agricultural sector to a capital intensive one. Additional capital infusion in the 1940s, '50s, and '60s clearly had dramatic impacts to increase farm productivity. But, the key purpose for much of the new current capital investment is the one of increasing the output volume (size) of farm operating units while "holding the line" on labor inputs. As a result, at least some current capital infusions do little to increase the total output-input (productivity) ratio in farming.

During the 1980s one can probably expect some continued softness in rates of current per acre yield gains due to established technologies, with the softness being most pronounced where nitrogen fertilizer applications are high (corn and, in some areas, wheat). Overall, rates of gain will probably continue to be down some from those of the 1945-70 period.

Most of the expected yield gains in the 1980s will be from improvements via plant breeding, soil moisture control, and integrative-type managerial technologies. The latter include scouting, electronic monitoring and control devices, and computerized information systems. Though important to past productivity gains, pest control and mechanization technologies are already servicing their functions at near maximum effectiveness. Thus, their future contributions to productivity will be mainly of a maintenance type.

In the case of emerging biotechnologies, the popular literature has suggested the likelihood of some major near-term impacts on crop yields from these developments. The analyses of my colleagues, Menz and Neumeyer, indicate, however, that these impacts will be minimal for the decade of the 1980s. Specifically, the Menz-Neumeyer survey of a large number of scientists engaged in agriculturally related biotechnology research indicates 1990 as the earliest date by which cell or tissue culture will contribute significantly to corn yields. It is the mid-1990s before the several other biotechnologies are expected to make their initial significant contributions to yields.

In sum, if the expected real increases in demand of 3 percent or more for the 1980s actually materialize and if the preceding appraisal of likely production capacity gains from more cropland and enhanced technological capability are correct, demand will be pressing production capacity by the mid-1980s or sooner, and managing production capacity will be a real issue, not a hypothetical one. One should keep in mind, however, that major adjustments in land use over the past several years have pushed current (1981) production rates to levels in excess of utilization.

Significant Environmental Externalities

Several adverse outside influences have been identified with the current agricultural production system. They are complex phenomena which are also significant issues in the management of our production capacity. With current production technology, the following environmental problems have been identified as existing in some degree:

(1) Excessive soil loss on some cropland due to water and wind erosion.

(2) A substantial mining of underground aquifers particularly in the Southern Plains.

(3) Some leaching of nitrates into drinking water supplies particularly on some coarse, heavily irrigated soils.

(4) Loss of wildlife habitat and/or other nonagricultural amenities due to (a) drainage and irrigation developments and (b) cropping of additional land.

(5) Excessive soil salinity caused by irrigation on some soils.

(6) Pollution of drainage waters via toxic pollutants (mainly pesticides) and nutrients (mainly nitrogen and phosphorus).

Managing our Production Capacity in the 1980s

Lessons from the Past: In managing our agricultural production capacity two lessons from the past seem paramount. First, future farm programs should avoid religiously the situation of supporting prices above world market levels. This was a problem in the 1950s and 1960s but would be a virtual nightmare in the 1980s with our heavy current reliance on export markets. Second, the inflexible acreage allotments and related regulations of earlier periods of "production surpluses" should be carefully avoided in the future.

Guidelines for the Future: Policies with regard to management of production capacity in the 1980s would do well to target on several key objectives. These include:

(1) Inducing the production system to perform at a high level of output while maintaining the quantity and quality of the natural resource base, particularly land.

(2) Addressing the problems of instability in prices for grains and oilseeds which result mainly from the volatile export market and from uncontrollable weather events at home.

(3) Encouraging the development of new improved technologies which are safe for humans while cost effective, energy efficient and yield increasing, and

(4) Maintaining an institutional and program support system which permits individual farmers to cope with problems of weather and price risk and with the cash flow problems which they currently face.

A single policy instrument may, of course, deal with more than one of these several objectives.

Inducing High Production Levels: If, as we suggest, the full capacity of production is needed, on average, in the 1980s, a set of effective price incentives should be a key instrument of farm policy. Price supports — but at levels below world prices — are an important, and probably necessary, component. Target prices may or may not be. But, they can certainly play a key "incentives" role when world prices are temporarily soft.

In any event, the price incentive system should aim at accommodating increasing production costs while avoiding windfall profits to landowners and the escalating land prices which such profits generate. Effective credit institutions and credit policies for "operting capital" are a must if farmers are to operate at or near capacity. Equity capital and/or credit for restructuring agriculture or for transferring ownership of assets may also be justified but not for reasons of managing production capacity in the near term.

Aggregate Price Instability: This instability, for U.S. farmers, can come from the volatility of either demand and supply or both. The current decline in price prospects for the 1981 crop, for example, results from both some modest decline in expected export volume and from the prospects for bumper domestic crops. But, if as we suggest, the production system needs, on average, to operate at or near capacity during the 1980s in order to meet demand needs, the key management tool available is that of intertemporal reallocations of product supplies, mainly via grain reserve mechanisms.

Operation of an effective farmer held grain reserve program would appear to be a desirable key component of grain reserve policies. Continued encouragement of reserve stockpiling by importing countries is another. And, effective trade policies, including those affecting exchange rates, are of crucial importance in reducing instability in export markets. We also need to expand our knowledge about the "shock absorber" role which can be played by the domestic livestock sector during periods of volatile grain prices.

Risk Management at the Farm Level: Farm program price supports of one kind or another are, of course, the most effective policy for reducing farm level price risk. Their inclusion in the kit of farm policy tools for the 1980s is almost a must. Comprehensive crop insurance is, aside from informal insurance schemes operated by producers themselves, the most effective protection from weather risk. But, most historical crop insurance programs have been excessively costly either for the treasury or farmers. Besides, they have provided ineffective protection.

Most farmers will, for the early 1980s at least, continue to have more weather risk than product price risk exposure. Over time, there may be opportunities to shore up the effectiveness of current crop insurance programs. But, weather risk exposure is not nearly as likely to affect the effective use of production capacity as is a combination of internal and external capital rationing generated by high input prices and the high cost of capital. Clearly, the continuation of effective credit institutions and credit instruments for farmers is a must as is a continuing effort to reduce inflation and interest rates.

Increased Productivity: As indicated earlier, we may have about exploited the major labor efficiencies in commercial crop production. With the labor input to produce 100 bushels of corn now down to 4 hours or less, and with similar labor efficiencies for other crops, additional mechanization, capital inputs, or chemical technology for further labor reduction is probably not top priority.

Rather, those technologies aimed at increasing yields (plant breeding, plant nutrition, cultural practices, etc.) along with those for reducing production variability (moisture modification, developing crop varieties with improved disease resistance, etc.) should receive highest priority. Already a good deal of technology for improving energy conservation is in the prototype or pilot stages (e.g., for crop drying and irrigation technologies particularly) and will be available for commercial use shortly.

Thus, the 1980s will see some substantial decreases in the intensity with which liquid energy is used in agricultural production. Improvements in productivity are not readily "managed" via public policy. But, several types of action do appear desirable. First, strengthened research funding coupled with some redirection of research towards output increasing technology appears warranted; so does an expanded effort to facilitate the rapid adoption of this technology by farmers. Moreover, improved information monitoring and management control systems can provide a significant opportunity to narrow the gap between experimental yield achievements and those realized by farmers.

Dealing with Undesirable Outside Effects: Our analysis of corn technology suggests that it would be economically profitable for farmers to reduce or eliminate some current nitrate pollution on sandy soils by curtailing wasteful over-irrigating and to reduce current water erosion of some Cornbelt soils by reduced tillage. We estimate, for example, that a continuing loss in corn yield equivalent of 0.2 bushels per acre per year is being incurred on traditionally tilled land as compared to land with reduced tillage.

Significant reductions in pollution of drainage water can be achieved by better timing of fertilizer and pesticide applications. Improved monitoring of pest infestations to determine when the presence of pest populations reaches threshold levels is one way to improve the timing and to reduce the quantity of pesticide applications.

Not all adverse environmental outside effects will be solved voluntarily by producers, however, and the public policy dimension of dealing with these issues needs strengthening. Though we have imposed environmental impact study requirements on many other economic sectors, environmental impact study requirements for irrigation developments on some very fragile soils are, in most cases, zero. And, we are imposing no economic penalty on producers for mining major underground aquifers which have very little recharge capability. Thus, until we develop and adopt effective policy instruments relative to environmental externalities we will continue to run high environmental risks in some areas of agricultural production.

In Conclusion

The U.S. agricultural production plant will be called upon to increase its production output substantially in the 1980s. It can probably do so without major adverse effects. Further efficiencies in labor use will be hard to achieve and will have only very limited value. Policy focus on the following aspects of managing our production capacity should probably receive high priority:

(a) Effective price incentives to induce production of feed grains and oilseeds.

(b) Trade and grain reserve policies to reduce fluctuations in exports and to minimize their impacts on producers.

(c) Development and adoption of output increasing technologies.

(d) Maintenance of effective credit instruments and institutions for producers along with reduced costs of short term credit.

(e) Incentives and regulations to reduce environmental pollution and to control the application of production technologies on fragile soils.

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