PUBLIC VS. PRIVATE RESEARCH IN THE FOOD INDUSTRY FOR THE 1980'S

Chairperson - Wes Kriebel

PUBLIC RESEARCH VIEW

by

Michael J. Phillips
Office of Technology Assessment
United States Congress

We have faced for many years a very interesting paradox in the food sector. The industrialization of American agriculture during the past decade has diminished farm numbers and population. While total agricultural production has increased, the distributon industries surrounding production agriculture have become the dominant economic components of the food and agricultural system. The transformation of production agriculture from a major economic sector of the economy to minor status has been in progress since the beginning of this country. However, it has progressed rapidly in the post-World War II era via the technological revolution involving mechanical, chemical, biological, and managerial innovations on the farm. This has resulted in a highly interdependent subsector of the economy for providing food and fiber for consumers at home and abroad (Polopolous, 1982).

Emphasis by agricultural scientists, including agricultural economists, has been placed upon the technical, economic, and social aspects of production agriculture as the food and fiber system changed over time. In terms of value added, employment, contribution to gross national product, balance of trade, energy usage, and impact on inflation, the food and fiber system beyond the farm gate is approximately twice that of production agriculture (OTA, 1982).

Item: U.S. consumers spent $285 billion for farm produced food in 1981. Approximately 30 percent was spent on farm production and 70 percent attributable to activities beyond the farm gate.

Item: Consumer expenditures have risen $170 billion since 1971, and increases in the marketing bill have accounted for 73 percent of that amount.

Item: The food and fiber industry accounts for 22 percent of the total U.S. employment. Eighty-six percent or 20.4 million people are employed in the market sector.

Item: The food and fiber system accounts for 20 percent of Gross National Product (GNP). Almost 18 percent comes from nonfarm industries.

Item: The food and fiber system consumes an estimated 17 percent of total U.S. energy supply. Production agriculture consumes three percent, the marketing sector, eight percent.

Despite the enormous importance of this area, scant attention is paid to it by the public research sector. Research expenditures, particularly by the Federal Government, for this area have historically been low, but more importantly have not increased in real terms. In fact, a major debate annually between the Executive Branch and Congress is whether to fund this area of research. Executive Branch members, including USDA and the Office of

Management and Budget (OMB) have taken the position that it is no longer necessary to invest in this form of research, the implication being that proprietary firms have sufficient resources to conduct their own research.

This paper addresses the question of the involvement of the public sector in research activity beyond the farm gate. It traces the research expenditures in this area, discusses the research benefits, and attempts to delineate the public and private research roles.

Definitions

For the purpose of this paper, research activities beyond the farm gate are referred to as postharvest technology and marketing economics (PHTME) research. PHTME research includes all the technological and economic transformations of agricultural products from harvest to consumption. Such research encompasses storage at various levels of the marketing channel, assembly, processing, packaging, warehousing, transportation and distribution of agricultural products through the institutional food trade, wholesale, and retail outlets.

PHTME involves two major components: 1) those involved with the technology of marketing, and 2) those involved with the economics of marketing.

The major characteristic of the technology of marketing (or, postharvest technology) is that it is primarily physical, chemical, biological, or mechanical. Postharvest technology research extends and complements the continuum of research beyond that concerned with soil, water, and air resources and the production of farm crops. It encompasses the technology aspect, which includes the functions of assembly, processing, packaging, warehousing, storing, transportation, and distribution of agricultural products through the institutional food trade, wholesale, and retail outlets. Postharvest technology research focuses on quality evaluation, physical efficiency, and protection of food, fiber, and other agricultural commodities during the handling, storage, and transportation throughout the market system. It also deals with composition, quality, preservation, safety, nutritional values, and other related properties that bear on the most effective use of agricultural products.

Marketing economics is characterized as being a social rather than a biological and physical science, and focuses on the economic aspects of human behavior. Two components of this behavior are taken into account by marketing researchers: One relates to demands of consumers for the combinations of products and services that make up the national food supply. This includes the full range of economic and behavioral activities involved in coordnating the various stages of economic activity from farm production to consumption. The second component of marketing economics research relates to efficiency. In order for an individual firm to maximize profits, it seeks to minimize the resource requirements and consequently the costs of the marketing functions they perform. In a macro sense, these cost-minimizing tendencies should result in the lowest total cost of performing all marketing services in a competitively oriented economy. Achieving this lowest cost requires evaluation of the efficiency with which products are marketed. It also requires the existence of a competitive market structure whereby efficiency in production and marketing are reflected in a minimum cost food supply. Evaluation is, therefore, required of the competitive organization of markets.

Based on these two components, marketing economics research is concerned with three broad areas: efficiency analysis, price analysis, and policy analysis. Efficiency analysis is concerned with problems of increasing efficiency in the procurement, processing, and distribution activities of the marketing system. Price analysis focuses on problems related to agricultural product

and input prices over time, space, form, and market levels. Policy analysis is concerned with the expected or observed effects of alternative policies that influence the marketing of agricultural products (Forker, et al, 1980).

Investment in PHTME Research

From a research funding perspective, PHTME research has not been a major priority in the public sector. Combined SAES and USDA expenditures for PHTME research were $212 million in 1979 and accounted for 24 percent of total agricultural research expenditures. Production research on the other hand, accounted for 69 percent of total public research expenditures. In addition, the trend in public expenditures for PHTME research has declined since 1966. In constant dollars, combined SAES and USDA expenditures for PHTME research decreased by 1.5 percent from 1966-1979 (Figure 1).

Analysis of USDA and SAES individual expenditures, however, show two different and distinct patterns. USDA constant dollar expenditures for in-house research and funds transmitted to SAES and other agencies decreased by 16 percent between 1966 and 1979 (Figure 2). Within USDA, ARS declined by 24 percent and ERS increased by 12 percent during this period (Figures 3 and 4). In contrast, SAES expenditures for PHTME research increased by 23 percent in constant dollars from 1966-1979 (Figure 5). Thus, by 1979 SAES had increased its share of the total public expenditures (SAES and USDA combined) for PHTME research from 38 to 47 percent of the total (Havlicek and Otto, 1981).

State appropriations to SAES account for the majority of funds for PHTME research. These appropriations increased from 43 percent to 56 percent of SAES funds for PHTME research. The Federal government's share to SAES for PHTME research from 1966-1979 has declined from 53 percent to 38 percent. Thus, state appropriations comprise over one-half of the expenditures for PHTME research in the SAES. This fact is important when considering the beneficiaries of PHTME research.

PHTME Research Benefits

The primary concerns of PHTME research are to: 1) increase productivity and reduce the real cost of food, 2) maintain or enhance the food's nutritional value, quality, and safety, 3) provide new or improved food products, 4) provide information to farmers, marketers and policy-makers to use in decision making, and 5) enhance competition (OTA, 1982). Each of these will be considered briefly.

Increased Productivity and Reduced Real Cost of Food: Seventy percent of consumers food cost is attributable to the assembly, processing, transporting, and distributing of food, the remaining 30 percent of consumer expenditure goes to farmers and suppliers. Productivity in the PHTME sector is lagging relative to other sectors. There are tremendous opportunities to increase productivity and reduce the real cost of food. These opportunities are through research that: 1) increases labor productivity, 2) provides for more effective processing and preservation, and 3) increases efficiency in marketing and distribution.

Enhance or Maintain Quality, Safety, and Nutrient Content of Food: Processing and preservation technologies can improve the nutritional value and quality of food, retain it in a stable condition or deteriorate it. PHTME research encompasses a number of operations which influences the product from its initial production on the farm to its ultimate purchase. These operations relating to storage, handling, shipping, intermediate processing, packaging, delivery to merchants, shelf life, and final sale can influence the nutritional value and quality of the products.

Some nutrients, notably vitamins and fats, are sensitive to pH, oxygen, heat, and light; and are particularly susceptible to damage in the presence of trace elements. PHTME research contributes to

Figure 1

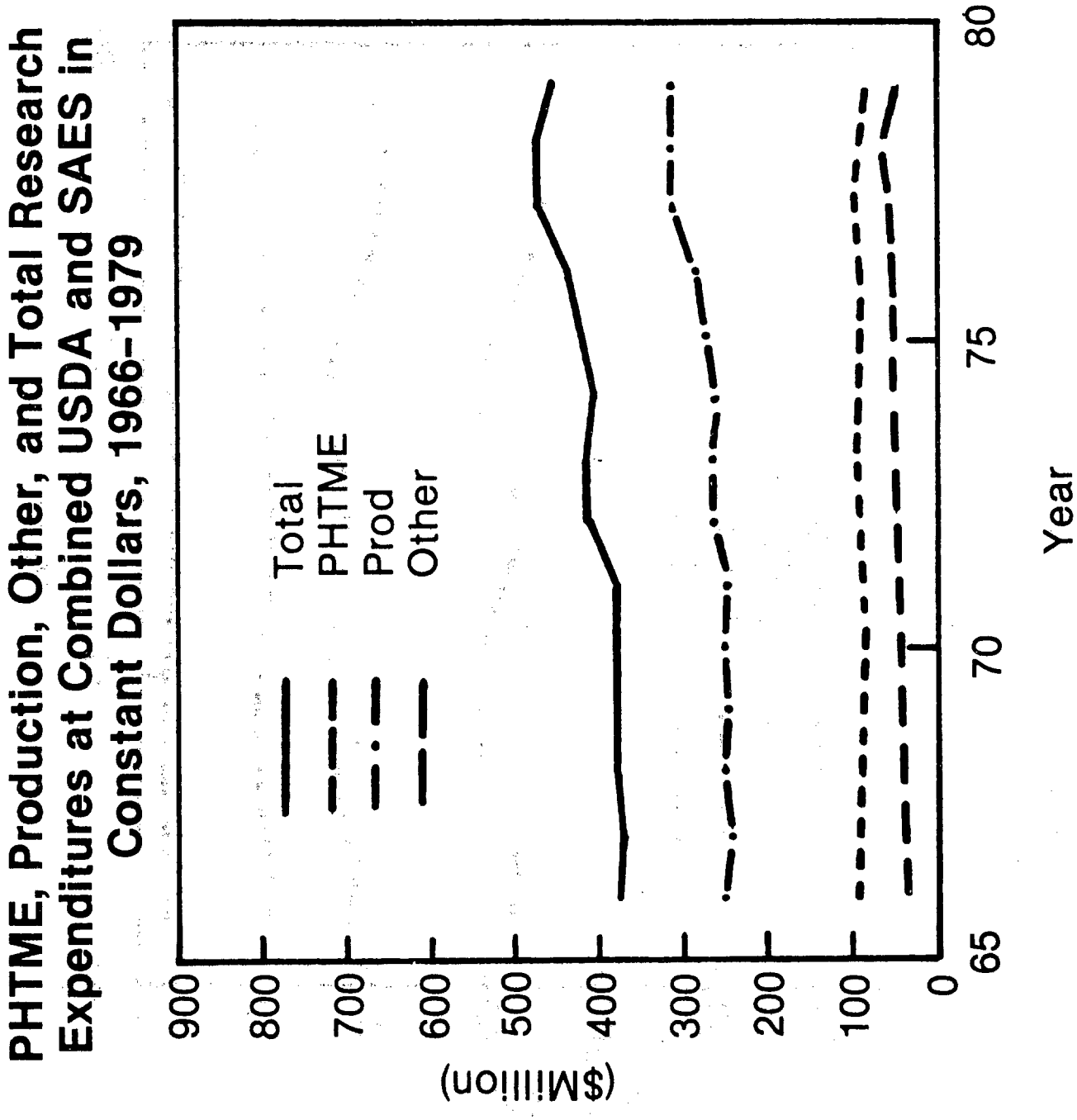

PHTME, Production, Other, and Total Research Expenditures at Combined USDA and SAES in Constant Dollars, 1966-1979
Total
PHTME
Prod
Other
($Million)
900
800
700
600
500
400
300
200
100
0
65
70
75
80
Year

Figure 2

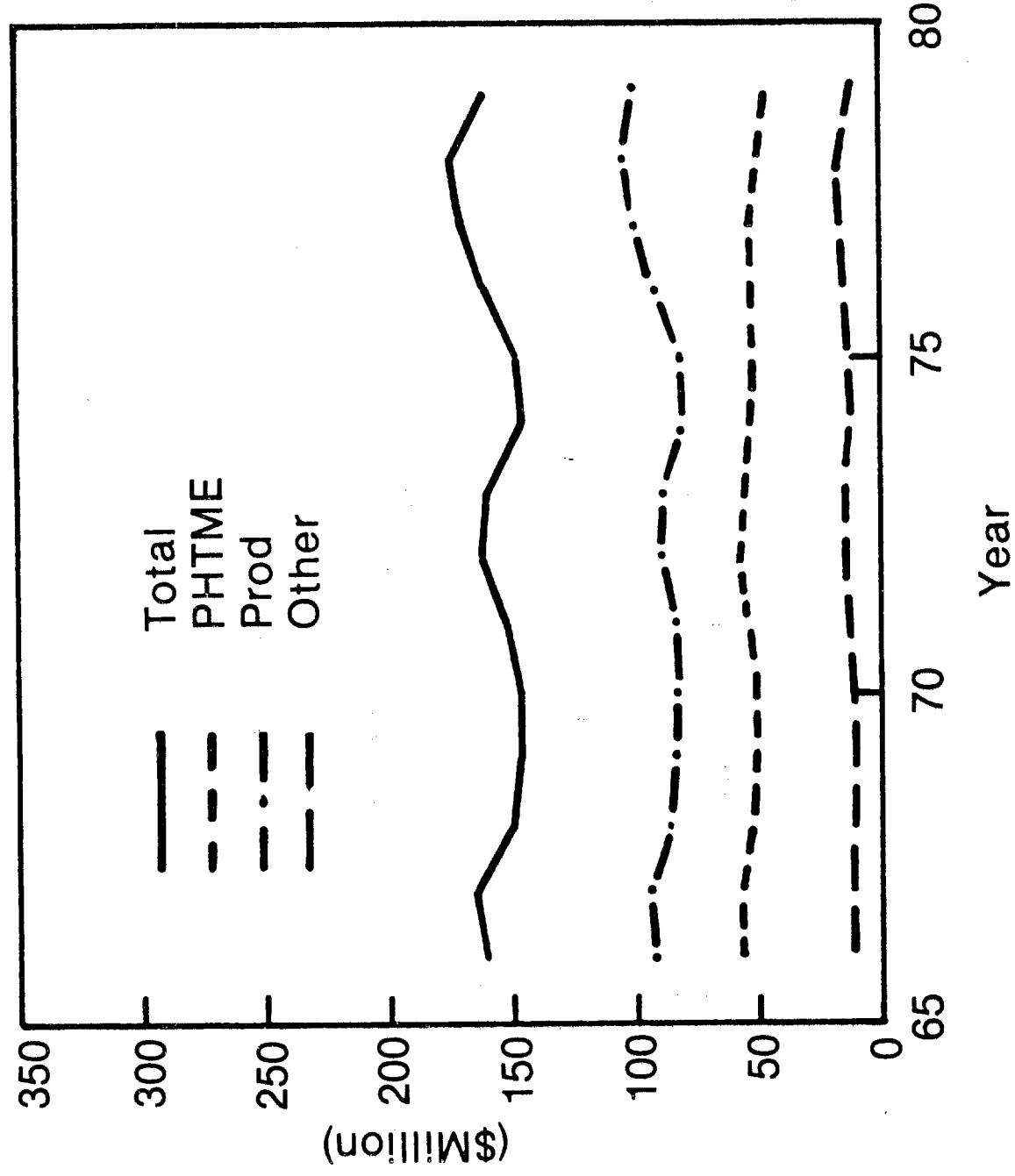

PHTME, Production, Other, and Total Research Funds at USDA in Constant Dollars, 1966-1979
Total
PHTME
Prod
Other
($Million)
350
300
250
200
150
100
50
0
65
70
75
80
Year

Figure 3

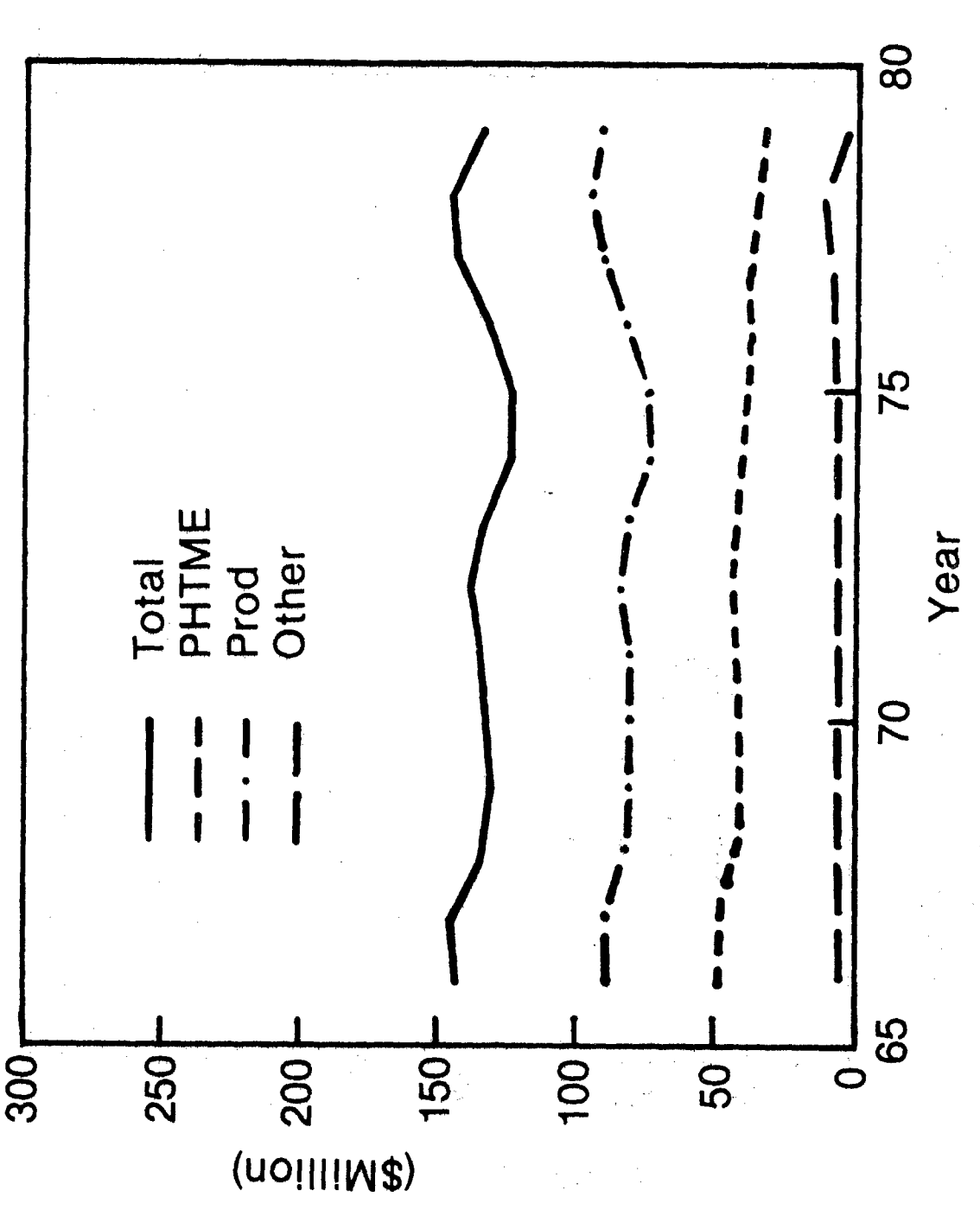

ARS PHTME, Production, Other, and Total Research Expenditures in Constant Dollars, 1966-1979
Total
PHTME
Prod
Other
($Million)
300
250
200
150
100
50
0
65
70
75
80
Year

Figure 4

ERS PHTME, Production, Other, and Total Research Expenditures in Constant Dollars, 1966-1979

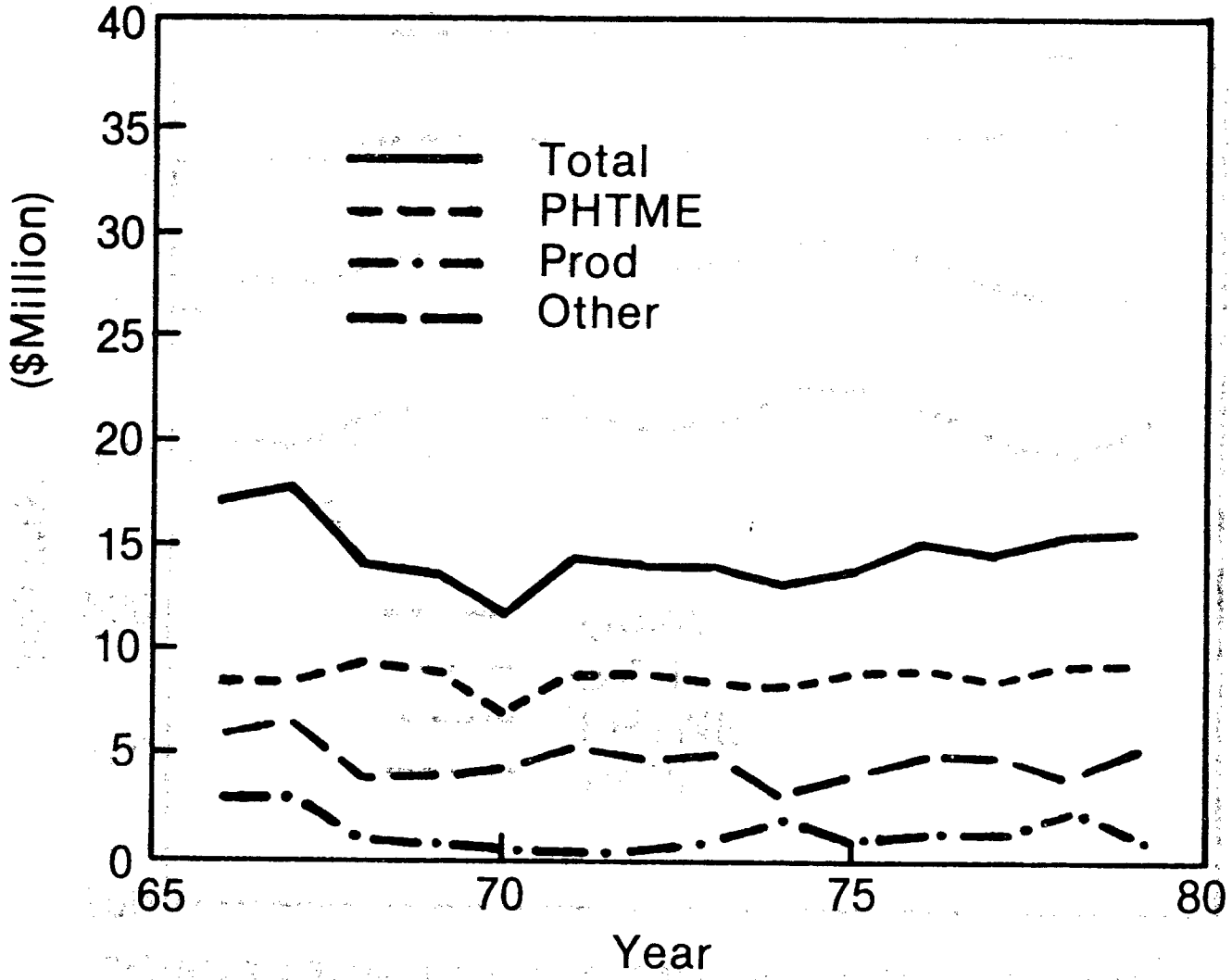
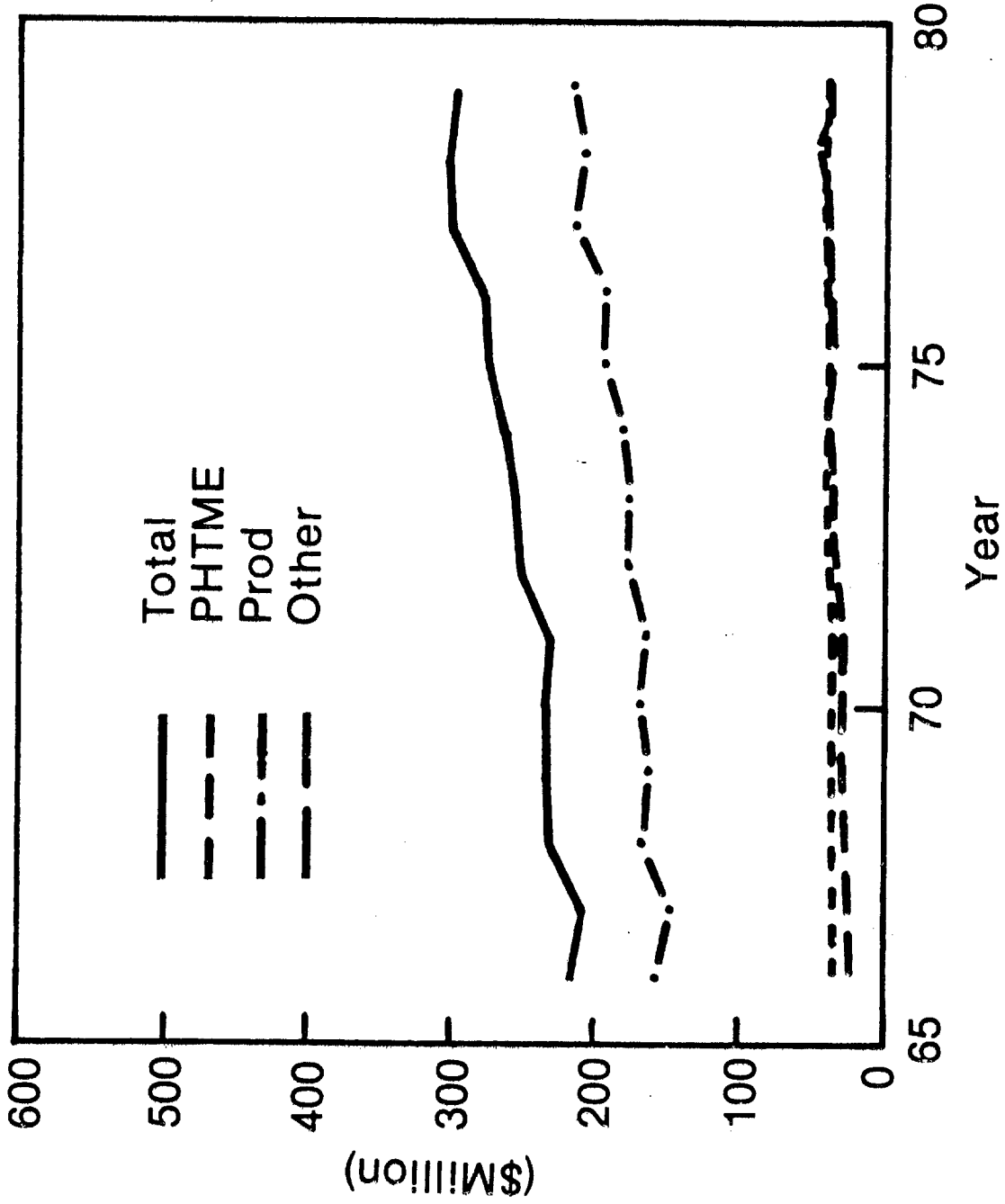


Figure 5


PHTME, Production, Other, and Total Research Funds at SAES in Constant Dollars, 1966-1979
Total
PHTME
Prod
Other
($Million)
600
500
400
300
200
100
0
65
70
75
80
Year

negating the influence of these factors. PHTME research contributes to negating the effects of environmental conditions on development of mycotoxins and insect and rodent infestation on the safety of the final food products. It has also contributed to improved diets of the U.S. consumer through addition of vitamins B_1, B_2, and niacin to cereal products, vitamin D to milk, and iodine to salt.

New or Improved Food Products: Food products developed from alternative food sources will provide alternatives to the highly capital-and-energy intensive development of today's foods. Substitute foods or ingredients that can be primary or subsidiary sources of food, have been developed by using diverse raw materials, both food and nonfood. For example, plant protein products introduced into the diet as either food ingredients or ersatz foods. Raw soybeans can be used to produce soy flour, protein concentrate, soybean isolates or textured products. The importance of plant protein in diets is expected to increase relative to demand for meat, fish, and egg protein. Research on these and other nonfood products may have the greatest potential for providing food materials to the world population at minimum or reasonable food costs.

Information for Decision Making: PHTME research, the marketing economics portion, is designed to provide information to farmers, processors, distributors, consumers and policymakers on which to make decisions. This can range from economic forecasts on grain crops for farmers and grain merchandisers to use in their decision making, to analyzing the benefits and costs of regulations which provide information for policymarkers to use in eliminating, modifying, or adding new regulations to benefit society.

Industry Competitiveness: PHTME research measures the competitive relationships among firms providing a similar set of products or services. Important aspects of this research includes: the degree of market concentration, barriers to entry, types of competing organizations and regulations that affect competitive behavior. Research provides information to: 1) affected businesses and the public on the forces shaping the industry, 2) assist business groups in developing long-range planning, and 3) policymakers on alternative legislative proposals or regulations to ameliorate, maintain, or enhance these competitive relationships.

Beneficiaries of PHTME Research

Analysis of the flow of benefits from PHTME research focuses on the distribution of benefits between domestic producers and consumers (OTA, 1981). OTA analysis on research beneficiaries has found the following:

Farm Producers: The market system enhances the value of farm commodities by changing their form and distributing the products over time and space. The demand for farm products is created by the demand for intermediate and consumer products. Farm producers also benefit from PHTME research which makes marketing services more efficient and productive.

Consumers and General Economy: A technological change in the marketing sector that reduces the cost of marketing services also reduces the retail price to consumers in a competitive market structure. Consumers (and farmers, too) also benefit from PHTME research which improves market or price information which leads to more informed decision making. Consumers also benefit through improved quality, nutrition, safety, and convenience of foods. Benefits include improved health and longer life.

The distributional impacts of the research over various income levels is important in terms of equity. OTA found that the ratio of consumer benefits to family income was almost four times higher for the lowest income class than

for the highest, indicating that such research has a greater beneficial impact on low income families than on high income families.

Marketing Firms: These firms in the marketing sector benefit from PHTME research to various degrees depending on the competitive structure of the industry. In a competitive economic environment, firms benefiting from PHTME research in the form of more efficient and productive technologies pass these lower costs on to consumers and producers. This would mean a higher price to farm producers and lower retail costs to consumers. However, marketing firms with some monopolistic power may retain a portion of the cost savings from technological change in the form of increased profits.

Labor and Other Input Suppliers: PHTME research that develops new technologies usually makes possible increased labor productivity and provides opportunity for increasing wages and salaries without placing upward pressures on retail prices. Adoption of more productive technologies also provides the opportunity for labor to move to other sectors, producing higher order goods and services. The end result is a wider variety and more abundant supply of all goods and services.

Benefits Related to Funding Source

Evaluation research has found that the majority of the benefits from PHTME research flow to those regions and states with high concentrations of population because the distribution of consumer benefits is highly correlated with food purchasing patterns and population distribution. In all geographic regions, except the Northeast, the benefits accuring to residents outside the region conducting the research are at least four times greater than the benefits accruing to the residents within the region (Eddleman, 1982). This gives rise to another paradox in public research and the food industry.

From an equity perspective, these findings indicate that the Federal Government's share of PHTME research investment is not as large as it should be. However, the bulk of PHTME research is funded by the states in the major farm producing regions, with the majority of the research supported by state appropriations. Thus, taxpayers in the food surplus states are subsidizing consumers in the food deficit states through their investment in PHTME research. When such research benefits have an impact on residents of the Nation, funding for the research can be more equitably provided by the Federal Government.

Roles of Public and Private Research Sectors

No fixed pattern has ever developed with respect to kinds of research performed by USDA, SAES, and industry, and no principle has been apparent in determining the role of each. Decisions as to where research is done in the public sector have invariably been decided ad hoc by discussion and agreement among concerned parties. Such decisions are arbitrary, expendient, inconsistent from year to year, and more influenced by the pressures of the moment than by uniform, long-range guidelines or principles. This has been a major part of the debate between the Executive Branch and Congress.

There is a role for both public and private research efforts in PHTME research. Both the public and private research participants make valuable contributions to the PHTME sector. However, with roles more clearly defined, it should be possible for each to contribute more fully in their respective areas.

Private Sector Research

The private sector is appropriately motivated by economic reasons. If management can foresee that the private rate of return is sufficient, resources are allocated for the necessary research. Indeed, evaluation research has shown that industry research results in social returns

that tend to be roughly double that of private returns to the investment (Mansfield, et al, 1977). However, there are some distinguishing characteristics of private sector PHTME research that need to be taken into account when considering the role of private research: 1) most private sector research tends to be focused on short-term applied problems for which there is an expectation of an acceptable return on the research investment; 2) longer term basic inquiry into how biological, economic, and social systems function would not be picked-up by private sector research if it were discontinued by the private sector; 3) even though there may be substantial social benefits from private research activities, private industry generally is not concerned with the net social benefits from their research endeavors; and 4) most private firms are reluctant to reveal knowledge that might cause existing technologies or processes to become obsolete prior to extracting the flow of economic returns (USDA, 1979).

Thus, the areas of PHTME research that are primarily in the private sector domain include: 1) patentable processes and techniques, which is research that most nearly fits the short-term applied problem characteristic for which there is an acceptable return on investment; 2) research to meet Federal and state regulations, which is basically research needed for a business to stay in operation; and 3) research to maintain or gain new clientele.

Public Sector Research

Public sector research may be justified on at least three grounds: 1) because of the spillover effect, substantial social benefits are derived from a mix of public and private research; 2) in the absence of public sector support, the direction of the research might tend to be biased strongly toward mechanical and chemical technologies; and 3) for those situations whereby private research might have a detrimental effect on the competitive economic environment of the industry, a mix of public and private research may serve to preserve competition or reduce the amount of concentration.

Thus, the areas of PHTME research are primarily the public sector domain include: 1) basic knowledge, 2) support to policymakers and government regulatory agencies, so that informed decisions can be made, and 3) enhancement of competition, through research, for example, that determines the competitive factors which affect market performance in the PHTME sector.

Private and Public Sector Research

There are some areas of PHTME research in which there is reason for research activity for both the public and private sector. In such cases, the social returns may exceed the private profit because a large share of the gains from the private research are captured by other firms and consumers. The public sector may need to be involved to conduct research in which a large share of the gains are captured by others. Thus, research that is partly private and public sector include: 1) new food sources and their development, 2) naturally occurring food contaminants, and 3) yields in relation to productivity versus nutritional components.

Federal and State Roles

The allocation of research responsibilities between USDA and SAES distributes itself very logically. The Federal government, either intra- or extramurally, must give highest priority to problems of national significance, and must, as a part of this responsibility, maintain an awareness of and take into account the contributions of States and private industry toward national objectives. The SAES, insofar as Federal funds are concerned, must give highest priority to concerns of the state and to those of the region of which it is a part. As more is known about the beneficiaries of this research, and researchers are better able to quantify the relationships between

funding source and beneficiaries, there is strong evidence for a major Federal input on PHTME research because the beneficiary is the general public and not any one state or region. Thus, the Federal role includes: 1) providing leadership in identification of national research priorities and conducting supporting research with a regional or national emphasis; 2) supporting SAES in conducting research of special concern to a locale, state, or region; 3) assuring development of new fundamental knowledge by supporting or conducting basic research, and 4) maintaining a research capability for conducting basic and applied research in support of unique Federal missions.

We face some paradoxes in this area of research. However, by focusing analysis on: 1) the importance of the PHTME sector to the national economy, 2) determining the nature of the research benefits and the beneficiaries, and 3) delineating the proper roles of the public and private research sectors; this will force more objective debates on this research area. Hopefully, this will move us toward a resolution of the problem that is consistent with the analysis.

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