Editor's Note

Welcome to the Proceedings from a conference on "Pennsylvania's Agricultural Economy: Trends, Issues, and Prospects." The conference was held March 20-21, 1991 on the campus of The Pennsylvania State University and sponsored by The Department of Agricultural Economics and Rural Sociology. It is my hope that you will find the information in these proceedings to be practical, informative, and useful now and in the future.

As an aid to those attending the conference, we included at the end of each paper copies of slides used in the presentations. We also included an appendix of recent Agricultural and Rural Sociology Departmental publications. Several faculty in the department publish regular newsletters and those listings are also in the appendix.

Many people contributed to the production of these proceedings and to the success of the conference. First, I thank the authors and speakers who gave their time to write and prepare excellent presentations. I appreciate their cooperation in getting their work done in a timely fashion.

Next, I thank the graphics staff of the Computer Support Group--Tura Eisele, Claudio Frumento, and Isabel Hoover--for most of the outstanding visuals. Several of the Department's secretarial staff contributed to the word-processing of the papers. Jane Mease, however, deserves special acknowledgement because, as well as processing several papers, she also did the style, layout, and compilation work on the proceedings. Many others, at Keller Conference Center and in the Short Course Office, helped to make things better. Finally, thanks to Milton Hallberg and Thomas Brewer who headed the planning committee for the conference and helped to put the proceedings together. Others who served on their committee are James Dunn, Larry Jenkins, Lou Moore and Wes Musser.

These people worked tirelessly to plan, coordinate, and present this conference and these proceedings. Through their efforts, the conference achieved its success. Without their combined efforts, my job as editor would have been substantially more difficult. I appreciate their efforts and accept responsibility for any errors or omissions that may remain.

John C. Becker
Associate Professor of Agricultural Economics
Editor

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THE ECONOMY IN WHICH WE LIVE: OIL, INTEREST RATES, DEFICITS, JOBS, AND TRADE

David G. Abler*

What a difference a year can make. One year ago, we heralded a new decade of peace and prosperity. The Berlin Wall had come down, Communist regimes had been toppled in Eastern Europe, and democracy seemed to be penetrating even the Soviet Union. At home, the country was in the 8th year of the longest peacetime economic expansion in our nation's history. There were clouds on the horizon, such as looming budget and trade deficits, but nothing that seemed unmanageable.

Today, the country is at war with Iraq, the economy is in a recession, the Soviet Union has retrenched in its move toward democracy, and the future looks uncertain. World oil prices, after being driven to $40 per barrel following Iraq's invasion of Kuwait, have fallen close to pre-invasion levels. There is hope that this drop in oil prices, combined with a relatively quick allied victory, will boost the economy out of its recession. Others, however, are not so sure.

What do these events mean for Pennsylvania farmers? From one point of view, not much. There is a long tradition of viewing Pennsylvania agriculture as independent of the national and international economy. The USDA estimates that only about 7% of Pennsylvania's agricultural products are exported, and this figure is almost certainly too high (Hallberg, 1991). Pennsylvania farmers receive over 40% of their cash income from dairy products.[1] These products are predominately produced with local resources and consumed within the region. The same could be said for poultry and eggs, which together account for about 13% of cash income.

My objective here is to demonstrate that Pennsylvania agriculture is by no means isolated from the rest of the world. Instead, it is today linked in a variety of ways to the national and international economy. My main message is that we cannot control the economic environment in which Pennsylvania farmers operate. What we can do is help them to better compete in the new international economic arena.

THE GLOBAL ECONOMY AND PENNSYLVANIA AGRICULTURE

Everyone knows that the economic well-being of U.S. agriculture is strongly related to national and international economic forces. U.S. farmers as a whole currently receive

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[1]The figures presented in this paper are drawn from a variety of data sources listed in the references.

about 25% of their cash income from exports. Developments in other countries can have a profound influence on prices received by U.S. farmers. Examples include import restrictions on commodities produced by U.S. farmers, export subsidies that make it harder for U.S. producers to compete, and the weather and other supply shocks. The competitiveness of U.S. farmers is also tied directly to the exchange rate. When the dollar is strong, U.S. exports become more expensive to consumers in other countries. In addition, imports from other countries become less expensive to U.S. consumers.

On the input side, world oil prices directly affect the cost of fuel and fertilizer used by U.S. farmers. Interest rates paid by U.S. farmers are also governed by world market conditions. World financial markets are so integrated today that it can take only seconds for a development on the New York markets to be reflected on the London markets. Moreover, farmland prices near urban areas depend on economic conditions in our nation's cities, which in turn depend on national and international economic events.

Is Pennsylvania agriculture as strongly related to the national and international economy? U.S. and Pennsylvania agriculture differ in some significant ways (Hallberg and Partenheimer, 1991). The critical difference for our purposes is that exports by Pennsylvania farms are much less than by U.S. farms as a whole. There are other differences. For example, net farm income on the average Pennsylvania farm is generally lower than on its Midwestern counterpart. However, including off-farm income, farms in the two regions do about equally well. In addition, Pennsylvania farms are much less dependent on direct government payments than Midwest farms. However, Pennsylvania dairy farms receive substantial benefits from federal dairy price supports. Moreover, Pennsylvania farms were not hit as hard as their Midwestern counterparts by the credit crisis of the early and mid 1980s.

While Pennsylvania farmers are not tied as directly to world markets as most other U.S. farmers, there are strong indirect linkages. Feed grain prices, which are determined on world markets, affect production costs for Pennsylvania dairy, poultry, beef, and hog farmers. Production costs for all Pennsylvania farms obviously depend on internationally-determined costs for fuel, fertilizer, and interest. Markets for Pennsylvania nursery and greenhouse products clearly depend on the overall economic health of the Northeast, which in turn depends on world economic conditions. In addition, no one needs to tell farmers in Lancaster county and other southeast Pennsylvania counties about the effects of urban growth.

These linkages are explored in greater detail below. For now, let us consider the overall picture. Suppose one wanted to make the case that Pennsylvania agriculture is isolated from international markets. For reasons noted above, dairy products would likely provide the most favorable evidence. Chart 1 plots the inflation-adjusted (January 1991 dollars) wholesale price of milk in Pennsylvania since the late 1970s.[2] It also plots an inflation-adjusted index of world food prices, reflecting prices paid and received by food

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[2]All prices are adjusted for inflation and expressed in constant January 1991 dollars.

importing and exporting countries. As you can see, the association between the two series is remarkably close. The unmistakable conclusion is that the same forces driving food prices on international markets are also driving Pennsylvania milk prices. The same can be demonstrated for other Pennsylvania agricultural commodities.

Two bottom-line indicators of farm economic well-being are net farm income and land values. Chart 2 plots average (per farm) net farm income in Pennsylvania since the late 1970s. It also plots average net farm income for the U.S. as a whole. As you can see, there is a strong association between the two series. Chart 3 plots the average value of land and buildings per acre in Pennsylvania, along with the corresponding series for the entire U.S. The association between the two series is more tenuous, but still indisputable. Clearly, the economic health of Pennsylvania and U.S. agriculture are intertwined.

A CLOSER LOOK AT GLOBAL ECONOMIC TRENDS

What will happen to international agricultural prices in the 1990s? The prophets of gloom and doom would have us believe that overpopulation, land scarcity, soil erosion, and drought will cause widespread famine and huge world food price increases. However, they have been making these forecasts for over 20 years and have been wrong every time. True, these forces will be putting upward pressure on world food prices. However, the most likely scenario is that continued productivity growth in world agriculture will hold prices down. Since the 1930s, agricultural research and extension have led to tremendous declines in farm prices. After adjusting for inflation, prices today are 40-50% lower than 40 years ago. Based on present investments in agricultural research and extension in the U.S. and other countries, there is every reason to believe that these trends will continue.

This means that Pennsylvania farmers must prepare themselves for an even more competitive economic environment. The future of GATT (the General Agreement on Tariffs and Trade) is uncertain at this time. However, there are proposals to modify GATT to reduce agricultural protectionism in the European Community, Japan, the U.S., and other countries (Hallberg, 1991). These proposals would probably increase world grain prices, but not substantially (Tyers and Anderson, 1988). The conclusion is that agricultural trade liberalization would not reverse the trend toward lower farm prices.

The future of the world oil market is very difficult to predict. Witness the run-up in world oil prices following Iraq's invasion of Kuwait: When war broke out and oil traders concluded that Iraq could not threaten Saudi oil fields, prices dropped to $20-25 per barrel. Experts had been predicting $60-100 oil in the event of war. Looking beyond the war, many people feel that oil prices will rise significantly during the 1990s, as world supplies are drawn down. This brings to mind a prediction I read in 1973 that the world would run out of oil by 1990! The world will eventually run out of oil, or at least oil that it is economical to pump out of the earth. However, that point is probably a century

away. Assuming the political situation in the Mideast is fairly stable, world oil prices should be moderate throughout the 1990s.

What we can do with more certainty is indicate the impact of world oil prices on Pennsylvania agriculture. Chart 4 plots the world price of oil since the late 1970s. It also plots expenses on manufactured inputs (principally fuel and fertilizer) by Pennsylvania farms as a percentage of gross farm income. The association between the two series is unmistakable. Oil price swings have caused manufactured input expenses to vary between 7% and 13% of gross farm income, which is a significant effect.

Interest rates are falling during the current recession. However, the long-term outlook is mixed. On the one hand, the U.S. government is becoming less and less able to finance its deficit spending with capital from Japan and Europe, especially Germany. Japan is increasingly turning its yen inward to address domestic concerns, particularly the sky-high cost and low quality of housing. Germany, meanwhile, will be spending hundreds of billions of dollars to rebuild the eastern part of its country. At the same time, the savings from last year's federal budget agreement are being eaten up by the recession and the Gulf war. All these forces will put additional pressure on world capital markets, keeping interest rates relatively high. On the positive side, however, corporations and consumers are reducing their debt loads. Some economists feel the yuppies of the 1980s will mature into the thrifties of the 1990s, saving much more of their income.

What do interest rates mean for Pennsylvania agriculture? Chart 5 shows the average U.S. real (inflation-adjusted) interest rate since the late 1970s.[3] It also shows interest expenses by Pennsylvania farms as a percentage of gross farm income. The association between these two series is also quite clear. The implication is that Pennsylvania farms have a significant stake in seemingly irrelevant domestic developments in Germany, Japan, and other countries.

Pennsylvania agriculture should be dealt only a glancing blow by the current recession, assuming it is a mild one. The demand for farm products is less sensitive to changes in income than the demand for other products, for the simple reason that people have to eat even when times are tough. Longer term trends are probably more relevant to employment in Pennsylvania agriculture. As we all know, farms are becoming fewer in number and larger in size. Chart 6 shows the trend in the number of farms in Pennsylvania since the late 1970s, with the corresponding trend for the U.S. as a whole. As you can see, Pennsylvania tracks the national trend quite closely. As farm prices decline during the 1990s, we can expect these trends to continue.

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[3]The interest rate used here is the average lending rate charged by major U.S. banks. The real interest rate is defined as the interest rate minus the inflation rate.

CONCLUSIONS

My objective in this paper was to explore the many ways in which Pennsylvania agriculture is connected to the national and international economy. Farm families in Pennsylvania are by no means isolated from the larger economic picture, but instead are affected in a myriad of ways. In saying this, I do not wish to imply that Pennsylvania farms have lost control over their own destiny. As always, the success of an individual farm will depend primarily on its own decisions. Instead, I suggest that we take a realistic look at the variables that we can control and those that we cannot. A great deal can be done in terms of innovative and low-cost methods of financing Pennsylvania agriculture (Hanson, 1991), giving farm families meaningful off-farm employment opportunities (Smith, 1991), and providing farms with information that can help them stay ahead in the new international economic environment (Hallberg, 1991).

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Chart 1. Pennsylvania and World Prices
(Inflation-Adjusted)

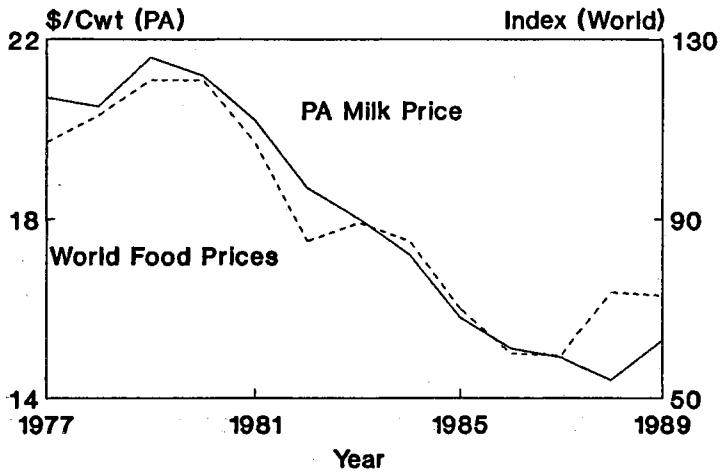

Chart 2. Net Farm Income
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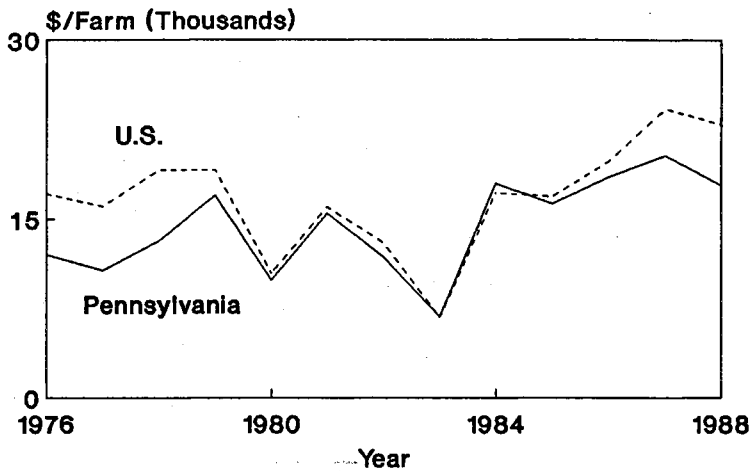

Chart 3. Land Values
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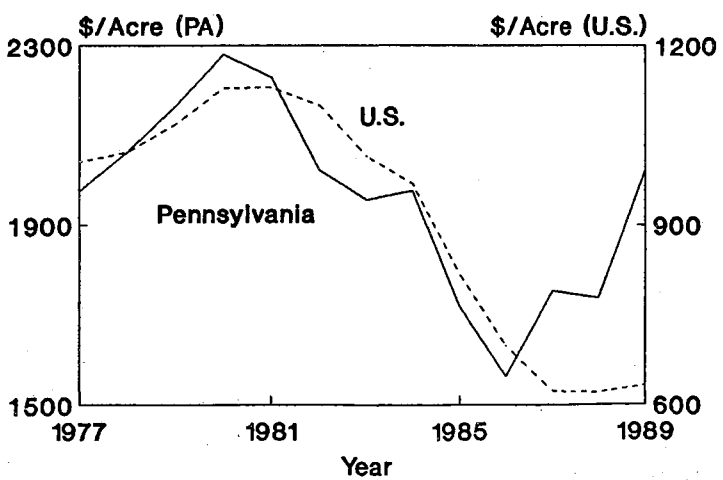

Chart 4. World Oil Prices and PA Manufactured Input Expenses
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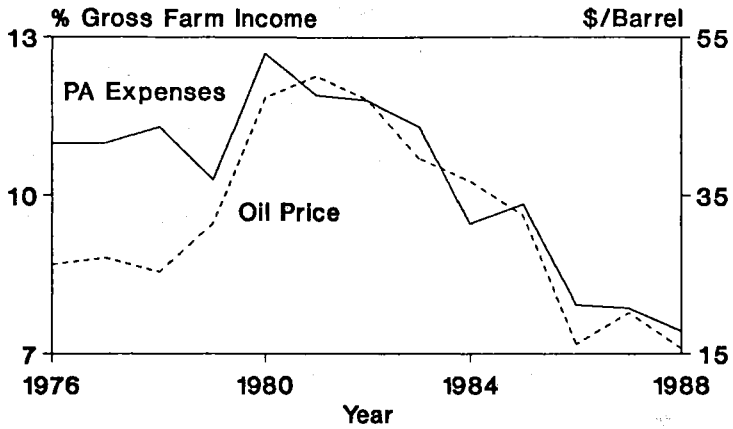

Chart 5. U.S. Interest Rates and PA Interest Expenses
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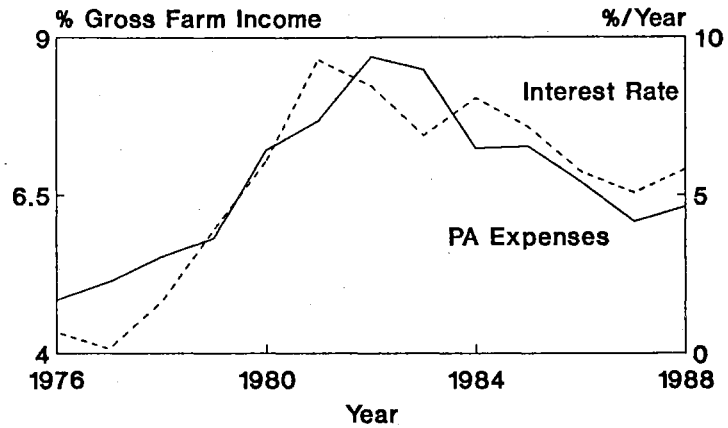
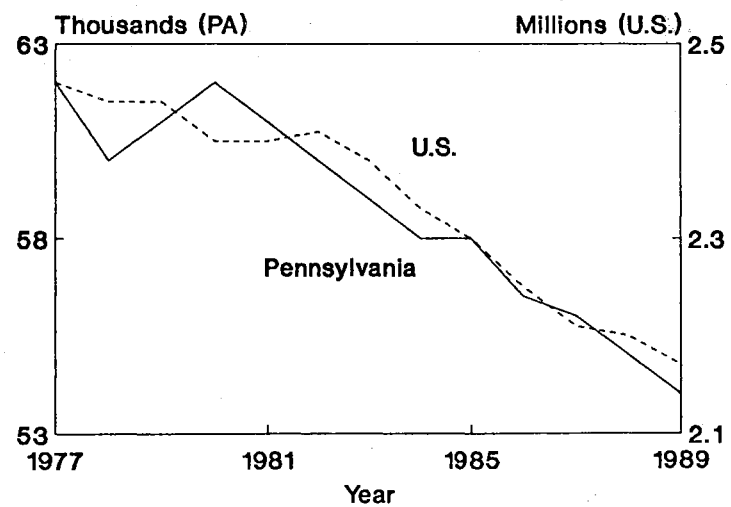


Chart 6. Number of Farms



FINANCING PENNSYLVANIA'S AGRICULTURE IN THE 1990s

Gregory D. Hanson*

What are the key finance issues facing farmers and lenders in 1991? In my view the important finance problems are not adequacy of credit, agricultural loan writeoffs, high loan to deposit ratios, bank capital inadequacy, or high interest rates (although they are always too high from a borrower view).

My reading is that the major finance concern of farmers is the adequacy of crop and livestock earnings to meet scheduled interest and principal payments. A related concern is the relationship of interest rates to farm rates of return. Should returns fall to 5 percent of assets, and interest rates lodge at 10 percent, then the two-edged sword of financial leverage bruises the farmer instead of furthering the farmer's goals.

Adequacy of crop and livestock earnings among Pennsylvania farmers is also a major concern of lenders. Obviously if the farmer cannot make the scheduled principal and interest payment, lender earnings worsen.

Lenders are wary of several other issues that broadly deal with regulations, legal interpretations and ramifications of legalese. These issues include lender liability for environmental damage to land and facilities that borrowers cede back as loan collateral to the lender. A borrower can conceivably walk away from the environmental problem, while the lender receives unwanted title to the damaged property through the foreclosure process.

Another key concern is the current intensification of the regulatory burden, including tightening of appraisal standards and the potential separation of the appraisal and lending functions. These types of enhanced regulatory burdens raise the cost of doing business for bankers. They can also choke off loan growth, and slow gains associated with larger loan size.

A final lender concern, or specifically, an agricultural banker concern, is on-going competitiveness. First, bankers compete against each other. This competition can be fierce. The Farm Credit System's Agricultural Credit Associations lost many of their quality loans during the mid-1980s, and they are now intent on gaining them back. Commercial banks experienced an expansion of real estate loans during the late 1980s, and they plan to keep their new clients. The Farmers Home Administration is sorting out the shift to guaranteed lending, and is struggling to finally digest its residual of bad loans from the 1970s and 1980s.

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But that is only half of the competitive concerns. One can capsulize the other half of agricultural banker concerns by suggesting there will soon be the day when a farmer can finance feed, seed, fertilizer, repairs, livestock and land without entering a bank. The giant cooperative, Farmland, is experimenting with making real estate loans to its clients. I recently spoke with a Missouri farmer who is advising the giant seed company, Pioneer Hybrid, Inc. on its fledgling business of providing operating capital to its seed customers. The loans cover fertilizer, pesticide and other operating costs as well as corn seed. John Deere Credit, with its point of sale financing and FarmPlan credit card is also making in-roads into the banking industry. In fact, a recent president of the national Agricultural Bankers Association told me that he could not remember when his Kansas bank made its last combine loan. Deere credit is the most profitable part of John Deere, Inc., and contributes about one-third to Deere's total profits.

Into this steaming cauldron of competition goes one more ingredient, that may or may not be digestible: FARMER MAC. The Farm Agricultural Mortgage Corporation has been set up to offer competitive pricing of fixed rate loans. One often over-looked advantage of FARMER MAC's loans is that they are assumable. It appears that the slow initial progress of FARMER MAC is entirely consistent with the relatively lengthy start-up periods of FANNIE MAE, SALLIE MAE and GINNIE MAE.

The consensus among agricultural lenders and financial specialists is that FARMER MAC will have a very difficult time during the next few years. In fact, a number of influential lenders doubt that FARMER MAC will survive. My view is more optimistic. I believe FARMER MAC will survive and make an identifiable niche for itself because it is too important that it not fail, especially for the commercial banks.

Statistically, we have not yet seen a resurgence in loan volume at the Farm Credit System Banks. It will be evident soon. This federally sponsored bank was never as weak or unstable as was commonly depicted in the mid-1980s. The FCS had some structural and operational weaknesses that contributed to high costs and leadership problems. These structural problems, however, have largely been addressed and leadership has been upgraded at many levels in virtually all districts. The result is a more formidable future competitor in agricultural lending than many of us projected. The ABA has recognized the structural gains made by the FCS, and is worried about the competition. This is the reason that FARMER MAC is likely to survive. If it does not survive, the farm real estate lending field will be slowly conceded to the revitalized FCS.

In terms of the red-tape, regulatory problems facing agricultural banking, I am less confident of the outcome. Our regulators are, in my opinion, behind the times. Whereas they were not conservative enough 10 years ago when agriculture was approaching a financial depression, they are now at the point where they will blunt the beneficial edge of the financial leverage sword that cuts ahead, and contributes to income gains on our farms.

Lender liability issues and the scope of the environmental problems on agricultural land will also be sorted out slowly during the next several years. Courts are slowly

becoming more conservative. The pendulum is swinging back from the extreme of over-regulation. This is consistent with the new environmental responsibility that is current among large corporations. In addition, there is a developing societal view that the liberal agenda, as it was offered, can not solve all our societal ills while promoting higher living standards and incomes.

On the regulatory and inter bank competition fronts, the next few years will be challenging. The environment will slowly be cleansed and the current generation of over-zealous (perhaps) regulators will become adjusted to the sanguine idea that agricultural lenders have fully climbed out of the financial sink hole of the 1980s. Bankers will adapt to the new rules, and by relentlessly cutting costs and trimming fat, they will provide quality, competitive products.

Now let's sweep these regulatory issues aside, and face full square the largest finance issue that confronts both farmers and lenders. Will there be money in farmers' pockets to pay the interest and principal? Let me provide my perspective on this over-riding issue, by focusing on the economic fundamentals of agriculture in the early 1990s.

FOCUS ON FUNDAMENTALS

Let's begin by establishing a few ground rules for this forward-look at finance. First, recognize that as important as the next 6 months are, farmers and their lenders need to focus most closely on long run conditions going out 1 to 3 or 4 years. That is, agricultural lending is not a steady business because of the impacts caused by weather disruptions and rapid price gyrations. Agriculture, despite government intervention, still fits the classical competitive model where prices rise or fall to clear markets. Farmers don't shut down plants like General Motors can. Thus, let's look at the fundamentals that play out over several years, and not just a few months. The next (forcast) inch of a line graph need not look like the previous six inches; that's far-sighted instead of near-sighted.

Second, let's plug in a severe drought in the next 3 years or so. There is firm statistical evidence based on wheat yields going back 150 years to indicate agriculture is subject to an 18-19 year weather cycle related to changes in the declination of the moon. You do not have to be a craps or poker player to bet on this cycle - the evidence, as compiled by mathematicians and agricultural climalotogists is too strong to ignore. We are now in the dry phase of that cycle. The year 1991 corresponds to 1936, 1954, and 1973, when conditions in the Corn Belt and Plains were dry.

Third, let's take a wide-angle view, and recognize that Pennsylvania farming is now linked hard, like the links of a heavy log chain, with the Midwest, the European Community, Argentina and Brazil, and Asia economies. How our farmers and lenders perform depends on world-wide weather patterns and governmental actions in Washington, Brussels, Tokyo, Brasilia, etc.

The Setting

Farmers and lenders have recovered from the twin crises of plummeting farm income and large loan losses.

- Between the mid-1970s and mid-1980s, real net farm income fell by more than $20 billion, or nearly half of the $47 billion average during the early 1970s (Chart 1).

- Lenders wrote-off more than $20 billion in bad debt of their farm borrowers (Chart 2).

Farmers made major economic adjustments to survive as viable producers. The brakes were applied to debt, which fell by about 6 percent annually in real terms during the 1980s. Cut-backs in borrowing translated into cuts in investment, which fell about 10 percent annually during the 1980s (Chart 3). Many farmers starved their appetites for new machinery and buildings, and cut back their land expansion plans. Production expense is down 25 percent in real terms over the last 10 years (Chart 4). Beef producers cut the cow herd by 25 percent in order to balance supply and demand.

The consequence of the loan write-offs, belt-tightening and down-sizing is a farm sector economy that is now financially sound. This is best shown by two financial ratios that our theory tells us should be equal to each other when economic conditions are in balance (Chart 5). The interest-to-income ratio was lower than the debt-to-asset ratio during the 1950s and 60s. This signalled that farmers were not accustomed to high debt use. But the relationship between these two key ratios inverted in 1976, providing a clear indication that the unprecedented doubling of nominal farm expense between 1970 and 1976 had stalled profits. Unfortunately, expenses grew by an even larger amount between 1976 and 1981. But the two ratios once again converged after 1985 and declined as well. This behavior provides our best indication that the farm economy is now fundamentally corrected.

Long-Run Fundamentals are Brighter Than The Current Outlook

Farmers and lenders are facing much short-term uncertainty due to the recession, the economic impact of the Persian Gulf war, and the breakdown of trade negotiations in Europe. The next 6 to 9 months could be difficult, financially, for many of our crop and dairy producers. In our state, the projected $2 to $3 slide in dairy prices could be more financially burdensome than the decline in cash grain prices from 1988 to 1989. However, most finance and economic fundamentals are still positive:

- The dollar has fallen 35 percent and is forecast to drop even lower. This makes our farm exports competitive abroad (Chart 6).

- U.S. corn stocks have declined by 75 percent from 4.8 to 1.2 billion bushels. Even a 10 percent cut in yields would cause corn prices to surge higher.

- The livestock meats sector, beef, poultry and hogs, is poised for another solid earnings year given strong poultry and beef exports and low inventories of cattle and pork bellies.

- The 1990 Farm Bill is positive for the long run competitiveness of U.S. agriculture. The flex component of triple base shifts more decision-making to producers, and the 15 percent cut in payments shifts more fiscal responsibility as well. The upshot will be less boom-bust mentality in farm communities.

- The continuing success of the 1986 Tax Reform Act to lessen the burden of non-economic investments or tax-motivated investments is contributing to longer and more stable livestock cycles.

- The current dairy surplus of 2 percent is more manageable than the 10-12 percent surpluses of ten years ago. The over-production penalty of $.05 to $.11 per cwt. will also keep dairy more responsive to market conditions.

- The 35 million acre Conservation Reserve Program (CRP) ensures that we are idling land more consistently and sensibly than in the 1970s-80s.

Also, the world, and particularly the European Economic Community, cannot long afford current levels of protectionism. Tariffs and non-tariff barriers alike are likely to decline slowly over the next few years. Because U.S. producers, in general, and Pennsylvania farmers, specifically, are market-oriented and increasingly efficient, our farmers will do better than average when tariffs fall and trade grows (Chart 7).

Income Gains Likely To Support Financial Progress

When I factor in the above fundamentals, and recognize the current low commodity stocks levels and the present dry phase of the weather cycle, I find farm income continues to be high during the early 1990s.

Although dramatic changes in government policies significantly change the farm income picture, aggregate income levels tend to alternate every 9-10 years. There tend to be high and low segments of 4-5 years within each swing of farm income (Chart 8). My forecast is for one more upward movement in farm income, although at a slower growth rate than in the recent sharp 1985-89 rebound from the financial depression. This approach is similar to the charting often done by those that analyze commodity markets.

If we look at the modern farm bill era, which I believe began about 1950 when both political parties embraced price supports and supply control, then we see the large 18-19

year cycle in farm income that corresponds to the weather pattern. Of course, wars and economic depressions can over-ride the weather cycle. But, in the absence of catastrophic occurrences that are man-made, we may see real farm income rising to the $45-$52 billion level during 1990-94 (Chart 9).

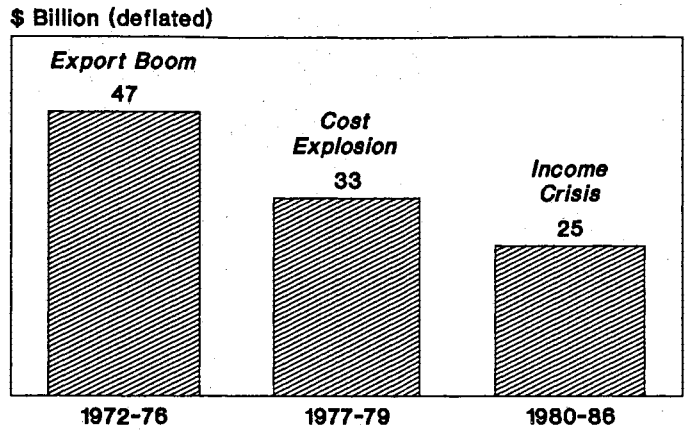
Income of this magnitude will ensure that most farmers will make financial progress in the next few years, and that agribusiness and farm lenders will also enjoy a meaningful level of prosperity. Consistent with higher income, real capital purchases could also rebound to the longrun trend. This trend has slowly declined from $15 to $14 billion, and may regain a level close to the $11-$14 billion trend-line, in a long run sense, by the mid-1990s (Chart 10).

In summary, farm financial progress will spillover to lenders and agribusiness during the early to mid-1990s. A sector with rising capital purchases, asset values, exports and incomes, that is also characterized by tight cost-controls and improved financial management, can be labeled a growth sector (Chart 11). Borrowing is also likely to expand if this scenario is correct.

We need to recognize that the lingering financial problems of the 1980s remain, even in this growth sector perspective. Many producers still have too little production per dollar of investment and hour of labor. Just as prevalent are producers with too much debt relative to their income. For these producers, the temporary decline in prices projected for the next 6-9 months will be difficult to offset in their income statements. Should oil prices not decline this spring, cost over-runs will further haunt farm finances.

However, over the next few years we will need to think less about agriculture as a sector in decline, and more often of agriculture as a vibrant, highly competitive growth sector that will contribute modest gains in farm income. Those producers and lenders that do not recognize the longrun viability of our farm economy, may find that their business will eventually suffer by not keeping pace with this dynamic set of strategic agricultural products for both the benefit of our own people and for increasing numbers of consumers around the globe.

Chart 1
The Past: Farm Income Fell $20 Billion



U.S. net farm income in constant 1982 dollars

Chart 2
Cumulative Lender Loan Losses: More Tham $20 Billion

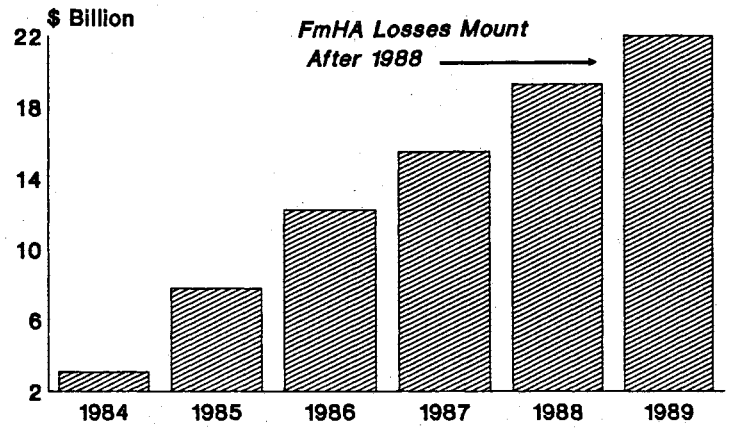


Chart 3
Annual Rate of Growth in Debt and Investment to Rebound From 1980's Low

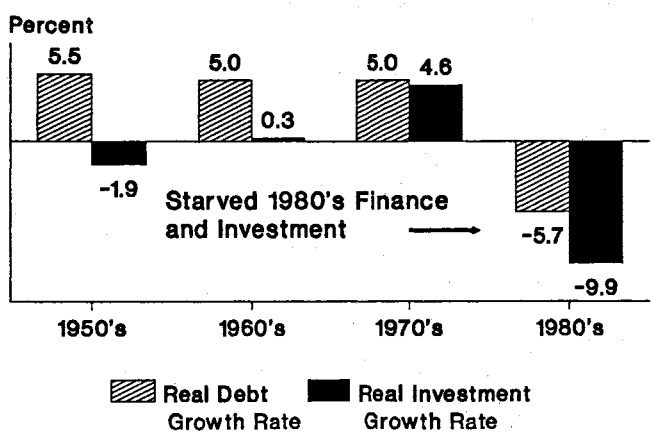
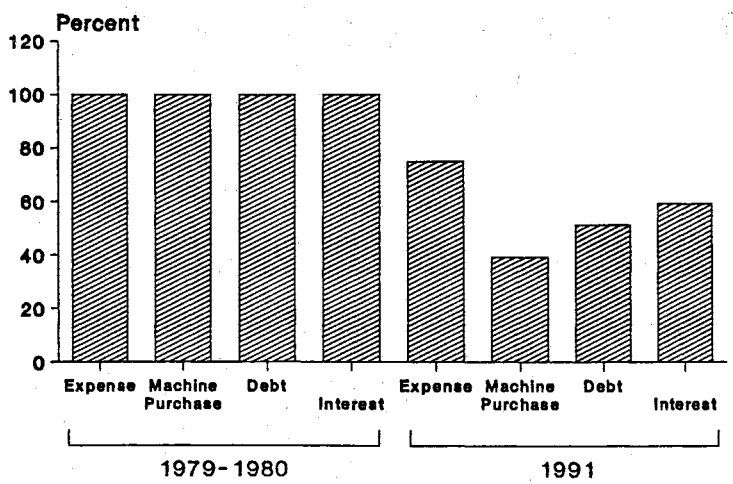


Chart 4
Present: Farmers Lowered Costs



Deflated: constant 1982 dollars

Chart 5
Key Finance Indicators: Gave Leading Signal of Crisis and Recovery

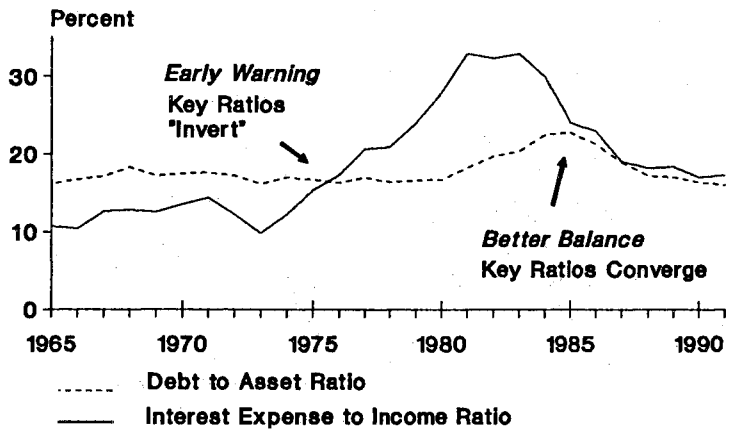


Chart 6
Dollar: Back to Late 1970's Level

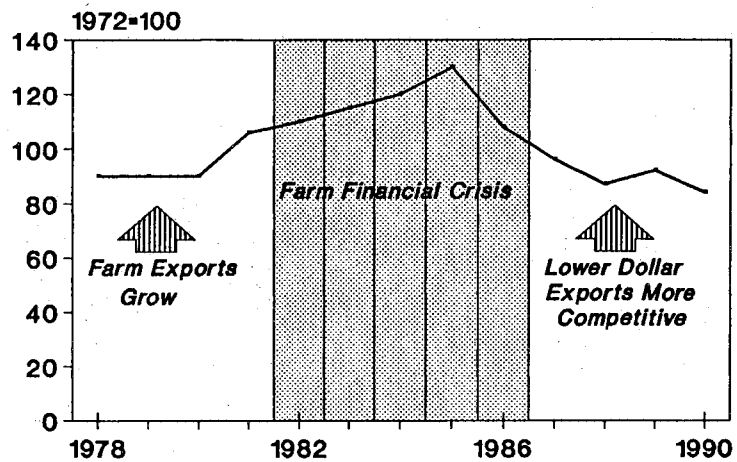


Chart 7
Long-Run Fundamentals Positive

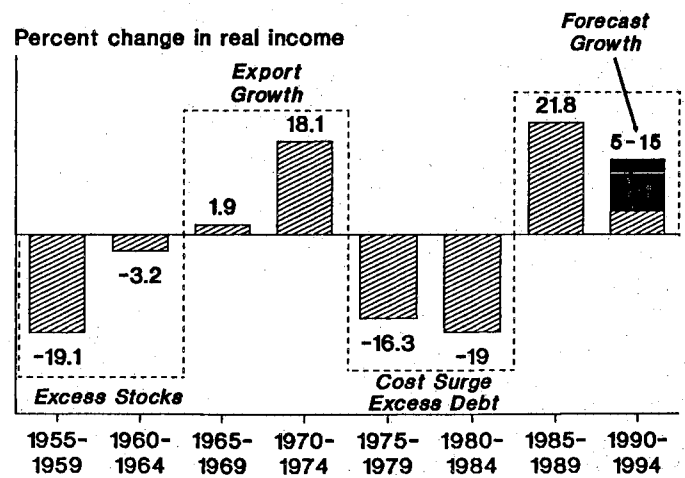
Low Dollar and Trade Liberalization

- World Cannot Afford Protectionism
- Phase-Out of Tariffs Raise U.S. Prices 10-20%
- Dollar to Fall Further - Win/Win for AG

Bullish Institutional Changes

- Market-Based Farm Bills
- Fewer Artificial Investment Incentives
- 35 Million CRP Acres Idled
- Farmers Now Battle-Tested

Chart 8. Continued Growth Phase of Income Cycle in Early 1990's



5 year average annual growth in cash income

Chart 9
Average Real Net Cash Farm Income

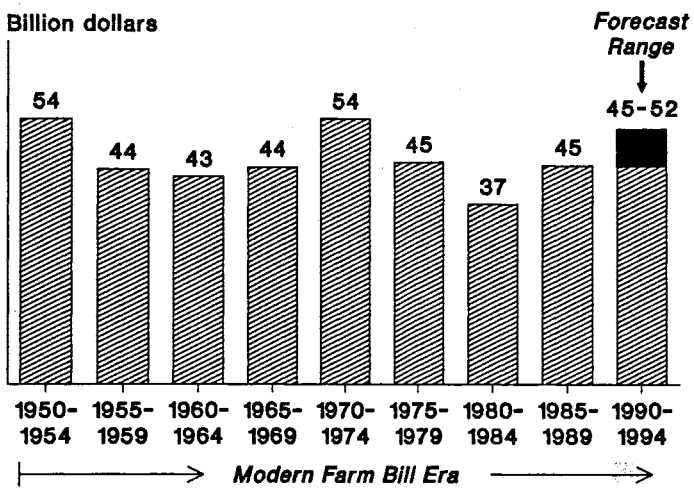
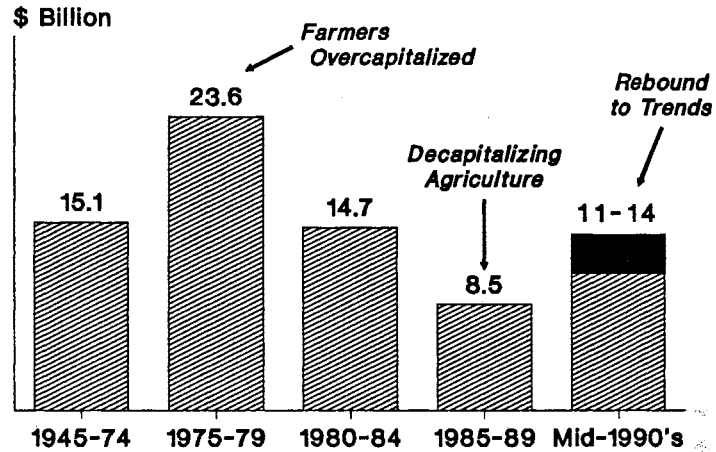


Chart 10. Annual Real Capital Purchases Fell to Record Lows in Late 1980's



Constant 1982 Dollars

Chart 11
AG as a Growth Sector

1980's Viewed as Decline
- Land, Debt, Investment, Exports Down 30% or More, 1983-1986

1991 Slow
- Recession, High Fuel, Cut in Exports

Early & mid-1990's Generally a Growth Period
- Strong Land Collateral
- Confidence for Renewed Borrowing
- Strengthened Exports, Low Inventories

Summary Comments

SHORT RUN: Next 6-9 Months Difficult Financially

LONG RUN: Better Balance in Basic Economics

- Dry Cycle Could Maintain Low Inventories Until Mid-1990's
- Staying Power is Essential to Farmers/Lenders
- Need Contingency Plans for Downturns and and Daily Cost Control

NEXT 5 YEARS: Moderate Growth Likely to Occur

RURAL PENNSYLVANIA'S NONAGRICULTURAL ECONOMY: ITS STATUS AND DIRECTION

Stephen M. Smith*

Why should farm and agriculturally oriented people be concerned with Pennsylvania's nonagricultural economy? I think there are several compelling reasons why, and also that this concern should translate into more direct involvement to maintain and improve this segment of the economy. In short, the long run sustainability of rural communities and rural families, as well as family farms, depends on successful efforts to improve the viability of rural areas for nonagricultural business and industry. This is true not only for what might be termed "traditional" nonagricultural industries, but especially for nontraditional rural activities. By the end of this paper the information I provide will help you see why I have this perspective.

I will review recent trends in Pennsylvania's rural economy. This will focus on employment in major industry sectors in metropolitan and nonmetropolitan counties, and changes since the mid-1970s. Reasons for the changes will be discussed, and the information will be used to examine the implications for the future rural economy.

INDUSTRY EMPLOYMENT TRENDS

Pennsylvania is the most rural state in the United States, measured by number of people. More than 3 million people, over a quarter of the state's population, live outside urbanized areas. Any discussion of the rural economy in the 1990s, however, must start from a far different perspective than historically has been the case. Rural does not mean agriculture or farm, and nonmetropolitan or nonurban does not mean farm. One cannot understand the problems of rural economies and people today if rural is equated with agriculture, or with other traditional rural nonagricultural industries such as mining and forestry. We must start by recognizing the steadily smaller role farm work plays in the life and economy of rural and small town America. "The rural landscape is still farm and forests, but the people and their pursuits are overwhelmingly part of the nonfarm economy" (Beale, p. 14). This is particularly true for Pennsylvania.

The change in farm population provides an initial illustration of the meaning of the above statements. Chart 1 shows the state's total farm population, and its percentage of the state and rural totals, in 1950, 1970, and 1988. In 1950, the farm population was 6.7% of the state total, and about 23% of the rural total. By 1988, farm population had decreased by over 80% (from 705,000 to 132,000), and represented about 1% of the state

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total, and only 3.5% of the rural population. In comparison, for the nation as a whole, the farm population averaged 7.2% of the rural total in 1988.

Charts 2 and 3 provide further illustration of the increasingly nonagricultural character of Pennsylvania and the nation. Chart 2 shows the counties designated as farm dependent by the USDA in 1950. (Farm dependent is defined as at least 20% of county wage, salary and proprietor income from farming.) Even 40 years ago only about a dozen Pennsylvania counties were classified as farm dependent. By the mid-1980s (actually, at least 10 years earlier), the number was zero (Chart 3). On the other hand, Chart 4 shows that over half of our nonmetropolitan counties were classified as manufacturing dependent in the mid-1980s (30% or more of income from manufacturing), which is actually a decrease from the late 1970s. Much of this manufacturing is, however, resource-based; that is, food or wood processing.

A broader picture of the changes from 1975 to 1987 in Pennsylvania's economic structure, for both metropolitan and nonmetropolitan counties[1], is shown in Chart 5. (Table 1 provides numerical detail for these changes.) This chart divides employment into six broad industry categories. The first four categories can be thought of as traditional "rural," resource-based industries. The last two include manufacturing and service industries that are not directly related to these rural industries. There are interesting differences between the two groups of counties in the employment changes in these industry sectors. The Farm category, including farm proprietors, family labor and hired labor, is clearly continuing its long term decline. The percentage decreases were the same in metro and nonmetro counties, but absolute declines in farm employment were much greater in metro counties. The Agriculture Related category includes industries directly related to farm production--agricultural services, food processing, farm machinery manufacturing, and farm supply and equipment distributors. Employment in these industries declined in nonmetro counties at about the same rate as farm employment. In metro counties, however, employment in these agriculture related industries actually increased slightly, despite larger farm employment declines. This is due to sizeable increases in agricultural services employment. This pattern implies an increased concentration of agricultural services, farm supply outlets, and farm machinery manufacturing in fewer places, especially metropolitan areas. Mining employment declined substantially in both metro and nonmetro counties. The only traditional rural industries to show increased employment were the Forestry Related industries--wood products and paper manufacturers. They increased employment at high rates in both metro and nonmetro counties, although metro counties added twice as many jobs in these industries as did nonmetro counties.

The major declining industries in both metro and nonmetro areas were the manufacturing sectors not directly related to the rural extractive industries. In

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[1]A county is defined as metropolitan if it (1) has either a city with a population of at least 50,000, or an urbanized area of at least 50,000 and a total metropolitan area population of at least 100,000, or (2) has close economic and social relationships with the central counties (commuting patterns; population densities).

Pennsylvania's nonmetro counties, the net employment declines in these industries were more than four times greater than in agriculture and related industries (Chart 6). This raises an issue that seems to counter "conventional wisdom." The farm financial crisis and declining farm numbers in the mid-1980s led to great concern for the health of rural economies. Even nationally, however, this was but a small part of a widespread economic decline in the rural economy. Rural job declines were not primarily in farm or agriculturally related industries. This was particularly true for Pennsylvania. Statewide, job losses in mining alone far exceeded those in farm and agriculturally related industries (Chart 6).

The industries showing the largest net employment increases since 1975 were the service sectors (Chart 6). Service sector employment increases in nonmetro counties were more than double the losses in manufacturing. This category includes a wide variety of industries--transportation and communication; wholesale and retail trade; finance, insurance and real estate; medical and health; business and professional; and personal and social services. The largest percentage increases were in social, medical and health, and business and professional services. The latter two categories are generally high skilled and well-paid, and employment increases in these industries more than offset the losses in the farm, agriculture related and mining industries.

THE NATURE OF PENNSYLVANIA'S RURAL ECONOMY

So, what is the nature of the economy that these changes have brought? Before examining this, we must remember that these figures are aggregations across many individual industries and counties, which masks considerable diversity in changes. A few manufacturing industries in certain counties have shown strong employment growth. Furthermore, employment decline does not necessarily equal output decline. In agriculture, manufacturing, mining and forest products, total output and output per worker have increased considerably through adoption of new technology. For example, total personal income in agriculture has continued to rise although the number of farmers continues to decline. Also, the forest products and steel industries nationwide produce more than the late 1970s peak, with considerably fewer workers.

In general, we must conclude that the nature of our rural economy has changed greatly. The industries that we thought of as traditionally rural, and providing jobs for rural residents, no longer characterize rural economies. The economy of rural Pennsylvania is certainly not agriculturally or mining based. In addition, much of the rural manufacturing employment has been lost. Technology, and national and international economic forces make it extremely unlikely that we will regain this lost employment. Production technology requires fewer people to do the same tasks, and much low paid, low skilled routine manufacturing can be done more cheaply in other countries.

The data also vividly show that farm does not equal "rural," or "nonmetropolitan." The same is true for mining and forestry related industries. In fact, most employment in

traditional rural industries is in metropolitan counties. About 60 percent of farm proprietors and farm employment, 90 percent of agriculture related manufacturing and services, 75 percent of wood processing, and over half of mining employment is in metropolitan counties (Table 1).

Charts 7a and 7b illustrate the extent to which the economy of Pennsylvania's rural areas has become based on nontraditional industries. For the state as a whole, the traditional rural industries of agriculture, forestry and mining provide less than 8 percent of total employment, other manufacturing less than 20 percent, and the service sector two-thirds of all jobs. The nonmetro counties are more dependent on manufacturing, and fully twice as dependent on the traditional rural industries (17 percent of employment), but 56 percent of the jobs are now in the service sectors.

This trend toward more service jobs, both absolutely and as a percentage of total employment, will continue. One reason is the nature of the modern economy, where technological change continues to decrease the need for labor in manufacturing and resource exploitation, and where services make up more and more of the final value of a product. Another reason is the large and still increasing elderly and retired population in rural Pennsylvania, which leads to demand for more and different types of social, health, and medical services. Wayne, Pike and Wyoming counties in northeastern Pennsylvania are now officially designated as retirement destination counties. Interestingly, these counties also have performed better economically than the rest of the state's rural counties in recent years. Increased tourism and recreation is another reason for more service sector jobs, primarily in the lodging, restaurant, retail and entertainment industries.

One key result of these changes is that the economy of rural Pennsylvania has become more diversified. Although this certainly means changes in employment opportunities, in general it is a positive development. Diversified economies are more stable over the business cycle, with respect to employment and income. Industries react differently to changes in the national economy. A region with a wider variety of industries is less likely to have all of them on a down-cycle at the same time. Many service industries, in particular, tend to be more stable, increasing employment faster during upswings, and maintaining employment during down turns.

IMPLICATIONS

What do these changes imply for rural Pennsylvania and its people and communities? A key implication involves the question I asked at the beginning - what does this mean for farm and agriculturally oriented people? Pennsylvania has maintained a relatively stable structure of small and medium size family farms, with more than half in metropolitan counties. Why? Farming is no more profitable in Pennsylvania than in other states. A main reason is the availability of off-farm employment. It has become increasingly clear that the maintenance of family farms and farm family income is related

to the structure and vitality of the rural nonfarm economy (Hallberg et al. 1987). In almost 70 percent of Pennsylvania farm families, either the operator or the spouse works off the farm, and both have off-farm jobs in 30 percent of the farm families. Off-farm income accounts for two-thirds of taxable farm family income in Pennsylvania, with more than 80 percent of farm families earning more than half their taxable income from off-farm sources. The continued survival of farm enterprises throughout the state will be based on the availability of job opportunities in, or within a reasonable commuting distance of rural areas. As we have seen, these opportunities are more and more likely to be in nontraditional rural industries, particularly services.

What advantages do rural areas have for nontraditional new business and industry? The focus of many development efforts has been, and still is, to tout an area's low wage labor. However, low wage, unskilled labor is not the attraction it once was. While rural areas in the United States are still relatively low wage compared to urban areas, it is not at all clear that this balances out the low levels of skills, training, education, and infrastructure. Wages in many other countries are low enough to provide this balance. Our competitiveness, for the nation as a whole, and increasingly for rural areas, is in industries that require more highly skilled and educated labor for the modern manufacturing and service industries. Unfortunately for rural communities, most of these businesses find what they need in or close to urban areas.

In addition to an educated labor force, success in competing for new rural industries also requires maintaining and improving the traditional physical infrastructure of transportation, water and waste disposal; building a modern communications base; and improving social, public and private services.

The result of such efforts will be to provide a work force, an economy and communities that are much more flexible in the face of certain change. The lack of flexibility in rural communities in response to economic change lies behind their economic problems. While rural areas have become more diversified, they still depend on too limited a range of industries, relative to urban areas, and are thus more subject to fluctuations. Changes in national and international economic conditions have made this lack of diversity more risky than in the past. The 1980s brought this home to most of rural Pennsylvania. In the past, the opening of a mine or a manufacturing plant meant a relatively secure future. No longer. Market conditions or technological change can suddenly do away with those jobs. In many rural areas, specialization is region-wide, with many communities sharing the same specialty--narrow types of mining or manufacturing in Pennsylvania, for example. This implies a need for still more diversified economies in rural areas to help counter the adverse effects on traditional industries. An educated work force supported by proper modern infrastructure, can provide rural communities with much more flexibility.

CONCLUSIONS

Where is Pennsylvania'a rural economy going? There will be opportunities in high technology industries, both manufacturing and services. The United States is facing greater competition in all these industries, however, and we will likely lose the race for such industries as routine high tech assembly. To capture and maintain employment in high tech industries we will have to stay on the cutting edge.

We must also learn to focus on services as we have manufacturing. Services provide jobs in their own right, and also create the environment for other economic activity. Attracting many types of services will not be easy, however. Most service employment growth in Pennsylvania has been in metropolitan counties and large urban areas. The service growth in nonmetropolitan counties has taken place primarily in counties adjacent to metro counties. Keys to attracting service employment seem to be a modern telecommunications infrastructure, convenient air transportation, natural amenities, and high quality public services, including education.

The future cannot be all high tech and services, however. We must also build on our current strengths. Many of these strengths still are our traditional rural-based industries, although they may no longer be strictly rural. These industries are food processing, wood products and many traditional manufacturing industries. To maintain profitability in these industries we must use high technology in both manufacturing and services. This also implies, however, that we need more "high tech" people--educated and trained; flexible--so that they can change with the changing needs of both traditional and new industries.

Pennsylvania's rural economy has seen considerable decline in the traditional agricultural, resource and manufacturing industries. Future sizeable growth in these industries is very unlikely. Almost all net new employment has been in service industries. Maintaining and improving the rural economy will depend on being able to attract nontraditional industries. This will not happen without a more educated and skilled work force that can adapt to the needs of modern business and industry. Improvements in the physical, communications and social infrastructure are also necessary. At the same time, agriculture and other resource-based industries cannot be neglected. Rural areas will continue to rely on them to a greater extent than urban areas. The same work force and infrastructure improvements necessary to attract nontraditional rural industries will also enhance the competitiveness of the traditional rural industries.

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Table 1. Total Employment and Changes by Industry Sector, Pennsylvania's Metro and Nonmetro Counties, 1975-1987

	Total Employment		Change	% Change
	1975	1987	1975-87	1975-87
Nonmetro counties[a]				
Farm[b]	50,220	44,472	(-5,748)	(-11.4)
Agriculture Related[c]	12,068	10,599	(-1,469)	(-12.2)
Forestry Related[d]	15,280	19,907	4,627	30.3
Mining	20,596	15,760	(-4,836)	(-23.5)
Construction	14,395	18,652	4,257	29.6
Other Manufacturing[e]	152,632	120,760	(-31,872)	(-20.9)
Service Sector	223,555	290,651	67,096	30.0
Total Nonmetro	488,746	520,801	32,055	6.6
Metro Counties				
Farm[b]	73,780	65,528	(-8,252)	(-11.2)
Agriculture Related[c]	99,267	99,929	662	0.7
Forestry Related[d]	56,784	66,165	9,381	1.65
Mining	34,796	16,361	(-18,435)	(-53.0)
Construction	168,560	201,238	32,678	19.4
Other Manufacturing[e]	1,029,421	750,424	(-287,997)	(-27.1)
Service Sector	1,696,758	2,723,784	1,027,026	60.5
Total Metro	3,159,586	3,923,429	763,843	24.2

[a] 1980 classification

[b] The farm workforce was calculated by multiplying the percent of farm operators in nonmetro and metro counties times the total farm workforce in Pennsylvania for the respective years. The 1975 farm employment is actually 1974, as 1975 employment was not available. Included are farm operators, unpaid family labor and hired labor.

[c] Includes S.I.C. categories 07, 20, 287, 3523, 5083, 515, 5191.

[d] Includes S.I.C. categories 24, 25, and 26.

[e] Excludes manufacturing industries included in Agriculture Related and Forest Related categories.

Sources: Farm employment is from the Census of Agriculture, 1974 and 1987, and Table C1. "The structural character and recent trends of Pennsylvania agricultural economy" by M. C. Hallberg and E. J. Partenheimer. Bulletin 869, Agricultural Experiment Station, The Pennsylvania State University, January 1991. Employment for other industry sectors is from County Business Patterns, 1975 and 1987.

Table 2. Percentage Distribution of Employment in Pennsylvania, 1987

	% of State	% of Metro	% of Nonmetro
Farm	2.5	1.7	8.5
Agriculture Related	2.5	2.6	2.0
Forestry Related	1.9	1.7	3.8
Mining	0.7	0.4	3.0
Construction	5.0	5.1	3.6
Other Manufacturing	19.6	19.1	23.2
Service Sectors	67.8	69.4	55.8

Chart 1. Pennsylvania Farm Population

	Number	Farm as a % of: Total State	Rural
1950	705,000	6.7	22.8
1970	210,000	1.8	6.2
1988	132,000	1.1	3.6

Chart 2. Farming Counties, 1950

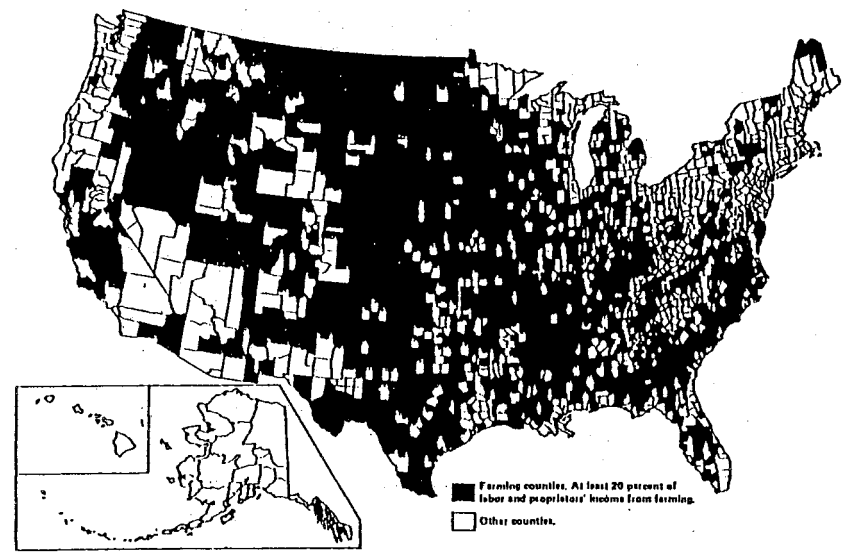


Chart 3. Farm-dependent nonmetro counties, 1988

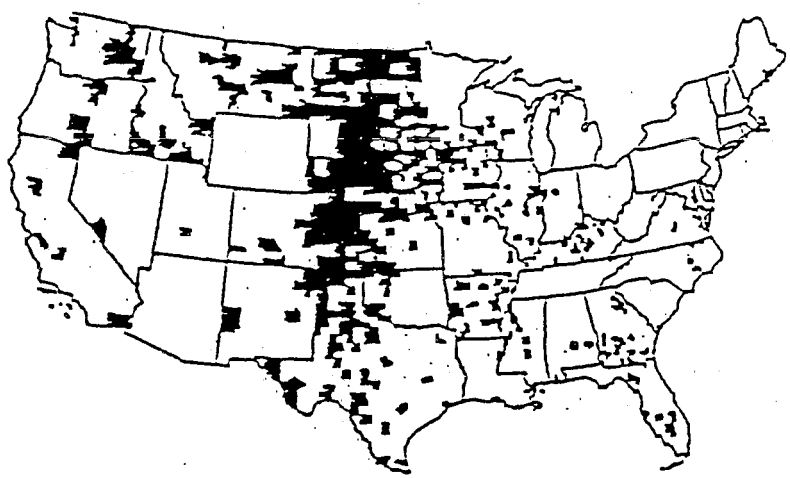


Chart 4. Manufacturing-dependent nonmetro counties, 1986

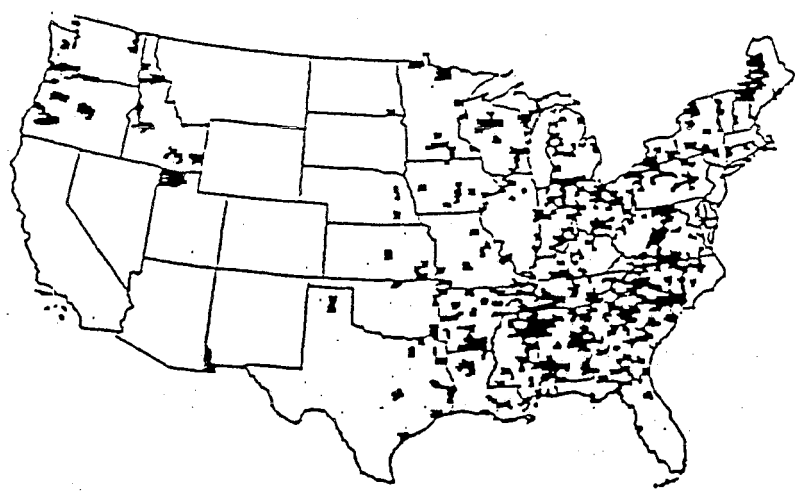


Chart 5. Percentage Change in Employment in Metro and Nonmetro Counties in Pennsylvania, 1975-1987

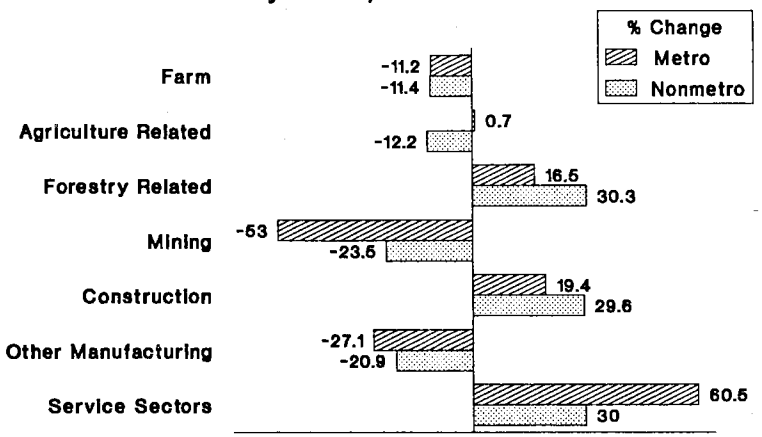


Chart 6. Employment Change in Metro and Nonmetro Counties in Pennsylvania, 1975-1987

	Metro Counties		Nonmetro Counties	
	Employment Change	Percent Change	Employment Change	Percent Change
Farm	(-8,252)	(-11.2)	(-5,748)	(-11.4)
Agriculture Related	662	0.7	(-1,469)	(-12.2)
Forestry Related	9,381	16.5	4,627	30.3
Mining	(-18,435)	(-53.0)	(-4,836)	(-23.5)
Construction	32,678	19.4	4,257	29.6
Other Manufacturing	(-278,997)	(-27.1)	(-31,872)	(-20.9)
Service Sectors	1,027,026	60.5	67,096	30.0

Chart 7a. Distribution of Employment in Pennsylvania, 1987

Percent of State

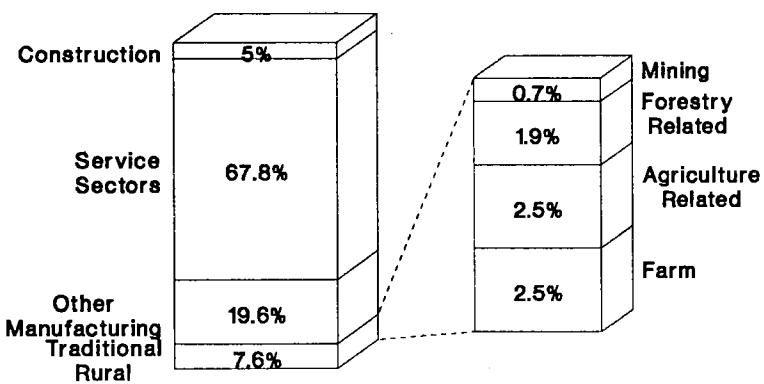
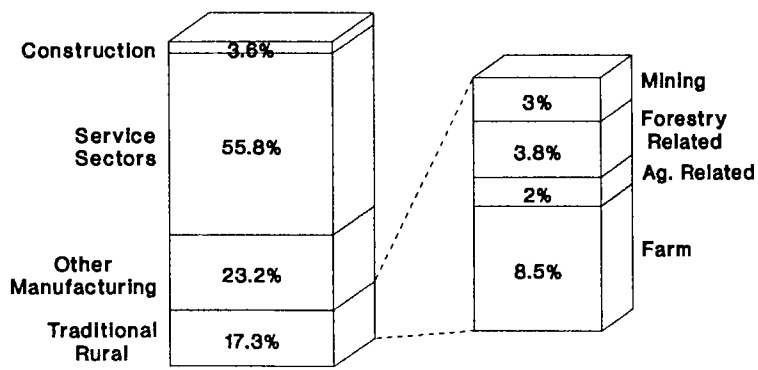


Chart 7b. Distribution of Employment in Pennsylvania, 1987

Percent of Nonmetro Counties



AGRICULTURAL TRADE AND TRADE AGREEMENTS

M. C. Hallberg*

Agricultural exports are now and always have been of great importance to American farmers. Following the Civil War, agricultural exports accounted for 80-85 percent of all U.S. exports (see Chart 1). This percentage has declined steadily since 1880 as the U.S. economy diversified and grew, but agricultural exports still account for about 12 percent of all U.S. exports. In fact some proudly point to the fact that the agricultural trade balance has been positive every year since 1959 while the total U.S. trade balance has been continuously negative since the early 1970s.

It is somewhat more instructive, though, to trace the path of agricultural exports relative to total value of agricultural sales over the past several years. Here we see that agricultural exports as a percent of cash receipts from farming reached nearly 30 percent in 1879 and again in 1900 (Chart 2). This percentage declined steadily through World War I and the Great Depression of the 1930s, and reached its lowest point ever at the beginning of World War II. Subsequent to World War II and its aftermath, this trend was reversed--slowly through the 1950s and 1960s, then more rapidly starting in 1972-73 and continuing through 1980-81. Many analysts point to the increasing importance of exports to agriculture now that international markets have become more open and interrelated. It is interesting to note here that it took 80 years for agricultural exports to regain their 1900 level of relative importance!

It is hazardous to carry this type of analysis too far. The mix of products making up agricultural exports has changed markedly since the Civil War as have the prices for the different commodities exported. For example, the United States now exports more corn and less cotton than it did in 1900. Further, we undoubtedly export more processed products relative to the total than we did in earlier years. Nevertheless, Chart 1 shows some rather interesting trends and offers the possibility of associating specific historical events with different segments of the graph.

The period from 1949 to 1969 might be characterized as one when nations were attempting to put international commerce in order (following several wars and associated periods of restricted trade) with a variety of new institutions of international cooperation. The period from the early 1970s to 1981 was one of agricultural production shortfalls in many countries (not including the United States), coupled with rising incomes in Western Europe and parts of Asia and greater flexibility in currency markets. The period from 1982 to the present might best be characterized as one in which (1) the U.S. dollar had become too over-valued to sustain 1981 levels of agricultural exports, and (2) other countries (notably Western Europe and Japan) ushered in a new era of agricultural protectionism.

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IMPORTANCE OF AGRICULTURAL EXPORTS TO PENNSYLVANIA

The fortunes as well as the foreclosures of U.S. farmers in the aggregate have been closely associated with the ups and downs of agricultural exports. When agricultural exports are relatively high, aggregate farm income tends to be high and asset values in agriculture tend to rise. On the other hand, when agricultural exports are relatively low, farmers on the whole experience low incomes and reduced asset values. The U.S. agricultural sector, then, generally favors increased agricultural exports and movements toward agricultural trade liberalization as advocated by our trade representative in the current round of multilateral trade negotiations.

Clearly, Pennsylvania farmers are less directly affected by farm exports than are Iowa or Illinois corn and soybean farmers or Kansas wheat farmers. USDA's Agricultural Statistical Service provides estimates of the value of exports of agricultural commodities in Pennsylvania (Pa. Dept. of Agr. Statistical Summary. Agricultural Statistics Service. Harrisburg. 1989.) These estimates are not based on a census of Pennsylvania exporters so they are, at best, rough approximations. They indicate that about 7 percent of Pennsylvania's agricultural products are exported. Census of Manufactures data, on the other hand, which are based on a survey of food manufacturing firms suggests that only about 3.5 percent of Pennsylvania's manufactured food products are exported. Given that most Pennsylvania exports are probably in the form of processed products, hides for tanning, and breeding stock or production animals rather than bulk commodities, the 7 percent figure is suspect. Nevertheless, these data suggest that direct exports of Pennsylvania agricultural products are not negligible.

Pennsylvania farmers are likely indirectly affected to an even greater extent by international trade in agricultural commodities. When, for example, feed grain prices rise and feed grain production increases as a result of increases in foreign demand, Pennsylvania milk, broiler, and egg producers' costs rise. The price farmers receive for milk, broilers, and eggs frequently rise also when feed grain prices rise, but if the lag is quite long or if excess supplies of milk, broilers, or eggs prevent a price rise in these commodities, Pennsylvania producers will be disadvantaged by the increased exports. Thus all farmers will not necessarily benefit equally from increased exports brought about by world agricultural trade liberalization.

PROTECTIONISM TAKES MANY FORMS

Unfortunately, nations frequently adopt policies that work to restrict trade in agricultural commodities. They do this primarily to isolate domestic producers from international competition and in this way preserve a local industry that may not otherwise be able to survive the international competitive process. The result is not only reduced agricultural trade, but also reduced world prices of the impacted commodities.

One way this is done is with import tariffs and/or import quotas as is the case, for example, in Japan for rice, in the European Economic Community (EEC) for almost all agricultural commodities produced there, and in the United States for milk, peanuts and sugar. What happens when such policies are adopted is that (1) domestic price as well as domestic production increase, (2) world price and world production fall, and (3) world exports decline. The world loses in terms of overall reduced production efficiency, even though there are some isolated gainers. The principle gainers are the rent-seeking quota holders, domestic processors dependent upon a large and readily available supply of the impacted commodity, and/or the treasuries of the countries imposing the import barriers. Local consumers clearly lose because they are required to pay a higher price for the food or fiber produced from the impacted commodities.

Politicians claim that local producers protected by the trade policy also gain. But do they? Local producers gain only in the sense that their jobs or their way of life are preserved. The more likely result is that local producers lose because they are discouraged (by the protective legislation) from shifting to an occupation in which they could earn even higher labor, capital, and/or management returns.

A second means of isolating domestic producers from foreign competition is via price supports (or target prices) sustained with export subsidies as, for example, is the case in both the United States and the EEC. Again the result is that (1) domestic price increases (with price supports) and domestic production increases, (2) world prices and production fall, and (3) exports from the country using price supports and export subsidies increase. But there is a cost. First, the country implementing the price supports must subsidize exports to drive world prices down and in this way encourage foreign consumers to purchase more of the commodity. This involves a direct government outlay. Some of this outlay is transferred from domestic taxpayers to domestic farmers, but much of it gets transferred directly to foreign buyers in the form of reduced prices.

These two examples highlight several fundamentals about international protectionism:

1. International markets and international marketing are distorted.

2. World prices of the protected commodity tend to be driven down while domestic prices of the protected commodity tend to be artificially buoyed up.

3. There is almost always a third party who benefits--a quota holder, a state trader, a storage agent, a related industry processor, etc.--who exercises considerable political power in seeing that the protectionist policies continue.

4. The protected producers and/or resources are prevented (discouraged) from seeking their best alternative employment which leads to significant efficiency losses.

5. World productive efficiency is significantly reduced as countries that do not enjoy a natural (absolute or comparative) advantage are encouraged to overproduce at the expense of countries that do enjoy a natural (absolute or comparative) advantage.

6. Consumers in the country imposing the protectionist measure are materially affected since they must pay a higher price for the protected commodity and/or must pay the cost of the subsidy.

ELIMINATING PROTECTIONIST POLICIES IS IN OUR INTEREST

In general, it can be said that everyone benefits from free trade unhampered by protectionist strategies at home or abroad in any commodity area. Policy makers in Great Britain became convinced of this fact during the middle 1800s as evidenced by their repeal of the protectionist British Corn Laws in 1846. The major Western countries of the world became convinced of this following World War II as they conceived and put into motion an organization (GATT) to serve as a means of increasing world trade. Two organizations (the World Bank and the International Monetary Fund) formed during this period were designed to assist nations with their economic development efforts so they could become better trading partners and thereby contribute to increased world trade.

With free trade, consumers in all countries will have available a larger and more diverse bundle of goods and services at lower overall prices than they would under total or partial isolation. Prices of most imported goods and their domestic equivalents will be lower. Prices of most exported goods will be higher on the international market. Consumers, though, will be able to reallocate their incomes in such a way as to achieve greater satisfaction from consuming less of the now more expensive goods and more of the now less expensive goods.

Trade will also have an impact on the structure of the economy in that investment and expansion will be stimulated in the export industries and discouraged in the import industries. This in turn means there will be a change in the demand structure for inputs and in the value of resources devoted to the respective industries. Of course, some producers in the United States and some producers in other countries will need to shift into production of an alternative commodity or service where their prospects are better. They may not be happy about having to make the switch, but they will be forced to do so in order to make a comparable level of income.

GENERAL AGREEMENT ON TARIFFS AND TRADE (GATT)

The GATT was negotiated in 1947 among 23 countries, including the United States, with the aim of increasing international trade by reducing tariffs and other trade barriers

and thereby contributing to global economic growth and development. This agreement provides a code of conduct for international commerce. It also provides a framework for periodic multilateral negotiations on trade liberalization and expansion. Eight negotiation sessions ("rounds") have been held, including the first Geneva Round (1947), the Annecy Round (1949), the Torquay Round (1950-51), the second Geneva Round (1955-56), the Dillon Round (1960-61), the Kennedy Round (1963-67), the Tokyo Round (1973-79), and the Uruguay Round initiated in 1986 and formally terminated just before Christmas of 1990.

The agreement is currently subscribed to by 96 signatory governments which together account for more than 80 percent of world trade. It is informally adhered to by an additional 30 or so largely developing nations.

Under GATT, quantitative trade restrictions and nonagricultural export subsidies are generally prohibited, and export "dumping" is subject to prescribed legal action. Domestic quotas are permitted when a country is attempting to curtail production, and export restrictions are allowed during periods of severe domestic shortages. Several policies such as variable levies (as implemented by the EEC), minimum import prices, and voluntary export agreements not in use when GATT was drafted have not come under its jurisdiction.

The first seven GATT "rounds" focused on tariff cuts on manufactured products. Attempts to bring agricultural trade into the negotiations in a significant way were unsuccessful. The Uruguay Round was the first to focus on agriculture. The aim here was to bring discipline to agricultural trade by reducing distortions caused by import barriers and export subsidies.

The United States and the Cairns Group sought removal of all forms of protection over the course of the next ten years. The Cairns Group is an interesting collection of bedfellows. It includes several developed economies poised to benefit handsomely from increased prices of traded goods because of sizable exports (Canada, Australia, New Zealand, Argentina, and Brazil), some additional Latin American countries with an excess of exports over imports of agricultural commodities (Chile, Colombia, and Uruguay), other Pacific Rim countries that are large exporters of agricultural commodities (Indonesia, Malaysia, The Philippines, and Thailand), and one Eastern European country (Hungary) with a positive trade balance in agricultural commodities.

The United States subsequently softened its position somewhat, calling for (1) the total cost of export subsidies on agricultural commodities as well as the total quantity of subsidized agricultural commodities to be cut by 90 percent over ten years from their 1986-88 levels, (2) export subsidies on processed farm products to be cut by 100 percent in six years over the 1986-88 base level, (3) non-tariff barriers (production subsidies, import quotas, voluntary export arrangements, "health and safety" standards, licensing and customs regulations, etc.) to be converted to their tariff equivalent and reduced by 75 percent in ten years from the 1986-88 level--the so-called "tariffication" requirement, (4) a "tariff snap-back" option under which tariffs may be restored temporarily to base levels

if import quantities exceed 120 percent of former levels, and (5) subsidies to domestic producers to be reduced by 75 percent in ten years from 1986-88 levels. This position is also subscribed to by the Cairns Group.

The EEC position, on the other hand, includes three elements: (1) a reduction in export subsidies by 30 percent in ten years, (2) the base level for tariff reduction to be the single year 1986 when subsidies were exceptionally high, and (3) "rebalancing" under which lower import protection in some commodities (e.g., cereals) would be accepted in return for higher import protection in other commodities such as oilseeds and corn gluten. It is significant to note that import protection on oilseeds and corn gluten is at present not permitted under GATT!

Japan is agreeable to elimination of export subsidies on agricultural commodities--she has few if any agricultural commodities to export. Japan (and other Asian nations), though, refuses to give up domestic subsidies and import controls that promote self-sufficiency.

As we all know, the United States, the Cairns Group, the EEC, and Japan failed to come to consensus on these issues, and the current round of GATT negotiations terminated in December, 1990, without an agreement on agricultural subsidies. The EEC maintained its position arguing that short-term "market management" is sufficient--that is, no support reductions would be needed if "market management" resulted in higher prices on the international market. Japan also maintains her position arguing that it is exporters who are the problem, not major importers like Japan and Korea concerned only about food security. But, of course, it is the latter markets that the major exporters seek to penetrate.

WHAT ARE THE ALTERNATIVES?

To some, the current failure of GATT is neither new nor surprising. Over the course of GATT's history, tariffs have indeed fallen, but non- tariff barriers to trade have actually risen so as to overshadow the tariff reductions. These non-tariff barriers are difficult to control and nearly impossible to police. GATT has been slow to adjust to changing patterns of international commerce brought about by more freely mobile capital among nations and increased use of information technology by the financial industry. The GATT process is itself snail-like. The Tokyo round took 6 years to complete and the current Uruguay round was initiated in 1986. (In contrast, the Canada-U.S. free trade agreement was worked out in 18 months.) The agenda for discussions among 96 sitting members is extremely complex. Numerous exceptions to the rules must be made to accommodate such a large and diverse group. Further, the negotiations proceed by consensus rule so any one country can effectively and easily block progress. Finally, enforcement is difficult at best.

The United States has used a variety of methods in an attempt to direct the GATT debate and/or to encourage concessions from other nations. It uses the threat of retaliatory action under section 301 of its Trade Laws. The Food Security Act of 1985 gave the President two new instruments--the Export Enhancement Program and the Targeted Export Assistance Program--both of which amount to Congressionally sanctioned export subsidy programs and of which were continued by the 1990 Farm Bill.

More recently the United States has pursued and is pursuing the option of bilateral trade agreements. One such agreement was concluded with Israel in 1985 and a second with Canada in 1989. We are currently exploring the possibility of free trade agreements with Mexico, Chile and other Latin American countries, the ASEAN countries,[1] and (albeit with less vigor) Japan, South Korea, and Australia. In addition the Caribbean Basin Initiative, while not a free trade agreement, was designed to foster closer economic ties with that region and to afford the Caribbean countries duty-free access to the U.S. market.

One argument for bilateral trade agrrements is that if global welfare is maximized by global free trade and if free trade agreements are a move toward global free trade, then global welfare can at least be improved by bilateral free trade agreements. Another argument for bilateral trade agreements is that they put nations such as the EEC and Japan on notice that we are serious about trade liberalization and that they should abandon their protectionist policies.

ARE FREE TRADE AGREEMENTS IN OUR INTEREST?

Most of the countries indicated above are interested in a trade agreement with the United States for rather selfish reasons: (1) to maintain access to the huge American market, (2) to protect themselves against a possible future protectionist trade policy on the part of the United States as it tries to counter the protectionist policies of the EEC and Japan, (3) to buffer themselves against third party traders (e.g., the ASEAN countries against Japan), (4) to gain a formal mechanism for settling trade disputes with the United States, and/or (5) to achieve closer political as well as economic ties with the United States. In few, if any, cases are they interested in trade liberalization per se unless it means increased exports to the United States.

Charts 3 and 4 give some perspective on the relative importance of agricultural trade between the United States and the countries with which the United States has a trade agreement or is considering one. Canada, Central and South America, the ASEAN countries, and Australia have an agricultural trade deficit with the United States. All of the other countries/regions, though, already have an agricultural trade surplus with the United States. For the trade deficit countries, the situation is not likely to change given their

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[1]The ASEAN countries consist of Indonesia, Malaysia, The Philippines, Singapore, Thailand, and Brunei.

population and resource base. The trade surplus countries are, for obvious reasons, interested in maintaining their trade position.

The United States is also, of course, interested in selling more agricultural products abroad. Based on the range of per capita exports to the various countries shown in Chart 3--from $3.2 in the ASEAN countries to $82.6 in Taiwan--it might be concluded that much potential exists for increased U.S. agricultural exports to Mexico, Central and South America, the Caribbean, and the ASEAN countries. The ASEAN countries are some of the fastest growing countries in the world at the present time, and they account for the largest share of growth in U.S. agricultural trade in recent years. Nevertheless, a variety of factors must be considered here including comparative advantages, per capita income levels, and existing debt loads. Indeed the ASEAN countries have the lowest per capita income of any country or region considered in these tables. A full discussion of export potentials would take far more space than available here. The question we wish to address is: Will bilateral trade agreements with these countries lead us toward the goal of greater trade liberalization?

There are at least three possible outcomes of these types of trade agreements. The first relates to what trade distorting policies between the two countries to an agreement are to be altered, the second concerns the advantages to be achieved by changing the mix of production and trade in the two countries to the agreement, and the third concerns the sacrifices to be made by altering trade with other countries.

Consider first the fact that both parties to the agreement seek unrestricted trade between themselves while maintaining existing trade policy instruments vis-a-vis other countries. To accomplish unrestricted trade between themselves, pre-agreement policies affecting trade will need to be harmonized if not dismantled altogether. If higher-level distortions in one country are not negotiable, the end result may be a situation with greater distortions than existed before the agreement.

Assuming these problems can be worked out, the next issue is how the mix of trade and production in the two countries will change. The best scenario is that the parties to the agreement replace relatively more expensive domestically produced commodities with relatively less expensive imports from their counterpart. Clearly this constitutes a move toward a more optimal situation in the sense that it leads to increased production efficiency world-wide.

However, a bilateral free trade agreement may also lead to a movement away from the more optimal situation. It seems likely that the two countries will insist that trade between the two increase. Under this scenario it is conceivable that relatively more expensive imports from a partner may replace relatively less expensive imports from the outside world. In this way the agreement may be undesirable in that it leads to reduced world efficiency.

WHERE DO WE GO FROM HERE?

There are clearly several positive aspects to bilateral trade agreements. It is not at all certain, however, that a few or several such agreements will lead the world significantly closer, if closer at all, toward global trade liberalization in agriculture. Based on past experiences it seems likely that bilateral trade agreements will lead to the erection of trade barriers against countries outside the agreement--the very thing that GATT is designed to prevent. Thus we could expect to see trade-distorting blocs of countries emerge. In the longer term, there will be enormous problems associated with merging bilateral trade blocs into multilateral trade blocs. Finally, agricultural production, comparative advantages, and trade flows are extremely complex--so much so that if increased trade liberalization in agriculture is to occur, multilateral approaches will be required. Indeed there may be no substitute for pressing harder for a successful GATT agreement on subsidy reductions and trade liberalization for agriculture.

Chart 1. Agricultural Exports as Percent of Total U.S. Exports, 1869-1989

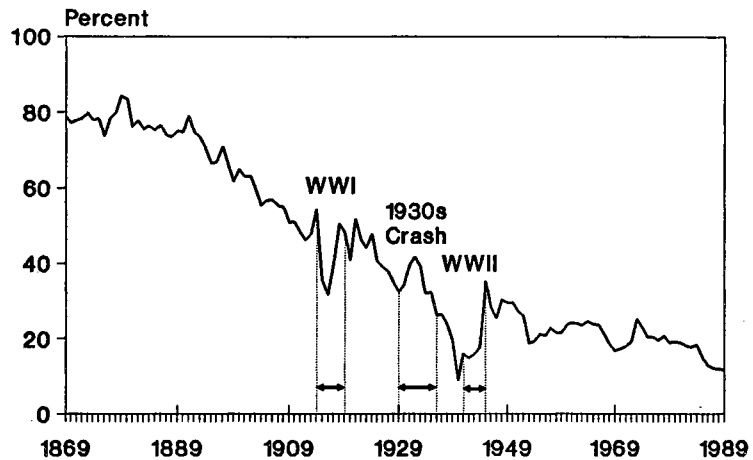


Chart 2. Agricultural Exports as Percent of Cash Receipts from Farming, 1869-1989

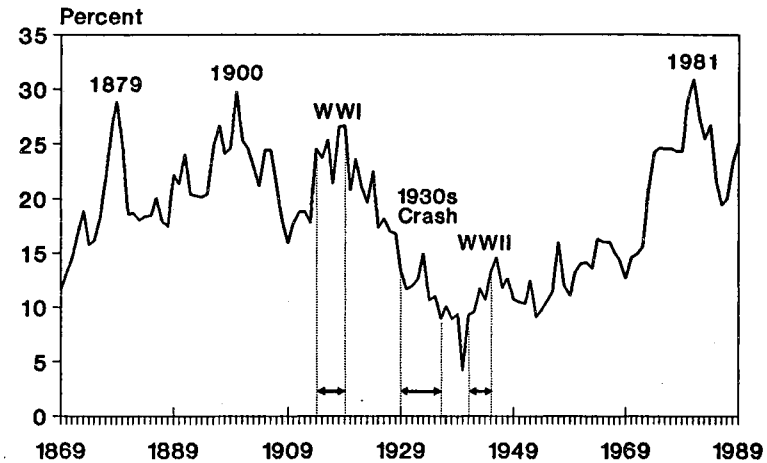


Chart 3. U.S. Agricultural Trade with Selected Countries or Regions, 1988 (% of Total U.S. Ag Exports/Imports)

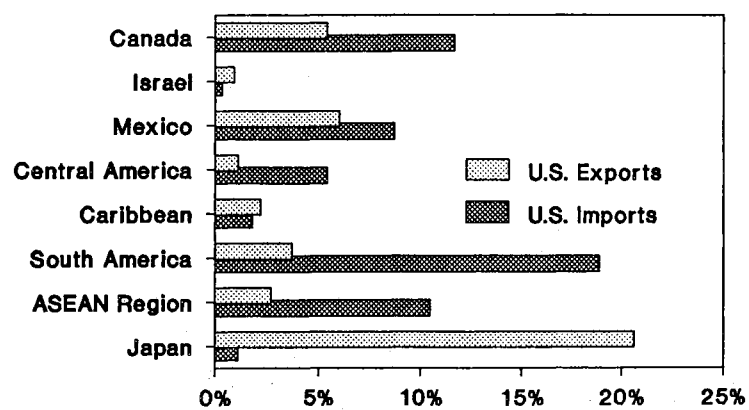
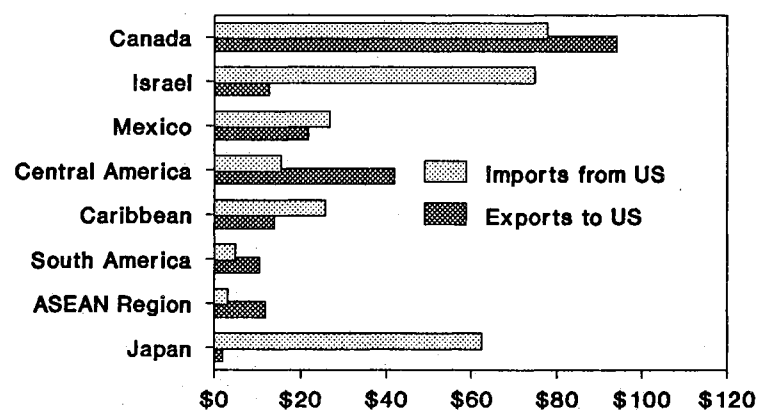


Chart 4. Volume of U.S. Agricultural Trade with Selected Countries/Regions in 1988, ($/capita)



PROBLEMS AND PROSPECTS FOR PENNSYLVANIA FOOD PROCESSORS: MEETING THE CHALLENGES OF THE 1990s

James G. Beierlein*

American agriculture is in transition. If current trends continue, the future for all of us promises to be both challenging and exciting. But to be a successful participant in this future requires that each of us pay close attention to the fundamental changes that are at hand and that are likely to emerge. Those that turn a deaf ear to the voices of change run the risk of lower profits and extinction.

THE EMERGING TRENDS

The trends that are emerging can be classified into four general areas (Beierlein and Woolverton, Chapter 23). First, agriculture is becoming more business-like. The advent of affordable computer systems means that managers no longer have to guess at where they stand, but rather can gain access to timely, accurate information that can be quickly processed into a framework for informed decision making. The result is better decision-making, better management control, and a stronger, more efficient agriculture.

Second, the scope of markets is expanding. Advances in transportation, telecommunications, and other such activities now make it possible for firms to buy and sell in Rotterdam and Rio de Janeiro as effectively as they do in Reading. Many local and state markets have expanded to become regional, national or even international in scope. This means that if a firm is not expanding into new markets it should, at the very least, expect to see new competitors in its existing markets.

Third, the application of technology to production agriculture (which is soon to be enhanced greatly by biotechnology) has changed the dynamics of the market for food and fiber. Markets are no longer driven by the need to expand output to meet a seemingly endless demand, but rather by a need to better understand and better meet the needs of customers.

Fourth, customers have also changed. They are more knowledgeable, and sophisticated. As a result their tastes and preferences for all forms of goods and services are more fragmented and subject to rapid change than ever before. The irony is that just as businesses are finally able to systematically evaluate customer needs, these needs have become more volatile and diverse. The result is that marketing management has become a survival skill that must be pursued with the same vigor and proficiency as has typically been applied to production management. The impact of these changes has not

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been limited only to the food processing industry. Rather, these forces are reshaping the entire food system and the way it conducts business.

THE AGRIBUSINESS SYSTEM

The agriculture of today is largely a product of technological change (Beierlein and Woolverton, Chapter 1). Few industries have adopted new technologies as quickly and successfully as agriculture. In the years following World War II, American farmers quickly recognized the profit potential from the application of new technologies such as hybrid seeds, pesticides, herbicides, machinery, and a host of other production inputs. Producers were soon replacing many of the production inputs they previously made on the farm with new more productive purchased inputs. This made farmers more productive, gave them more time to devote to production, and farm productivity grew rapidly. The shift to purchased inputs led to the birth of a number of firms whose sole purpose is supplying the needs of producers for chemicals, credit, buildings, machinery, seed, feed, and a variety of other inputs. This group of firms is called the agricultural input sector.

The forces of technology were also at work on the other side of the farm gate. Advances in food processing and manufacturing, particularly food canning, helped to move food processing off the farm. Advances in technology quickly made it less expensive and time consuming for all families, even farm families, to buy processed and manufactured food products than to do the work themselves. This group of firms is called the food processing-manufacturing sector. This sector employs more than 18 million people in a variety of establishments ranging from grain elevators to fruit and vegetable processing plants to fast-food restaurants.

What emerges from all this is that the definition of agriculture needs to be broadened to include those that supply the inputs to producers, and those that transform the raw farm output into food products. This broad, complex combination of firms is referred to as the Agribusiness System (Chart 1). The strength and vitality of the entire system rests on the efficient and effective performance of each of its parts.

Success in today's highly competitive business environment requires that agribusiness firms have: (1) a clear, precise understanding of their customer needs; (2) a broad view of their market; (3) a keen eye for changes both internal and external to the firm; (4) a good flow of timely and accurate data on business performance: and (5) an unrelenting commitment everyday and in every way to look for better, more efficient and effective ways to profitably satisfy customer needs.

In fact, the goal of all food industry managers should be the maximization of their firm's long run profits by profitably satisfying customer desires. It is the satisfaction of customer needs that gives the firm its right to earn a profit. In today's business environment this means greater attention must be devoted to meeting these needs.

CHANGES IN THE POST FARM SECTOR OF THE AGRIBUSINESS SYSTEM

The impact of these changes on the Agribusiness System can be seen in several ways. One way is to examine the change in value-added (i.e. the difference in value between what a firm pays for its inputs and the revenue it receives for selling it's output) and employment (USDA). As can be seen from Chart 2, the proportion of value-added in the general economy coming from the Agribusiness System declined nearly steadily between 1975 and 1987 as it moved from 20.4% to 15.5% of the total value-added in the economy. (1987 is the latest year for which data is available.) During this period, the proportion of value-added coming from the farm sector declined dramatically from 2.7% of the total to 1.2%. A similar trend is seen with employment where the Agribusiness System's proportion of total employment declined from 21.5% to 16.7%, and the farm sector's share of employment declined from 3.2% of the total to 1.6% (Chart 3).

A closer look at the post-farm (i.e. the processing-manufacturing) sector of the Agribusiness System shows shifts in the make up of its contribution over this period in both value-added and employment (Charts 4 and 5). The application of productivity raising technology again is seen in the declines in employment in both the processing and manufacturing industries. These declines are more than offset by growth in the retail-transportation-wholesaling, and restaurant industries. Employment growth in these two areas reflects the growing importance of convenience and meals away-from-home. A similar pattern is seen for value-added as the retailing-transportation-wholesaling, and restaurants industries account for a growing share of the total, while the proportion coming from the processing and manufacturing industries declines.

What seems to be a very substantial increase in the amount of value-added between 1975 and 1987 for the Agribusiness System (116.5%) appears somewhat less impressive when compared to the general economy's growth in value-added (183.3%) over this same period (Chart 6). A closer look at the Agribusiness System's components shows that the majority of the growth in value-added came in the non-farm sector where the percentage change over this period (130.0%) was more than four times greater than that of the farm sector (28.9%).

A look at the employment figures makes this point even more sharply. While employment in the general economy grew by 27.8% over this period the Agribusiness System's employment declined 0.4%. Only the sheer size of the post-farm sector with its 5.2% employment gain was able to offset the 33.3% decline in farm sector employment. The bright side of these numbers comes when value-added is calculated on a per worker basis. Here, the performance of the Agribusiness System (117.6%) and, in particular, the post-farm sector (118.5%) closely matches the gains in the general economy (121.6%). Its only in the farm sector that the gain (93.3%) is significantly less.

Implications--The declining relative importance of the Agribusiness System to the overall economy is both good and bad. It is bad in the sense that the importance of the

food industry to the general economy is diminishing and may result in less political influence. It is good for the economy because it means that fewer people and other resources must be expended to feed the nation. This releases greater numbers of people to become teachers, medical researchers, politicians, and so on. Because they are freed from having to provide their own food, they can work toward meeting other human needs.

Food Processing--A closer look at the numbers shows that in terms of value-added per worker, the food processing industry posted the second largest gain (143%) in the post-farm sector (Chart 7). This gain is also larger than the increase for the Agribusiness System (117.6%) and the general economy (121.6%). This growth reflects the industry's unrelenting devotion to greater efficiency and lower unit costs.

These desires typically reveal themselves in the form of larger processing facilities that utilize the latest labor saving technologies to further minimize cost per unit. This idea is reinforced by noting that the industry saw the second largest decline (13.3%) in the post farm sector in terms of employment during this period. The firms in the food processing industry have clearly attempted to become "lean and mean."

Given the nature of their business (i.e. high volume with very thin profit margins per unit), they can not afford to do anything else if they wish to survive. When firms buy and sell essentially undifferentiated commodities, where the products of any one firm match those of any other firm in terms of quality, the only thing left on which to compete is price per unit. The only way to preserve narrowing profits margins in this environment is through lowering the cost of processing. Thus, the reason for larger processing plants and the quick adoption of new processing technology in this industry.

Manufacturing--It is surprising that the manufacturing industry had an increase in value-added per worker (109.0%) that was the second lowest in the post farm sector. It would have been reasonable to assume that the increase for manufacturing (which typically turns the flour, milk, eggs, and so on from the processors into food products such as cakes, cookies, etc.) would have matched the gains found in processing. Yet even the largest decline (15.6%) in employment could not overcome the smallest (76.5%) increase in value-added of any part of the post farm sector over the period (USDA).

Retailing-Wholesaling-Transportation, and Restaurants--The near average growth in value-added per worker for the retailing-wholesaling-transportation and restaurants industries reflects their growth in value-added (105.6% and 111.6%. respectively) and employment (15.8% and 19.4%, respectively) during this period (USDA). These events reflect the growing preference for convenience in foods and the expansion of the meals away-from-home market. Increases in employment were the largest of any industry in the post farm sector, and were the primary sources of growth for the entire post farm sector. Given the increased demand by customers for the services offered by these industries and the difficulty of automating them, the growth in employment is not surprising.

All Other--A large part of the all other category is made up of the food service industry which provides those at schools, businesses, government, and so on with meals. Like many other parts of the Agribusiness System firms in this industry sought ways to replace labor with capital investment. During the period examined this industry experienced the largest percentage change in value-added (154.2%), while employment grew just 5.4%.

WHAT THE FUTURE HOLDS

Describing the past is always considerably easier than predicting the future. This is certainly true today. While forecasting the exact details of events to come is beyond the ability of most of us (perhaps even economists), it is possible to predict the general directions of change. These include:

1. **Increased Competition in the Marketplace will lead to Increased Interest in Overseas Markets**--The change in the dynamics of the Agribusiness System from a supply-driven to a demand-driven system will intensify and place even greater pressures on profit margins as expanding firms compete in a slow growing domestic food market. Agribusiness firms will have to turn increasingly to foreign markets to more fully capture the anticipated cost savings from operating larger processing and manufacturing facilities.

2. **Market Areas for Firms of Nearly All Sizes Will Increase**--Continued advances in computers, transportation, telecommunications, and data processing will combine to allow firms of nearly every size to effectively do business in larger market areas. As nearly all firms expand their market areas they will experience increased competition in their existing markets.

3. **Agribusiness Firms Will Become More Business-Like in Their Operation**--The firms in the food and fiber business will increasingly rely on more formal business management procedures with less reliance on intuition, rules of thumb, etc. These advances will be possible due to the application of computers, telecommunications, and data processing hardware and software. The increased availability of timely, accurate business information for decision making will greatly enhance management control and increase the quality of decision making. This will make the entire Agribusiness System more efficient and effective in meeting customer needs.

4. **Small-Scale Processing and Manufacturing Will Develop to Fill Market Niches Arising From Fragmentation of Customer Needs**--Computer-assisted processing and manufacturing will reach the point both in terms of cost and volume where it can be profitably applied to very small-scale operations. This will permit smaller firms or units of larger firms to successful operate in small market niches where previously it had not been financially

feasible to do so. A good example of this is the operation of local mini-breweries who are capable of profitably producing small quantities of very high quality beer tailored to meet the tastes of local markets.

5. **An Increased Use of Product Branding**--As mentioned above, when firms deal in commodities they enter a business whose financial survival depends heavily on maximizing volume and minimizing cost per unit. One way to break out of this situation is to use product branding. Under branding firms attempt to differentiate their product from the rest of the pack.

One of the more successful efforts in this area is Perdue Chicken. The firm has successfully separated its products from the generic chicken which is typically found in the supermarket meat case. Because of this perceived difference, consumers are willing to pay a premium in order obtain a Perdue Chicken, and the firm gains greater control over its fate and higher profit margins than it could have if it marketed just plain chicken. If the differentiations of products are meaningful they may actually help customers gain greater satisfaction from the products they buy.

CONCLUDING REMARKS

It should be clear from these remarks that American agriculture has changed and will continue to change in the future. The level of competition in most markets and growing sophistication of customers makes it more important than ever that agribusiness managers keep a close eye on their customers and their markets. Both are changing. Failure to change can lead to financial ruin. Being aggressive about seeking better, more effective ways to meet customer needs is the only sure fire way of keeping your firm financially strong. Remember that old saying, "the only time you can coast is when you are headed downhill."

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Chart 1. The Three-part Agribusiness System

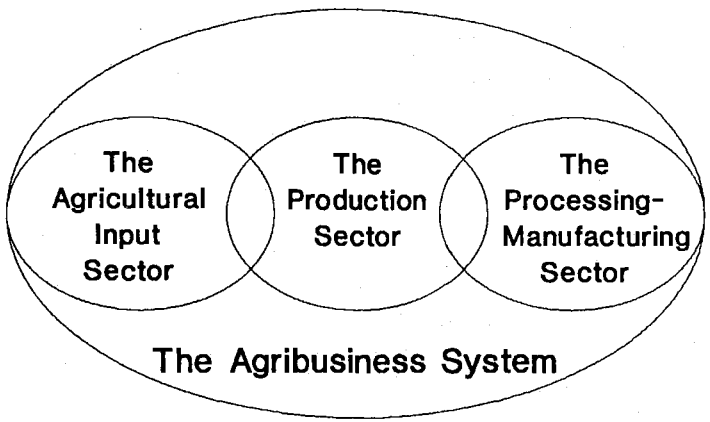
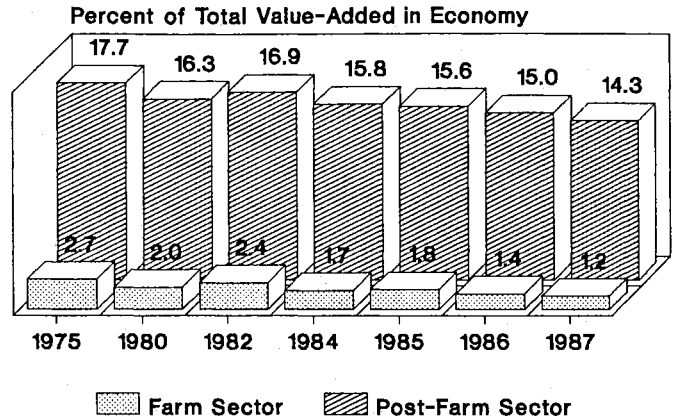
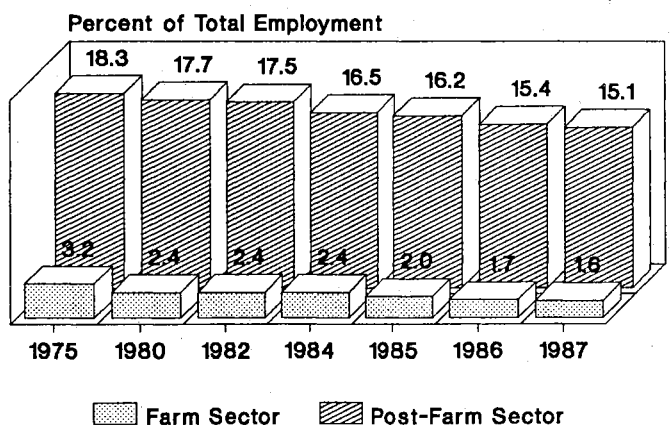


Chart 2. Agribusiness System Value-Added, Selected Years, 1975-1987



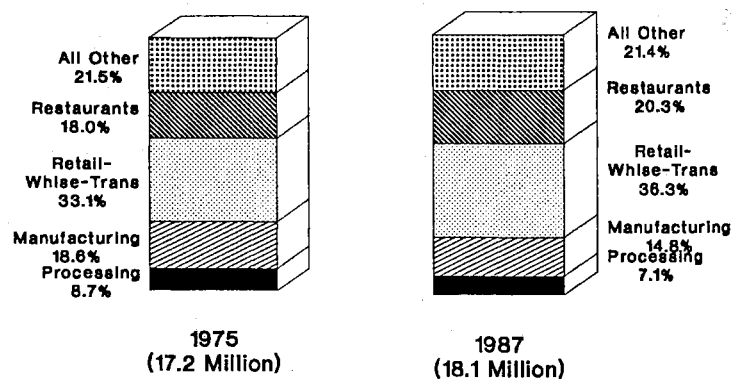
Source: USDA, Economic Indicators of the Farm Sector, Farm Sector Review, 1987.

Chart 3. Agribusiness System Employment, Selected Years, 1975-1987



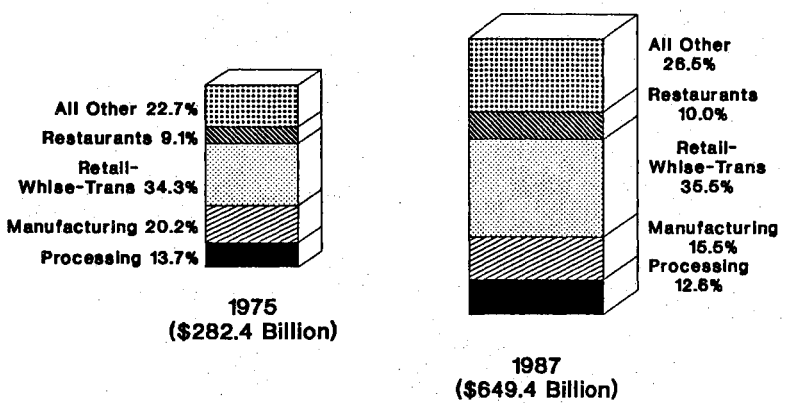
Source: USDA, Economic Indicators of the Farm Sector, Farm Sector Review, 1987.

Chart 4. Comparison of Post-Farm Employment, 1975 and 1987



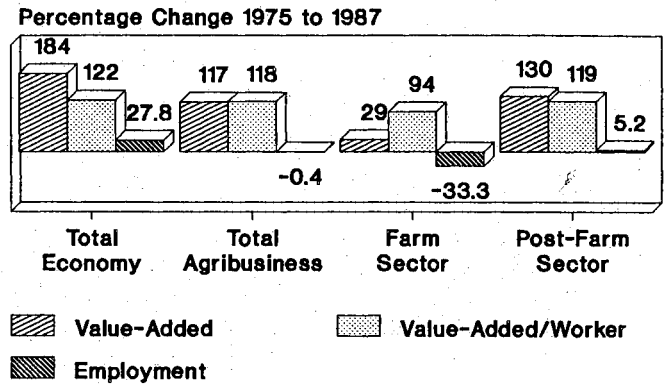
Source: USDA, Economic Indicators of the Farm Sector, Farm Sector Review, 1987.

Chart 5. Comparison of Post-Farm Value-Added, 1975 and 1987



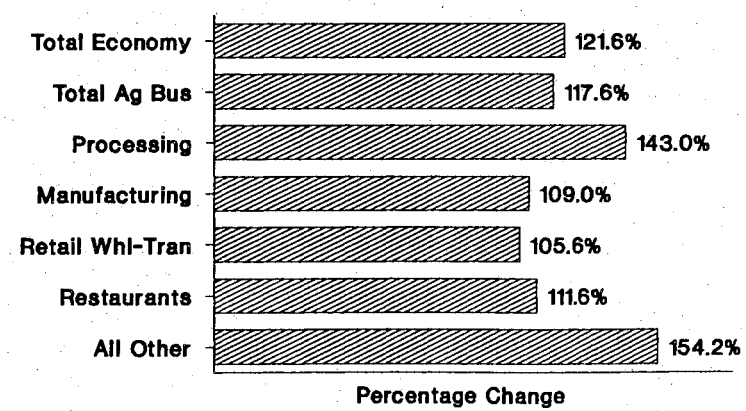
Source: USDA, Economic Indicators of the Farm Sector, Farm Sector Review, 1987.

Chart 6. Comparison of Change in the Agribusiness System and General Economy Between 1975 & 1987



Source: USDA, Economic Indicators of the Farm Sector, Farm Sector Review, 1987.

Chart 7. Comparison of Growth Rates in Value-Added/Worker Post-Farm Sector, 1975 to 1987



Source: USDA, Economic Indicators of the Farm Sector, Farm Sector Review, 1987.

HEALTH CONCERNS AND FOOD CHOICES: WHAT'S THE PUBLIC WORRYING ABOUT NOW?

Robert O. Herrmann*

For centuries, what people ate was determined chiefly by what they could afford. As incomes have risen, diets have become less constrained by cost and more influenced by other factors. In the period since World War II, these influences have included the ever-wider variety of processed foods offered by the food industry and new distribution forms: the fast food and home-delivery pizza chains. Another influence for change has been the exposure of more and more Americans to foreign cuisines. Millions of Americans eat Mexican and Chinese dishes and more exotic menus--Indian, Japanese, Vietnamese and even Afghani and Ethiopian--are available in some areas.

Another increasingly important influence on food choices has been diet and health concerns. As diet-health links have become more clearly established (National Research Council, 1989), health professionals have become more confident in prescribing dietary changes. As a result of these various influences, American dietary patterns have become more volatile than ever before. Huge percentage changes in the use of some familiar food items illustrate some of these changes. Over the 20-year period from the late 1960s to the late 1980s, usage of the following items increased (Putnam, 1990):

- fresh broccoli - up 940 percent
- yogurt - up 846 percent
- cheese - up 134 percent
- chicken - up 72 percent

Some items, however, felt the downside of change:

- whole milk - down 53 percent
- coffee - down 28 percent
- eggs - down 21 percent

There are other, even more recent, dramatic changes. Some of these are in the dairy category. The frozen yogurt boom has received some press coverage. The upsurge in skim milk consumption has, however, received less attention. I would like you to join me in taking a closer look at these two changes and at the broader pattern of shift toward lower-fat dairy products of which they are a part. As we look at these shifts there are several questions which need answers including "what's behind these changes?" and "are they likely to be permanent?"

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WHAT DOES THE PUBLIC SAY CONCERNS THEM MOST ABOUT NUTRITION?

During the last decade, the Food Marketing Institute has conducted a series of annual surveys of consumers' food buying concerns (Opinion Research Corp., 1990). One of the questions which they have asked has been "what about the content of what you eat concerns you and your family the most?" This question has been asked each year over the 1983-1990 period. The question was open-ended and respondents were able to give multiple answers. As a result, the response frequencies add to over 100 percent. Experience suggests that the respondents probably gave one or two answers to the question.

The most frequent responses have been grouped into four categories so that we can look at changes in the patterns of dietary concern. In the early years of the survey, food safety concerns were the items mentioned most frequently (CHART 1). In 1983, chemical additives were the most frequently mentioned concern and preservatives were the third most frequently mentioned concern. These responses have trended down sharply over the eight-year period. They now are rather infrequent.

A second group of factors deals with general health and dietary concerns (CHART 2). We can see that vitamin and mineral content was a fairly widespread concern in the early years of the survey. The percentage of respondents mentioning vitamin/mineral content has changed relatively little over the period. In each year, about one respondent in five has mentioned this concern. The other general dietary concerns in this category were mentioned relatively infrequently and their frequency of mention has changed little over the years.

We see a more dramatic set of changes when we look at factors relating to heart disease (CHART 3). In 1983, fat was mentioned infrequently (9 percent). In 1990, fat was the most frequently mentioned concern, with 46 percent mentioning it. The increase in mentions has been especially sharp since 1987. Fat has been linked both to heart disease and to cancer (National Research Council, 1989) and, of course, is also a highly concentrated sources of calories. This seems to have given it some kind of triple whammy. Cholesterol also has risen sharply in mentions. In 1990 it followed close after fat in total mentions (44 percent). In contrast to the sharp increase in mentions of cholesterol and fat, mentions of salt concerns are up less dramatically over the eight year period.

CHART 4 deals with changes in factors which relate to weight control. Sugar concerns were much in the news in the early 1980s. We can see that the percentage of respondents mentioning sugar as a concern remained at about the same level then declined somewhat over the eight year period. For calories, there has been a substantial increase in the number expressing concern. Fat also can be regarded as a weight control concern because of its high calorie content per ounce. The increase in mentions of fat has been marked, as noted above.

The overall pattern of responses suggests that priorities shifted significantly during the 1980s. Concern with food safety issues declined sharply. At the same time, concern with cholesterol and fat became widespread. Weight control concerns also were mentioned more frequently than in earlier years.

A look at the most frequently mentioned concern in each successive year suggests that the public has focused largely on the negatives. In 1983 and 1984, chemical additives were mentioned most frequently. In 1985, it was sugar. In 1986, a positive factor, vitamin and mineral content, was mentioned most frequently. In 1987, it was salt. In 1988, fat got most frequent mention, while in 1989 cholesterol topped the list. And, most recently, fat has hit the top of the charts, again.

A CLOSER LOOK AT THE FROZEN YOGURT BOOM

The boom in frozen yogurt sales has been helped along by several factors: its generally lower fat content, its rapidly growing distribution and its novelty as a new product. In an August 1990 phone survey, we found big increases in its use. Our survey questioned men and women throughout the continental U.S. and used random-digit dialing to ensure that we would reach both listed and unlisted numbers. In our study we looked at both current consumption and recent changes in consumption for frozen desserts and for other major dairy product categories.

We found, not surprisingly, that regular ice cream was the most widely consumed frozen dessert (CHART 5). A total of 53 percent of the respondents said they had consumed regular ice cream in the previous four weeks. The widespread use of frozen yogurt was, however, unexpected. Overall, frozen yogurt was the second most widely used frozen dessert category with 44 percent saying they had eaten frozen yogurt some time in the previous four weeks. Premium ice cream came in third, with 38 percent reporting use. A combined category consisting of sherbet / ice milk / light frozen dessert had been consumed by 30 percent. A relatively new product, nonfat frozen dessert had been consumed by nine percent.

We next looked at the pattern of changes in use. Each respondent who used a particular frozen dessert category was asked how their usage had changed over the past year (CHART 6). The most dramatic change was in use of nonfat frozen dessert; 45 percent reported their use had increased over the past year. In looking at this figure we need to recall that the product is a new one, and that the number of users was still small.

For frozen yogurt, 40 percent said their use had increased over the past year. At the same time, 8 percent said their use had decreased. For the sherbet / ice milk / light frozen dessert category the number of increasers outweighed the number of decreasers, although a sizable proportion said their use had declined. The two higher fat desserts had, however, taken serious hits. Some 24 percent of premium users said their

consumption had declined in the past year. The cuts were even larger for regular ice cream users with 30 percent saying their usage had declined. Overall, there appears to be a clear shift toward lower fat frozen desserts and away from the higher fat products.

We next looked at the demographic patterns for those who had changed their frozen yogurt consumption. We could find no clear linkage between changes and the most-used demographic variables. This suggests that these changes were occurring throughout the entire population, rather than in any particular groups.

We wondered how these broad patterns of change were related to changes by individual consumers. To check this we looked at those who had increased their use of frozen yogurt and examined the other changes they had made (CHART 7). We found that there were major linkages. Among those who said that their frozen yogurt use had increased over the previous year, 43 percent said that the use of regular ice cream had declined - 10 percent said it had increased. A number of frozen yogurt increasers, some 21 percent, said they had decreased their use of premium ice cream.

While a number of frozen yogurt increasers were cutting their use of higher fat frozen desserts, many were also increasing their use of other lower fat items. Some 13 percent said their use of nonfat frozen desserts had increased and 18 percent said their use of light ice cream / ice milk / sherbets had increased. Those who said they had increased their use of frozen yogurt constituted 25 percent of the total sample. For this group the shift to frozen yogurt clearly was linked to a shift away from higher fat frozen desserts and a shift toward lower fat items.

CHANGES BY REGULAR ICE CREAM EATERS

Despite the changes we have been describing, regular ice cream still is eaten by more adults than any other frozen dessert (CHART 5). You will recall that 53 percent of the adults questioned said they had eaten regular ice cream in the previous four weeks. Since regular ice cream remains such an important product we felt it was important to look at changes that were going on among regular ice cream eaters.

Among the regular ice cream eaters, 30 percent said that their use had declined over the previous year (CHART 6). as we noted above. Let's look more closely at this decreasers group to see what other changes they had been making (CHART 8). Even a quick glance shows a pattern. There was a major shift among this group toward frozen yogurt, with 43 percent reporting increased usage. We also can see some smaller shifts toward other lower fat products. Among the regular ice cream decreasers, many also had cut their premium ice cream usage--28 percent reported this.

As we had with frozen yogurt, we checked to see if these changes could be linked to any basic demographic variables. We did not come up with much except sex and income. Women were more likely to be increasing or decreasing use, while the men

tended to report their use of regular ice cream had remained the same. Lower income respondents tended to report their usage had increased, while those with higher incomes tended to report their use had declined.

What about other changes in usage among the regular ice cream decreasers? Were their cuts part of a broader pattern of shifts away from higher fat dairy products? The evidence of this is not clear-cut (CHART 9). Clearly, some regular ice cream decreasers had made cuts in their usage of other dairy products. However, similar percentages reported increasing use of these products.

CHANGES IN MILK USE

We also investigated changes in milk use to see if we could find the same shifts toward lower fat products. When we asked about current use, we found that lowfat users constituted more than half the milk drinkers (CHART 10). About one in four reported using chiefly regular milk and one in five reported using skim. When we compared current use with the type of milk consumed two or three years earlier we found that major changes had occurred over the period. The percentage using regular milk had declined sharply, while the percentages using skim and low fat had increased.

We then turned to look more closely at changes by individuals using particular products. We first looked at the past usage of those who were current regular users (CHART 11). Not surprisingly, most of them had been regular drinkers two or three years earlier.

We then looked at the past use of current low fat drinkers (CHART 12). While about two-thirds had been low fat drinkers earlier, about one third had been recruited from the ranks of regular drinkers.

Finally, we looked at the past use patterns of current skim drinkers (CHART 13). We found that many (37 percent) had been skim milk drinkers previously. About an equal number had been low fat drinkers. And, one quarter had been regular drinkers. Overall, there appeared to have been a cascade downward toward lower fat products with regular drinkers shifting to low fat, and low fat drinkers shifting to skim. Fewer had made the shift directly to skim from regular.

SOME CONCLUSIONS

What can we conclude from the changes we have seen? The trends over the past decade in reported concerns indicate that fat, cholesterol and other heart-related concerns have come to be widely held. At the same time, the proportion of the population with weight control concerns remains substantial. Fat concerns seem linked

to both these issues, giving them special potency. The FMI survey results also can be taken to suggest that nutrition and health issues are important to a larger proportion of the population than they were in earlier years, and that negative factors (fat, cholesterol, salt, calories, etc.) seem to be a focus of particular concern.

There seems to be clear evidence that frozen dessert eaters are shifting from higher to lower fat products. There also is evidence that milk drinkers are shifting from higher to lower fat products. We did not, however, find any clear linkage between frozen dessert shifts and milk shifts. We also did not find evidence that frozen dessert shifters were shifting their use of any other dairy products. Overall, there was clear evidence of shifts within the frozen dessert and the milk categories. There was not much evidence that many individuals were making across the board shifts toward lower fat dairy products.

Just how long-lasting are the new-found concerns with fat? And how much are the likely to affect consumption? I believe that fat concerns are likely to have some real staying power. Several factors are working to reinforce them:

- The concerns are widely held, those who are concerned will get substantial support from others who also are concerned.

- The percentage of the population with concerns about fat will increase in future years as the average age of the population increases.

- Fat concerns will be strengthened by the fact that fat has been linked to several dietary problems: obesity, heart disease and cancer.

- Acceptable substitutes are available for those who wish to cut their fat intakes. Food processors have come up with a variety of lower fat products which are good-tasting.

- Changers who shift to lower fat products are likely to become accustomed to them over time and eventually may find the traditional product forms too rich and too creamy.

- New scientific findings about linkages between fat intake and disease are likely. For example, there are new findings about the linkage between hydrogenated fats (vegetable fats which remain solid at room temperature) and blood cholesterol levels. These will keep the hazards of fat intake in the news.

Fat and cholesterol clearly are <u>widely</u> held concerns. Less clear is how <u>strongly</u> held these concerns are. Many people are acting on their concerns and changing their use of particular product categories. They do not, however, seem to be making the across the board shifts we might expect. This suggests that the fat and cholesterol wave may recede somewhat in coming years. It seems unlikely that it will drop back to the level of eight or ten years ago.

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Opinion Research Corporation (1990). Trends: Consumer Attitudes and the Supermarket 1990. Food Marketing Institute: Washington, DC.

Putnam, Judith Jones (1990). "Food Consumption." National Food Review (Economic Research Service, U.S. Dept. of Agriculture) 13(3):1-9.

Chart 1. Food Safety Factors

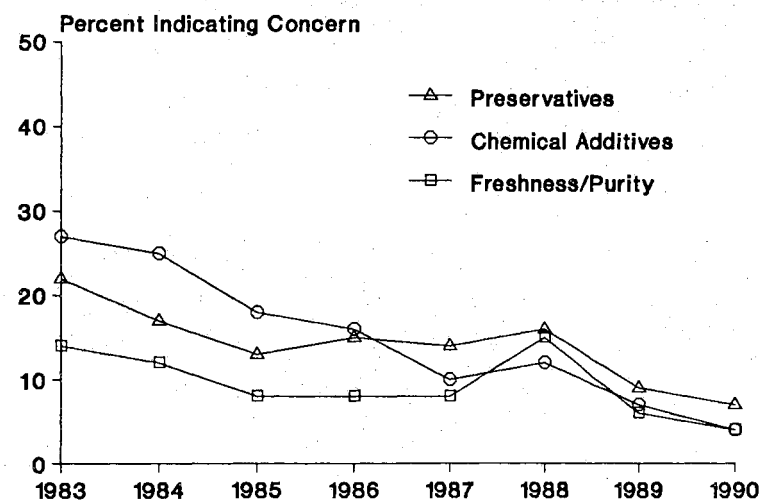


Chart 2. Health Factors

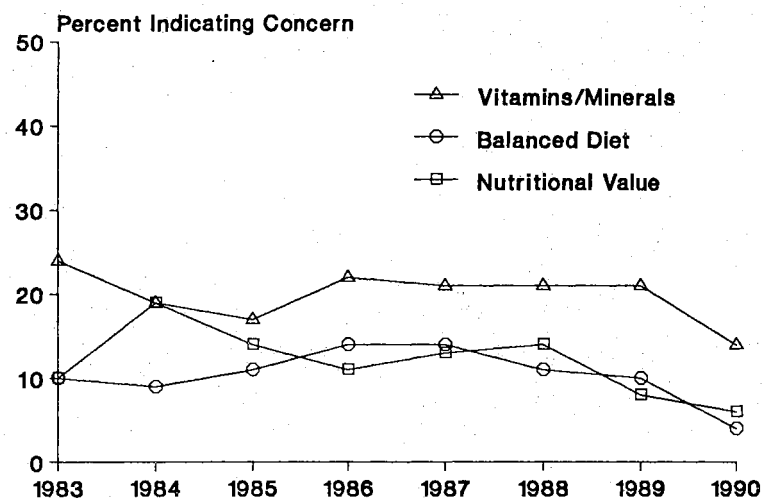


Chart 3. Heart Factors

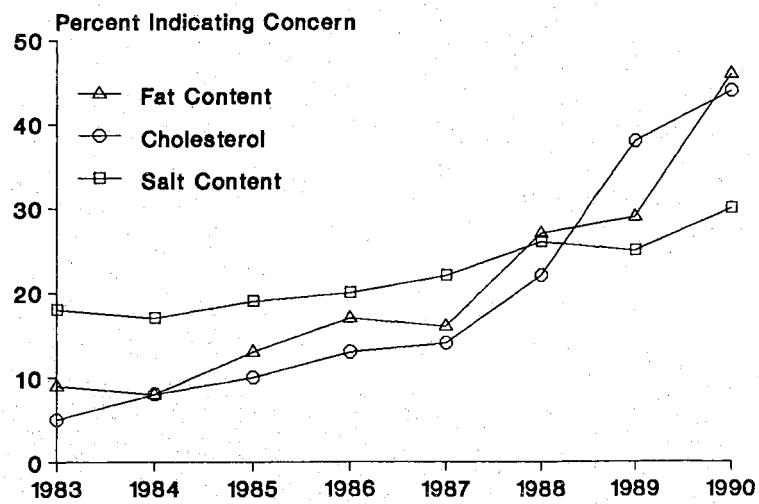
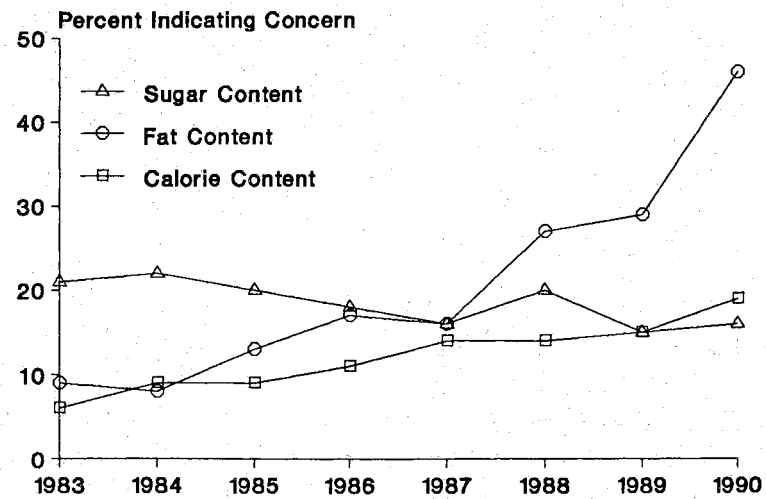


Chart 4. Weight Control Factors



Concerns About Risk Factors
Recent Trends

Risk Factor	Trend	Frequency Cited
Heart Health	Sharp increase	Very frequently
Weight Control	Increase	Frequently
General Health	Relatively flat	Varies
Food safety	Downward	Relatively infreq.

Ice Cream/Dairy Product Survey

National survey (48 states)

Random sample of 1,200 adults

Random-digit dialing (RDD)

Computer-based telephone interviewing

August, 1990

Chart 5. Ice Cream Use Patterns

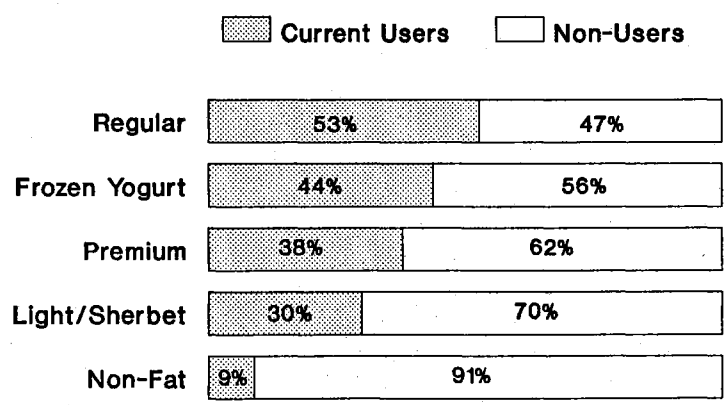


Chart 6. Change In Ice Cream Use
Past Year's Users

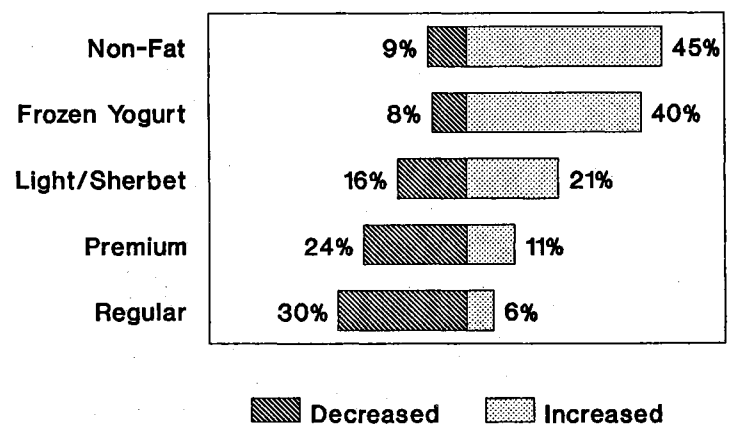


Chart 7. Those Who Increased Frozen Yogurt Also Made These Changes

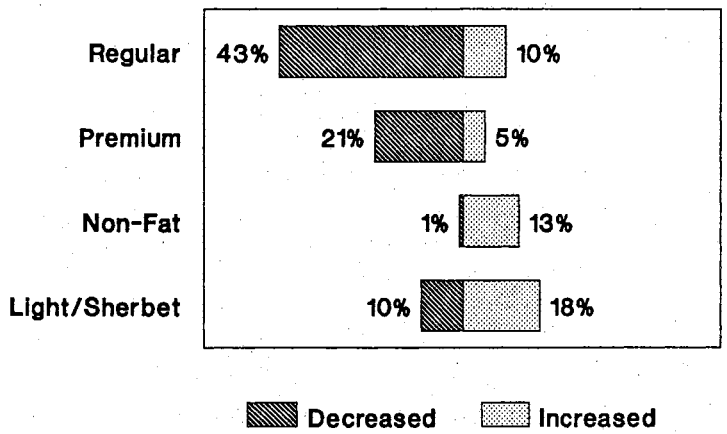


Chart 8. Those Who Decreased Regular Ice Cream Also Made These Changes

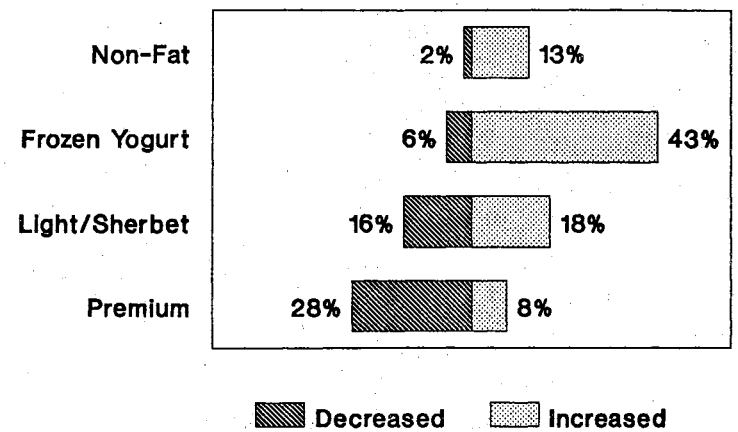


Chart 9. Those Who Decreased Regular Ice Cream Also Made These Changes

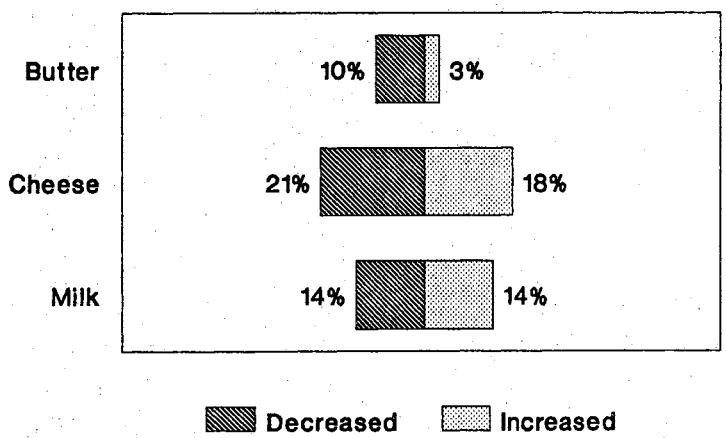


Chart 10. Change In Type Of Milk Use
Current Users

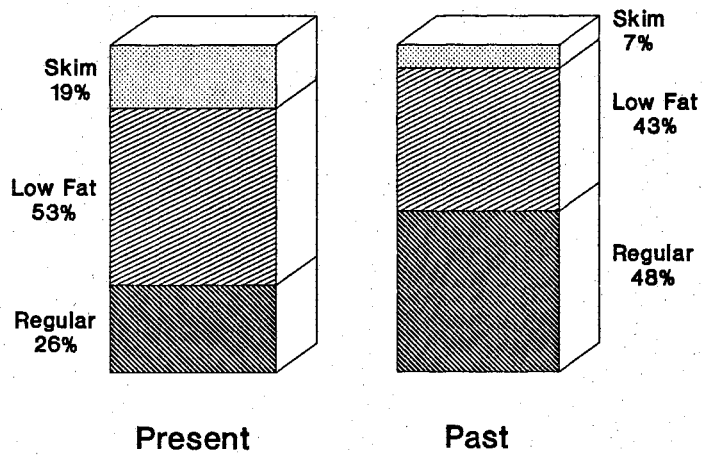


Chart 11. Past Milk Use of Current Regular Milk Drinkers

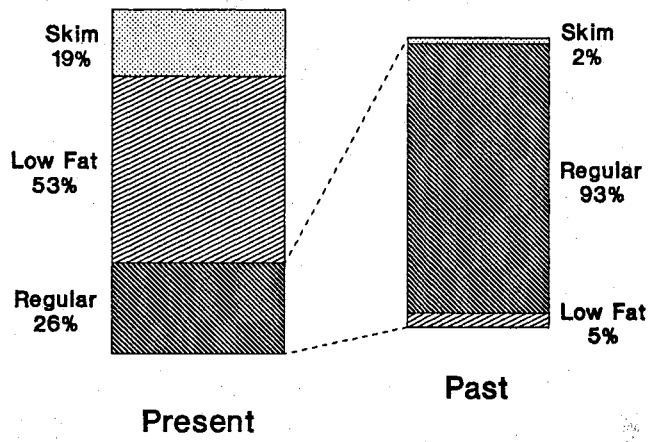


Chart 12. Past Milk Use of Current Low-Fat Milk Drinkers

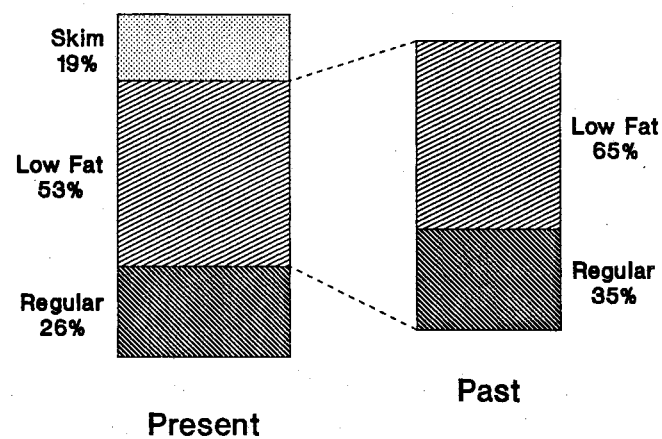
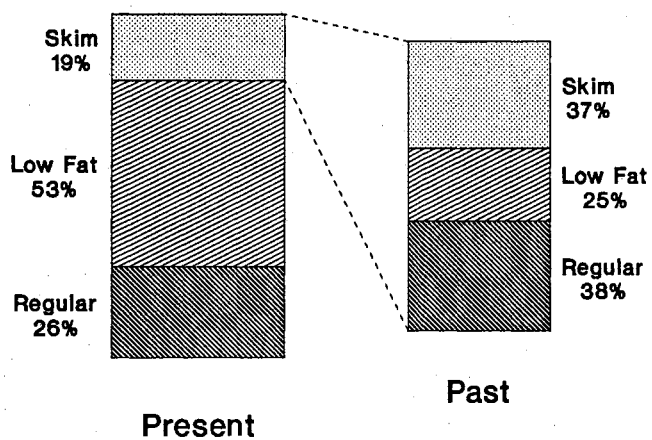


Chart 13. Past Milk Use of Current Skim Milk Drinkers



Special Topics

COMMUNICATING ENVIRONMENTAL RISKS FROM AGRICULTURE

Ann Fisher*

In November 1990, Phase I final results were released for the U.S. Environmental Protection Agency's (EPA's) National Survey of Pesticides in Drinking Water Wells (NPS). The NPS was designed to provide the first national estimates of the frequencies and concentrations of pesticides and nitrate in community water system (CWS) wells and rural domestic drinking water wells. EPA's Project Summary reports:

> that the proportion of wells nationwide found to contain any particular pesticide or pesticide degradate is low...Survey results do not demonstrate any immediate widespread health problem.

However, it also states:

> that substantial numbers of wells, particularly rural domestic wells, could be affected by the presence of one or more pesticides. In addition, substantial numbers of wells are affected both by the presence of nitrate and by nitrate over EPA levels of health concern.

These quotes suggest that the NPS findings were neither all good news nor all bad news. The news media's coverage was mixed:

> Pesticides and other agricultural chemicals have invaded more than half the nation's groundwater supplies... USA Today, November 14, 1990, 3A.

> Unhealthy levels of pesticides and nitrates are believed to be contaminating wells that provide drinking water for hundreds of communities... Baltimore Sun, November 14, 11A. Also Boston Globe and Boston Herald, same date (from Associated Press release).

> EPA survey finds most wells OK. The News Journal, Wilmington, DE, November 15, 1990.

> Most wells are "clean," EPA finds in survey. The Delmarva Farmer, November 20, 1990, 1.

Such mixed reactions are similar to concerns about other health and environmental risks from agricultural activities. These concerns include nonpoint source pollution of both surface water and groundwater by pesticides, fertilizers, and animal wastes; residues on

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foods for human or animal consumption; drift from spraying activities; air and water pollution from food processing activities, etc.

This paper takes a closer look at the results of the NPS and then explores why communications about the health and environmental risks from agricultural activities seem to be divisive. It also suggests some actions that can move the public toward consensus about the seriousness of such risks.

WHAT DID THE NPS FIND ABOUT RISKS?[1]

EPA's five-year, $12 million study analyzed water samples for 101 pesticides, 25 compounds formed when pesticides break down, and nitrate. The samples came from 1349 wells, selected to be nationally representative of the 94,600 CWS wells and 10.5 million rural domestic wells in the United States.[2] (There was some oversampling in areas where the groundwater is especially vulnerable to contamination and where pesticide use is heavy. Samples from a much larger number of wells would have been needed to provide reliable estimates by state or substate regions.) Nitrate occurs naturally, but most of that found in cultivated soils is from inorganic fertilizers. Nitrate in soil and water also comes from septic systems, animal manure, plant residues, and fixation from the atmosphere. Because the sources of nitrate in drinking water wells differ from pesticide sources, it is reported separately.

Pesticides

Chart 1 shows that 10.4 percent of CWS wells and 4.2 percent of rural domestic wells are estimated to contain at least one pesticide above the detection limits used in the NPS. Sampling all drinking water wells would be prohibitively expensive, so EPA calculated confidence intervals to reflect the precision of its estimates, as shown in Chart 2. For example, the 95 percent confidence interval indicates that the 10.4 percent estimate for community water system wells could be as low as 6.8 percent or as high as 14.1 percent.

Presence of pesticides, however, does not necessarily imply health risk. For those suspected of causing cancer, any level of exposure is presumed to increase the risk of

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[1]Information about the NPS is taken from the series of fact sheets published by the Office of Water jointly with the Office of Pesticides and Toxic Substances, U.S. Environmental Protection Agency, Fall 1990, and available through EPA's Public Information Center, 401 M Street SW, Washington, DC 20460, 202-382-2080.

[2]The results from the NPS do not apply to wells used primarily for nondomestic purposes. Wells for livestock or irrigation could have higher (or lower) levels of pesticides and nitrates.

cancer. But for those causing other health effects, a threshold level can be established below which exposure is not harmful. Two threshold levels were used in the NPS analysis. Maximum contaminant levels (MCLs) have been established under the Safe Drinking Water Act, and specify the maximum permissible level of a contaminant in water that is delivered to any user of a public water system (so are not enforceable for rural domestic wells). A lifetime health advisory level (HAL) is the maximum concentration of a contaminant in water that may be consumed over a lifetime without harmful effects, based on human or animal laboratory studies and a margin of safety. MCLs or HALs are available for 58 of the pesticides. Fortunately, much smaller shares of wells contained pesticides above the health limits, as shown by the indented rows in Chart 2.

Health limits have been established for all 12 of the pesticides found above the Survey reporting limits, as shown in Charts 3a and 3b, and with more detail in Table 1. The acid metabolites of DCPA (formed when DCPA breaks down) were found in about 6 percent of the CWS wells and 2.5 percent of the rural domestic wells. Maximum concentrations detected were about 7.2 micrograms per liter (μg/L), much less than the HAL of 4000 μg/L. Atrazine had the next highest detection. Maximum concentrations were about 0.92 μg/L for CWS wells and 7.0 μg/L for rural domestic wells. The proposed MCL for atrazine is 3 μg/L. In addition to atrazine, four other pesticides--alachlor, dibromochloropropane (DBCP), ethylene dibromide (EDB), and gamma-HCH (lindane)--were detected in rural domestic wells above their respective MCLs/HALs. For CWS wells, none was detected above its MCL/HAL.

Nitrate

Chart 4 corresponds to Chart 2, and shows the percent of wells containing nitrate, along with their confidence limits. As is the case with pesticides, presence does not imply harm until a threshold is exceeded. Chart 5 shows that although about half of the wells have nitrates, only 1.2 percent of the CWS wells and 2.4 percent of the rural domestic wells exceed the 10 milligrams per liter (mg/L) MCL and HAL.[3] The maximum concentrations detected were 13 mg/L in CWS wells and 120 mg/L in rural domestic wells.[4] In infants, exposure to nitrates above the MCL can cause methemoglobinemia (blue baby syndrome), which reduces the blood's ability to carry oxygen. Not enough information is available for EPA to determine whether nitrate increases the risk of cancer.

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[3]Note that nitrate measures (mg/L) are in units a thousand times larger than the pesticide measures (μg/L).

[4]Other studies have detected higher levels. The Phase II report should include a prediction of nitrate distributions for wells nationally.

JUDGING THE SERIOUSNESS OF RISK INFORMATION

After reviewing the NPS findings, the question becomes whether they represent a serious problem that should be remedied. Sometimes that decision is made by scientists within regulatory agencies. Other times it is made jointly by experts and various interest groups.

Scientists base their risk judgments on risk assessments, which have three components (Fisher, 1982). The first examines whether the contaminant has the potential to cause any of several illnesses. The second determines whether it will be present quantities large enough to result in symptoms. The above description of the NPS results provides information for these two components. However, that information has some gaps. The section on nitrate stated that EPA cannot determine yet whether nitrate increases the risk of cancer. As shown in Table 1, there is sufficient evidence to expect that simazine, hexachlorobenzene, DBCP, EDB, lindane, ETU, and alachlor will increase cancer risk. But the information is too limited for a determination about the cancer-causing potential for atrazine, bentazon, DCPA metabolites, dinoseb, and prometon. Health risks for illnesses other than cancer also could be important, but have not been assessed for many pesticides. Health effects also could be caused by cumulative exposures below the detection limits used in the NPS. The third component estimates how many people will be exposed to quantities above health limits. This component will be part of the NPS Phase II report, which is planned for June 1991. Such risk assessments yield two types of risk estimates: the risk to the maximally exposed individual (MEI risk) and the number of people who could be at or above a given risk level (population risk). Scientists then judge the seriousness of a particular risk on the basis of the magnitude of the MEI risk and the population risk.

People often want to be better informed about the effects of exposure to environmental pollutants, yet are not experienced in understanding the scientific evidence available. Most citizens find understanding small risks difficult. Many people do quite well understanding probabilities larger than about one in a hundred, but have trouble processing risk information for lower probabilities (McClelland, et al., 1987). People tend either to ignore risks entirely (e.g., some smokers) or to worry a great deal even when scientists' estimates show low MEI risk and low population risks (e.g., typical public responses to waste facility siting programs). Such dichotomous reactions to the **same** risk information are not unusual--which often leads to conflict regarding the desirability of proposed policy choices.

Chart 6 shows a model of risk judgment as a first step for explaining how the same risk information can lead some people to dismiss a risk as too small to worry about, while others view the risk as a threat to themselves, their family, or their property.[5] Such a bimodal distribution of risk judgments may happen because people confront so many low

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[5]Much of the rest of this section has been adapted from Fisher, McClelland, and Schulze (1989).

probability risks that evaluating each one fully would be impossible. One coping strategy is to **dismiss** those risks perceived to be below some threshold (i.e., the left side of the risk judgment model in Chart 6). Research shows that the amount of dismissal increases as the probability of loss becomes smaller. For those who do think the risk is large enough to evaluate (i.e., the right side of Chart 6), the problem is determining an appropriate level of concern. The model suggests that people first **anchor** on the loss that could occur; they focus on the magnitude of the potential loss. Then they **adjust** their concern downward because they know the loss will occur only some of the time. The cognitive psychology literature indicates that such adjustments nearly always are incomplete (Tversky and Kahneman, 1974; Lichtenstein, et al., 1978).

The result is strong societal concern about some risks that scientists view as posing little danger and neglect of other risks that experts judge as carrying the potential for disaster (but that have been "dismissed" by many following the left side of Chart 6). Allen (1987) and a recent issue of Science (1990) note the significant discrepancy in risk judgments between U.S. Environmental Protection Agency experts and the general public. These discrepancies could be caused by the difficulty in understanding small risks, suggesting that the scientists often are correct in feeling that citizens do not understand the magnitude of the risk.

Risk perceptions have important implications for the public sense of well-being and for private and public decision-making related to pollution control for agriculture. Advocates of policies that affect agriculture often perceive problems differently from those who are familiar with the facts of agricultural production and its impacts. Farmers occupy a unique cultural niche in our nation, inheriting cherished agrarian traditions. General public awareness of agriculturally related degradation of environmental resources such as groundwater is relatively recent. Unless farmers find their own wells to be contaminated, they may not view degradation of groundwater quality as a problem for themselves or others. The few environmental regulatory programs that apply to farmers are quite new. Regulatory programs to protect the environment simply are not part of our agrarian tradition, and farmers generally have not viewed their agricultural practices as threatening to the environment.

Thus farmers, government officials, educators, and other opinion makers must understand what affects perceptions in order to design appropriate informational materials and strategies for informing various interest groups, and for getting their input in the policy decision process. One strategy may be for these opinion makers to help people move toward the more appropriate of the "dismissal" and "concern" modes of Chart 6, even though neither may be completely accurate. The judgment of which mode is more appropriate is not a trivial issue. Our discussion of the NPS results illustrated the uncertainties associated with two components of the risk assessment process: the number of wells with specified levels of contaminants, and the determination of the concentrations below which exposure would not cause harmful effects. Still more uncertainties will accompany the analysis of how many people are experiencing various exposure levels above the health limits (to be part of the Phase II report). Even more important to the determination of whether the "dismissal" or "concern" mode is most

appropriate is the recognition that other characteristics of risk--in addition to the MEI risk and population risk estimates--are important to the public. Keep these cautions in mind while reading the next section about factors that influence whether people dismiss a risk or evaluate it.

Determinants of Dismissal Versus Concern

1. **Framing of gains and losses**--Kahneman and Tversky (1979) used a concept they called prospect theory to explain the intuitive notion that people are more concerned about losses than about (the same size) gains relative to the status quo. This implies that saying a given "probability that there **will not be** adverse health effects" is likely to generate less concern than expressing the same risk information in terms of the (corresponding) "probability that there **will be** adverse health effects."

   Styles of presentation also can be important. Influence cannot take place until an individual attends to the message. Information formats that are vivid and emotional are more likely to arouse attention than traditional "official" formats that are more scientific and objective (Slovic, 1987). Using normative appeals, such as our duty to future generations, and incorporating personal case histories and prestigious models may be more effective in promoting message acceptance (Short, 1984).

   Another framing issue is the quantitative expression of risk. Some people understand absolute numbers best, while others are more comfortable with percentages. The NPS reports include both. For instance, the 2.4 percent of rural domestic wells with nitrates above the health concern level amounts to 254,000 wells. This large number illustrates that different ways of expressing the same information can influence judgments about seriousness: a problem affecting only 2.4 percent of a group may seem less serious than the same problem affecting 254,000 units in that group.

   Recent research suggests that people are more likely to pay attention when a risk estimate is compared to a standard (Weinstein, Sandman, and Roberts, 1989; Smith, personal communication). One possible implication is that respondents' rankings of risk magnitudes would be more like the scientists' rankings if they were given information about standards for more than the one substance that is the topic of the risk communication activity.

2. **Experience**--Risks that are familiar, for which the science is understood, and with which people have had prior benign experience are more likely to be dismissed. For many farmers, the NPS results represent a new, fairly unfamiliar risk, where the science is not especially well understood. On the other hand, most of them will report

benign experience, because they cannot name anyone who suffered ill effects from drinking water.[6]

3. **Characteristics of the risk**--The level of concern also is influenced by characteristics of a particular risk (called risk qualities by the National Research Council in its recent book, Improving Risk Communication) that go beyond the two scientific measures of the magnitude of the risk. These characteristics include, but are not limited to the following:

   - whether the risk is imposed on citizens rather than being voluntary (such as pollution in a community water supply),
   - whether the risk occurs naturally (such as radon and some nitrate in groundwater) compared with being manmade (such as pesticides in the same water),
   - whether it has the potential to affect many people in one area at one time (often called catastrophic; an example would be serious contamination of a large CWS well compared with a rural domestic well), and
   - whether the risk involves a particularly dreaded disease (cancer).

   If the risk is viewed by citizens as being involuntary, manmade, having the potential to be catastrophic, or involving a dreaded disease, they are less likely to follow the "dismiss risk" path in Chart 6.

4. **Media attention**--Research indicates that frequent exposure to media reports about an environmental issue is correlated with being in the concern mode. This may be amplified by other sources of risk information, such as informal networks of family and friends, schools, extension and government agencies.

5. **Physical reminders**--The more perceptual cues people see, the more likely they are to be in a concern mode. For example, many people living near a Superfund site perceived a dramatic decline in risk after the site was closed--even though nothing had been done to safeguard the community from the hazardous wastes already at the site (McClelland, Schulze, and Hurd, 1990). The disappearance of physical reminders such as trucks and workers on the site seems to have been enough to change the community's risk perceptions.

Many of these concepts can be summarized as shown in Chart 7, based on Peter Sandman's explanation of why it often is difficult to get consensus on the seriousness of a particular risk (Sandman, 1986, 1989). Scientific estimates of the risk range from small to large, or low to high. Similarly, the combination of other influences described above contributes to non-experts' judgments about seriousness that range from low to high.

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[6]Farmers in Iowa and Nebraska might report a different experience. Excess rates of non-Hodgkins lymphoma in those states may be linked to atrazine or nitrate in their wells.

When scientific estimates of the risk are large and when other risk characteristics lead non-scientists to judge the risk as serious, then action will be taken to reduce the risk. Conversely, when the risk estimates are small and other risk characteristics cause many to dismiss the risk, nothing will be done. Both of these decisions can be viewed as appropriate. Conflict is likely for risks in the other two sections of the Sandman box--which seems to be where many of the environmental risks from agriculture are likely to fall.

Because people's risk judgments are affected by risk characteristics, their concerns are broader than the typical elements of a risk assessment. They may view a particular risk as serious enough to warrant action even if they agree with the scientists that the magnitude of the risk is small. Citizens may view the scientists' emphasis on quantitative estimates over qualitative aspects of the risk as being reductionist.

There are several reasons for seeking a strategy that will lead to convergence between judgments by experts and by ordinary citizens. One is that if truly low-risk activities are banned or restricted, costs are higher for goods using these as inputs. Some potential alternatives for achieving the same effect (e.g., a particular pesticide to reduce insect damage) actually could have higher risks. There are real social costs associated with worry, and these costs could be reduced if the experts and others agree about which risks are most serious. Finally, such agreement makes it easier to allocate both public and private resources toward reducing the most serious risks, rather than scattering efforts on some serious risks and some much less serious risks, yet not addressing some of the most serious risks. At the margin, however, the ranking of judgments about seriousness will not necessarily be the same as the ranking by MEI risk or population risk. This is because of the impact of other risk characteristics on risk judgments. The process for achieving convergence will make clear what reductions in risk magnitude must be given up to ameliorate other risk characteristics. Finally, and perhaps most important, many decisions about agricultural activities that can affect health and the environment will be made at the local level. Better decisions will be made if the various parties have a better understanding of the risks associated with these activities.

COMMUNICATING EFFECTIVELY ABOUT ENVIRONMENTAL RISKS FROM AGRICULTURE

While the path to effective risk communication is complex and uncertain (Covello, et. al., 1989), the literature suggests the potential for more effective communication with various groups about the health and environmental risks from agricultural activities.[7] Here are several recommendations:

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[7]The Seven Cardinal Rules of Risk Communication are a good place to start (Covello and Allen, 1988). The recommendations here are intended to provide additional guidance.

1. **Identify what you want to accomplish with the risk communication**--Is the primary goal to raise awareness about a risk that is being neglected, or to provide reassurance about a risk that has been blown out of proportion?[8] Identify the target audience(s). Help them understand the science behind the risk assessment, so that all parties can agree on the magnitude of the risk estimates.

2. **Identify and address the concerns of various interest groups**--Farmers' perceptions (and perceptions of others in the agricultural community) of the environmental risks from agriculture differ from experts' estimates of those risks and from citizen groups' perceptions. Simply repeating the (small) risk estimates from the scientists does little to ameliorate citizens' concerns, and may alienate them because it shows that you are not responding to what they are worried about. An example could be a specific odor. The experts may know that it is not related to the contamination identified in a CWS well, or to potential pesticide residues on produce. But you should address the concern and explain why it would be impossible for the odor to be a signal of that contamination.

3. **Establish and protect credibility**--Use neutral experts to reinforce risk communication messages. If the community is still skeptical about that odor, the best way to establish credibility may involve testing to verify the experts' statements about it not being related to the contamination in the well (or the pesticide on produce). Your experts may call this a waste of testing money, but it may be a worthwhile investment in trust.

4. **Account for typical reactions to low-level risk**--Most environmental risks from agriculture have annual odds much smaller than one in a hundred. This means people will find it difficult to understand these risks and will tend either to dismiss them or to have a high level of concern about them, potentially leading to conflict. Someone needs to assume responsibility for deciding whether the larger problem is raising awareness of those who tend to dismiss (so that they would become less likely to ignore warnings and more likely to take protective action) or reassuring those who believe specific agricultural risks are larger than the scientific evidence indicates.[9] Divergence in risk judgments will be appropriate, though, when some people are at higher risk (perhaps because of more contamination in their wells).

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[8]Consider the message about the NPS results. According to EPA's director of the study, the main message was that there is no cause for immediate alarm, but steps need to be taken now to prevent further contamination of drinking water wells and assure that concentrations of pollutants stay below health-based limits (Briskin, 1991).

[9]EPA's recent guidebook, Hazardous Substances in Our Environment (1990) may help with that decision. This can be ordered from EPA's Public Information Center, PM-211B, U.S. EPA, Washington, DC 20460, 202/475-7551. Ask for Publication Number EPA-230-09-90-081.

5. **Recognize that characteristics of risk matter**--Even when people agree that the probability and consequences are the same, they often object more to a risk that is imposed on them than to one that is voluntarily sought or under their own control, one that affects many people at once rather than one at a time, and one that involves dread. This may reflect their real desire to devote more resources to reducing some risks compared with others that may have a higher probability or affect more people. Acknowledge such preferences when communicating about risk. If possible, allow those preferences to influence the risk management decision.[10]

6. **Use comparable risks--but carefully**--It often helps to put risks in perspective by using the context of other risks. This tends to be more effective when trying to convey the magnitude of the risk, and when the two risks have similar characteristics. Comparisons tend to backfire when used to make implications about the acceptability of the risk, or when the characteristics of the comparison risk are quite different from the one being discussed.

7. **Treat the media as a legitimate partner**--Providing complete and consistent information to the media makes it less likely that their coverage will lead to inappropriate levels of concern. If the problem is apathy, access to experts can make it easier for reporters to prepare an accurate, interesting story about a risk that is larger than people realize. If you are alerting people to a risk, be sure to tell them how to reduce their exposure or mitigate the risk's effects.

8. **Recognize that you cannot please everyone**--Ideally the risk communication is part of setting up a process for the risk management decision. If the various parties agree to the process, then they will tolerate the outcome even if it is not the decision they would have chosen.

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[10]Sometimes legal restrictions will not allow certain risk characteristics to influence the risk management decision.

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Table 1. National Estimates for Percent of Wells Containing Detectable Amounts of Pesticides and Pesticide Degradates

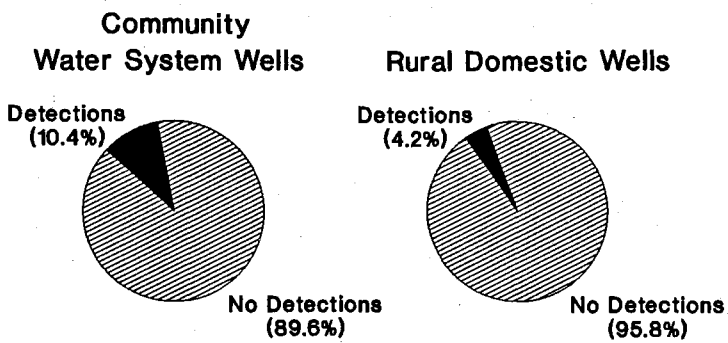
	Estimated Percent	95% Confidence Interval (Lower-Upper)	NPS Reporting Limit (μg/L)	MCL/HAL (μg/L)	10^{-6} Cancer Risk[b] (μg/L)
Community Water System Wells					
DCPA acid metabolites	6.4	3.4-9.3	0.10	4,000	--
Atrazine	1.7	0.5-2.9	0.12	3	--
Simazine	1.1	0.4-2.7	0.38	1	0.3
Prometon	0.5	0.1-1.8	0.15	100	--
Hexachlorobenzene[a]	0.5	0.1-1.7	0.060	1	0.02
Dibromochloropropane (DBCP)[a]	0.4	<0.1-1.6	0.010	0.2	0.03
Dinoseb[a]	<0.1	<0.1-0.9	0.13	7	--
Rural Domestic Wells					
DCPA acid metabolites	2.5	1.2-4.5	0.10	4,000	--
Atrazine	0.7	0.1-2.0	0.12	3	--
Dibromochloropropane (DBCP)[a]	0.4	<0.1-1.6	0.010	0.2	0.03
Prometon	0.2	<0.1-1.4	0.15	100	--
Simazine	0.2	<0.1-1.3	0.38	1	0.3
Ethylene dibromide (EDB)[a]	0.2	<0.1-1.2	0.010	0.05	0.0004
Gamma-HCH (Lindane)	0.1	<0.1-1.1	0.043	0.2	0.03
Ethylene thiourea (ETU)	0.1	<0.1-1.1	4.50	--	0.2
Bentazon	0.1	<0.2-1.0	0.25	20	--
Alachlor	<0.1	0.1-1.0	0.50	2	0.4

[a]Registration cancelled by EPA.

[b]EPA's lifetime exposure estimate for an increase in cancer risk of one in a million. That is, if a million people are exposed to this dose over their lifetime, one would be expected to develop cancer from this cause.

Source: NPS Project Summary, p. 5, and NPS fact sheets.

Chart 1. Wells Containing Pesticides



Source: NPS Summary Results, p.10

Chart 2. National Estimates of Wells With Pesticides

	Estimated Percent	95% Confidence Interval
CWS wells with at least one pesticide	10.4	6.8-14.1
CWS wells above MCL/HAL	0	0-0.8
Rural domestic wells with at least one pesticide	4.2	2.3-6.2
Rural domestic wells above MCL/HAL	0.6	0.1-1.9

Source: NPS Project Summary, p.4

Chart 3a. National Estimates of Community Water System Wells Containing Pesticides

	Estimated Percent	NPS Reporting Limit	MCL/ HAL
		(μg/L)	(μg/L)
DCPA acid metabolites	6.4	0.10	4000
Atrazine	1.7	0.12	3
Simazine	1.1	0.38	1*
Prometon	0.5	0.15	100
Hexachlorobenzene	0.5	0.060	1*
Dibromochloropropane (DBCP)	0.4	0.010	0.2*
Dinoseb	< 0.1	0.13	7

* Carcinogen

Chart 3b. National Estimates of Rural Domestic Wells Containing Pesticides

	Estimated Percent	NPS Reporting Limit	MCL/ HAL
		μg/L	μg/L
DCPA acid metabolites	2.5	0.10	4000
Atrazine	0.7	0.12	3
Dibromochloropropane (DBCP)	0.4	0.010	0.2*
Prometon	0.2	0.15	100
Simazine	0.2	0.38	1*
Ethylene dibromide (EDB)	0.2	0.010	0.05*
Gamma-HCH (Lindane)	0.1	0.043	0.2*
Ethylene thiourea (ETU)	0.1	4.50	--*
Bentazon	0.1	0.25	20
Alachlor	< 0.1	0.50	2*

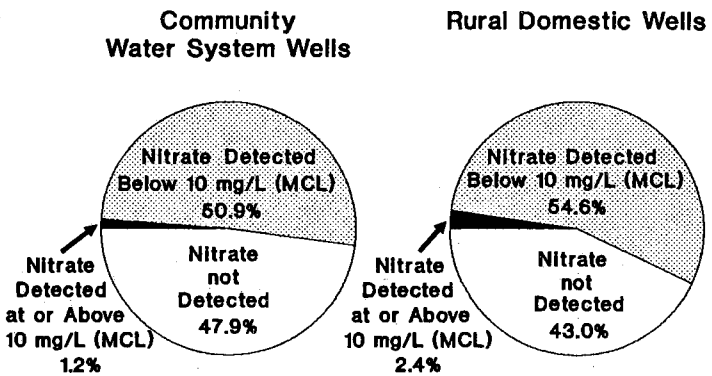
* Carcinogen

Chart 4. National Estimates of Wells With Nitrate

	Estimated Percent	95% Confidence Interval
CWS wells	52.1	48.0-56.3
CWS wells above MCL/HAL	1.2	0.4-2.7
Rural domestic wells	57.0	50.3-63.8
Rural domestic wells above MCL/HAL	2.4	1.2-2.4

Source: NPS Project Summary, p.4

Chart 5. Wells Containing Nitrate



Source: NPS Summary Results

Chart 6. A Model of Risk Judgement

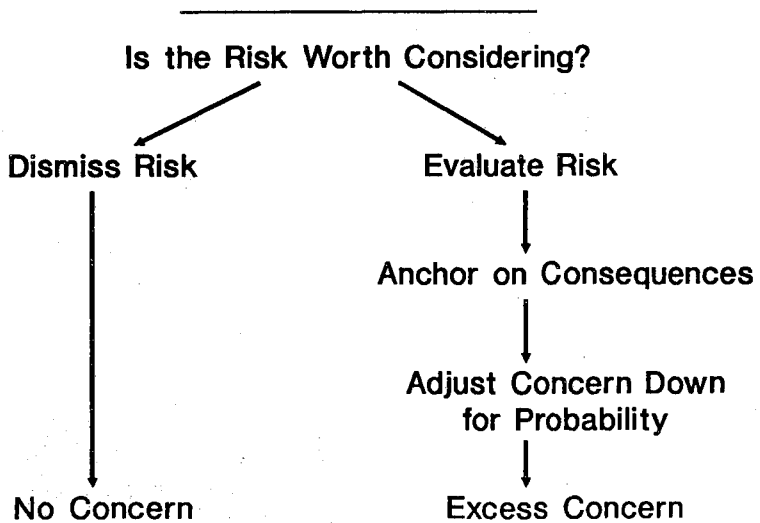
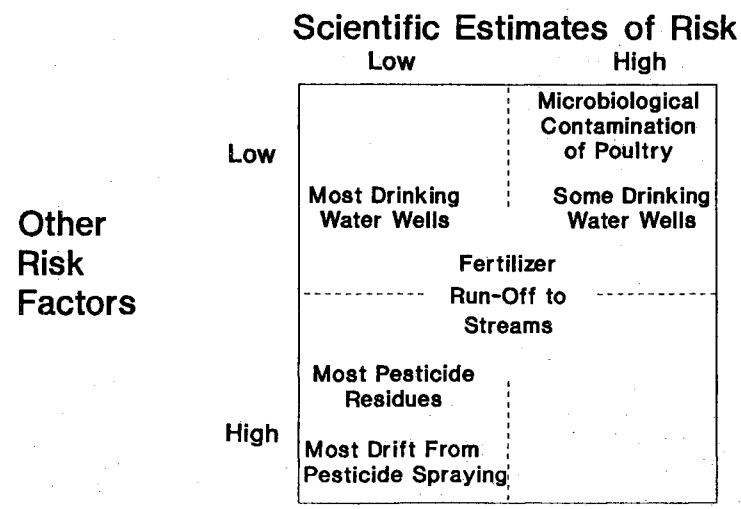


Chart 7. Size of Risk is Not the Same as Perceived Seriousness



EVALUATING BEST MANAGEMENT PRACTICES FOR CONTROL OF AGRICULTURAL POLLUTION

Donald J. Epp*

The quality of our lakes and streams has been a major concern of the citizens of the United States since the 1960s. The people of Pennsylvania have a long-standing interest in the effects of water pollution since acid mine drainage affected so many of the streams in this state. Even before water pollution abatement was a national political issue, Pennsylvanians instituted state programs to protect the quality of our streams and lakes. We have made notable progress in reducing the damage done by acid mine drainage and have been active participants in federal efforts to reduce the pollution coming from sewage treatment plants, factories and businesses.

We have not, however, solved all of our water quality problems. Sediment and nutrients continue to pollute streams and rivers and significantly change the character of our surface waters. Our region of the United States is particularly concerned about the problems of the Chesapeake Bay. While agricultural sources are not the only ones contributing the nutrients and sediment that pollute our lakes, streams and estuaries, the fields and livestock facilities of American agriculture are a major part of the problem. A 1983 Environmental Protection Agency report indicated that the Susquehanna River contributes a major portion of the nutrient loading as well as over half of the fresh water entering the Chesapeake Bay. Over one-third of the Bay drainage basin is in Pennsylvania with 35% of this area in agricultural cropland or pasture. Runoff from these agricultural lands often carries nutrient and sediment pollutants into the Bay where they degrade water quality and harm aquatic organisms. The governments of Pennsylvania, Maryland, Virginia, and the District of Columbia have joined with the federal government in agreeing to institute policies that will reduce the amount of these pollutants entering the Chesapeake Bay.

Until now, programs designed to reduce agricultural non point-source pollution focused on increasing the voluntary adoption of best management practices (BMPs). Most of these practices have been suggested by the Soil Conservation Service for many years as part of the erosion control plans they develop for farms. The Chesapeake Bay Program has provided additional resources to help farmers develop a plan to adopt BMPs for their farms and increases the portion of the cost paid by the government. There have been proposals to require the use of improved nutrient management plans or plans for the handling of manure in ways that will reduce the loss of nutrients to surface and ground water. While these have not been passed by the General Assembly of Pennsylvania, the proposals under consideration focus on the use of BMPs, but require their use rather than making adoption voluntary.

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ANALYSIS OF BMPs

Penn State University was contracted to evaluate the water quality impacts of selected conservation and nutrient management practices and to perform a field level economic analysis of these practices. Results from this study may guide implementing the Bay Program within Pennsylvania. The remainder of this paper describes the study, reports some of the results and discusses the implications for agriculture in Pennsylvania.

A field-scale microcomputer model (CREAMS) was used to assess the impacts of selected BMPs on water quality for three specific fields representing soil and typical field configurations encountered in intensively farmed areas of the Bay drainage basin. The sites chosen represent the Northern Piedmont area in southeastern and south central Pennsylvania (Adams County site), the Appalachian Ridge and Valley area of central Pennsylvania (Union County site), and the northern glaciated region of the Allegheny Plateau and Catskill Mountains (Wyoming County site). The field conditions examined for the Adams site included a Penn silt loam soil with an average slope of 7.5% and a crop rotation of corn, corn, corn, winter wheat, soybeans. Turkey manure was applied to the corn production land area. At the Union site Edom soil derived from limestone was modeled with 10% average slope and a continuous corn cropping system. Dairy manure was applied during the winter-spring period. The Wyoming site has Wellsboro soil with an average slope of 16%. The crop rotation was three years of corn followed by three years of alfalfa. A winter cover crop of rye was used following each year of corn production. Dairy manure was applied during the winter in years preceding corn production. Each of the field descriptions was provided by conservationists in the local Conservation District office. Each represents a situation frequently encountered in the respective districts and is judged to be an important contributor to erosion and water pollution problems in those areas.

The basic approach of the study was to compare the effects of various BMPs and nutrient management plans (NMPs) relative to a baseline condition at each site. The specific cases evaluated included:

1. Conventional tillage, up and down the hill, with the typical cropping rotations commonly used at each site (this is referred to as the Baseline condition.)
2. No till cropping using the baseline condition.
3. Contour farming, conventional tillage practices, and the typical crop rotation.
4. Contour farming with grassed waterways, conventional tillage practices, and the typical crop rotation.
5. Strip cropping with conventional tillage and approximately half of the area in close-grown crops and the other half in row crop production.
6. Filter strips at the field border or end-of-slope with conventional tillage.
7. Graded terraces with grassed waterways using conventional tillage and the typical rotation.
8. Parallel tile outlet terraces with conventional tillage.

9. Water and sediment control basins along the major waterways, or at the field boundary, with conventional tillage.

Two nutrient management alternatives were evaluated by modelling the eight BMPs with a baseline NMP and an improved NMP. The baseline NMP represented the typical nutrient application program used by farmers in the area. This included application of manure from animals typically raised in the area and commercial fertilizer applications. The analysis accounted for nutrient carryover from manure application in previous years and nitrogen credit for legumes grown in the previous year. The improved NMP represents an estimate of the best amount, timing, and placement of both manure and commercial fertilizers based on specific crop needs considering the crop rotation as well as the BMPs used.

SEDIMENT AND NUTRIENT LOSSES[1]

The CREAMS model used rainfall information from 1949 through 1978 as well as data on field soil and slope conditions and cropping information to indicate the amount of soil erosion on the field, sediment transport from the field boundary and deposition within the field. The model also shows the amount of nitrogen and phosphorus that leave the field attached to sediment, dissolved in the runoff and the amount of nitrogen dissolved in the water that percolates through the root zone and is presumed to enter the groundwater.

Runoff and Sediment--Table 1 shows the effects of selected BMPs on average annual runoff for the three sites. Compared to the baseline practice, the BMPs provide varying levels of reductions in runoff. Water and sediment control basins were ineffective in reducing field runoff and contouring and strip cropping reduced runoff more than filter strips and no till. Graded terraces with waterways, strip cropping, and parallel tile outlet terraces were the most effective in reducing runoff. With runoff reduction, the use of BMPs increased percolation compared to the baseline condition at all sites. Overall, strip cropping caused the greatest increase in percolation followed by graded terraces with waterways, parallel tile outlet terraces, and contouring with waterways.

The structural practices that provide impoundment basins are quite effective in reducing sediment delivery from the fields (Table 1). For all sites, the water and sediment control basins and parallel tile outlet terraces resulted in greater then 97% reduction in the total volume of sediment delivered off site. Contouring was not effective in reducing sediment delivery, primarily because no protection is provided against concentrated flow and channel erosion. Reductions in sediment delivery varied among the three sites. Contouring, contouring with waterway, and strip cropping practices were substantially less effective in reducing sediment delivery on the steeper slopes with less area devoted to

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[1] This section reports results of work done by Dr. James Hamlett, Department of Agricultural and Biological Engineering, and draws extensively on material written by him.

row crops at the Wyoming site than at the Adams and Union sites. On the other hand, the no till practice provided a much greater reduction at the Union and Wyoming fields than for the Adams field because of the substantial channel erosion that occurred on the Adams field. Also, filter strips were much more effective for the smaller field (Adams) than for the larger field (Union). This indicates that filter strips are best suited for use at the base of small areas.

Phosphorus--Phosphorus losses occur either in runoff solution or attached to sediment. Thus, BMPs that reduce runoff and sediment loss are expected to reduce phosphorus loss also. An examination of the data on total phosphorus losses under the various scenarios (Table 2) again illustrates the variation among sites. The Union site loses more phosphorus than either of the other sites regardless of BMP considered. It is clear that the structural practices (water and sediment control basins, parallel terraces and graded terraces) were most effective in reducing phosphorus losses at the Union and Wyoming sites. The effectiveness of these practices in reducing sediment loss and hence the loss of attached phosphorus accounts for the greatest portion of this reduction. At the Adams site, the total phosphorus loss was about the same for all BMPs. This is most likely a result of the low erosion and sediment loss at the site with a greater portion of the total loss due to phosphorus dissolved in the runoff, which is less affected by the type of BMP. Overall, terraces with grassed waterways seemed to be most effective in reducing total phosphorus losses. Contouring and contouring with grassed waterways were least effective. No till was effective in reducing phosphorus losses at the Union and Wyoming sites, but not very effective at the Adams site where strip cropping was the most effective non-structural BMP.

Nitrogen--Water polluting nitrogen losses from fields follow three pathways--leached, dissolved in runoff water, and attached to sediment. BMPs that reduce runoff and erosion typically decrease the surface nitrogen losses (runoff and sediment), but often result in no reduction or even an increase in leached nitrogen because of the increase in total percolation through the soil profile. Total losses of nitrogen are shown in Table 2. Part of the reason that Wyoming is lowest of the three sites is that the typical nutrient management program for that area applied less excess nutrients than at the other two sites. Similar to the results for phosphorus losses, structural BMPs are more effective in reducing total nitrogen losses at the Wyoming and Union sites. No till is most effective of the non-structural BMPs in controlling nitrogen losses, except at the Adams site where strip cropping reduces nitrogen losses the most. This reversal in relative effectiveness can be partially explained by the fact that introducing strip cropping at the Adams and Union sites required a change in the base cropping pattern and reduced the relative portion of the field devoted to row crops.

Summary--In this study the loss of pollutants varied considerably with the site and practices considered. The use of BMPs was effective in reducing pollutant losses, with the effectiveness dependent upon the site characteristics, crop and livestock enterprises, and pollutants. At all sites structural BMPs were most effective in controlling sediment losses, primarily because of the sediment deposition in the impoundments. No till was the most effective of the non-structural BMPs in most cases. For the sites with large

sediment losses and hence, sediment attached phosphorus losses, the structural BMPs also provided large reductions in total phosphorus losses. Where phosphorus in runoff solution was the primary pathway of loss, structural BMPs provided little reduction in losses. Likewise, BMPs that reduced runoff and sediment losses were effective in reducing surface nitrogen losses but increased nitrate leaching.

FIELD-LEVEL ECONOMIC ANALYSIS

The contract covering this project specified that the focus of both the physical and economic analyses should be the field level. Thus, the economic analysis examines the effects of BMPs on the costs of field operations, the changes (if any) in crop yields, and costs of construction of structural BMPs. Costs that are inherently farm level, such as the purchase of no till equipment or construction of manure storage facilities, were allocated to the field costs either on a per acre basis by using average costs for farms in the area or were calculated on a per ton basis (manure storage) and added to field costs after multiplying by the number of tons applied. Since the economic impacts of various BMPs differ depending on the crop grown, or the BMP requires altering the crop rotation, it was necessary to evaluate each BMP and NMP over at least one complete crop rotation. In addition, most cost-sharing contracts require that the BMP remain in place for between 10 and 15 years. A 10-year period was modelled, a sufficient time to include at least one complete rotation at each of the sites and a period approximating the decision horizon of a farm operator. To facilitate comparisons between practices and between sites a present value was calculated for each BMP for each site. Since the focus of the project is on effectiveness and costs relative to the baseline condition, results are reported as changes in the present value of net field income.

Costs of BMPs--The costs of installing the structural BMPs for the study sites were estimated from the design of each BMP developed in the modelling portion of the study. The amount of structure needed (linear feet of terrace, acres of grassed waterway, etc.) was multiplied by the typical rates charged by local contractors for constructing each type of structure. This procedure gives a cost similar to the social cost of the BMP. Since there is currently a cost-sharing program in place to transfer part of the cost from the farm operator to the federal budget, a second cost figure was calculated. The cost of installing the BMP was reduced by the cost-share rate in effect for the county in which each site is located to determine the farm operator cost. Maintenance costs were calculated using standard percentages of the construction cost obtained from the conservation district personnel. Since BMP maintenance costs are annual costs they were discounted to develop a present value of the stream of maintenance costs.

Field Costs--Some BMPs affect the time required for labor and machinery to complete field operations, such as tillage, spraying or harvesting, due to the need to farm around structures and the extra time to farm point rows in some BMPs. They also affect expenditures for purchased materials, such as fuel, fertilizer and herbicides. The effects of these changes on the cost of farm operations was calculated by first obtaining the

number of crop acres in each field and the field layout from the modelling portion of the study. Standard time adjustment factors and analysis of the field layouts determined how much time would be needed for each field operation for each crop in a rotation.

Machinery and operator time and expenses, such as maintenance and fuel, were considered by multiplying the field time required by the prevailing custom rates for the area of the study site or from rates used in calculating information contained in the Penn State Farm Management Handbook. Since the fields studied are only small portions of an operating farm, the size of which was not specified in the study, this procedure avoided the problem of allocating the costs of specialized machinery across the entire farm operation. Custom work is commonly performed in the portions of Pennsylvania where the study was conducted so reported rates reflect realistic costs of obtaining custom work. The amount of materials, such as herbicides, to use on each crop with each BMP was obtained from the Pennsylvania *Agronomy Guide* and from the report of common practices supplied by the conservation districts in which each site was located. Baseline fertilizer and manure applications were obtained from the conservation districts. Prices for purchased inputs were obtained from suppliers near each site and adjusted, if necessary, using information from annual reports of prices paid by farmers in Pennsylvania. Harvesting costs were determined by multiplying the crop acres by the appropriate rate. Corn drying costs were determined by first calculating the yield for the specific field which depended on the level of erosion projected by the CREAMS model for that field. The projected yield was multiplied by the average cost of drying per bushel.

Total field operating costs were determined for each year of the 10 year planning period as appropriate for the rotation used on each site. A present value of the field costs for the period was calculated for each BMP and NMP on each site.

Discount Rate--Since there was no projection of inflation in this study, it was only necessary to account for time preference of money when selecting the discount rate. A 2% rate was judged to be conservative, yet realistic. Choosing a rate that is too high diminishes the effects of costs and revenues appearing later in the planning period while too low a rate has the opposite effect. In this study the starting point in a rotation is somewhat arbitrary, so it is preferable to choose a conservative discount rate. Such a choice avoids having the discount factor interact with the higher or lower valued crops in the rotation in such a manner that an erroneous present value is calculated for a particular BMP.

Revenue--Conservation district personnel supplied estimates of crop yields per acre for the sites studied. These yields were differentiated by the amount of erosion (overland soil loss) calculated for the field with higher yield estimates for soil losses less than or equal to tolerance (T) and lower yield estimates for soil losses greater than T. The prices for each crop in Pennsylvania were obtained from *U.S. Agricultural Statistics*. In some recent years, prices have been unusual due to droughts in parts of the United States. Therefore, an average of the price for 1985, 1986 and 1987 was used to estimate the normal prices for this study.

The crop yield for each year of the 10 year period was determined from the rotation for each site and from the soil loss results of the erosion and transport analysis using the CREAMS model. Per acre yields were multiplied by crop acres and then by the appropriate price to obtain total crop revenues for each year of the period. A present value of revenues was calculated for the 10 year period for each BMP and NMP on each site.

Cost-Effectiveness--Two summary calculations were made to facilitate comparison of the BMPs at a site and between sites. The present value of the field costs and the present value of BMP installation costs were subtracted from the present value of crop revenues. This net return was compared with that of the baseline case to determine a change in net income from baseline for each of the BMPs. The second comparison was to divide the change in net income from baseline by the change in sediment discharge, nitrogen loss or phosphorus loss estimated by the CREAMS modelling portion of the study. These calculations permit comparison of the reduction (or increase) in net revenues per unit of pollutant reduction for each of the BMPs.

Results--The impact of BMPs on net income is shown in Table 3. Since the emphasis of this study was on impacts of BMPs relative to the usual practices followed by farmers (called Baseline in this study), Table 3 shows the change in the present value of net field income per acre induced by the introduction of each BMP.

Even a quick glance at Table 3 shows that the changes in income vary greatly among BMPs and among the three sites and this is most pronounced when cost-sharing is not considered (the upper left number in each cell). For example, at the Adams site, the no till BMP increased net field income by almost $260 per acre while the parallel terraces BMP reduced income by about $1,200 per acre. Similarly, at the Wyoming site, the strip crop BMP increased income by $387 per acre while the contour with waterway BMP reduced it by about $34 per acre. The differing effect of a given BMP at different sites is illustrated by the contour BMP, which increases income at the Wyoming site and reduces it at the Adams and Union sites. The results given in Table 3 also indicate that some BMPs greatly reduce net field income. Sediment basins, terraces with waterways and parallel terraces reduce income at all three sites and by very large amounts in some cases. These are all BMPs with large construction costs for the structures. By themselves (a condition assumed in this project) these BMPs do not greatly reduce field erosion, although they do reduce the discharge of sediment and in some cases reduce the loss of nutrients. The failure to reduce field surface erosion means there is little or no crop yield gain to offset the costs of constructing the BMPs. Thus, the large negative impact on net field income.

The effects of the cost-sharing program can be seen by comparing the lower right numbers in each cell of Table 3. A few of the BMPs that have a negative impact on income without cost-sharing have a positive impact with cost-sharing. For example, filter strips at the Adams site and sediment control basins at the Wyoming site switch from negative to positive impacts when the cost-sharing program is included. It should also be noted that several BMPs that are profitable without cost-sharing still receive cost-

sharing and have an even larger positive impact on income. Examples of this effect are no till and strip cropping at the Adams and Wyoming sites, and filter strips at the Union site.

To measure cost-effectiveness, the effects of the BMPs on income, shown in Table 3, were combined with the modelled effects on losses of sediment and nutrients, shown in Tables 1 and 2, to produce the results shown in Tables 4-6. These tables present the change in net field income per ton of sediment loss reduction or per pound of nutrient loss reduction. It is apparent that BMPs that achieve large reductions in sediment or nutrients (terraces, parallel terraces, and sediment basins) impose large costs on field income, even with costs-sharing. For example, at the Adams site a sediment control basin lowers sediment discharges by one and two-thirds tons per acre per year more than contour farming without waterways. Also, the cost-share payments are much greater for sediment basins than for contouring. Income loss per ton of sediment loss reduction, however, is 17 times greater with sediment basins.

The non-structural BMPs, although unable to achieve large reductions in pollutant discharges from the field, were more cost-effective. In some instances the greater cost-effectiveness was due to changes in cropping necessitated by BMP which turned out to be revenue enhancing. The strip crop BMP, for example, required an increase in the proportion of the field in meadow or small grains or introduction of these crops if they were not reported as typically included in rotations at the studied sites. This increased field income in some cases because the introduced crops were more profitable than the typical crops. The added crops were frequently grown in the areas of the study sites but, given the field level approach of this study, it was not possible to determine if the efforts to reduce sediment and nutrient losses really increased farm income or represented relocation of crops already grown elsewhere on the farm.

The pattern of cost-effectiveness in reducing sediment losses is also found in the reduction of nutrient losses (Tables 5-6). The non-structural BMPs are usually more cost-effective than the structural BMPs. There is some change in the relative efficiency of BMPs as one shifts from considering sedimentation and phosphorus losses to nitrogen losses. The main reason for this difference is that nitrogen can be lost from a field through percolation as well as in runoff, while phosphorus is not lost from these sites through percolation. For this reason, some BMPs that retain runoff to allow sediment to precipitate out and thereby increase percolation do not reduce nitrogen losses as much as they reduce sediment and phosphorus losses.

In summary, the physical and economic modelling of this study shows that structural BMPs provide greater reduction in the losses of sediment and nutrients than non-structural BMPs. However, the high cost of constructing terraces or sediment basins make these BMPs less cost-effective than the non-structural BMPs.

POLICY IMPLICATIONS

Even though the project is continuing, some policy conclusions can be drawn at this point. First, cost-share rates do not reflect differences in the effects of BMPs on income. For a given county, cost-share rates are usually a uniform percentage of installation costs of a BMP. With the large differences between BMPs in impact on field costs and returns, it is not surprising that they also differ greatly in effects on income even after cost-sharing. If the purpose of cost-sharing is to offset some or all the costs of adopting a conservation BMP, then cost-shares should be calculated differently.

Second, this study shows that cost-share rates are not related to the cost-effectiveness of various BMPs in reducing sediment and nutrient losses from the field. The cost-share rates do not vary among the BMPs. Thus, the rates do not encourage farmers to adopt the BMPs that give the greatest reduction per dollar of public expenditure. If the farmers of the sites studied were able to calculate the effect on income, there would be an incentive to adopt the non-structural BMPs. This calculation is not simple and I suspect adoption decisions are frequently made without a full understanding of the income consequences.

Third, this study has shown that in selecting BMPs there is a trade-off between the amount of reduction in pollutant losses and the cost-per unit of pollutant reduced. If very large reductions are needed in sediment or nutrient losses from a particular field or farm, non-structural BMPs may not be able to accomplish the needed reduction. In such a situation the decision is whether to use the more costly structural BMPs or cease cultivation. If adequate pollutant reduction for a given area can be achieved by widespread use of non-structural BMPs, society gets greater total reduction for the money spent using non-structural BMPs. Achieving social efficiency in the reduction of these pollutants from agricultural non-point sources may require some changes in programs so as to encourage greater adoption of non-structural BMPs.

FURTHER WORK

The research on this project is continuing and preliminary results suggest that improved nutrient management plans hold significant promise for greater reductions in the loss of nitrogen and phosphorus than that achieved with conservation BMPs. Physical modelling has shown that the improved nutrient management plans greatly reduce nutrient losses and reduce the amount of purchased nutrients, but require costly storage and machine inputs. Economic analysis of the improved nutrient management plans is underway but results are not yet available.

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Table 1. Average Annual Runoff and Sediment Loss

BMP	Runoff (inches)			Sediment Loss (tons/acre)		
	Adams	Union	Wyoming	Adams	Union	Wyoming
Baseline	4.34	7.81	4.49	3.00	21.88	8.50
No till	3.37	7.07	4.35	1.62	3.89	1.73
Contour	3.14	6.28	4.15	1.74	18.08	7.56
Contour with waterway	2.93	5.99	4.15	0.61	8.71	6.72
Strip Crop with waterway	3.07	6.14	3.59	0.86	5.37	6.86
Filter Strip	3.00	7.31	N/A	0.48	9.81	N/A
Terraces with waterway	1.90	5.31	2.81	0.74	3.27	0.89
Parallel Terraces	2.58	5.66	3.91	0.03	0.12	0.04
Sediment Basins	4.34	7.81	4.33	0.08	0.75	0.08

Table 2. Average Annual Phosphorus and Nitrogen Losses Per Acre with Typical Nutrient Management

BMP	Phosphorus (pounds)			Nitrogen (pounds)		
	Adams	Union	Wyoming	Adams	Union	Wyoming
Baseline	78.36	135.55	58.87	18.68	49.41	19.33
No till	73.14	69.41	33.87	16.51	20.46	8.66
Contour	71.15	120.37	55.36	15.79	42.18	17.80
Contour with waterway	66.83	88.22	52.63	14.00	28.26	16.64
Strip Crop with waterway	38.87	62.92	50.55	9.50	20.79	16.71
Filter Strip	65.84	24.84	N/A	10.75	117.44	N/A
Terraces with waterway	65.85	66.14	27.64	8.00	18.29	4.26
Parallel Terraces	90.12	53.64	25.11	12.51	10.87	4.53
Sediment Basins	66.08	51.75	25.11	13.45	13.67	4.77

Table 3. Difference From Baseline of Present Value of Net Field Income Per Acre

BMP	Cost Share	Site		
		Adams	Union	Wyoming
No till	without	259.58	- 66.14	306.97
	with	271.58	- 56.64	314.97
Contour	without	- 26.87	- 61.37	39.45
	with	- 20.87	- 55.37	45.47
Contour with waterway	without	-134.06	-123.84	- 33.92
	with	- 90.56	- 85.26	- 19.51
Strip Crop with waterway	without	373.04	-186.71	387.20
	with	385.04	-101.16	433.80
Filter Strip	without	- 27.75	5.42	N/A
	with	12.42	70.95	N/A
Terraces with waterway	without	-249.27	-686.59	-948.76
	with	-234.77	-286.89	-327.95
Parallel Terraces	without	-1,200.18	-619.85	-867.80
	with	-489.93	-166.25	-309.23
Sediment Basins	without	-2,960.98	-371.46	-124.32
	with	-836.76	-113.08	68.10

Table 4. Difference From Baseline of Change in Present Value of Field Income Per Ton of Reduction in Sediment Discharge Per Acre

BMP	Cost Share	Site		
		Adams	Union	Wyoming
No till	without	188.10	- 3.68	326.56
	with	196.80	- 3.15	335.07
Contour	without	- 21.33	- 16.15	41.96
	with	- 16.56	- 14.57	48.35
Contour with waterway	without	- 56.09	- 9.40	- 36.09
	with	- 37.89	- 6.47	- 20.76
Strip Crop with waterway	without	174.32	- 11.31	411.91
	with	179.93	- 6.13	461.49
Filter Strip	without	- 10.84	0.55	N/A
	with	4.93	7.23	N/A
Terraces with waterway	without	-110.30	- 36.89	-1,009.32
	with	-103.88	- 15.42	-348.88
Parallel Terraces	without	-404.11	- 28.49	-923.19
	with	-167.99	- 7.64	-328.97
Sediment Basins	without	-1,014.04	- 17.58	-132.25
	with	-286.56	- 5.35	72.45

Table 5. Difference From Baseline of Present Value of Net Field Income Per Pound of Reduction in Nitrogen Loss Per Acre

BMP	Cost Share	Site		
		Adams	Union	Wyoming
No till	without	49.73	- 1.00	12.28
	with	52.03	- 0.85	12.60
Contour	without	- 3.73	- 4.04	11.24
	with	- 2.89	- 3.65	12.95
Contour with waterway	without	- 11.63	- 2.62	- 5.43
	with	- 7.85	- 1.80	- 3.13
Strip Crop with waterway	without	9.45	- 2.57	46.54
	with	9.75	- 1.39	52.14
Filter Strip	without	- 2.22	0.05	N/A
	with	0.99	0.60	N/A
Terraces with waterway	without	- 20.93	- 9.89	- 30.38
	with	- 18.77	- 4.13	- 10.50
Parallel Terraces	without	-194.65	- 7.57	- 25.71
	with	- 79.41	- 2.03	- 9.16
Sediment Basins	without	-241.12	- 4.43	- 3.68
	with	- 68.20	- 1.35	2.02

Table 6. Difference From Baseline of Present Value of Net Field Income Per Pound of Reduction in Phosphorus Loss Per Acre

BMP	Cost Share	Site		
		Adams	Union	Wyoming
No till	without	119.62	- 2.28	28.77
	with	125.15	- 1.96	29.52
Contour	without	- 9.30	- 8.49	25.78
	with	- 7.22	- 7.66	29.70
Contour with waterway	without	- 28.64	- 5.86	- 12.61
	with	- 19.35	- 4.03	- 7.25
Strip Crop with waterway	without	40.64	- 6.52	147.79
	with	41.94	- 3.53	165.57
Filter Strip	without	- 3.50	0.22	N/A
	with	1.57	2.86	N/A
Terraces with waterway	without	- 23.34	- 22.06	- 62.96
	with	- 21.98	- 9.22	- 21.76
Parallel Terraces	without	-194.52	- 16.08	- 58.64
	with	- 80.86	- 4.31	- 20.89
Sediment Basins	without	-566.15	- 10.39	- 8.54
	with	-159.99	- 3.16	4.68

Commodity Trends and Issues

DAIRY

Robert D. Yonkers*

A one word summary of the recent history of the dairy industry might be the word "change." A look back to the decades of the '50s and '60s reveals a relatively unexciting industry with steady policy goals and programs and small year-to-year changes in milk supply, dairy product demand and prices. In contrast, there were significant deviations from trend in various dairy industry variables beginning in the 1970s and wholesale changes in dairy policy during the 1980s.

In order to look ahead, and even to help understand events of the past few years, let us start with a brief review of events in the dairy industry during the last two decades leading up to the Food, Agriculture, Conservation, and Trade Act of 1990 (FACT). Following a description of the dairy provisions of that legislation will be the outlook for the Pennsylvania dairy industry in 1991 and beyond.

HOW WE GOT TO THIS POINT: A REVIEW OF THE PAST TWO DECADES

Beginning with the Agricultural Adjustment Act of 1949, the U.S. government supported the price of milk through the dairy price support program. The support price was adjusted once each year as a percentage of parity, using a range of 75 to 90 percent of parity. By the early 1970s, the lower end of this range was consistently used. Government purchases of dairy products under this program generally amounted to a small fraction of the total milk supply, and no significant reserves of storable products were carried over in most years.

Starting in 1973, major inputs to the milk production process, notably feed and energy items, experienced significant changes in supply-demand balance. This occurred while the Nixon administration was attempting to control inflation by using wage and price controls. As a result, USDA kept the support price for milk at 75 percent of parity, and even relaxed dairy product import quotas (used to protect the dairy price support program). This allowed imported dairy goods to slow the rise in domestic farm milk prices. The sharp rise in the costs of producing milk without corresponding increases in the price of milk significantly lowered net returns (margins) to dairy producers (Table 1). At the same time, high feed grain and oilseed prices increased the profitability of cash crop farming, an alternative resource use for many assets (land, machinery, labor) used to produce milk. The result was a significant decrease in the number of dairy farms (and cows on farms) during the mid-1970s.

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The dairy industry emerged from this period determined to exert more political pressure to ensure that such a situation never occurred again. Dairy policy became an issue during the 1976 presidential election. Fulfilling a campaign promise, the Carter administration made two significant changes in dairy policy in the 1977 Farm Bill; raising the minimum price support level to 80 percent of parity, and requiring twice-a-year adjustments in the support price. These actions, coupled with a return to relatively stable supply-demand balances in dairy input markets, resulted in increased net returns to producing milk (Table 1). Dairy producers, with guaranteed, twice-yearly increases in the price of milk regardless of market conditions, entered a period of herd expansion.

Government purchases of dairy products under the price support program began to rise, as milk supplies exceeded commercial demand. This was noticed, but not considered to be an emerging trend, by policy-makers. In the 1981 Farm Bill, the use of parity to set dairy support prices ended. Instead, price levels were written into the bill explicitly; $13.10 per hundredweight of milk in 1982, and increasing each year to $14.60 by 1985. The response was continued expansion by dairy producers and larger purchases of dairy products by the government, as demand did not keep pace with the rising supply of milk.

The dairy price support provisions of the 1981 Farm Bill had a short life. New legislation froze the support price of milk in 1983 at the 1982 level of $13.10, and policy discussions regarding a quota system to control the milk supply began. Milk production surged as dairy producers "raced" to build production for an anticipated quota base. Government purchases of dairy products reached record levels in 1983.

The Dairy and Tobacco Adjustment Act of 1983 contained provisions never before used in dairy policy. For the first time, a voluntary, dairy supply management program appeared, the Milk Diversion Program (MDP), which paid dairy producers to reduce marketings. This was accompanied by an assessment on all dairy farmer milk marketings to offset the cost of diversion payments (the first time farmers of any government-supported commodity were required to pay the cost of a paid diversion). A second supply-controlling feature of this legislation was to lower the support price at the end of the 15-month MDP in April, and again in July, of 1985. In order to boost demand by consumers for dairy products, a National Dairy Promotion and Research Board was created and funded by having dairy producers pay $0.15 per hundredweight of milk marketed.

Despite these changes, milk supplies still exceeded demand in 1985 as milk production rebounded sharply after the MDP ended in March. The 1985 Farm Bill contained a different supply management program designed to remove productive assets (farms and dairy livestock) from milk production. This Dairy Termination Program (dairy buyout) accepted bids from dairy producers asking to be paid to leave the dairy industry for a period of five years, including slaughtering or exporting all their dairy cows. Assessments on all farm milk marketings helped to pay the cost of dairy buyout payments, and support prices were lowered to $11.10 by the end of the program in October, 1987.

During the remaining life of the 1985 Farm Bill, support prices were adjusted based on USDA's forecasts of government purchases of dairy products. This authority was used to lower the support price in January, 1988 to $10.60, and would have been used again in January, 1989 had dairy policy again been changed in late 1988.

THE DAIRY INDUSTRY IN 1988, 1989, 1990

Two events seriously affected the dairy industry in 1988, one domestic, one foreign, and both beyond the control of dairy producers. The growing season in all major dairy producing areas of the country, including the northeast, upper midwest, and the west coast, experienced drought conditions. Milk production was just returning to trend after the dairy buyout of 1986-87 in mid-1988 when feed prices, increased 18 percent over 1987 levels, slowing the rate of grain feeding to dairy cows. The result was a small contraction in the milk supply in late 1988.

At about the same time, European international trading firms were forced to seek out sources of nonfat dry milk (NFDM) to fill contracts, as the quota instituted in the EC in the mid-1980s resulted in declining surpluses of dairy products for export. The world price rose above the U.S. price support level for this product, and numerous U.S. dairy manufacturing plants contracted to deliver NFDM for export in the coming year. The combination of a small contraction in the milk supply and a new source of demand for dairy products resulted in farm milk prices rising well above the government support price for the first time since the mid-1970s (Chart 1).

As demand exceeded supply of milk for use by cheese and NFDM manufacturers, consumers accelerated a long-run trend toward purchasing lower fat dairy products. A growing portion of the milkfat produced was made into butter for sale to government under the price support program. Even though farm milk prices remained above the farm bill support price, USDA purchases of butter indicated a surplus of milk still existed.

Year-to-year carryover stocks of grains and forages by dairy producers, while of good quality, were below normal in quantity due to lower yields and harvested acres due to the 1988 drought. Legislation passed in late 1988 prohibited USDA from lowering the support price for milk in January, 1989, and raised it to $11.10 for three months (April, May and June, 1989) to offset higher feed costs. Despite a higher farm price for milk, production was slow to rebound during the normal "spring flush" in 1989. The 1989 crop year was much wetter than 1988 and many dairy producers were unable to make good quality forages. Milk production never did climb in the spring, and from May on was well below 1988 levels. Dairy product manufacturing plants, anxious to run at capacity to fill domestic and export contracts, bid up the farm price of milk to record levels. Dairy producers began to reduce culling in their herds and raised more heifers.

The USDA, forecasting government purchases of dairy products (primarily butter) to exceed the trigger level, lowered the price support level to $10.10 on January 1, 1990.

The European dairy industry began to return to producing surpluses of dairy products, especially NFDM, as a result of relaxing quotas in order to recapture the international trade market share lost in 1988-89. U.S. farm milk prices remained unseasonably high in the first half of 1990, as manufacturers, having run at below capacity and unable to fill demand for two years, built inventories of dairy products. For the first time in three years, above average conditions for crops lasted during all 1990. The rebound in milk production, coupled with unusually high inventories of dairy products slowing the demand for milk by manufacturing plants, resulted in farm price declines in late 1990. For the year, farm milk prices set a record in 1990, above the previous record set in 1981, but year end prices were well below the levels of December, 1989.

1990 LEGISLATION AFFECTING THE DAIRY INDUSTRY

It is useful to see how past policy shifts have impacted the dairy industry. The productive capacity of the industry as measured by the number of milking cows in the national dairy herd is seen in Figure 1. The number of cows steadily declined until the late 1970s, when milk prices increased as a result of the 1977 Farm Bill, and the number of cows starting increasing by 1980. This change from the long-run trend was halted during the Milk Diversion Program in 1984-85, and the rate of decline in cow numbers increased during the dairy buyout in 1986-87.

On the demand side, the declines in farm milk prices during the early- and mid-1980s resulted in dairy product prices increasing at a slower rate than the general level of inflation in the economy (as measured by the consumer price index). This, coupled with the increased spending on advertising and promotion from the National Dairy Promotion and Research Board, led to a higher rate of increase in commercial sales of dairy products (Figure 2) beginning in 1984. Higher dairy product prices, relative to inflation, in late 1988 and all of 1989 actually led to declines in commercial sales of dairy products. By late 1990 dairy product prices were falling, while inflation grew at over 6 percent for the year. Consumers again increased purchases of dairy products relative to the previous year.

Having set the stage for how the dairy industry got were it is today, we can now turn to significant policy changes made in 1990. The Budget Reconciliation Act of 1990 used baseline spending forecasts in FACT as a starting point for reducing the federal budget deficit. As a result, spending on government dairy programs must be reduced by $700 million during the period 1991 through 1995. This will be accomplished by an assessment on all milk marketed by dairy producers, set initially at 5 cents a hundredweight in 1991, and increasing to 11.25 cents in each of the next four years. This assessment is refundable each year to any dairy producer who is able to demonstrate that the farm's milk marketings are below (by at least one pound) those of the immediately preceding year. However, this is not intended to be a supply management plan, but rather the dairy industry's contribution to reducing the budget deficit. Since all $700 million must be collected, the amount of any refunded assessments must be added

to the following year's assessment. This means that the 11.25 cents in 1992-1995 is a minimum assessment, and may increase depending on how many dairy producers qualify for and request refunds.

FACT once again changed dairy policy. There will be a floor below which the support price for milk cannot go, currently $10.10. A supply-demand adjuster based on forecasts of government purchased still exists under this legislation, but cannot lower the price below the floor. Also, USDA must change the formula used to calculate government dairy product purchases in terms of milk equivalence from a milkfat basis to a total solids basis. As an illustration, the 8.1 billion pounds of milk equivalent, milkfat basis, purchased by the government in 1990 amounts to about 4 billion pounds of milk equivalent, total solids basis. USDA forecasts that 6.4 billion pounds of milk equivalent, total solids basis, will be purchased by the government in 1991.

In the 1990 Farm Bill debate, budget concerns took center stage. However, a compromise could not be reached on how to control government exposure to the high cost of large dairy product purchases and resulting government inventories. Therefore, a provision of the bill requires the USDA to evaluate proposals on inventory management submitted by the public, and to report back to Congress by August, 1991 with recommendations. Only two proposals are prohibited from consideration; another dairy herd buyout and any plan resulting in a support price below $10.10. Congress may pass new legislation governing dairy policy in late 1991 in response to this report, but, if it does not, there is a fall-back provision in FACT. In any year USDA forecasts government purchases of dairy products to exceed 7 billion pounds of milk equivalent, total solids basis, all milk marketings by dairy producers must be assessed to cover the cost of all purchases above the 7 billion pound level. This would be in addition to the assessment outlined in the budget deficit act and, unlike that assessment, would not be refundable to producers who reduce marketings.

Another provision of the 1990 Farm Bill may result in structural changes in the U.S. dairy industry. In order to calculate dairy product purchase prices from the support price reported in the farm bill, USDA uses two calculations. The first uses yield equations to estimate the pounds of product which can be manufactured from 100 pounds of milk, on average. The second attempts to account for costs incurred in manufacturing, also known as the "make allowance". Under FACT, no individual state may use a make allowance greater than that set by USDA in order to set farm prices lower than the support price. Currently, only California has a state agency which sets farm milk prices lower than the support price by using a make allowance greater than that used by USDA. Industry impacts of this change, which goes into effect in November, 1991, are uncertain, as the language used in the bill is being interpreted several ways and the courts may have to decide the "correct" interpretation.

THE OUTLOOK FOR THE PENNSYLVANIA DAIRY INDUSTRY IN 1991 AND BEYOND

The factors described above have set the stage for the Pennsylvania dairy industry in 1991. After two unusual crop years, 1990 left Pennsylvania dairy producers with above average inventories of relatively good quality forage. The rebound in milk production nationally and large stocks of manufactured dairy products in both commercial and government warehouses have resulted in product prices falling to government purchase prices. In fact, the government has been buying large quantities of butter, cheese and NFDM for several months now. Manufacturing plants have lowered the prices paid for farm milk to the support price; how long prices stay this low depends on a number of factors.

On the positive side for dairy producers, grain prices should be lower than those seen during 1988, 1989, and even 1990. This, coupled with good quality and quantity of forages on farms, will mean lower feed costs in 1991 (unless, of course, Pennsylvania experiences another drought or very wet period during the crop year). The strong prices received for cull dairy livestock of the past few years should continue, which will help dairy farm revenue (cull cows, newborn calves and surplus heifer sales account for nearly 10 percent of dairy farm revenue). However, prices received for replacement cows sold for dairy purposes will be much lower than last year.

There are some major factors which point to a rough time in 1991 for Pennsylvania dairy producers. We start the year with low milk prices relative to the past three years, and the outlook is not promising. Milk prices will stay at current levels through the spring and possibly early summer before recovering $0.75 to $1.25 in a normal seasonal pattern during the fall months. Look for milk prices to average $2.00 to $3.00 below the record high average for 1990 of $14.70. This is not only due to falling Federal Order minimum prices, but includes declining overorder premiums as manufacturing plants have a larger milk supply available. Remember, the $14.70 is a state average price for milk received by farmers; prices tend to be 10 to 25 cents higher in the southeastern counties, and 10 to 30 cents lower in western counties due to differences in Federal Order conditions. Farm milk prices in Pennsylvania could be lower yet if the Pennsylvania Milk Marketing Board lets current provisions adding $1.35 to the Class I price expire in June, 1991.

A number of other factors could impact the Pennsylvania dairy industry in 1991. Lower farm prices, with a short time lag, result in lower retail dairy product prices. Consumers normally respond to lower prices by increasing purchases. However, this year the health of the national economy will play a big part in consumer buying decisions. A year-long recession could reduce disposable income, more than offsetting any advantage gained by lower retail dairy product prices. Another uncertainty is how dairy producers respond to lower farm milk prices and to the refundable assessment outlined above. It is doubtful that many producers will make major farm management decisions based on a small, refundable assessment. However, some producers may respond to lower milk prices and reduced profitability during 1991 by leaving the dairy industry. If the

national inventory of dairy cattle shrinks later this year, the increase in milk prices during the fall months may be larger than indicated above.

Looking beyond 1991 is a risky venture, especially since the 1990 Farm Bill provisions may be changed as early as this fall. Any general trends which are forecasted are always subject to one-time shocks to the industry, such as a drought, new technologies, or a sudden change in demand. The 1980s were a turning point for the dairy industry, a time of adjustment to changing policy, market conditions and uncertain weather.

In comparing 1991 milk prices to the recent past, remember that 1990 prices were the highest on record. Given the federal budget problems, the ongoing quest for international agreements liberalizing trade, and the philosophical change away from government involvement in agriculture, some forecasts appear obvious. Prices for milk in a market-oriented future will be more volatile than in the government-supported past. Since the same can be said for other commodities, major inputs to milk production like feed costs will also be more volatile, but will be more likely to trend downward (milk prices have already trended down). Other fixed costs of milk production will continue to be spread over more hundredweights as the long-term trends toward higher output per cow and more cows per farm continue. Declines in the total number of milk cows in the U.S. will be more than offset by gains in productivity per cow, resulting in growing milk production.

Ultimately, the demand for dairy products will set the farm price for milk, signaling the amount of milk that can be profitably produced without heavy government involvement. Consumer movements away from higher fat dairy products to those with lower fat are well documented (see "Health Concerns and Food Choices: What's the Public Worrying About Now?" by Robert O. Herrmann in this proceedings). The attitudes of consumers toward our products will determine any future trends, either positive or negative in terms of dairy product consumption. Perhaps more time and effort should be devoted to understanding this important segment of the dairy industry.

Table 1. U.S. Average Dairy Revenues and Costs of Production per Hundredweight of Milk, 1970-1989

Year	Revenue[1]	Costs[2]	Margin[3]
1970*	6.42	5.34	1.08
1971*	6.63	5.60	1.03
1972	6.86	5.98	0.88
1973	8.16	7.36	0.80
1974	9.12	8.79	0.33
1975	9.23	8.79	0.44
1976	10.32	9.09	1.23
1977	10.36	9.04	1.32
1978	11.55	9.49	2.06
1979	13.42	11.07	2.35
1980	14.33	12.27	2.06
1981	14.94	12.64	2.30
1982	14.66	12.50	2.16
1983	14.59	12.91	1.68
1984	14.45	12.95	1.50
1985	13.76	12.24	1.52
1986	13.49	11.99	1.50
1987	13.69	11.75	1.94
1988	13.47	13.17	0.30
1989	14.82	13.62	1.20

[1] Includes milk, cull cows, cull calves and surplus heifer sales

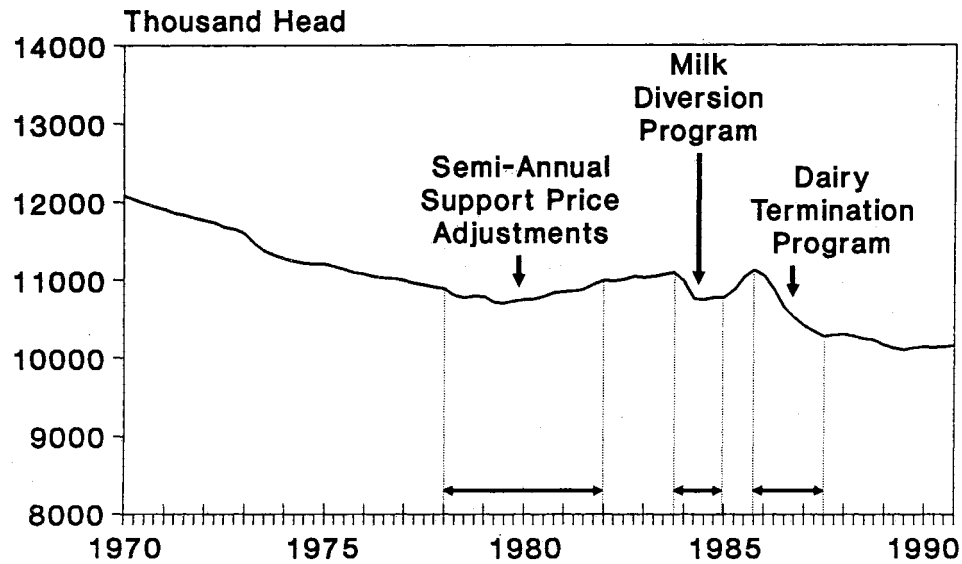
[2] Includes charges for unpaid family labor, capital replacement and return to production assets

[3] Residual return to management and risk

* Estimated from other data sources by R. D. Yonkers

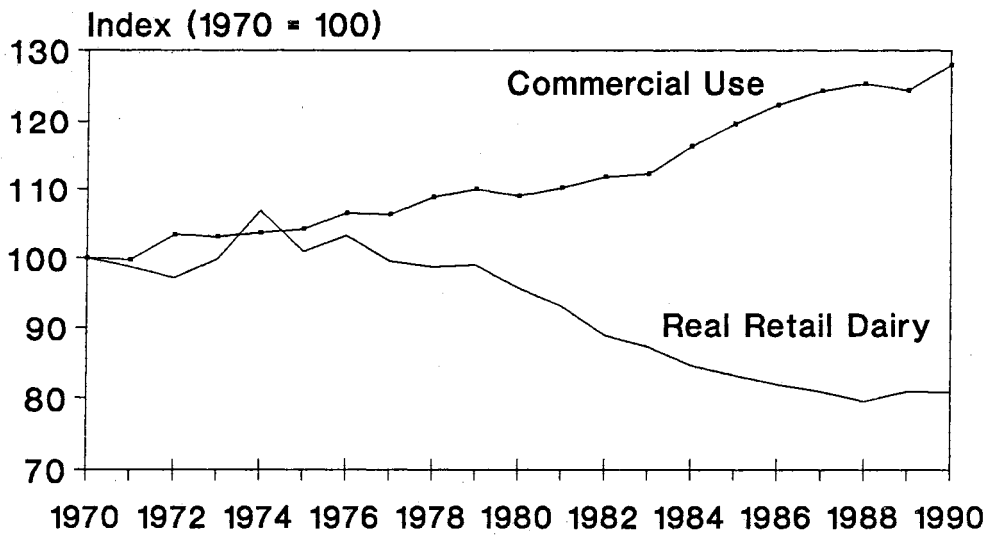
Source: ERS, USDA

Figure 1. Effects of Dairy Policy on U.S. Milk Cow Numbers, 1970-1990



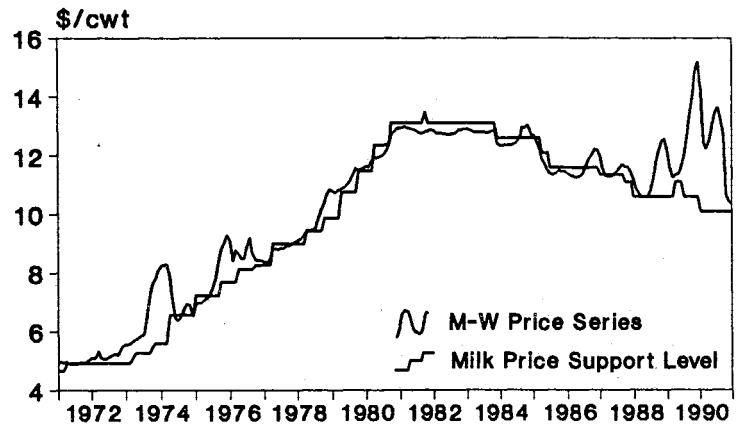
Source: ERS, USDA

Figure 2. U. S. Real* Retail Dairy Product Price and Commercial Use



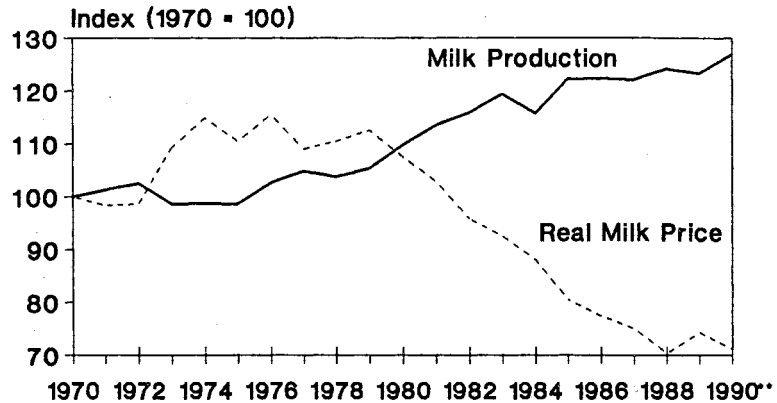
* Deflated by the CPI
** Preliminary 1990 values
Source: ERS, USDA

Chart 1. Milk Price Support Level and M-W Price Series (3.67% BF), 1971-1990



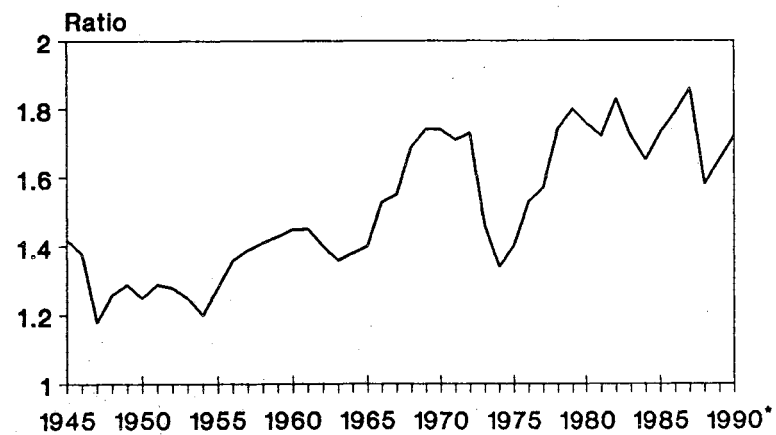
Source: AMS, USDA

Chart 2. Real* All Milk Price and Milk Production



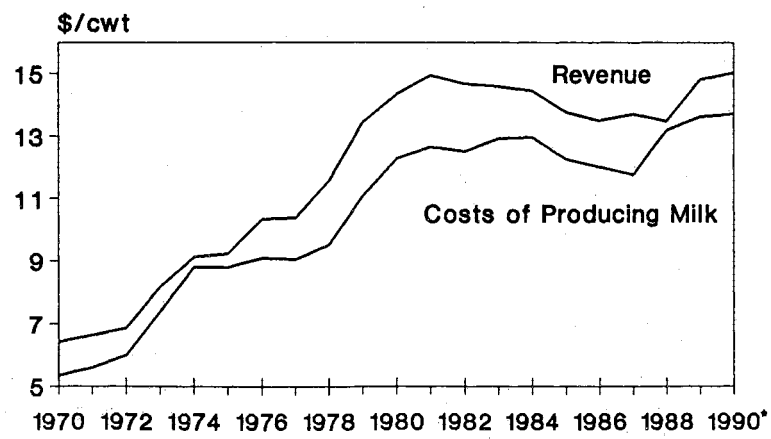
* Deflated by the CPI
** 1990 estimates by Robert Yonkers
Source: ERS, USDA

Chart 3. Milk: Feed Price Ratio, 1945-1990



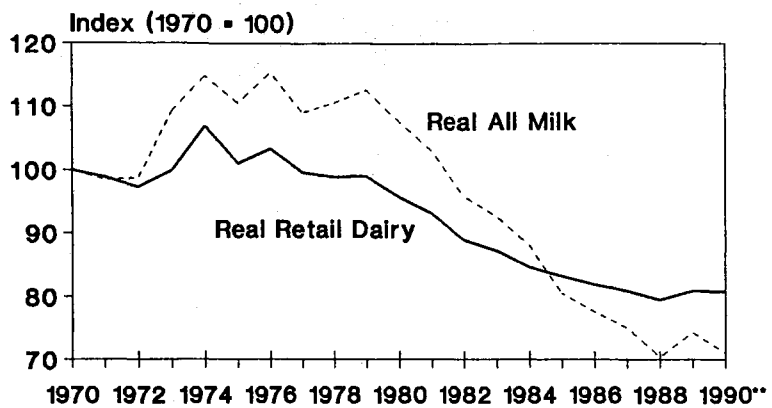
* 1990 estimates by Robert Yonkers
Source: ERS, USDA

Chart 4. Dairy Revenue and Costs of Producing Milk, Per Cwt



* 1990 estimates by Robert Yonkers
Source: ERS, USDA

Chart 5. Real* All Milk Price and Real* Retail Dairy Product Price



* Deflated by the CPI
** 1990 estimates by Robert Yonkers
Source: ERS, USDA

Chart 6. Percent Share of U.S. Milk Production, Selected States

State	1960	1975	1989
	Percent		
PA	5.6	6.2	6.9
NY	8.3	8.6	7.7
WI	14.4	16.4	16.6
MN	8.3	7.8	7.0
CA	6.5	9.4	13.4
WA	1.6	2.0	2.8
TX	2.4	2.8	3.6
FL	1.1	1.7	1.7

Source: NASS, USDA

POULTRY

Milton E. Madison*

EGGS

Egg producers had two very profitable years in 1989 and 1990 which came on the heels of the most unprofitable year recorded by USDA, 1988. This turnaround was the result of a greater than three percent reduction in production. The draw down of liquid egg stocks during 1989 allowed increased production in 1990 to be sold profitably. Pennsylvania production had been growing at greater than the national rate in the 1980s but was held back by concerns about salmonella enteritidis (Se), in 1990 (Chart 1).

During the last half of 1990, six of the ten active Se investigations involved Pennsylvania producers. Some of the state's largest producers were involved in Se tracebacks. Regulatory requirements and lawsuits resulting from consumer illness put a financial strain on producers and required a large time commitment to deal with Se generated problems. This distracted producers from thoughts of production expansion. Longer cleanout periods were also employed to give more time to clean potentially infected houses, leading to more down time between flocks and lower production in existing facilities.

Fourth quarter exports to Mexico and increased defense department purchases of eggs made the end of 1990 more profitable than expected at 22 cents per dozen. This brought the 1990 average profit per dozen to a new record, exceeding the 1989 level of 15 cents per dozen (Chart 2). The wholesale price for eggs averaged 82 cents per dozen in 1990, the same as in 1989 (Chart 3). Net returns for the past two years encouraged producers to think about expansion. Cautious expansion of one percent in production is expected in 1991 with a wholesale price of 78 cents per dozen. This will allow profitable egg operations if crops develop normally and feed costs do not substantially increase.

BROILERS

Broiler companies in the U.S. have had seven years of profitable production, 1984-1990, while expanding production by an average of five percent per year (Chart 4 & 5). Production of broilers in Pennsylvania has not grown as rapidly as national production for the past two years (Chart 4). Labor availability and environmental regulations are discouraging existing companies from expanding at present locations. Tyson does not appear to be interested in expanding its Weaver product line which competes with its own similar products. Acquisition of Weaver was just part of the deal to get Holly Farms' chicken production capacity and will not be a high priority in Tyson's plans.

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*Assistant Professor of Agricultural Economics

Broiler companies have looked at sites for expansion outside of the southeastern corner of Pennsylvania. A transportation study of state broiler production and processing showed that location of a processing facility outside of the present concentrated production area, along with production facilities, could reduce the combined production, processing and distribution costs. Inquiries in areas outside the southeastern part of the state have not generated much interest among potential contract producers or banks to finance contract operations. Pennsylvania based companies have turned to looking outside the state for potential expansion sites.

Broiler prices for 1990 averaged four cents per pound below the 1989 level (Chart 6). A more moderate production increase in 1991 of five to six percent should hold prices near the 1990 level of 55 cents per pound even with increases in red meat production. Net returns will remain near the level seen in 1990.

TURKEYS

Pennsylvania's turkey producers have not increased production at the rapid pace the national industry has maintained since 1985 (Chart 7). Production was increasing at greater than the national rate for a decade starting in 1975, but reorganization of companies handling contract production slowed expansion in the later half of the 1980s. It appears that growth rates for state production should more closely reflect national trends during the middle of the 1990s decade.

Wholesale profits on whole birds were negative for three years prior to 1990 (Chart 8). A shortage of consumer size whole birds at Thanksgiving caused prices to increase more than expected and made 1990 a slightly profitable year. National production for 1990 increased by nearly ten percent as companies involved in further processing continue to expand the quantity and variety of turkey products available to consumers. A more sustainable growth of five to six percent will be seen in 1991.

Turkey prices were three cents lower for 1990 than in 1989 (Chart 9). A smaller production increase for 1991 will allow average price to remain nearly the same as 1990 even with increased red meat production. The price pattern should be slightly different for 1991 with higher prices in the last half of the year than were seen during 1990.

CONCLUSION

This year has the potential to be a profitable year for all poultry producers. For meat producers, the need for new products and innovative marketing will determine if more poultry can be marketed at profitable prices. For egg producers in Pennsylvania, adjusting to Se regulations will continue to be a challenge. Nationally, egg producers will need to increase production very slowly to maintain profitability.

EGGS

Production

Wholesale Level Net Returns

Wholesale Prices

Chart 1
Egg Production

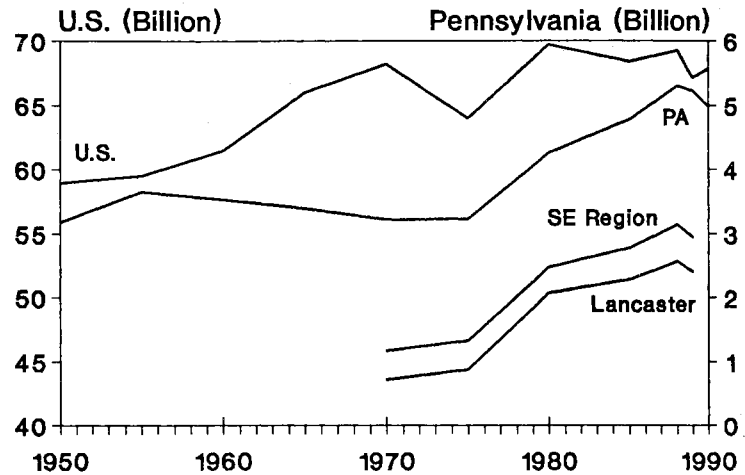
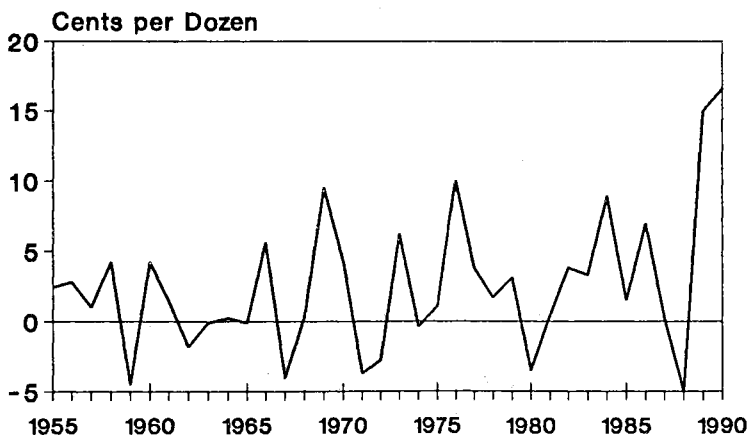
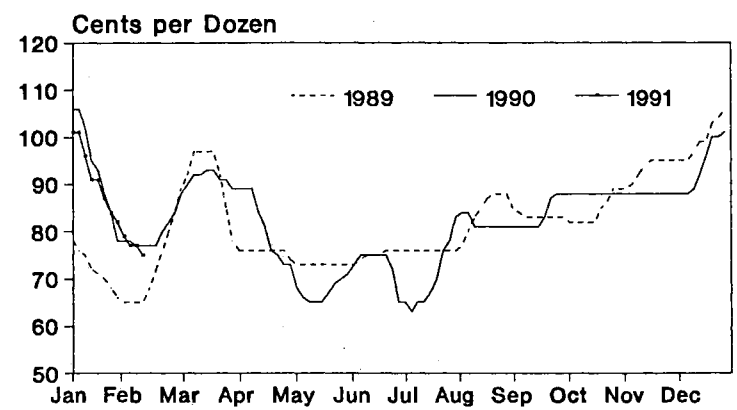


Chart 2
Wholesale Level Net Returns: Eggs



Source: USDA-ERS

Chart 3
Prices for Large Eggs
New York City Grade A White Cartoned



Source: USDA-AMS Egg Market News Report

BROILERS

Production

Wholesale Level Net Returns

Wholesale Prices

Chart 4
Broiler Production

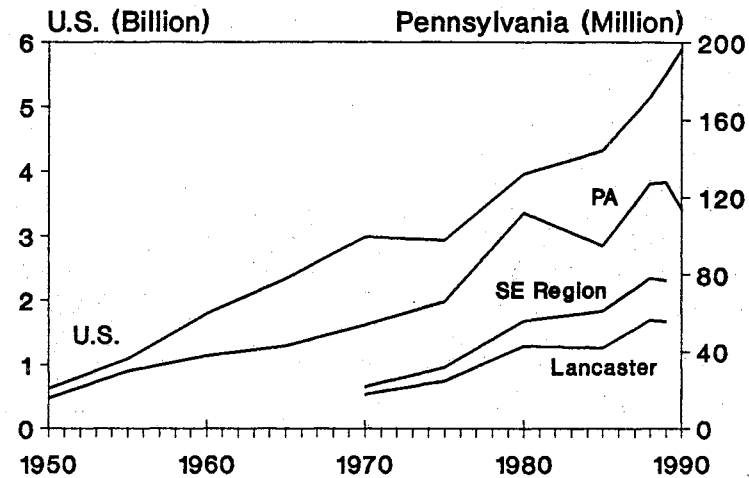
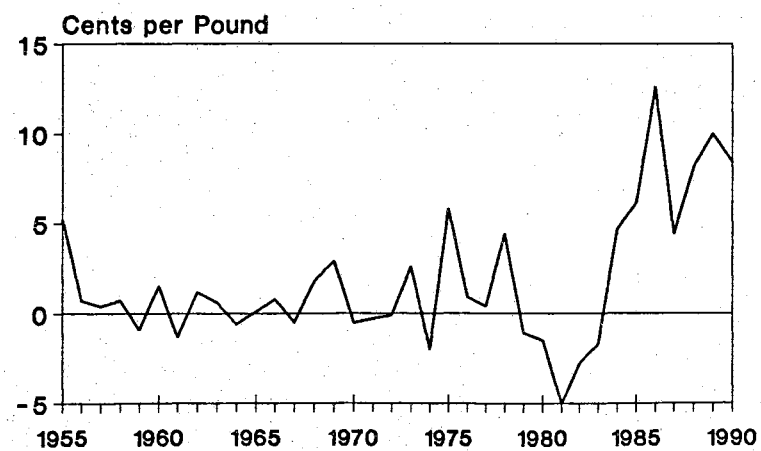
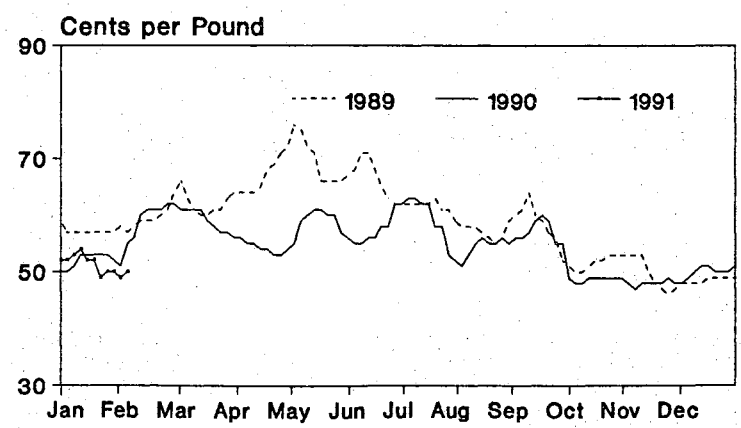


Chart 5
Wholesale Level Net Returns: Broilers



Source: USDA-ERS

Chart 6
Wholesale Broiler Prices
12-City Weighted Average



USDA-AMS Poultry Market News Report

TURKEYS

Production

Wholesale Level Net Returns

Wholesale Prices

Chart 7
Turkey Production

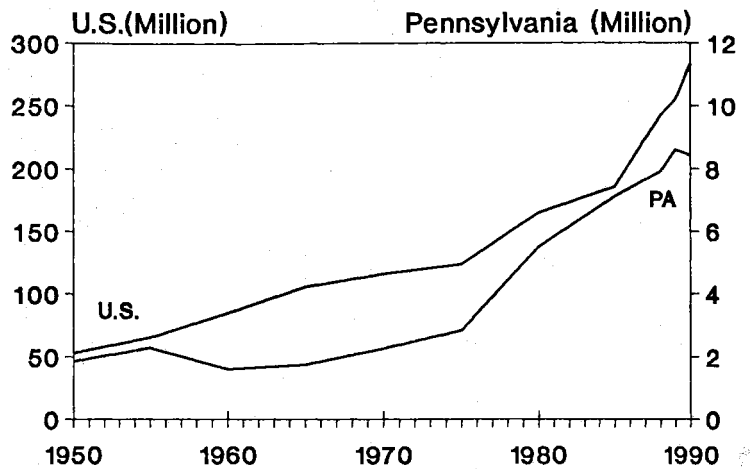
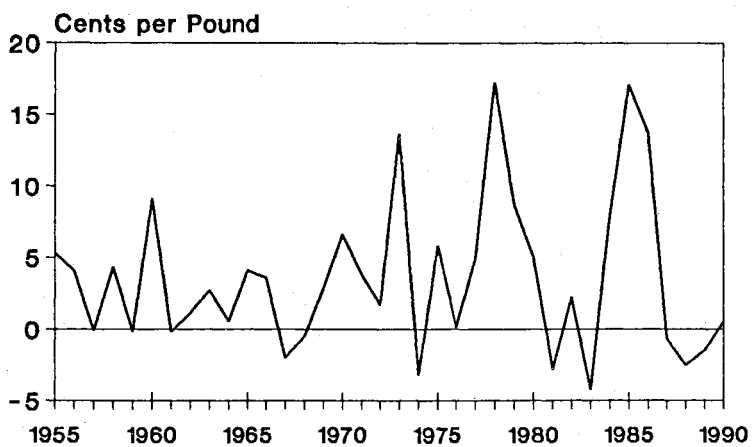
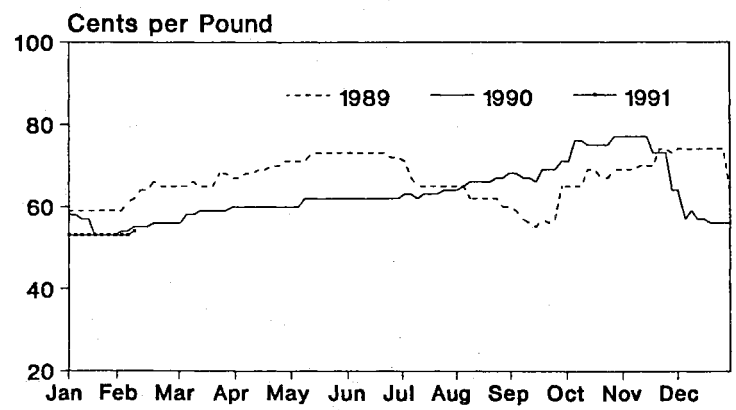


Chart 8
Wholesale Level Net Returns: Turkeys



Source: USDA-ERS

Chart 9
Wholesale Turkey Prices
8-16 Pound Hens - Eastern Region



USDA-AMS Poultry Market News Report

GRAINS AND OTHER LIVESTOCK

H. Louis Moore*

Productivity of the U.S. farm sector continues to climb steadily interrupted only by years of severe drought in major production areas, Chart 1. Productivity increases continue despite a drop in farm numbers and acreage in agriculture. Productivity increases have resulted in higher output of better, more uniform quality food. U. S. consumers eat better than most in the world, yet they spend the smallest proportion of their incomes for food than consumers in any other nation. Because of excess production, we have become increasingly dependent on export markets which no longer want all of our products. Some commodity groups have become more dependent on government programs just at a time when the government is trying to remove itself from agriculture.

IN GENERAL

Farm numbers will continue to decline and individual farms will grow in size. In 1990, the average farm size in the U.S. was 461 acres, double the average size in 1950. In 1990 there were 2.1 million U.S. farms compared to 5.6 million in 1950. Pennsylvania farms number about 54,000 in 1990 with an average size of 152 acres compared to 1950, when there were 159,000 farms with an average size of 91 acres.

Livestock prices in recent years have been more favorable to producers than grain prices, Chart 2. Pennsylvania farmers' cash receipts from livestock and livestock products comprise about 71.5 percent of total cash receipts compared to 52 percent nationally. When livestock and livestock product prices are favorable, as has been the case for about four years, Pennsylvania's cash receipts and net farm income increase. Pennsylvania cash receipts from farming reached $3.542 billion in 1989, up $258 million from the previous year. In the ranking of states, Pennsylvania moved up one position to 18th as measured by cash receipts. During 1989, Pennsylvania's share of cash receipts from agriculture in the North Atlantic region reached a record 40.4 percent compared to 39.2 percent the previous year.

As measured by net farm income, Pennsylvania ranked 16th in 1989 with income of $1.021 billion. Pennsylvania's neighboring states' net farm income and ranking in 1989 are as follows: Ohio $817 million (23), New York $807 million (24), Maryland $395 million (34), and New Jersey $248 million (37).

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* Professor of Agricultural Economics

GRAINS

Feed and food grain prices are likely to remain under pressure in the years ahead. A record domestic and world wheat crop and large feed grain harvests in 1990 reduced reminders of the 1988 drought. The 1990 Farm Bill, with its reduction in deficiency payments (triple base), flex acres, and restructuring of the farmer-owned reserve, will keep pressure on grain farmers to be more market oriented in their approach and make tough decisions in developing their participation level in government farm programs. The 1990's will be a new era for U.S. farmers, especially grain farmers. With federal dollars shrinking, the ability of farmers to attain or retain their profit margins will depend on the success of the hard choices they make.

World production of feed grain in 1990 was the highest in 4 years. Add to this plentiful supplies of wheat at prices that compete favorably with feed grains and you have a price depressing situation. The economic recession will reduce world trade in grain even more than earlier expected. The U.S. share of world feed grain trade will fall from 69 percent in the 1989/90 marketing year to about 65 percent in the 1990/91 marketing year. The brightest aspect of the feed grain situation is that U.S. carryover stocks next September will drop to about 1.236 billion bushels, the lowest since the 1983/84 marketing year.

The USDA expects the market price for corn in the marketing year ending September 1, 1991 to be the same or only slightly higher than a year ago. Will this provide any encouragement to cash grain producers preparing to plant the 1991 crop? Almost certain to increase are prices for inputs such as fertilizers and chemicals with petroleum bases. The extent of the income squeeze on corn growers is shown in Chart 3. In 1990, only 43 percent of corn farmers could cash flow a land purchase, the lowest for any year since 1985. However, this Chart favorably compares to the early 1980's agricultural recession. Corn will continue to compete favorably with soybeans and other alternative crops in 1991.

Farmer dependence nationally on government programs in 1990 fell to the benchmark level of 1960-84 when about 6 percent of gross cash income came from government programs, Chart 4. In the 1991-1995 period the percentage is likely to fall below the 6 percent level.

LIVESTOCK

The 1991 economic outlook is very cloudy and uncertain. The recession, even if a mild one ending by mid-year, will lead to conservative responses by livestock producers. It will also lead to consumers "eating a little lower on the hog" than during periods of economic expansion. Total red meat and poultry consumption for 1991 will be a record high with a slight expansion for beef, a questionable expansion for pork and a

certain expansion for poultry. Despite an uncertain consumer demand for meat in 1991, there is good news on the feed front. Feed costs for the livestock industry are not likely to increase in 1991.

The cattle industry has had six cycles since 1928, Chart 5. These cycles are measured from the beginning of an expansion phase through the next liquidation. The next cycle begins when expansion proceeds again. We have probably just entered the expansion phase of the seventh cycle. It appears that January 1, 1989 marked the end of the last cycle and the beginning of the current cycle. Recent cycles peaked well below the 132 million head recorded on January 1, 1975. On January 1, 1990 there were 99.3 million head of cattle in the U.S., which is up slightly from the 99.2 million head a year earlier, but nearly 25 percent below the number in 1975.

In recent years beef supplies have not dropped to the extent suggested by declines in animals slaughtered. A smaller percentage of the calf crop is now slaughtered as calves. In 1990, less than 2 million calves were slaughtered compared to 8 to 10 million annually 30 years ago. Another factor is the increasing production per animal, Chart 6. During the last half of the 1980"s the annual average beef production per animal has increased about 15 percent from the first half of the decade. Calf slaughter will continue to drop and dressed weight per beef animal slaughtered will likely continue to rise.

Returns to cow-calf operations have been favorable since 1986 following 5 years of losses. Four years of profits will encourage an expansion of about a half million head of calves in 1991. This constrained expansion will assure cow-calf operators of favorable returns for the next several years. Feeder cattle supplies are likely to remain tight in 1991 as some operators will hold heifer calves back for herd expansion.

Beef production is expected to increase by 1 to 2 percent in 1991. Fed cattle slaughter will rise to about 79 percent of total slaughter, continuing a long term trend. Beef and dairy cow slaughter will increase slightly from the 1990 level to about 7.9 million head. This is well below the level of preceding years. Increased culling will take place in dairy herds, but this should not contribute to a big increase in processing type beef.

Pork producers have had about 18 months of good profits. This industry is overdue for expansion, but the September and December surveys of producers indicate they are resisting the temptation to expand. The December 1, 1990 report indicates producers will actually reduce farrowings by 2 percent during the spring months. It was expected earlier that pork supplies would increase by about 3 percent in 1991. This new information seems to show that 1991 pork output may not increase over 1990. This would assure another year of continued profits for the pork sector.

Some stability in the size of the hog industry is probably due to the changes in production methods. More and more hogs are raised in large "confinement" units. These units require large capital investment and generally are operated at full capacity. Consequently, there are fewer farmers who are in and out of the hog business. They just

cannot afford to jump in when prices are high and out when prices are low. Increasingly, confinement hog houses are controlled by agribusiness firms who contract with producers. It is estimated that about one third of Pennsylvania's hog breeding herd is controlled by about a dozen firms.

The breakdown of the GATT talks and formation of more close knit trading groups, such as the European Community, will have great impact on future trade. In the meat area, U.S. imports are much greater than exports, yet we hear increased complaints, especially from the EC, they do not want any more of our meat (Charts 7 and 8). This tends to lead uninformed people to conclude that the U.S. is a meat exporting nation rather than an importing nation.

Chart 1. Farm Productivity, 1950-1989

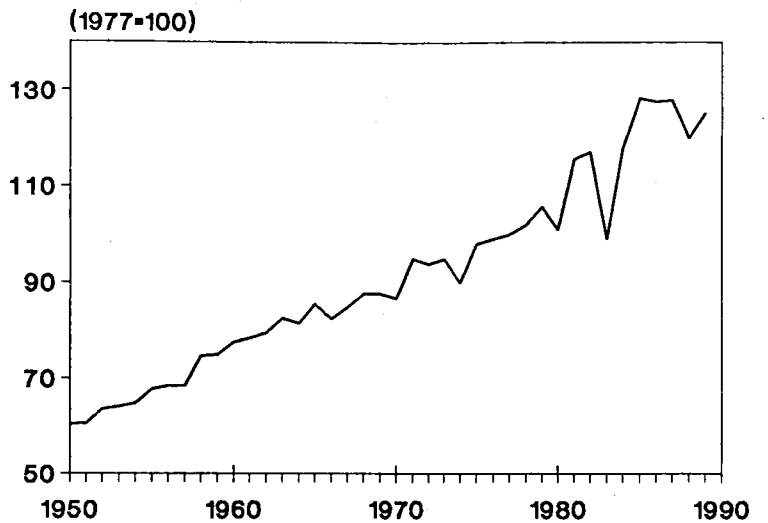


Chart 2. Livestock Prices Stable But Crop Prices Drop

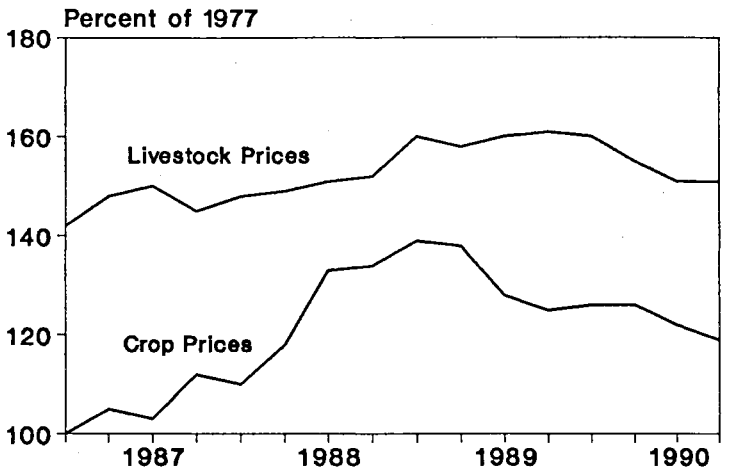
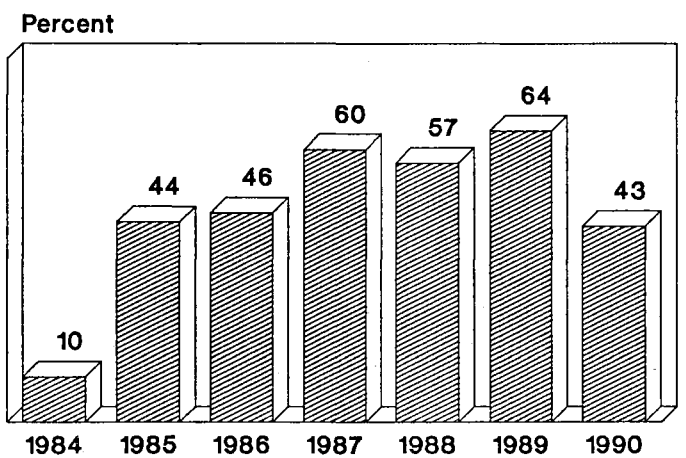


Chart 3. Commercial Corn Farms That Can Cashflow a Land Purchase



25 percent down payment

Chart 4. Government Payments Now Smaller Share of Income

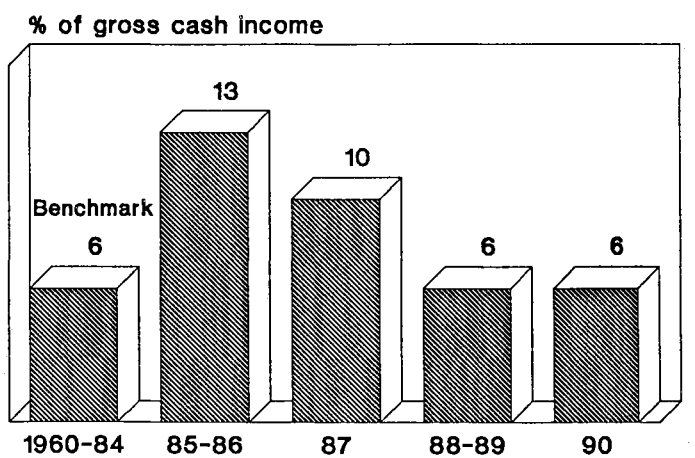


Chart 5. U.S. Cattle and Calf Inventory

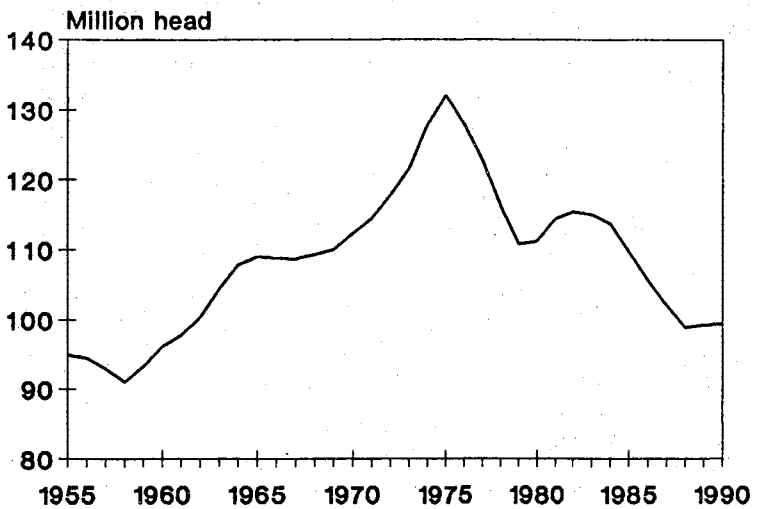


Chart 6. Average Dressed Weight of Cattle

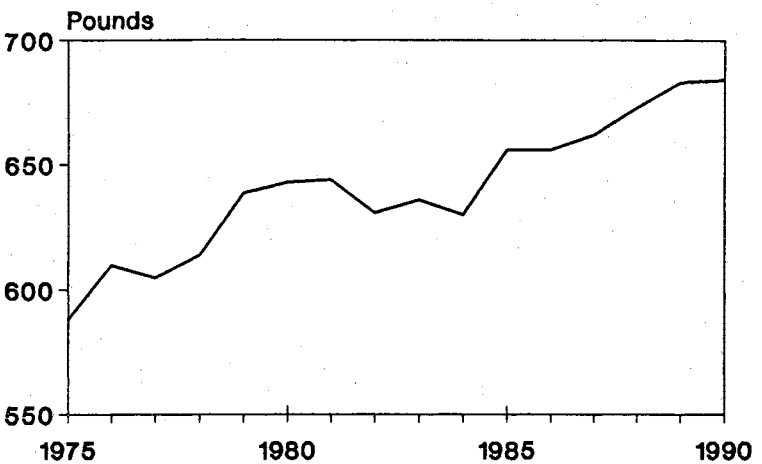


Chart 7. U.S. Pork Imports

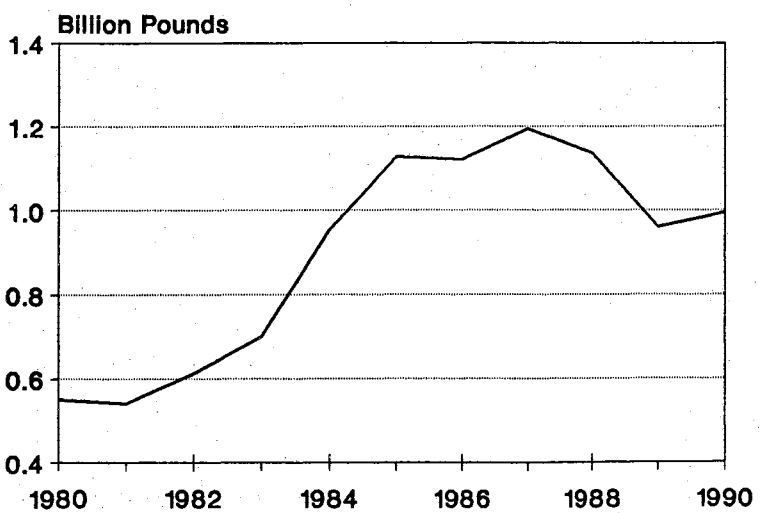
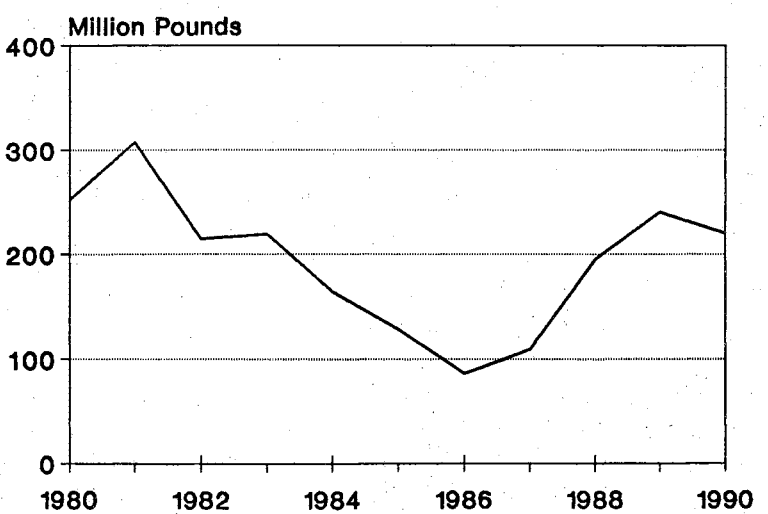


Chart 8. U.S. Pork Exports



ORNAMENTAL HORTICULTURE: A PEOPLE/PLANT INDUSTRY

Alvi O. Voigt*

People/plant interaction is a phrase used to incorporate the many ways in which plants affect human beings. Besides providing the usual rewards of food and beauty, plants contribute to our lives and the environment in many other relatively unheralded ways. Attempts to measure environmental effects have begun. NASA-sponsored research has shown indoor plants remove pollutants from the air. It has also been shown that plants clean the outside air, water, and soil of pollutants, they produce oxygen, and may help reverse the greenhouse effect.

From a social standpoint, plants provide personal rewards for work and opportunities to develop individual and group skills. Plants also provide a topic of conversation, a pride of possession, and even an aspect of subtle competition.

Psychologically, plants appear to reduce stress, improve self-image, teach long-term values, and provide links between the past and the present. A quarter century ago, the Dichter Motivational Institute identified three motivations for gardening. These are enjoyment, a sense of achievement, and mental and physical therapy.

Charles Lewis of the Morton Arboretum said,

> Plants are non-threatening, non-restrictive, non-discriminating. They are predictable...such as an oak tree and a rose. They generate neighborliness, a sense of community ("we did it together"). Rather than a feeling of helplessness there's a chance to make a difference. What satisfactions are derived from gardening? Peacefulness, tranquility. Not boredom but creativity. Behavioral changes from mental fatigue and irritableness; gardening is an opportunity to work out tensions. There's a sense of creativity, social well-being, self-esteem, respect, pride.
>
> Society has found horticulture. With the people/plant concept, horticulture can discover new and vital dimensions in society. The questions concerning people/plant interactions will be answered because the pressures of human needs demand answers. To what degree will horticulture participate in the search? Can we enlarge the area of our horticultural concerns to include inherent human benefits?

Harold Tukey, Director of the Center for Urban Horticulture, at the University of Washington said, "It is long past time when horticulturists should combine forces with the

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*Professor of Agricultural Economics.

psychologist, the artist, and the landscape architect to quantify in scientific terms the effects that plants have on humans in addition to providing food and substance."

WHY DO PEOPLE GARDEN?

The most recent studies of motivations for vegetable gardening were conducted by the Gallup Organization for the National Gardening Association in 1982, 1983, and 1984, Table 1 and Chart 7. Changes in people's motivations to raise vegetables were found even during this brief span. There was movement away from saving money and toward fresh vegetables and better tasting/quality food. Fun and enjoyment of vegetable gardening became a more important motivation than saving money, and, the relaxation/hobby motivation almost equalled saving money. Conjecture in the NGA/Gallup vegetable gardening results suggested the saving money motivation was perhaps less important because of the decline in food prices at that time. Vegetable gardens were getting smaller in size, suggesting either less interest in producing as much food or the more efficient use of garden space. Public interest issues involving health, nutrition, fitness, and food that is free from additives and chemical residues were becoming more important. The NGA/Gallup results concluded that home vegetable gardening can be positioned to appeal to consumers with a wide variety of needs.

Verification of declining interest in home vegetable gardening surfaced in the yearly analyses of sales by the bedding plant industry beginning in 1983 when only 7½% of the growers and retailers reported tomato and other vegetable plants as their best selling bedding plant. Tomatoes and vegetable plants had dropped precipitously from being the third best-seller (by 17% of respondents) in 1981-82 to only ½ percent in 1989. Still other evidence provided by USDA statistics indicated vegetable bedding plants averaging 28 percent of all bedding plants during the 1979-1981 period, 11% for the 1985-86 years and averaging only 8.2% for the most recent 1987-89 years. Essentially, vegetable plant sales had plateaued while flowering bedding plants sales were booming. The annual NGA/Gallup survey also contained evidence indicating a decline in vegetable gardening, beginning about 1983, when there was a decrease in the number of U.S. households with vegetable gardens, and also a decrease in size of vegetable gardens, and there was a decrease in expenditures on vegetable gardening supplies.

OTHER GARDENING ATTRACTIONS

So, what <u>was</u> happening with respect to people/plant interactions more generally...beyond the narrow aspect of home vegetable gardening? Changes in the mix of lawn and garden retail sales from 1985 to 1989 are provided in Table 2 and Chart 8. The data show vegetable gardening at $950 million sales in 1985 and $1.026 billion sales in 1989. This is actually a decline when adjusted for inflation (15.2 percent between 1985

and 1989). Total lawn and garden retail sales increased 35.4 percent, from $12.026 billion to $16.285 billion, which is clearly an increase in real money terms.

Lawn care, the most important activity, had the largest absolute dollar increase of $1.764 billion. This was followed by flower gardening at $598 million, landscaping at $480 million, insect control at $399 million, flower bulbs at $195 million and ornamental gardening at $120 million. Other lawn and garden activities had smaller absolute changes in dollar sales. One activity, raising one's own transplants, actually declined over the 1985-89 period. This may be indicative of our inability and/or unwillingness to grow our own transplants when the commercial bedding plant and perennial growers have provided better quality, greater variety and wider accessibility of such transplants at competitive prices. The more mature already-flowering plants that can be enjoyed immediately in the gardens are also growing in popularity.

In attempting to judge the dollar size of gardening in our society, the reader is cautioned that NGA estimates cover only U.S. households, and, the remaining nonhousehold market--consisting of lawn and garden usage by commercial, governmental, institutional and other nonhousehold entities--is an extremely large additional market that, so far, has escaped measurement.

PENNSYLVANIA'S PEOPLE/PLANT INTERACTION

Pennsylvania's combined greenhouse/nursery industry has become an increasingly important source of cash receipts for Pennsylvania production agriculture. From 1979-81 the greenhouse/nursery industry averaged 5.1 percent of all livestock and crop cash receipts; in 1985-88 its share averaged 8.9 percent, Chart 2 and Table 3. Indeed, the share will become even more significant as ornamentals are not restricted by stomach capacity and the past and future are allied with gardening, the number one outdoor leisure activity in our society.

The specialized greenhouse or floriculture portion of the industry has almost tripled in wholesale sales, going from $30.7 million in 1976 to $88.3 million in 1989, Chart 4 and Table 4. Cut flower sales have changed little due to increased imports. Sales of foliage or green plants [where the green plant market boom of the 1970s has settled into a somewhat mature mostly-replacement and maintenance market] have not even kept up with inflation. Potted flowering plant sales increased by 246 percent, while sales of bedding plants increased by almost 900 percent between 1976 and 1989. Similar growth is expected to continue.

Sales by Pennsylvania's nursery and landscaping portion of the industry have more than tripled from $143.7 million in 1975 to $438.5 million in 1989, Chart 3. These data include as 'nursery' those operations which are garden centers, greenhouse production, hobbyists, landscape contractors, landscape nurseries, mail order, nursery production, and 'dealer' operations of some of the foregoing plus chain stores, collectors, and

distributors. Chart 3 also shows the number of establishments to have increased by 61 percent, illustrating the attractiveness for new entrants. The number of hired workers more than doubled, and salaries and wages increased by 352%.

Data for Pennsylvania's retail florists and garden centers were instructive, Charts 5 and 6. Increases in retail flower shop sales (46.9%) were slightly above the average of all retail trade for Pennsylvania (44.7%), whereas growth in Pennsylvania garden center sales (111.7%) was 2.5 times that of all Pennsylvania's retail trade (44.7%). Additionally, the number of Pennsylvania flower shops increased by 12.5% (compared to an increase of 3.6% for all retail trade establishments) and average sales per shop was $190,401 in 1987 (compared to $146,121 in 1982). In contrast, new garden centers increased by 31.6 percent, and the average garden center sales in 1987 were $514,834 (compared to $319,884 in 1982). Obviously, important differences exist between retail flower shops and garden centers which reflect societal demand and basic people/plant relationships.

SOME FINAL THOUGHTS

With gardening being the nation's number one outdoor leisure activity, it appears that attention to quality control and consumer education will lead to favorable sales growth and profitability in the gardening market. Obvious opportunities exist for gardening entrepreneurs who are market-oriented.

Marketing strategies should include:

- identifying their market niche
- considering integrating forward to retailing for better business control and customer education
- orienting to those markets with customers who have better-than-average incomes
- developing a good reputation
- being a savvy marketer by listening and catering to customers' wishes
- and attempting to develop and maintain an influential share of the market.

Evidence from available sources indicates that ornamental horticulture, a people/plant interactive industry, has experienced strong growth in the last decade or so and likely will enjoy strong future growth.

Table 1. Motivation for Home Vegetable Gardening

Reason	1982	1983	1984
Fresh vegetables	26%	33%	30%
Better tasting/quality food	24	21	25
For fun/enjoyment	18	18	22
Produce for canning/freezing	18	14	19
Save money	**27**	**18**	**15**
Relaxation/hobby	11	11	14
More healthful food	8	6	8
Exercise	6	3	5
A family activity	2	2	2

Source: National Gardening Survey, 1984-1985, National Gardening Association, Burlington, VT. (Note: totals above add to more than 100% due to multiple responses)

Table 2. Lawn and Garden Retail Sales in Millions, by U.S. Households, 1985 and 1989

	1985	1989	Percent Changes
Lawn care	$3,896	$5,660	45.3%
Landscaping	2,125	2,605	22.6
Flower gardening	1,259	1,857	47.5
Insect control	653	1,052	61.1
Vegetable gardening	950	1,026	8.0
Tree care	795	886	11.4
Shrub care	699	844	20.7
Indoor houseplants	706	822	16.4
Flower bulbs	275	470	70.9
Fruit trees	271	287	5.9
Ornamental gardening	146	266	82.2
Container gardening	NA	240	-
Raising transplants	208	139	-33.2
Growing berries	41	73	78.0
Herb gardening	NA	58	-
Total	$12,026	$16,285	35.4
CPI	107.6	124.0	15.2

Source: National Gardening Key Results of the 1989-1990 National Gardening Survey.

Table 3. Cash Receipts (Millions of Dollars) from Sale of Agricultural Products from Pennsylvania Farms,1979-1988

All commodities	$2,486	$2,639	$2,924	$2,987	$3,012	$3,104	$3,183	$3,144	$3,213	$3,284
Livestock products	1,751	1,942	2,148	2,162	2,223	2,242	2,184	2,239	2,310	2,348
Crops	735	697	776	825	790	862	999	905	904	935
-Greenhouse/Nursery	$ 137	$ 137	$ 138	$ 174	$ 216	$ 244	$ 278	$ 285	$ 287	$ 283
% of all commodities	5.5%	5.2%	4.7%	5.8%	7.2%	7.9%	8.7%	9.1%	8.9%	8.6%

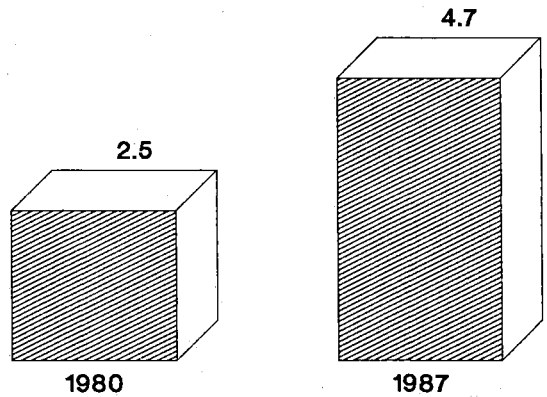
Source: Pennsylvania Agricultural Statistics Service.

Table 4. Changes in Wholesale Value in Pennsylvania for the Four Floriculture Categories, 1976-1989

	1976		1989		1976-1989
	Wsle Value (x 1000)	Share %	Wsle Value (x 1000)	Share % †	Value Change %
Cut flowers	$14,200	46	$14,513	16	+ 2
Pot plants	7,346	24	25,437	29	+346
Bedding plants	4,101	13	40,960	46	+999
Foliage plants	5,066	16	7,430	8	+ 47
Totals	$30,713	99	$88,340	99	+288

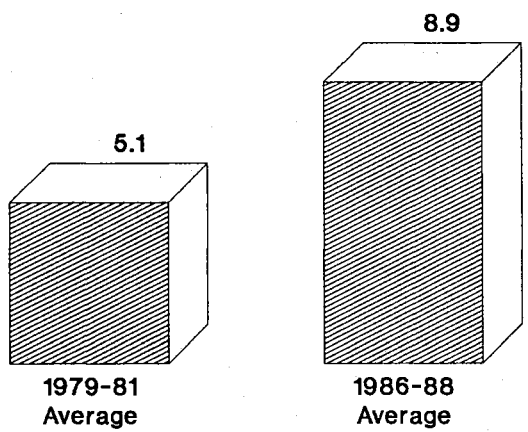
† The U.S. shares in 1989 were: Cut flowers 20%; pot plants 22%; bedding plants 37%; and foliage 20%.
Source: Floriculture Crops, USDA.

Chart 1. Greenhouse/Nursery Share of Cash Receipts on U.S. Farms



Source: ERS, USDA

Chart 2. Greenhouse/Nursery Share of Cash Receipts on Pennsylvania Farms



Source: Pennsylvania Agricultural Statistics Service

Chart 3. Growth of Pennsylvania Nursery and Landscaping Enterprises Between 1975-1989

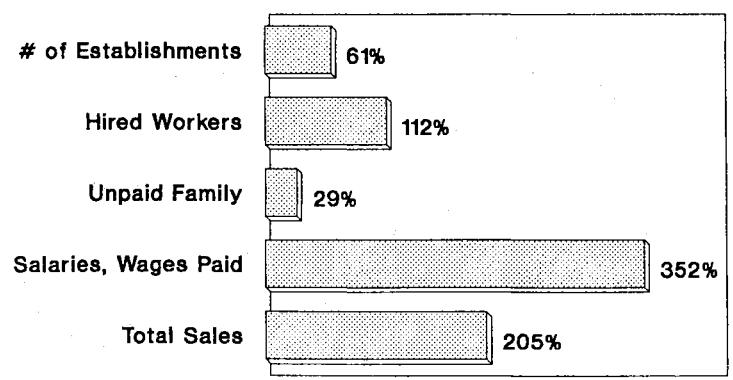
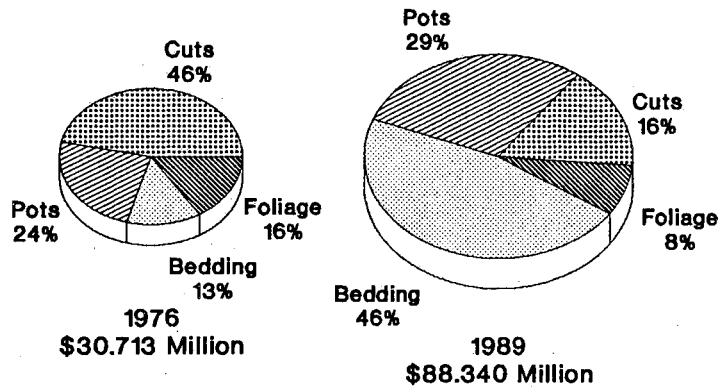


Chart 4. Wholesale Values in Pennsylvania Floriculture Between 1976 and 1989



Source: Floriculture Crops, USDA

Chart 4a. 1976 - 1989 Changes:

Cuts	+ 2%
Pots	+ 346%
Bedding	+ 999%
Foliage	+ 47%

Chart 5. Retail Sales of Flower Shops, Pennsylvania, 1982 and 1987

	1982	1987
Sales (Million)	$167.2	$245.6
Shops	1,147	1,290
Average Shop Size	$146,121	$190,401
Sales Per Employee	$31,216	$38,098
Sales Per Capita	$14.10	$20.57

Chart 6. Retail Sales of Garden Centers, Pennsylvania, 1982 and 1987

	1982	1987
Sales (Million)	$118.4	$250.7
Shops	370	487
Average Shop Size	$319,884	$514,834
Sales Per Employee	$68,414	$81,193
Sales Per Capita	$9.96	$21.01

Source: Census of Retail Trade, U.S. Commerce Dept.

Chart 7. Motivation for Home Vegetable Gardening

Reason	1982	1983	1984
Fresh Vegetables	26%	33%	30%
Better Tasting/Quality Food	24	21	25
For Fun/Enjoyment	18	18	22
Produce for Canning/Freezing	18	14	19
Save Money	**27**	**18**	**15**
Relaxation/Hobby	11	11	14
More Healthful Food	8	6	8
Exercise	6	3	5
A Family Activity	2	2	2

Chart 8. Selected Lawn and Garden Retail Sales to U.S. Households, 1985 and 1989

	1985 Millions	1989 Millions	Percent Changes
Lawn Care	$3,896	$5,660	45.3
Landscaping	2,125	2,605	22.6
Flower Gardening	1,259	1,857	47.5
Insect Control	653	1,052	61.1
Vegetable Gardening	950	1,026	8.0
Tree Care	795	886	11.4
Shrub Care	699	844	20.7
Indoor Houseplants	706	822	16.4
Raising Houseplants	208	139	-33.2
Industry Total	$12,026	$16,285	35.4
CPI (1982-1984 = 100)	107.6	124.0	15.2

PENNSYLVANIA'S POTATOES, MUSHROOMS, FRUITS, AND VEGETABLES

Thomas Brewer*

POTATOES

Value of Pennsylvania Production (1989) $36 Million

As recently as 1960 per capita utilization of table-stock (fresh) potatoes stood at 84 lbs. with only 7-8 lbs. of frozen potato products used each year. Per capita consumption of fresh potatoes declined rapidly and frozen use increased just as rapidly from then until the mid 1970s (Table 1). Since that time there have been no discernable trends in table-stock consumption and only slow growth in use of frozen potato products. Some believe that the micro-wave and other technological and nutritional developments will lead to a rediscovery of the fresh potato for home prepared meals. Consumption of frozen potato products (primarily french fries) has paralleled growth of the fast food market. Expansion of the fast food market is slowing. However, frozen french fries have been a major factor in the growing export market in recent years and much of this trade has been with E. Asian, other Pacific and Carribean countries.

Pennsylvania's share of U.S. potato production has been declining for some time (Chart 1). Most of the reduction in Northeast production since 1980, as well as the increase in total U.S. production can be attributed to increased output in the Northwest (Chart 2). Through the mid 1970s, per capita consumption of fresh potatoes was decreasing and frozen potato product usage was increasing. At the same time improved storage and transportation technology along with growth in consumer incomes enabled other regions to begin serving Northeast table-stock markets. Chip consumption has been relatively stable and the chipping industry has provided an important market for Pennsylvania grown potatoes.

Since 1980, Pennsylvania acreage and production have both leveled off (Table 2). The table-stock market will continue to be important, but improved storing, grading and marketing will be required if the state's growers are going to continue being successful in serving this segment of the market. The chipping industry will continue to be important too, but the state's growers must improve quality to compete with suppliers from other regions. More efficient production (higher yields/acre) would improve the competitive position of the industry in Pennsylvania. Development of acceptable methods of controlling insects and diseases are essential to improving Pennsylvania yields and maintaining the industry.

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*Associate Professor of Agricultural Economics

MUSHROOMS
Value of Pennsylvania Sales (1989-90) $256 Million

Per capita mushroom usage has almost tripled since 1970 (Table 3). Until the mid 1980s, usage increased steadily. Since 1984, total per capita mushroom use has not changed appreciably, though fresh usage may have increased a little at the expense of processed. As a part of the 1990 Farm Bill, the industry gained enabling legislation for establishment of a federal marketing order to collect funds for advertising and promotion. If a marketing order is issued and a successful promotional program developed, we may see increasing demand and higher prices for mushrooms. It will quite likely be 1993 before it would have much impact.

Most mushrooms produced in the U.S. are Agaricus (the common button mushroom). Exotic mushrooms (Shiitake, Oyster and other) are but a small percentage of total production. However, production of exotic mushrooms is expanding.

Pennsylvania, long the center of U.S. mushroom production has declined in importance over the years even though the states' output continues to grow (Table 4). Twenty years ago Pennsylvania produced more than 60% of all U.S. mushrooms, but by the late 1980s that percentage had declined to about 45%. In the early 1970s, Pennsylvania sold about three quarters of its mushrooms to processors and for the most part they were canned. The remaining fourth of the crop was sold on the fresh market. By the latter part of the 1980s, sales to processors were about the same as in the early 1970s but fresh sales had experienced a five fold increase (Chart 3). Total Pennsylvania production has more than doubled since the early 1970s.

Pennsylvania's heavy dependence on the processing market during the 1970s, when about 70% of the state's production was canned, left the industry particularly vulnerable to competition from imported processed mushrooms. Pennsylvania growers were not well organized to serve the rapidly growing fresh market. In recent years though, the Pennsylvania part of the industry has shifted and now sells about 60% of its output for fresh use. Nationally about 75% of the crop is sold fresh.

Grower intentions of filling beds or tray areas during the July 1990-June 1991 year indicate a 1% increase over 1989-1990 in Pennsylvania and a 2% increase nationally. A lack-luster economy coupled with increased production could signal lower prices for the industry. An advertising and promotion program that might be established under a Federal Marketing Order can not be expected to be up and running in time to have any appreciable impact on prices for a year or two.

FRUIT

Value of Pennsylvania Fruit Production (1989) $86 Million

Per capita consumption of fruit (citrus and non-citrus) has increased from about 180 lbs. per year during the early 1970s to 210 lbs. in the period from 1985 to 1989. Two thirds (20 lbs.) of that 30 lb. increase has been due to increased consumption of non-citrus fruits. Among the non-citrus fruits, fresh purchases account for nearly all of the increase. Except for grapes, sour cherries, and apples, the fresh market is of primary importance to Pennsylvania's fruit industry. Per capita use of dried and frozen non-citrus fruits has remained fairly stable while consumption of canned product has been declining.

The processing market is very important to Pennsylvania's grape and apple growers (Table 5). Most other Pennsylvania fruit is marketed through fresh market channels.

In terms of either tonnage or value, apples are easily the most important of Pennsylvania's fruit crops. Peaches and grapes come next and are followed by pears, cherries (tart and sweet), strawberries, cane-berries, and nectarines in no particular order (Table 6 and Charts 4 and 5). A significant proportion of Pennsylvania-grown fruit, sold for fresh market use, passes through direct marketing outlets.

Pennsylvania usually ranks from 4th to 6th among the states in apple production. It follows Washington, New York and Michigan as do California and Virginia which, depending on the year's crop, may rank ahead of or behind Pennsylvania. Apple sauce manufacturers are a major user of Pennsylvania's apples. In 1983 (the last year for which data is available) the Eastern region, centered around Adams County, Pennsylvania, and stretching from New York to Virginia, produced nearly 60% of the apple sauce produced in the United States. Substantial quantities of juice are also processed in the East, primarily from apples that are not satisfactory for the fresh market. Canned pie filling, frozen apple slices and vinegar manufacturing are among other important uses of Pennsylvania produced apples.

1989 was not a great production year for Pennsylvania's fruit producers except for those who grew pears or strawberries. 1990, on the other hand, saw increased apple production, somewhat stronger prices and very good peach prices. Rains during harvest and other weather related factors led to a dissappointing grape harvest.

VEGETABLES

Value of Pennsylvania Vegetable Production (1990) Estimated at $54 Million

Per capita use of vegetables in the United States has been increasing for the last decade (Table 7). Most of the growth can be attributed to increasing fresh vegetable purchases but some is due to purchasing of more vegetables in the frozen form. Per capita fresh and frozen purchases have more than offset the decline in the use of canned vegetables.

Pennsylvania's location, near to market, makes it possible for growers to share in the growth of the fresh vegetable market even if for only a short period of time each season. A substantial portion of fresh vegetable sales take place through some type of direct marketing outlet (roadside stands, farmer's markets, etc.). However, centralized packing and marketing of vegetables for fresh market is beginning to increase in importance. As a result, more and more growers are now able to serve the larger volume traditional wholesale markets. Total sales of fresh market Pennsylvania vegetables have a dollar value of three to five times that of vegetables sold for processing.

Pennsylvania's production of the so-called principal vegetables[1] has been decreasing for several decades. A strong downward trend in production of tomatoes for processing has not been offset by the rather rapid growth in production of sweet corn and tomatoes for fresh market. Besides tomatoes and sweet corn for fresh market there has been greater interest in, and increased production of a number of other fresh market vegetables in recent years.

The tonnage of the principal vegetables produced in Pennsylvania is only 50-60% of the volume produced in the late 1960s and early 1970s (Chart 6). The values of the Pennsylvania's processing and fresh-market vegetable crops were about equal in 1970 even though processing tonnage was four times as great as that for fresh market (Table 8). By contrast, in 1990, tonnage of fresh market vegetables was about 1.25 times that of vegetables for processing but the value of the fresh market crop of principal vegetables was more than three times that of the processing crop.

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[1]Fresh-market (sweet corn and tomatoes); processing-market (snap beans, sweet corn, and tomatoes).

Table 1. Potatoes, All: U.S. Per Capita Utilization, 1970-89

Year	Total	Fresh	Freezing	Chips and Shoestring	Dehydrating	Canning
	Pounds per capita, farm-weight					
1970	119.3	62.3	25.6	17.4	12.0	2.0
1975	121.6	52.6	36.8	15.5	14.7	2.0
1980	115.9	51.1	36.9	16.7	9.4	1.9
1981	112.7	45.7	37.8	16.8	10.5	1.8
1982	114.9	46.8	39.1	17.2	10.1	1.9
1983	118.1	49.7	38.7	17.9	9.7	1.9
1984	119.2	48.8	40.5	18.1	10.0	1.8
1985	121.3	46.7	44.0	17.7	11.0	1.9
1986	126.0	49.4	45.9	18.2	10.5	1.8
1987	124.0	48.9	45.7	17.7	10.4	1.8
1988	127.3	51.4	43.9	17.3	10.0	1.9
1989	126.2	49.8	46.1	17.8	10.5	2.0

Source: Economic Research Service, USDA.

Table 2. Potatoes: Harvested Acres and Production (U.S. and PA) 1970-90

	1,000 Acres		1,000 cwt.	
	U.S.	PA	U.S.	PA
1970	1,421	35	325,716	8,280
1975	1,259	29	321,978	6,815
1980	1,148	22	303,905	4,180
1981	1,232	21	340,623	4,500
1982	1,267	21	355,131	4,935
1983	1,241	22	333,726	4,300
1984	1,298	22	362,039	5,160
1985	1,359	22	406,609	5,720
1986	1,220	22	361,743	5,160
1987	1,293	22	389,320	4,730
1988	1,259	21	356,438	3,690
1989	1,282	21	320,444	4,715
1990	1,359	23	393,204	5,400

Source: Crop Production, NASS, USDA.

Table 3. Mushrooms: U.S. Per Capita Utilization, 1970-89

Crop Year	Fresh	Processing	Total
	----------Pounds per capita, (farm weight)----------		
1970	0.3	1.0	1.3
1975	0.7	1.3	2.0
1980	1.2	1.7	2.9
1981	1.4	1.5	2.9
1982	1.4	1.8	3.2
1983	1.6	1.6	3.2
1984	1.8	1.9	3.7
1985	1.8	1.8	3.6
1986	1.9	1.8	3.7
1987	1.9	1.8	3.7
1988	2.0	1.6	3.6
1989	2.1	1.4	3.5

Source: Economic Research Service, USDA.

Table 4. Mushrooms: Production by Type of Sale, 1970-89

Crop Year[1]	U. S.			Pennsylvania			PA as % of U.S.
	Fresh	Processed	Total[2]	Fresh	Processed	Total	
	----------Millions of pounds----------						
1970	58	149	207	32	96	128	62
1975	142	168	310	65	114	179	58
1980	275	195	470	88	150	238	51
1981	319	198	517	120	153	273	53
1982	337	154	491	129	117	246	50
1983	388	173	562	155	125	280	50
1984	420	176	596	160	116	276	46
1985	427	161	588	156	100	256	44
1986	457	157	614	183	98	281	46
1987	469	163	632	185	100	285	45
1988	485	183	668	176	118	294	44
1989	512	203	715	193	140	333	47

[1] Crop year begins July 1 and ends June 30 the following year. Thus 1989 is from July 1, 1989 through June 30, 1990.

[2] Total production, fresh market and processing estimates are primarily agaricus, but also include exotics and specialties through 1986. Statistics after 1986 are for agaricus only.

Source: Mushrooms, NASS, USDA.

Table 5. Utilization of Pennsylvania's Grape, Apple and Peach Crops, 1970-89

Year	Grapes		Apples			Peaches	
	Fresh	Proc.	Fresh	Proc.	% Proc.	Fresh	Proc.
	millions of pounds						
1970	4	86	195	315	62	74	10
1975	3	93	228	275	55	83	7
1980	4	108	208	362	64	95	10
1981	4	118	152	247	62	60	5
1982	4	90	183	341	65	83	7
1983	2	122	175	325	65	83	12
1984	3	116	207	368	64	79	7
1985	2	98	210	375	64	34	4
1986	2	118	136	484	78	93	7
1987	2	123	157	303	66	78	7
1988	2	114	138	382	73	73	7
1989	2	118	120	200	63	62	3

Table 6. Production of Apples, Peaches, Grapes, Pears, Cherries and Strawberries in Pennsylvania 1970-89

Year	Apples	Peaches	Grapes	Pears	Tart Cherries	Sweet Cherries	Straw-berries
	Millions of lbs.						
1970	540	84	90	8	16	1.2	4.7
1975	550	110	96	9	12	1.7	4.8
1980	570	105	112	7	6	1.4	6.2
1981	400	65	122	6	8	.6	6.8
1982	525	90	94	9	6	1.2	7.6
1983	500	94	125	5	8	1.6	7.2
1984	575	85	120	7	9	1.8	5.1
1985	585	40	119	7	6	1.0	5.1
1986	620	100	124	11	12	2.1	6.1
1987	460	85	131	11	5	1.4	7.2
1988	520	85	126	10	9	2.4	8.2
1989	320	65	120	11	6	1.3	8.5

Source: Various annual summaries, Pennsylvania Crop Reporting Service, now the Pennsylvania Agricultural Statistics service. (Some production figures have been rounded to nearest whole number for ease in presentation.)

Table 7. Total U.S. Per Capita Utilization of Commerically Produced Vegetables, 1970-89

Year	Total Fresh and Processed	Vegetables		
		Fresh[1]	Canned[2]	Frozen[3]
	----------Pounds per person, farm-weight----------			
1970	175.3	70.6	91.4	13.3
1975	176.2	73.5	88.9	13.8
1980	185.5	80.5	90.6	14.4
1981	174.0	79.3	80.0	14.7
1982	174.7	82.3	78.9	13.5
1983	176.6	82.5	79.6	14.5
1984	190.3	87.6	85.2	17.5
1985	192.7	88.0	87.5	17.2
1986	198.7	95.3	87.6	15.8
1987	202.3	98.5	87.0	16.8
1988	200.6	100.3	82.8	17.5
1989	198.7	99.6	82.2	16.9

[1] Includes asparagus, broccoli, carrots, cauliflower, celery, sweet corn, lettuce, onions, tomatoes, and honeydews.

[2] Includes asparagus, snap beans, carrots, sweet corn, green peas, pickles, and tomatoes.

[3] Includes asparagus, snap beans, broccoli, carrots, cauliflower, sweet corn, green peas.

Source: Economic Research Service, USDA.

Table 8. Production and Utilization of Principal Vegetables,[1] Pennsylvania 1970-90

Year	Fresh	Processing	Total
	----------Thousand of cwt.----------		
1970	972	3758	4730
1975	1130	2792	3922
1980	1229	1274	2503
1981	1445	2111	3556
1982	1498	2278	3776
1983	1219	1985	3204
1984	1926	1814	3740
1985	1819	1724	3543
1986	1406	1224	2630
1987	1653	1004	2657
1988	1550	1199	2749
1989	2254	1194	3448
1990	1503	1219	2722

[1] Fresh-market (sweet corn and tomatoes); processing-market (snap beans, sweet corn and tomatoes)

Chart 1.
Potato Production in the U.S. and Pennsylvania, 1970-1990

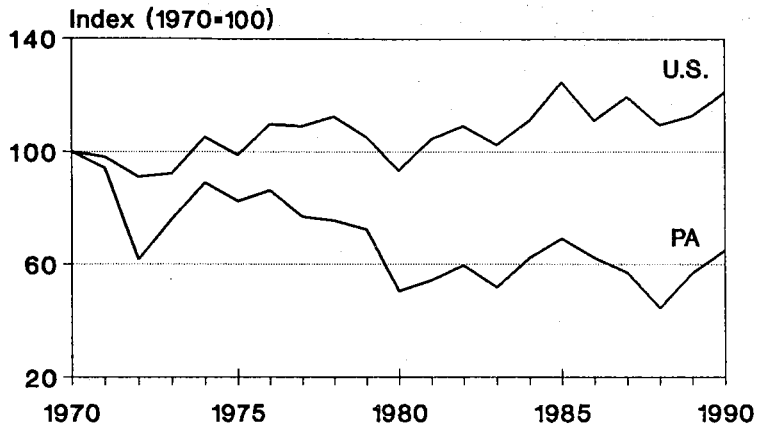


Chart 2.
Northeast and Northwest Fall Potato Production Trends, 1978-1988

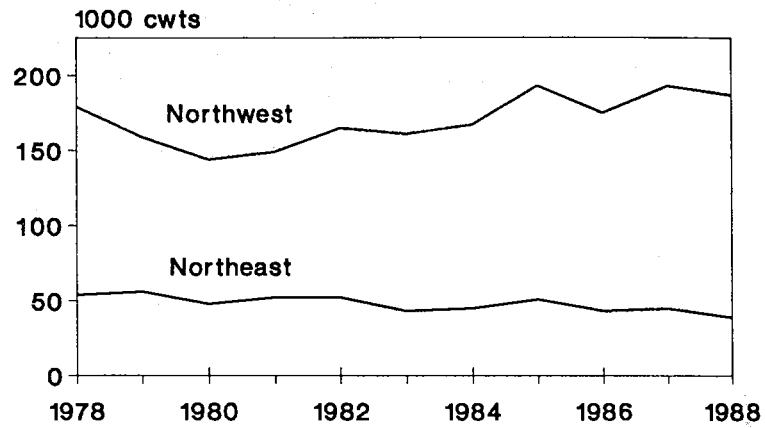


Chart 3.
U.S. Produced Mushroom Utilization and Grower Prices

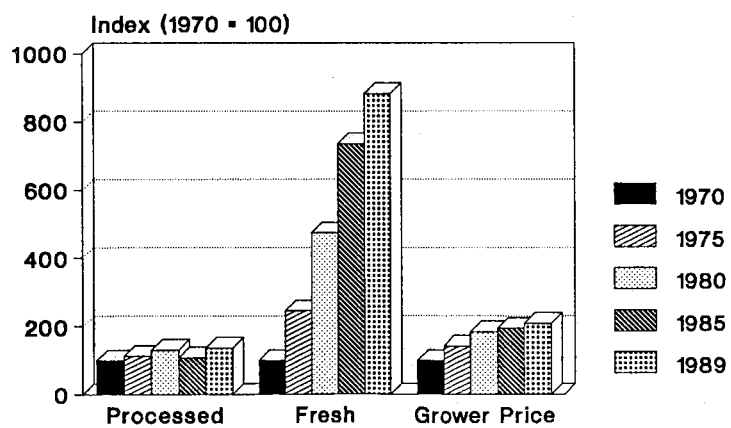


Chart 4.
Pennsylvania Fruit Production Trends 1970-1990

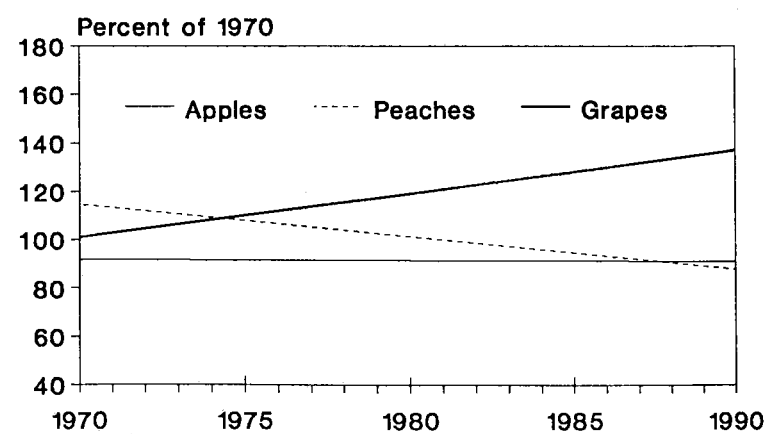


Chart 5.
Pennsylvania Fruit Production Trends 1970-1990

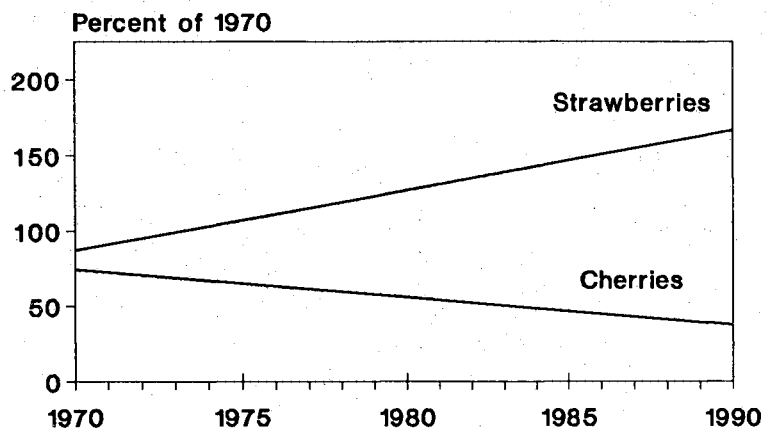
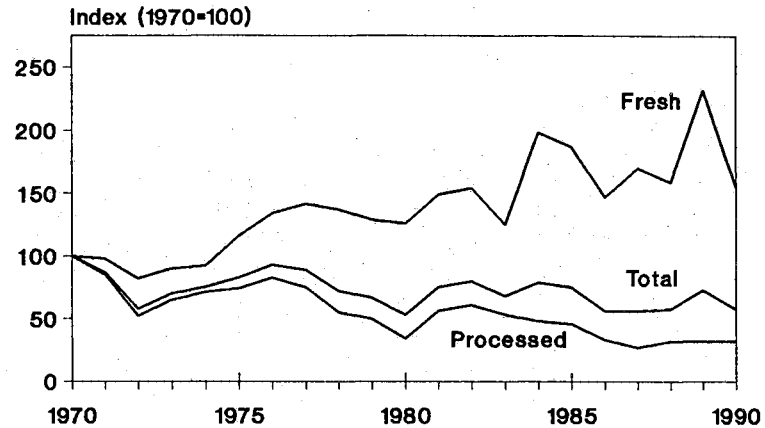


Chart 6.
Production of Major Vegetables in Pennsylvania, 1970-1990



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