VALUE-ADDED RESEARCH INVESTMENTS: 
BOON OR BOONDOGGLE?

Proceedings of an Organized Symposium*
Edited by Gary W. Williams**

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ABSTRACT: Adding value to agricultural products is often seen as a means to dispose of raw
commodity surpluses and to add jobs, boost incomes, and otherwise promote rural economic
development. A major component of this development strategy has been federal and state
investments in research intended to boost the production, marketing, and distribution of value-
added agricultural products. This symposium explored the economic rationale and implications
of such research investments.

The Texas Agricultural Market Research and Development Center (TAMRDC) celebrated its 20th
anniversary of providing timely and unique research on issues affecting agricultural markets and
commodities important to Texas and the nation this year. TAMRDC is a market research
service of the Texas Agricultural Experiment Station and the Texas Agricultural Extension
Service. The main objective of TAMRDC is to conduct research leading to more efficient
marketing of Texas and U.S. agricultural products in domestic and international markets.
Research areas include domestic and foreign market opportunities for Texas and U.S. produced
agricultural products; marketing policies and strategies; competitiveness of Texas and the U.S.
in the production and marketing of traditional bulk and high value/value-added products in a
global setting; the impact of new technologies on markets and prices; efficiency of market
information systems; market structure and performance; consumer attitudes and preferences.
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EXECUTIVE SUMMARY

The recent growth of global markets for value-added commodities and increasing surpluses of raw agricultural products have turned attention to the production and marketing of value-added agricultural products, such as meat, wheat flour, and corn syrup, as a means to dispose of surplus commodities and to add jobs and incomes, increase tax revenues, and otherwise generate economic activity and promote economic development in flagging rural U.S. communities. As a consequence, numerous states have made and are now contemplating significant investments in research to boost the production and marketing of value-added products. These investments include the funding of increasingly numerous value-added research centers at land-grant institutions. Many state governments are also making significant research investments at non-land-grant universities and with private industries to boost value-added agricultural commodity production and marketing in their states. Federal investments in this area include sharing the costs of state initiatives in value-added research (such as in the Center for Food and Industrial Agricultural Product Development at Iowa State University) and the promotion of exports of value-added agricultural commodities (including the numerous international agricultural trade development centers around the country).

Although the trend toward consumption of higher value commodities is continuing, some are questioning whether the returns from the rapidly increasing investments in value-added research outweigh the benefits, i.e., whether there is actually a net social gain from such investments. Within the United States, does such research appreciably increase the total demand for value-added commodities or simply shift market share from one state to another? In international markets, given the declining competitive position of the United States for many agricultural products in recent years, is it reasonable to expect that the United States can share significantly in a growing market for value-added agricultural commodities? To address these and related questions and to enhance communication and understanding on a significant trend in agricultural research, a symposium entitled "Value-Added Research Investments: Boon or Boondoggle" was held on August 3, 1987 at Michigan State University in connection with the annual meeting of the American Agricultural Economics Association.

The first paper by Otto and Williams suggests that value-added research intends either to expand the market share of existing value-added products or to develop and market new value-added commodities. They discuss both types of research, define the role of economists, and offer some thoughts to policymakers and research administrators for developing the value-added research agenda. Among other things, they suggest that the agenda must go far beyond product or process development and bridge the gap between the research laboratory and the consumer table. They also challenge university administrators to broaden the set of criteria for promotion and tenure to include nontraditional, and likely nonpublishable, research activities concerning the development and marketing of value-added products.

In the second paper, O'Rourke considers value-added research as a strategy to boost foreign demand for domestically produced raw agricultural commodities. He concludes that such research must focus on (1) improving understanding of foreign markets, (2) adapting products to changing market needs, and (3) harnessing technology that gives U.S. products a competitive edge. He uses the International Marketing Program for Agricultural Commodities and Trade (IMPACT) Center at Washington University as an example of this approach.
Next, Ferris discusses the potential inefficiencies from investments by numerous states in similar value-added research activities. He concludes that the question is not whether states should be involved in value-added research activities but rather how they should be involved. He uses the Michigan experience, and particularly that of the development of the Food Industry institute at Michigan State University, as an example of the problem and process of deciding on the appropriate level of state involvement in value-added activities.

Dean Holt explores the appropriate roles for public institutions in the value-added research process from a research administrator's point of view. He suggests that basic research, some developmental research, adaptive research, and technology transfer for value-added commodities in markets characterized by many firms are appropriate for public support. He discusses the public interest in value-added research, "earmarking" public funds for such research activities, and whether farmers benefit from that research.

In the final paper, Paarlberg considers both the conceptual issues and the practical problems of the promotion of exports of value-added products. He argues that the owners of the inputs specific to the production of primary agricultural commodities may lose from a policy to subsidize exports of processed agricultural commodities. That is, under certain conditions, a value-added export promotion policy can simply shift income from farmers and landowners to owners of capital in the processing sector. He does not conclude, however, that promotion of value-added product exports is inappropriate but rather suggests a case-by-case empirical examination of such policy proposals.
Concerns about excess capacity in agricultural production, the cost of farm programs, and the need to create employment in rural areas have led to renewed interest in utilization research. Numerous attempts have been made to derive new products from agricultural commodities. One distinguished Iowa State graduate, George Washington Carver, made a career-long search for such products and new markets. However, such a search is often difficult and subject to disappointment. Historically, it seemed to be more appropriate to invest in production rather than utilization research.

On the surface, utilization research seems to offer broad benefits to society—expanded markets and improved incomes for farmers, new products, and employment for consumers. However, if we are going to design research programs to bring about those benefits, we need to have a well-defined sense of direction. Agricultural economists can play a critical role in guiding and conducting utilization research. They can identify and measure opportunities and tradeoffs in a competitive global economy. They can examine the impact of public policies and institutions on new technology initiatives. They can help sort out the winners from the losers. And, they can design technologies by working closely with utilization researchers.

The organizers of this symposium have taken an important first step in examining, in a systematic manner, some of the economic issues inherent in utilization research. Research administrators should find the discussions provocative. Technical scientists will gain insight in making long-term commitments to utilization research. I am pleased with the organizers' initiative. I look forward to their continuing contribution to this important area of research.

Dr. Robert W. Jolly  
Professor of Economics and Former Assistant Director  
Iowa Agriculture and Home Economics Experiment Station  
Iowa State University
VALUE-ADDED RESEARCH AS A
STATE ECONOMIC DEVELOPMENT STRATEGY

Daniel M. Otto and Gary W. Williams*

The major states producing agricultural products have long been interested in boosting exports of agricultural commodities. As a major component of the economic base in farming regions, state agricultural exports provide the earning power to support services and related agricultural industries. The final destination for these exports can be markets either in other states or in other countries.

States are interested in not only the volume but also the value-added composition of agricultural exports. Growth in markets for bulk agricultural products provides direct benefits to producers in the form of higher farm prices and increased employment in the input and marketing sectors. Growth in demand for value-added agricultural products, however, expands the economic impact of exports beyond that of bulk commodities by employing additional resources in a variety of productive activities. Value-added commodities are generally classified as either semi-processed or highly processed food products (Table 1). High-value unprocessed commodities such as fruits and vegetables are often included as a third category. From the state's perspective, larger export volumes of high-value products mean higher levels of employment and income in the state. Table 2 clearly illustrates that the higher the level of processing associated with a commodity, the greater the number of jobs added to the state's economy. Consequently, many agricultural-based states have become increasingly interested in developing and exploiting value-added industries in agriculture as a means of fostering economic development.

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Table 1. Classification of High-Value Agricultural Products

A. Semi-processed products
   fresh, chilled, and frozen meat, wheat flour, refined sugar, coffee, cocoa, tea, animal feeds, oilseed cake and meal, animal oils and fats, and vegetable oil

B. Highly processed products
   prepared and preserved meats, milk, butter, cheese, cereal preparations, dried fruit, preserved/prepared fruit, preserved/prepared vegetables, nonchocolate sugar preparations, chocolate, spices, miscellaneous food preparations, beverages, and cigarettes

C. High-value unprocessed products
   eggs, fresh fruits and nuts, and fresh vegetables

D. All other products are classified as low-value products (LVPs)


Table 2. Economic Activity Generated in Exporting Selected Farm Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Tons</th>
<th>Value of 1,000 Tons of Feedstuffs ($)</th>
<th>Employment Required to Export 1,000 Tons of Feedstuffs (worker years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedstuffs</td>
<td>1,000</td>
<td>434,150</td>
<td>4.7</td>
</tr>
<tr>
<td>Corn</td>
<td>720</td>
<td>157,700</td>
<td>2.2</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>280</td>
<td>276,450</td>
<td>2.5</td>
</tr>
<tr>
<td>Soybeans</td>
<td>390</td>
<td>202,800</td>
<td>2.26</td>
</tr>
<tr>
<td>Poultry</td>
<td>335</td>
<td>825,000</td>
<td>5.6</td>
</tr>
<tr>
<td>Pork</td>
<td>250</td>
<td>1,200,000</td>
<td>6.8</td>
</tr>
<tr>
<td>Packaged meat</td>
<td>300</td>
<td>1,750,000</td>
<td>8.5</td>
</tr>
<tr>
<td>Processed foods</td>
<td>600</td>
<td>1,350,000</td>
<td>11.7</td>
</tr>
</tbody>
</table>

A major component of this development strategy in many states has been investments in research to boost the production and marketing of value-added agricultural products. These investments include the funding of value-added research centers at land-grant institutions such as the International Marketing Program for Agricultural Commodities and Trade Center at Washington State University, the Meat Export Research Center and the Food Crops Processing Research Center at Iowa State University, the Food Protein Research and Development Center and the Texas Agricultural Market Research and Development Center at Texas A&M University, the International Feed and Food Grain Institute and the International Livestock Center at Kansas State University, and the Food Processing Center at the University of Nebraska. Other states are in the process of initiating or building research programs in value-added areas.

Value-added research can be defined as research associated with any value-added commodity or activity. Added value is a form of wealth, but not all forms of wealth are added value. Natural resources are wealth provided by nature. Value is added to this wealth by the efforts and ingenuity of mankind. Traditional agricultural research has focused primarily on the value-adding activities of farmers in utilizing seeds, fertilizer, fuel, machinery, and other farm-level inputs to raise and market crops and livestock. Typically, however, value-added activities are defined as those occurring after the commodity leaves the farm gate. Under the federal Cooperative Research Information System (CRIS) for reporting Experiment Station research, value-added research would fall primarily under Research Problem Areas (RPAs) 400 through 704 (Table 3). The RPAs cover the range of value-added activities involved in moving raw agricultural products from the farm to consumer markets.

Most value-added research activities can be classified into one of the following two categories:

1) Research to help firms begin and/or become more efficient at producing and marketing value-added products for which well-established markets already exist;

2) Research to develop and market new value-added commodities for new markets or as substitutes/complements to products already on the market (e.g., corn sweeteners replacing sugar).
Table 3. Research Problem Areas (RPAs) Involving Value-Added Research

GOAL IV: EXPAND THE DEMAND FOR FARM AND FOREST PRODUCTS BY DEVELOPING NEW AND IMPROVED PRODUCTS AND PROCESSES AND ENHANCING PRODUCT QUALITY

401 New and Improved Forest Products
402 Production of Fruit and Vegetable Crops with Improved Acceptability
403 New and Improved Fruit and Vegetable Products and By-products
404 Quality Maintenance in Storing and Marketing Fruits and Vegetables
405 Production of Field Crops with Improved Acceptability
406 New and Improved Food Products from Field Crops
407 New and Improved Feed, Textile, and Industrial Products from Field Crops
408 Quality Maintenance in Storing and Marketing Field Crops
409 Production of Animal Products with Improved Acceptability
410 New and Improved Meat, Milk, Eggs, and Other Animal Products
411 New and Improved Nonfood Animal Products
412 Quality Maintenance in Marketing Animal Products

GOAL V: IMPROVE EFFICIENCY IN THE MARKETING SYSTEM

501 Improvement of Grades and Standards--Crop and Animal Products
502 Development of Markets and Efficient Marketing of Timber and Related Products
503 Efficiency in Marketing Agricultural Products and Production
506 Supply, Demand, and Price Analysis--Crop and Animal Products
507 Competitive Interrelationships in Agriculture
508 Development of Domestic Markets for Farm Products
509 Performance of Marketing Systems
510 Group Action and Market Power
511 Improvement in Agricultural Statistics
512 Improvement of Grades and Standards of Forest Products
513 Supply, Demand, and Price Analysis--Forest Products

GOAL VI: EXPAND EXPORT MARKETS AND ASSIST DEVELOPING NATIONS

601 Foreign Market Development
602 Evaluation of Foreign Food Aid Programs
603 Technical Assistance to Developing Countries
604 Product Development and Marketing for Foreign Markets

GOAL VII: PROTECT CONSUMER HEALTH AND IMPROVE NUTRITION AND WELL-BEING OF THE AMERICAN PEOPLE

701 Insure Food Products Free of Toxic Residues from Agricultural Sources
702 Protect Food and Feed Supplies from Harmful Micro-organisms and Naturally Occurring Toxins
703 Food Choices, Habits, and Consumption
704 Home and Commercial Food Service
The next two sections discuss the relationship between research in these two areas and state economic growth. The role of economists in value-added research is then considered. The paper concludes with some observations for policymakers and research administrators.

**Value-Added Research and Efficiency**

To increase a state's share of value-added activities in products for which markets already exist such as meat packing or grain processing and milling, it is usually necessary for the firms in the state to gain and maintain a competitive cost advantage. Research investments in the development of new or more efficient processing technologies and transferring them to in-state firms would increase the volume and enhance the competitiveness of the processing activity in the state. Technical research could focus on improving efficiencies at each stage in a value-added commodity firm's operations including assembling the raw inputs, processing, and marketing the intermediate or final products. Research investments could also be made to help identify optimal locations and the economic feasibility of capital subsidies for relocating or expanding firms with value-added products.

There are risks to states involved in the strategy of competing for a larger share of an existing market. Since most of the major Midwest agricultural commodities are homogeneous, state-funded research in the Midwest has applicability across a wide section of the country, not just for the state funding the research. The transferability of the research across state lines raises questions concerning the role of state-level funding of research when the benefits can be appropriated by nonfunding states. Another concern for state economic development efforts is that many types of agricultural processing are highly capital intensive so that the employment gains from this strategy may be small.

**New Product Research**

Value-added agricultural research is most often thought of as research to develop new products of higher value from lower-value raw or traditionally produced commodities. The idea
is that the value of many raw commodities that are traditionally produced and sold can be 
enhanced by altering their form, size, composition, appearance, texture, or other physical 
attributes. Other raw products can be decomposed into their various chemical components to 
be recombined with other ingredients to produce new products of potentially higher value. The 
successful development of a new product provides the potential for developing and expanding 
the productive activity in the state and helping to promote overall economic development. 
There is a promise not only of expanding jobs and economic returns for the state in the 
production, marketing, and distribution of the new product but also of strengthening traditional 
economic activity in the state by providing new markets for raw commodities. 

It is possible, of course, that new product research of this type may accomplish little 
more than support the life-styles of researchers at state-supported institutions. Whether or not 
the research actually leads to the desired economic outcomes depends crucially on a number of 
factors, including 

1. the efficiency of any existing mechanism for technology transfer from the public to 
   the private sector; 
2. the transferability of the new product technology to the private sector, i.e., the 
   technical adaptability of the process for commercial use; 
3. the existence of a market for the new product at the price necessary to cover costs 
   and provide an acceptable return on the investment; and 
4. the ability of the private sector of the state to capture and retain the returns (or 
   value added) from the new product research. 

The most well-known agricultural technology transfer mechanism is operated by the 
Cooperative Extension Service (CES), which is comprised of state extension services and the 
U.S. Department of Agriculture Extension Service in affiliation with land-grant colleges and 
their associated experiment stations. Traditionally, however, the CES system has focused few 
resources on creating or enhancing value added beyond the farm gate. Unless an efficient 
mechanism exists in the state to transfer new, value-adding processes and technologies from
the state-supported institutions where the research occurs to the private, food processing industry where it will be applied, much of the value-added research investment could be wasted. Such a mechanism would draw the food industry and universities into the type of successful working alliance that has characterized the CES system at the farm level. The research necessary to develop and apply an appropriate transfer mechanism is no less important than the new product research itself.

Most often the processes required to produce new products are developed under laboratory conditions and must be adapted if possible to the workplace. Too often, however, too few research resources are dedicated to developing efficient, cost-effective means to commercialize new technologies. The consequence, again, is that much otherwise promising research might never lead to an increase in the value of agricultural products.

It is important to understand that the measure of value added is not the effort that has gone into the activity. Added value is determined by the satisfaction of the customer, not by the work of the producer. Developing and producing a meat product with an unusual texture, for example, might require considerable effort on the part of the researchers and the workers and managers of a meat-fabricating company. But if no one wants to buy such a product, no added value has been generated. Often, however, researchers proceed with new product development based only on the general principle that new products add value to the raw commodity and assume that commercialization of the process and product will result in new jobs and income in the state. New product development research must go hand in hand with technical and economic feasibility studies to determine the potential commercial production costs and sales. It is not enough, however, to determine that a market for the new product exists. There must be a market for the product at a price that will yield a sufficient return over costs. Effective market research can often precede and help guide new product development. By analyzing food consumer behavior and markets around the world, market research can provide some guidance to scientists in their efforts to develop marketable value-added products that fit into traditional food consumption patterns.
A major problem for a state in supporting such value-added research is ensuring that the returns from their research investments can be captured and retained. If the new product technology is readily accessible or easily duplicated, for example, firms in other states could quickly compete away any economic rents that might exist. This is particularly the case for national companies with offices in various regions of the country. Working with small and medium-size companies in the state may offer the best potential for maintaining the value added from the research investments. Some characteristics of new products from which the value added in research can be most easily captured include

1. The labor skill required to produce the product is unique and not easily learned.

2. The economies in the research, handling, and marketing of the product are difficult to duplicate elsewhere.

3. The product is identified closely with the state in terms of quality and availability.

4. The technology is "protected" in some way as to be relatively unavailable to potential competitors.

**The Role of Economists**

To achieve economic growth, value-added research must go far beyond the laboratory and follow the new product along its path to the final consumer. This requires a multidisciplinary team of animal and crop scientists, food chemists, microbiologists, and other food scientists and technologists, nutritionists, agricultural engineers, economists, marketing specialists, sociologists, and others working together on the various interrelated stages of the research process. Not all of the research efforts of such teams, however, will yield new economic growth for the state. Precisely because only a small percentage of all value-added research can be expected to yield significant new economic activity in a state, a large percentage of such research is publicly funded.

The economist on the team can help guide the research in directions that are more economically feasible by conducting benefit/cost analyses of alternative value-added research
investments. Once the research investments are made, the economist can help ease the technology transfer process by providing benefit/cost analyses of value-added production investments. Unfortunately, however, scientists rarely consult economists before developing their research agendas. By first conducting research to analyze the potential of alternative new value-added products, scientists could minimize the amount of time wasted in developing interesting products with unique properties that no one can use or wants to buy.

Traditional market research includes economic analyses of numerous economic indicators such as income, inflation, and employment as well as trends in commodity supply, demand, prices, trade, and policies in given countries. To successfully assist in capturing value added for any given state, however, market research must move "downstream" and provide producers of value-added products in the state with much more detailed information about the markets for the specific commodities they want to produce and market. This includes information and analyses on specific government regulations relevant to the value-added product, transportation methods and costs, distribution channels, consumer preferences and customs, alternative marketing strategies, the behavior of firms producing similar or complementary products, and more.

The development of new agricultural products can lead to difficult policy issues that require detailed economic analysis. The growth of the corn and artificial sweetener industry, for example, has complicated policy decisions with regard to sugar price supports. Economic research is also needed to analyze the potential impacts of the new products on the markets for substitute and complementary commodities and the related policy issues that arise.

Some Observations for Policymakers and Research Administrators

Investments in value-added research are a tremendous potential catalyst for state economic growth. The important question for policymakers is how to ensure that the investments will pay off. For research administrators, the key problem is developing a research agenda that
maximizes the returns to investments in value-added research. In developing such an agenda, the following observations may be useful.

First, the research agenda must extend far beyond product or process development and bridge the gap between the research laboratory and the consumer table. This includes research to develop and maintain a technology transfer mechanism, research to commercialize new processes and technologies, research to determine the size, growth, and location of markets for newly developed value-added products, economic and technical research investment feasibility studies, and more.

Second, much of the research required is not that which is traditionally done at state-supported institutions. How much of this research should be done in the public sector and how much in the private sector? Also, university researchers are usually rewarded based on the number of publications flowing from their research. How will researchers who must conduct necessary but unpublishable research (such as research to discover markets and develop marketing strategies for new products) be rewarded?

Third, allocations of research funds among the areas included on the agenda should reflect the relative likelihood of a state economic development payoff. This may require some study of the economic and technical feasibility of the research on the agenda before significant funds are committed to the various promising projects.

Fourth, it may be difficult to capture the value added from research on raw commodities, such as corn and soybeans, that are widely produced and available. This suggests that the primary research focus should be on adding value to commodities in which the state has a particular competitive advantage. Such an advantage could arise from agroclimatic conditions, tax laws, the proximity of markets, or other factors that make production of the commodity relatively more difficult and costly elsewhere. One alternative could be for a number of states that are potential beneficiaries of value-added research of this type to fund such research or to seek federal support jointly.
Finally, the existing institutions regarding proprietary research and patent rights at state-supported universities need to be reviewed. Restricting researchers from participating in the returns from new product process and technology discoveries may amount to a disincentive to conduct needed value-added research. Also, some attention needs to be given to reconciling the conflicting interests of the public orientation of land-grant universities and the proprietary concerns of private firms when undertaking joint research.
VALUE-ADDED RESEARCH AS A STRATEGY TO BOOST FOREIGN DEMAND FOR DOMESTICALLY PRODUCED AGRICULTURAL COMMODITIES

A. Desmond O'Rourke*

The International Marketing Program for Agricultural Commodities and Trade (IMPACT) Center was set up by the Washington state legislature on June 30, 1985. Its broad role was to harness science and technology in the cause of expanded state exports of agricultural products. It was mandated to coordinate the research, extension, and teaching efforts involving international marketing of agricultural products. Its focus is both on the development and dissemination of improved marketing information and on providing solutions to technical marketing problems.

The center was not swept in on a political bandwagon. There was lengthy debate within the university community, the many commodity groups in the state, and numerous legislative committees on the viability of such a center. There was also an 18-month probationary period with a provisional program. The major objections came from certain commodity groups that felt their current programs were adequate. However, there eventually was broad consensus on the need for the state of Washington and the whole Pacific Northwest to take greater control of their fate in international agricultural markets; that is, that current national programs were inadequate.

Why an IMPACT Center?

The IMPACT Center was formed in reaction to the circumstances in which Washington agriculture found itself in the early 1980s. A dramatic slowdown in national, regional, and state exports forced a reassessment of the state's agricultural marketing efforts. While it was clear that exogenous and uncontrollable factors such as the world debt crisis and the strength

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of the dollar had contributed to the downturn, it was also clear that Washington agriculture was responsible for much of its own troubles.

Washington producers and processors knew little about the markets in which they were selling. When sales declined they did not know, nor did they have the system in place to find out, why. They had a poor understanding of the major changes that were sweeping world agricultural and food markets. Thus, they were not positioning themselves to take advantage of emerging opportunities.

University and state governments, battered by recessionary budget cuts, had not been able to give leadership in improving information, attitudes, and practices in international agricultural marketing. Our physical scientists were production oriented - concerned, for example, about breeding characteristics that would aid the farmer while ignoring the changing needs of users. Little of the work of agricultural economists or business school professors was filling the void. Most business professors did not classify food or agriculture as business. The agricultural economics profession, in general, conducts what I call "passive" analysis. Market expansion, in contrast, demands "active" analysis. The methods of analysis may be the same, but the goal is different - how to bring about favorable change. Historically, too, economists have been enamored with aggregate demand analysis, whereas for most firms, states, and even countries, specialized market niches are more relevant.

Our model for successful market development was one that has been tested and proved in U.S. industry time after time. A company such as IBM, in general, maintains and enhances its market by designing product enhancements that are technically feasible and preferred by buyers. From numerous alternatives, it selects those enhancements that will best meet company criteria such as profitability, scale, risk, competitive advantage. Only rarely will enhancements be sufficiently dramatic to be designated as "new" products. Agriculture must now compete in the same type of discriminating and fickle market. However, unlike IBM, its supply system is composed of independent and amorphous units. Cooperation is essential among research,
production, processing, and marketing firms if product enhancements are to be effectively introduced.

In recognition of that fact, we have put together a number of consortia in the state to achieve the same goals that IBM and other private companies can control internally. For example, the private sector, the IMPACT Center, the Washington Department of Trade and Economic Development (WDTED), and the Washington State Department of Agriculture (WSDA) work closely together and share a common advisory board. Many of our projects involve multidisciplinary teams including agronomists, economists, business administrators, and engineers. The IMPACT Center also works closely with rural development agencies in the state. In all these consortia we strive to be market oriented.

**Is This Value-Adding?**

Is the IMPACT Center, then, in the business of targeting value-added products for market development? Yes, but not in the framework of much of the current debate. We do not accept the premise that it is necessarily desirable to add value by insisting that additional processing stages take place in our state or to switch agricultural production from lower value items such as grains to higher value items such as fruits and vegetables. Our concept of value-added is demand driven. We believe that sales and profitability (and job and income spin-offs) will result if we satisfy user needs better than do our competitors.

Of course, when we look at the product areas in which demand is growing most rapidly, high-valued products (as defined by USDA) do tend to be prominent. However, our producers and processors must also choose products that fit their resources of land, climate, management, technical know-how, etc. In any individual case, it may well be more prudent to choose to supply the lower-valued products. Clearly, too, we see the positive multiplier effects of added processing in state. However, the desirability of that strategy for any product has to be judged against the other demand, competition, and technical criteria.
Examples of IMPACT Center Work

Some examples may illustrate how the IMPACT Center approaches its objectives.

1. By geography, tradition, and infrastructure, the Pacific Northwest is a major trading partner of Japan. Our socio-demographic studies of Japan indicate a large, older, traditional market. Our agronomists are attempting to grow traditional Japanese foods to serve that traditional market. Our next step will be to work with food scientists, processors, and packers to see if these products can be delivered to Japanese markets at a competitive price.

2. Japan buys one million tons of rapeseed annually from Canada. Field trials show Pacific Northwest yields and quality on a par. We have a slight transportation cost advantage, and the Japanese want an alternative source of supply. We are trying to see if we can do what Brazil has done in soybeans and Europe in wheat; namely, capture a share of the world market from the market leader.

3. Chinese purchases of dairy cattle from Washington state were handicapped by quarantine requirements related to blue tongue. Our Canadian competitors had declared their cattle free of blue tongue. A team of scientists demonstrated that, in fact, the humid western Washington was free of blue tongue and sheltered from transmission by the Cascade Mountains. Both the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) and the Chinese accepted these findings, leading to an annual trade of $3 million.

4. Successful marketing of Washington apples has depended on spreading sales over the 12 months after harvest through advances in storage technology. However, in export markets, the quality of stored apples compares poorly with new season southern hemisphere apples. Our scientists are trying to use mineral analyses of soils, trees, and fruits prior to harvest to select those fruits that will best maintain their quality in storage and be more competitive with southern hemisphere fruit.
Conclusions

If the U.S. international marketing effort for agricultural products is to be successful in the future, we must focus our scientific endeavors more on 1) improving understanding of foreign markets, 2) adapting products to changing market needs, and 3) harnessing technology that gives U.S. products a competitive advantage. The era of clear superiority for U.S. agriculture in world markets is over. In the future, we will have to engineer our advantages. All of us will have to focus on the value we add.
STATE VALUE-ADDED ACTIVITIES AS RELATED TO ECONOMIC EFFICIENCY

John N. Ferris*

From a viewpoint of a traditional agricultural economist, if all the resources now being devoted to state value-added activities were to be channeled into projects approved by a team of economists specializing in location theory, the nation and the world might be better off in the long run. Drawing from the thinking of Isard, Beckmann, Bressler and King, Takayama and Judge, Greig, and others, this team would assemble large data bases on production costs of raw materials by states, transportation costs on raw materials, scale economies in processing, transportation, and other distribution costs on the processed product. This information would enable them to determine, under current production patterns, technologies, and demands, where new processing facilities should be located, how large these facilities should be, and what direction raw materials and finished products should be shipped - if the sole criterion was operational efficiency. Operational efficiency refers to moving the raw material from the farm to the processing plant and the finished product to the consumer at the lowest total cost. While such a project would be enormous, it would be possible with the methodologies and data currently available.¹

The solution to this model could be used as a standard by which the alternative scenarios could be judged. That is, the results of state efforts to encourage food processing could be evaluated in terms of the departure from the model that minimizes the cost of producing, processing, and distributing food. The many ways in which states subsidize food processing

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¹ This is not to say that the mathematical problems in location analysis have been completely solved. This is pointed out by Koopmans and Beckmann relative to quadratic programming.
would have to be stripped away in order to establish a comparable base for evaluation. This would add a major dimension to the project. Conway Data, Inc., tabulates 18 ways states provide financial assistance to industry, 15 tax incentives for industry, 18 special services for industrial development, 19 forms of industrial revenue bond financing, and 10 incentive programs for pollution control.

The location analysis team would face many more challenges if they embarked on a truly comprehensive study. This would involve long-range projections of consumer demands in the United States and abroad; costs of production, processing, and transportation; exchange rates; environmental concerns; public attitudes toward structure, conduct, and performance aspects; new technology; the political climate; and other forces very difficult to forecast. Even so, agricultural economists have methods to approach this task either empirically or with the use of assumptions.

For example, the analysis could proceed with the assumption that no consideration would be given to the possible implications of increased concentration of industries into fewer plants and firms nor the loss of jobs in rural areas. The next step would be to establish upper bounds on firm size and/or job loss and measure the trade-off in terms of operational efficiency. To arrive at some optimum solution taking into account explicitly all the major considerations would be beyond the scope of current economic methods. Perhaps the use of Delphi, nominal group process, and other techniques to solicit expert opinion could assist the economists in establishing some realistic assumptions.

To the traditional agricultural economist, many of the state programs subsidizing industry, including food processing, appear unnecessary and are simply a transfer of capital from taxpayers to private industry in a zero-sum game. What one state wins, another loses. There is an analogy with advertising. Firms must advertise to survive and maintain market share, but the total market is limited. Advertising costs are passed on to the customer. The result is that producer costs are not minimized and consumer utilities are not maximized - or so it appears.
As strongly as I believe in the perfect competition model as a standard - a point of departure for economic analysis - I am aware of the realities of the marketplace and the weaknesses of a purely competitive market structure. Because of these imperfections, state government has a proper role.

Let's examine the conditions for perfect competition and the real world departures.

1. Many buyers and sellers, none large enough to influence price or terms of sale.

While the number of producers of the raw materials and the number of consumers of the finished product are large in most food industries, the number of processors may be relatively small. Typically, a food industry may have a few large processors and many small processors. Public policy pronouncements indicate general support for assisting small businesses to maintain competition. Small firms have limited resources for research and development. State government has a proper role in assisting these firms to compete.

2. Ease of entry into and exit from the industry.

A state may be the ideal location for a new food processor, but getting started is difficult. The state government can properly facilitate the process by providing certain services such as furnishing information on sites, regulations, quality of the labor force, etc.

3. Homogeneous product.

One of the strongest drives of food processors is to make their product different, real or imagined. The imagined differences are created through promotion and advertising. The more innovative firms can encroach on market territory where other firms have a cost advantage. The success of these firms can result in a net social benefit if they provide a wider variety of choices and improved quality. The total market may be enlarged and other firms may later follow suit. Providing assistance to small food processing firms that the state identifies as having a quality product and/or innovative marketing ideas may be justified even though the state is not the optimum location for the firm from the operationally efficient standpoint.

4. Perfect knowledge.

Even with extensive data bases and analytical resources, firms make many mistakes in deciding on location. The state has a proper role in providing information that will help private firms in making the correct decision. This may be in terms of state support for agricultural statistics services, market news, and land-grant universities.

The question is not so much whether the state should be involved in value-added activities. The question is how they should be involved. Let me briefly describe the Michigan experience. In the early 1980s, Michigan agriculture and the food industry received increased
attention from state leadership in its drive to diversify an economy strongly dependent on automobiles. Later, food processing was singled out as one of three target areas for special support.

A committee with university and state government representation was given the assignment to identify promising growth industries or at least point to those sectors deserving further study. Ten such sectors were identified. Further research indicated that some of the areas so named were not conducive to rapid expansion. For example, while some increase in cattle slaughtering facilities is warranted, plants the scale of Iowa Beef could not be justified.

The study provided guidelines to the state in terms of where to direct their assistance programs. For example, if proper entrepreneurs can be located, the broiler industry has promise in the state; proposals to build a large cattle slaughtering plant, however, are not given much attention. As agricultural economists, we have the obligation to point out possible "white elephants" as well as industries having potential.

A focal point of agricultural economists at Michigan State University in value-added activities has been the formulation of the Food Industry Institute two years ago. The institute was initiated with the assistance of state government and is an integral part of the Agricultural Experiment Station and the Cooperative Extension Service. The major purpose of the institute is to conduct research and educational programs for the food industry utilizing the resources of the College of Agriculture and Natural Resources and the other colleges with responsibilities in this area. Our rationale for developing this new institution was not motivated by pressure to add value to the farm products of Michigan. The motivation came from a careful assessment of the comparative advantages of Michigan State University and Michigan's agriculture and food industry.

Michigan agriculture is quite diverse, probably second only to California. In 1985, Michigan ranked first in the nation in the output of 10 products, second to fifth in the production of another 22 products, and sixth to seventeenth in 26 additional products. Food processors in the state have been shipping over $8 billion worth of product. Because of the
diversity and importance of the agriculture and food sector, Michigan State University has
developed broad research and educational programs spanning this area. While our linkages to
production agriculture have been strong, as is the case in many other states, we felt that we
did not have the same degree of interface with food processors, retailers, and others beyond
the farm gate - even though such activities have been under way for years.

We reviewed the status of research and development resources for the food industry at
the national level. As pointed out by Sundquist, only 18 percent of the U.S. Department of
Agriculture and state Agricultural Experiment Station research expenditures is devoted to the
post-harvest end of the food system. He also stated:

"Numerous studies have shown annual rates-of-return for public agricultural
research to be very high (35 to 50% or more) and to be well above the rates required,
even by the private sector for inducing investments in high-risk R&D. Individual
states, even after losing some research benefits through a "spillover" to other
states, still reap high rewards for the expenditures which they make for farm and
food research."

Of course, food processors do conduct their own research. Even so, as an industry they
devoted less than one-half of one percent of net sales to research and development in recent
years, low among all industries, and most of this allocation was by the largest firms.

We concluded that a need existed for a public-supported research and education institution
to serve the food industry, not only for Michigan but for the entire nation. We generated
supportive evidence that Michigan had a comparative advantage as a location for such an
institute and that the appropriate site was Michigan State University - the land-grant
university.

Much more could be said about the rationale for the Food Industry Institute, its location,
and the mission. The point is that state government can be an effective catalyst for
development and that agricultural economists have responsibilities to assist state government in
this effort. But, as in the process for initiating and locating the Food Industry Institute,
agricultural economists need to provide the perspective of their discipline - examining market
potential, possible retaliation of other states with economic incentives, underlying comparative
advantages, and other aspects of location of value-added activities.
References


A RESEARCH ADMINISTRATOR'S PERSPECTIVE ON VALUE-ADDED RESEARCH

Donald A. Holt

The Agricultural Research and Development System

Two simple diagrams provide a conceptual framework for this paper. Figure 1 is a simplified model of the U.S. agricultural research and development (R&D) system that serves production agriculture. One of its objectives is to generate ideas for improving agriculture (first - or left - column of Figure 1) and develop them to commercial application (last - or right - column of Figure 1). In general, the same steps are required to bring ideas to application in any industry.

Basic research (second column of Figure 1) is the means by which we come to understand the physical, chemical, biological, and economic processes involved in agricultural systems. It generates many ideas for, and enables the development of, new products and procedures. I want to construe basic research broadly in this presentation and to include both basic research and what some would consider early-stage developmental research.

Once potential new input products, such as varieties, fertilizers, pesticides, and animal pharmaceutical are identified, the private sector usually conducts the necessary developmental research (third column of Figure 1) to make these products marketable. They sometimes call this "process" research. Public institutions and agencies are active in developmental research leading to prototype procedures and practices for agriculture.

Public institutions and agencies have primary responsibility for what Bonnen refers to as adaptive research (fourth column of Figure 1). In this research, new input products and procedures are tested, compared, and integrated into operational systems and tailored to the specific soil, environmental, and socioeconomic situations that make up U.S. agriculture.

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Figure 1. A conceptual model of information flow in agricultural research and development.
Adaptive research provides site- and situation-specific information that farmers can use to plan, implement, and manage profitable agricultural production and marketing systems suitable for each farm situation.

Once the information on new products and practices has been generated through basic, developmental, and adaptive research, it must be transferred to the users (fifth column of Figure 1), either directly or indirectly, via agricultural extension and other educational programs. Finally, the user must undergo a period of learning and practical experience (sixth column of Figure 1) with a product or procedure in order to use it effectively. The users of value-added research information might be production line managers or others involved in processing operations.

Feedback is important in the system. That is why the arrows in Figure 1 are pointed on both ends. Linkages are extremely important. The assignment of individuals to more than one of the component activities helps provide the essential linkages. As the process proceeds through the major steps in R&D, the activities become more site- and situation-specific, more technically difficult, more labor intensive, more costly, and, unfortunately, far less prestigious.

The Public/Private Value-Added Relationship

In addition to conducting basic, developmental, and adaptive research on behalf of farmers, public agricultural institutions and agencies conduct research that benefits other economic components of agriculture. Figure 2 depicts this relationship, which is the public link to value-added activities in agriculture.

The letter "R" in Figure 2 represents basic research, and the letter "D" represents developmental research, adaptive research, and technology transfer. D is the activity that brings the ideas generated in basic research to practical application in commercial operations and other human activity. There is a perception in some circles that the public should support R and private firms should do D. In some situations, however, universities and other public
Figure 2. A conceptual model of public contributions of education (E), basic and early-stage developmental research (R), and later-stage developmental research, adaptive research, and technology transfer (D) to value-added activities in agriculture.
agencies need to do both R and D in order to maximize the efficiency of the overall production, marketing, and utilization system.

Figure 2 depicts the increase in value of agricultural products as they move through various stages. The process of adding value begins at the bottom of Figure 2 with industries manufacturing inputs and providing services to the producers of raw agricultural products, namely, the farmers. Using their production facilities, purchased inputs and services, and management skills, farmers produce raw agricultural products.

Raw agricultural products become inputs for the processing industry, which in turn passes on processed products for distribution, marketing, and, ultimately, use by consumers. At each step value increases, thus the term "value-added." For example, a food product is more valuable on the shelves of many grocery stores where it is readily available to consumers than it is when still stored in the processor's warehouse.

Families obtain agricultural products on the retail market. These products usually fall into the categories of food, clothing, and shelter. By obtaining these products in a certain mix, modifying some of the products, integrating them with human resources into a system of living, and maintaining the durable capital items, a family creates a certain quality of life. The aggregate value of this latter value-added and value-maintenance activity in the home is 60 to 80 percent as large as the gross national product. Thus, value-added and value-maintenance activities in the home constitute a huge but largely invisible economy. Because of its invisibility, the general public has greatly underestimated the potential return on investment in R&D leading to improved management of value-added activities in the home.

The objectives of the overall system should be to increase the difference between the base value and the value of the quality of life and to decrease the costs of value-added activity. Research and development can improve the productivity, efficiency, and quality of value-added activities at any level in the agricultural system. Colleges of agriculture, agricultural experiment stations, and other public agencies conduct research in support of each level of value-added activity depicted in Figure 2.
In general, when the value-added activity at a particular level is accomplished at least in part by large commercial firms with their own research programs, colleges of agriculture provide basic research in support of that level of value-added activity. Agricultural institutions have that relationship with the input industries and with the industries that process, distribute, and market agricultural products. In those industries, large firms conduct much of the product-oriented, developmental research, adaptive research, and technology transfer needed to sustain the productivity, efficiency, and quality of those particular levels of value-added activity. In other words, they do their own D. They can afford to do this because they use D to capture proprietary advantage.

The situation is different, however, for farming and for value added in the home. Farming is structured as a large number of small businesses, no one of which can carry on its own research and development (see paper by John Ferris in this volume). Even when farmers direct resources to research, as they do through the commodity groups, they support collective activities.

It has been efficient for the public to support a research and development effort that provides information to farmers. In fact, the public is the principal beneficiary of adaptive agricultural research and related extension activities. These activities foster competition in agriculture, assuring an abundant supply of high-quality, relatively inexpensive agricultural products. The entities that add value in the home, namely families, are also small structural units. It is efficient for public institutions to conduct both the R and the D that serve value-added activities in the home.

There are many exceptions to this general scheme. Nevertheless, the simplification is justified, because it provides a relatively simple and useful conceptual framework for thinking about the allocation of resources in agricultural R&D. Few people think about public R&D serving various industries in this manner. For that reason, the resources allocated to public agricultural R&D are inadequate, and the institutional structure of that system is not configured appropriately to serve all the needs and opportunities associated with agriculture.
To make the entire system work most efficiently and effectively, public funds should be used primarily for research (R) supporting the agricultural input, processing, distribution, and marketing industries and for both research and development (R and D) supporting production agriculture and value-added activities in the home. The D is extremely important because it is the mechanism by which the public realizes a return on its investment in both agricultural R and agricultural D.

Appropriate R&D Role for Public Institutions

If these conceptual models are valid, they provide a useful way to think about value-added and other research activities and to envision an R&D system that effectively integrates activities of the public and private sectors in this area. It seems that, in general, the public-private relationship should take three general forms:

1. For industries that are structured primarily as large firms that can conduct or contract out their own research and gain proprietary advantage by doing so, the public should provide basic research.

2. For industries that are structured primarily as a large number of small business units, public institutions and agencies should provide basic research, some developmental research, adaptive research, and technology transfer. The product-oriented, developmental research that serves these industries will usually be conducted in the private sector.

3. There will be situations in which it is economic for individual firms or consortia of private firms, either small or large, to contract with public institutions and agencies for basic research in specific areas and, more importantly, for developmental and adaptive research and technology transfer support.

The appropriate source of financial support for research activities conducted by public institutions and agencies will depend on the degree to which the public research and technology transfer activities provide proprietary advantage to individuals or groups. If the general public
is the principal beneficiary, as is the case, for example, with agricultural production research conducted by universities, then the public should bear most of the costs.

To the extent that the research provides proprietary benefits to a specific clientele and thereby permits that clientele to gain economic advantage over competitors, that clientele should bear most of the research costs. For example, the small and medium-size seedmen of the nation have been the primary beneficiaries of publicly developed seed varieties. Therefore, it is appropriate for seedmen who use such varieties to pay an R&D fee. The fee should be larger if the private firms are allowed to market such varieties under their own brand names.

Public Interest in Value-Added Research

There is obviously strong public interest in value-added research. That interest is particularly strong among agricultural groups. Some are promoting increased public investment in value-added research on the grounds that there are growing markets for processed or other value-added agricultural products. The central concern in the minds of most proponents of value-added research, however, is the need to find more uses and expand markets for the vast quantities of what are perceived as surplus commodities and to deal with the continued growth in the world capacity to produce agricultural commodities.

Interest in value-added research has both positive and negative dimensions. On the positive side, it is another mechanism to obtain funding for agricultural research, for which there never seems to be enough support. Public agricultural research budgets have benefited from the interest in value-added research. We are receiving additional support earmarked for this activity, not only from the state and federal governments but also from commodity groups.

The Illinois legislature appropriated an additional $500,000 per year in recurring, general revenue funds for value-added research and development. A wise decision on their part was to delegate management of the funds to the University of Illinois. We are devoting half the money to creating two new positions in the bioprocessing area and half to an internal
competitive grants program involving several colleges in our institution, with preference given to interdisciplinary projects.

The Illinois Soybean Program Operating Board, which allocates the check-off money to soybean promotion and research, has shifted its research emphasis toward utilization and marketing research. The Illinois Corn Marketing Board, a more recent organization, directs its research money only to utilization and marketing research. Their bylaws forbid the use of corn check-off money for production research.

A puzzling aspect of the avid interest of some commodity groups in research on new products and processing techniques is that the projects they like, such as developmental research on making ethanol or biodegradable plastics from corn starch, would primarily benefit processors. When weighing such proposals against alternatives, they often do not consider the distribution of benefits between processors and farmers. Check-off money, which comes from the farmers of a state, region, or nation, should be expended primarily to capture proprietary benefits for the farmers of that state, region, or nation. Other sources of funds should be used to serve the interests of processors.

Earmarking Public Funds for Research

In the stressful agricultural situation, there is great pressure on legislators to earmark funds for specific research activities. These areas of interest include value-added research, marketing, new crops, alternative agricultural systems, low-input systems, appropriate technology, rural revitalization, biotechnology, basic research, and others. The expressions of need for these areas are often associated with suggestions or demands that other research and extension activities, particularly production-oriented activities, be reduced or eliminated.

Agricultural scientists and administrators would like to see resources devoted to all of these important areas but would like to have considerable influence on the balance of allocation among these areas. The earmarking of funds for specific research activities reduces managerial
flexibility and prevents tailoring the R&D efforts of colleges and agricultural experiment stations to the specific needs of states and the capabilities of institutions.

Once the public starts redirecting resources to the current fads in research, the continuity of less glamorous but equally important programs is virtually impossible to maintain; as a consequence, the research support infrastructure starts to fall apart. Most adaptive research and related extension programs must be long-term or continuous programs. Thus, publicly supported adaptive research and extension suffer most in this situation.

Administrators would rather be given enough funds to maintain a base level of support for a broad program of agricultural research, maintain the continuity of programs, and employ our uniquely effective system for rewarding merit. Then scientists, who are tapped into the worldwide basic research information network and, through extension, have close ties to the users of agricultural information, could decide how best to deploy the public research resources and could compete for other resources to enhance their programs.

Public agricultural research resources would be better managed under those circumstances and would realize an even higher return. We are not naive enough to believe, however, that that option exists. It will not exist until we have educated the public on the agricultural R&D system.

Will Farmers Benefit from Value-Added Research?

One of the unfortunate aspects of the interest in value-added research is that the proponents are holding out false hope to troubled farmers. This is particularly true of those who foster the idea that value-added research should be emphasized at the expense of production research.

Research to improve the efficiency of production of major U.S. export commodities is particularly important. An analysis of private firms operating in extremely competitive industries suggests that only two general strategies are effective. A firm must either be a low-cost producer or achieve enough product differentiation to occupy a clear market niche.
Because of the undifferentiated nature of basic agricultural commodities, the inability of individual producers to achieve proprietary advantage through R&D, and the rapid movement of agricultural technology in international circles, U.S. farmers, in the aggregate, cannot attain an exclusive niche or niches.

A basic business principle is that for producers of products that have about the same value over the entire market (i.e., commodities) the basis of competition is cost of production/marketing. We have no choice except to be the low-cost producers in the important commodity markets. To maintain a position as a low-cost producer requires constant, dedicated effort to develop, adopt, and employ better, more efficient production and marketing technology.

New and improved food, feed, fiber, fuel, and chemical feedstock products that can be made from raw agricultural commodities have great potential to expand the world grain market, given time. However, the capital needed for the factories and facilities to produce these new products will flow to regions where supplies of the raw materials (i.e., the commodities) are most plentiful, most reliable, of acceptable quality, and lowest priced, and to places of final distribution of finished products. In the global economy, that capital can flow to Brazil, Argentina, or elsewhere as readily as to the United States. The basis of competition among commodity producers will still be cost of production/marketing.

Agricultural R&D Strategy

As we try to solve our agricultural problems and to develop an effective agricultural R&D strategy, we should reflect on the landmark agricultural legislation of the past. The legislative acts we usually extol as having changed the course of history and having propelled U.S. agriculture to world preeminence, such as the Morrill, Hatch, Smith-Lever, and Evans-Allen acts, were not focused on specific subject matter. They created and strengthened institutional structure and institutional linkages. They created and provided for the maintenance of an infrastructure within which to conduct agricultural R&D and to capture its benefits.
These historic acts of legislation delegated the enormous responsibility of managing agricultural R&D to professional researchers and administrators, only demanding that they diligently pursue excellence and relevance, and that they tell the truth, as they see it, even when the truth is discouraging, counterintuitive, and/or unpopular. As we face the great challenges and even greater opportunities of an increasingly competitive global agriculture, we need legislation equal to the Hatch or Smith-Lever acts to strengthen the U.S. agricultural R&D system. Our legislators should address these major strategic issues and not get bogged down in tactical issues, which are best addressed at regional, state, and local levels.

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EXPORT PROMOTION OF HIGH-VALUE AGRICULTURAL PRODUCTS: WHO GAINS?

Philip L. Paarlberg

During the 1970s, a large market in high-value agricultural products (HVPs) emerged. Many commodities are considered high-value products and can be classified into three categories. The first category is semiprocessed products, which includes items such as soybean meal and wheat flour. Also, there are highly processed products such as beverages and dairy products. Finally, some high-value products, such as nuts, are unprocessed. By 1980, world trade in these products exceeded that in low-value agricultural products, such as primary commodities, by $10 billion (USDA/ERS 1983). Growth rates for HVPs consistently exceeded that for low-value agricultural products during the 1970s. Furthermore, while the United States expanded its share of world trade for low-value products, it lost share in world HVP trade to the European Community (EC) and Brazil.

At a time when export markets for grains and oilseeds are weak, the trends in the HVP market have prompted some to suggest a trade policy designed to capture the value-added components of these products (USDA/ERS 1983). Supporters of an aggressive HVP export expansion program believe that if the processing were done in the United States, the country as a whole would benefit through the income and employment effects. Producers of primary agricultural commodities would also benefit indirectly as the processing sector expands. That is, the United States would capture the value-added component of these products, and the producers who supply the raw ingredients would gain as demand for their output expands.

On the surface, export promotion of processed or high-value-added products appears to be desirable and has been embraced by government of the state of Indiana as a state level development policy (Indiana). Other states, including Iowa and Illinois, have also adopted a

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value-added promotion policy. However, several fundamental issues that must be examined before this policy should be embraced, particularly at the federal level.

The purpose of this paper is to present some of these fundamental issues - both conceptual issues and practical problems. The argument advanced in this paper is that owners of factors of production specific to the production of primary agricultural commodities may lose from a policy to subsidize exports of processed agricultural commodities. Such a policy may shift income from farmers and landowners to owners of capital in the processing sector. Thus, a policy to promote exports of high-value agricultural products must be analyzed on a case-by-case basis with empirical research.

Some Conceptual Issues

This section identifies some conceptual problems with an HVP export promotion policy. It is shown that the beneficial effects for the primary agricultural sector may not be obtained except under certain circumstances, but that the income effects for mobile labor are usually obtained.

Basic Model

To develop these ideas, a simple static general equilibrium model is used. The economy is assumed to produce three traded goods. Good 1 is a primary agricultural good that can be exported or used as an input into the production of a processed agricultural good (good 2). Thus, the farm commodity (good 1) can be analyzed as a traded intermediate good (Sanyal and Jones). Good 3 is a nonagricultural good and is a composite of all other goods produced in the economy.

The specifications of the factor markets are critical to the results obtained because the ability or inability of a factor to move between sectors determines the pattern of income redistribution in response to the export subsidy policy. The primary agricultural good is assumed to use two factors of production, denoted \( L_1 \) and \( K_1 \), each in fixed supply. The
former factor, \( L_1 \), represents inputs that are mobile among sectors. Labor could be an example of this type of factor. The latter factor, \( K_1 \), is sector specific and cannot be shifted from sector to sector. In the case of the primary agricultural commodity, this factor represents inputs such as land, machinery, and to the extent that they are immobile, farmers. Thus, the primary agricultural sector is characterized by a two-factor Ricardo-Viner (fixed factor) model (Dixit and Norman). A similar structure is imposed for the nonagricultural good.

The processed agricultural good (good 2) uses three factors. In addition to the mobile factor, \( L_2 \), and the sector-specific factor, \( K_2 \), the processed good uses the primary agricultural good. This usage is denoted by \( C_1 \), which is domestic consumption of good 1 and is also sector specific.

The output of each sector is identified as \( q_j \) (where \( j = 1, 2, 3 \)). Use of factor \( i \) (where \( i = L, K \)) per unit of output of good \( j \) is denoted by \( a_{ij} \). Thus, the market-clearing conditions for the sector-specific factors can be written as:

\[
\begin{align*}
K_j \cdot a_{Kj} &= K_j \\
L_2 \cdot a_{12} &= C_1
\end{align*}
\]

where the technical coefficients \( a_{ij} \) are functions of the factor prices.

Because the mobile factor \( (L) \) is used in all three sectors, its market-clearing condition differs from those presented above. This condition is given as:

\[
L_1 \cdot a_{11} + L_2 \cdot a_{22} + L_3 \cdot a_{33} = L.
\]

Each of the three terms on the left-hand side of (3) represents use of the mobile factor in the respective sectors.

In addition to the factor market-clearing conditions, each sector has a complementary slackness condition. In the case of nonspecialization of production, these conditions require
that unit costs equal unit revenue. Modifications of these conditions provide the results subsequently discussed.

**Conceptual Results: Competitive Case**

The first issue concerning value-added products is identified by Krugman who notes that high value added may reflect high input costs. Therefore, a policy to promote value-added exports is, in effect, one of promoting high-cost products. Some of these high-cost commodities are goods in which the country has a comparative disadvantage. To illustrate this argument, assume that the processed agricultural good is produced with constant returns to scale by a competitive industry. Under these assumptions, the industry will earn zero profits because the complementary slackness condition shows that unit cost equals unit revenue. Under constant returns to scale, unit revenue is the price received by producers. This linkage between unit cost and price is given by:

\[ aL^2w + aK^2r_2 + aL^2p_1 = p_2 \]  

(4)

where \( w \) is the mobile factor price and \( r_2 \) is the return to the factor specific to the output of the processed agricultural good. If the value-added component of good 2 (VA2) is defined as the processed agricultural good’s price less the cost due to the primary agricultural product, then (4) can be rearranged as:

\[ aL^2w + aK^2r_2 = (p_2 - aL^2p_1) = VA_2. \]  

(5)

If the value added in this industry is large, then costs are large. The large costs are due either to high factor prices - \( w \) and \( r_2 \) - or are due to large input requirements per unit of output - \( aL^2 \) or \( aK_2 \). Thus, in some cases, by subsidizing exports of goods with a large value-
added component, the United States may be subsidizing industries that are technologically
inefficient or have distortions imbedded in factor prices.

Most of the support for promotion of value-added exports by agricultural interests is a
consequence of the belief that the United States, and U.S. farmers in particular, will capture
the rents generated by the export subsidy on the processed commodity. This issue can be
examined by analyzing the changes in factor returns in response to an export subsidy on good
2. The results obtained suggest that there are many dimensions to this issue. These
dimensions are shown by altering the conditions under which an export subsidy for the
processed good is imposed. Because the algebra of the comparative statics analysis quickly
becomes intractable, simplifying assumptions about the role of the country in world trade are
employed. Relaxing these assumptions requires an empirical model.

First consider the case when the country subsidizing exports of the processed agricultural
good (good 2) is unable to affect the world prices of the three goods. This is the "small
country" assumption. With the world price of good 2 fixed, the export subsidy causes the
domestic price of good 2 to rise by the full amount of the export subsidy. Because of the
small country assumption, the domestic prices of the primary agricultural good (good 1) and the
nonagricultural good (good 3) are fixed. For this scenario, the critical feature is the inability
of the subsidy on good 2 to affect the domestic price of good 1.

Retaining the constant returns to scale assumption, differentiating the zero profit
conditions, and applying the envelope property yields:

\[ \theta_{L1} \hat{w} + \theta_{K1} \hat{r}_1 = \hat{p}_1 = 0 \]  \hspace{1cm} (6)
\[ \theta_{L2} \hat{w} + \theta_{K2} \hat{r}_2 = \hat{p}_2 \]  \hspace{1cm} (7)
\[ \theta_{L3} \hat{w} + \theta_{K3} \hat{r}_3 = \hat{p}_3 = 0 \]  \hspace{1cm} (8)

where \( \hat{\cdot} \) denotes the percentage change in a variable;

\( \theta_{ij} \) is the unit cost share of factor i in industry j; and
\[ r_j \] is the price of the sector-specific factor in industry \( j \).

Because (6) through (8) are used to determine the changes in the four factor prices given an increase in the price of good 2, additional information is needed. Differentiating the factor market-clearing conditions and holding the supplies of \( L \) and \( K \) fixed gives the adjustments in the factor markets via changes in the technical coefficients and changes in the outputs. Using the definition of the elasticity of substitution in each industry (\( \sigma_j \)) expresses the adjustment in the mobile factor market in terms of factor price changes:

\[
-(\lambda_{L1}\sigma_1 + \lambda_{L2}\sigma_2 K + \lambda_{L3}\sigma_3)\hat{w} + \lambda_{L1}\sigma_1\hat{r}_1 + \lambda_{L2}\sigma_2\hat{r}_2 + \lambda_{L3}\sigma_3\hat{r}_3 = 0
\]

(9)

where \( \lambda_{Lj} \) is the share of mobile factors used in industry \( j \).

Solving (6) through (9) shows that as the export subsidy on the processed agricultural good raises its domestic price (\( \hat{p}_2 > 0 \)), the price of the mobile factor rises (\( \hat{w} > 0 \)), and the price of the factor specific to sector 2 (\( \hat{r}_2 \)) rises even more. From (8), if \( \hat{w} \) is positive, then the return to the factor specific to the nonagricultural sector falls as \( p_3 \) is given from the world market. Similarly, from (6), the return to the factor specific to the primary agricultural sector falls.

Interpreting the factor definitions broadly suggests that in the small country case, an export subsidy on the processed agricultural good lowers returns to landowners, to farmers' human capital, and to owners of sector-specific capital such as farm machinery. Owners of nonagricultural sector-specific capital lose as well. Factors that are able to shift between sectors, such as labor, gain. Owners of capital specific to the agricultural processing industry benefit the most. The net effect of the policy on the economy depends on the factor shares of national income for the losers compared to the gainers.

If the country is large enough to affect the world price for the primary agricultural good (good 1), the impact of the policy on the return to the specific factor in sector 1 depends on the production structure in the processing industry and the elasticity of excess demand for the
primary product. To illustrate these issues, consider the case in which the country is a "large country" in the world market for good 1 and where good 1 is the only sector-specific factor used by industry 2. In this scenario, the differentials of the zero profit conditions become

\[ \theta_{L1} \hat{w} + \theta_{K1} \hat{r}_1 = \hat{p}_1 \]  
\[ \theta_{L2} \hat{w} + \theta_{12} \hat{p}_1 = \hat{p}_2 \]  
\[ \theta_{L3} \hat{w} + \theta_{K3} \hat{r}_3 = 0. \]

The differential of the mobile factor market-clearing condition becomes:

\[ - (\lambda_{L1} \sigma_1 + \lambda_{L3} \sigma_3 + \theta_{K1} \lambda_{L2} \sigma_2) \hat{w} + (\lambda_{L1} \sigma_1 + \lambda_{L2} \sigma_2 \theta_{K1}) \hat{r}_1 
+ \lambda_{L3} \sigma_3 \hat{r}_3 + \lambda_{L2} \hat{C}_1 = 0. \]

The presence of the change in domestic use of good 1 adds a complicating factor. The change in this variable is linked to the changes in factor prices, if the trade distortions in the market for good 1 are unchanged, in the following manner:

\[ \hat{C}_1 = -[(q_1/C_1) \theta_{L1} \sigma_1 + (X_1/C_1) \epsilon^* \theta_{L1}] \hat{w} 
+ [(q_1/C_1) \theta_{L1} \sigma_1 - (X_1/C_1) \epsilon^* \theta_{K1}] \hat{r}_1 \]

where \( X_1 \) denotes imports of good 1 by the Rest-of-the-World that are a function of the relative price of goods 1 and 2 in world trade. The elasticity of this excess demand function is given by \( \epsilon^* \). The substitution terms enter (14) through the output effect. The foreign excess demand elasticity is the adjustment in trade in response to changes in the world price of good 1 caused by the export subsidy on the processed agricultural good. Equation (14)
shows conflicts between these effects. A rise in the price of the mobile factor induces a fall in output of the primary agricultural good that is associated with a reduction in domestic use. Meanwhile, the rise in the mobile factor's price also lowers trade of the primary agricultural good since it is the result of a rise in the price of good 1. The decline in trade is associated with an increase in domestic use. The net effect of the change in the price of the mobile factor depends on whether the output effect dominates or is subservient to the trade effect. For a change in the price of the factor specific to the primary agricultural sector \((r_1)\) these effects work together to increase domestic use of good 1. Output rises and trade falls in response to an increase in the factor price.

Solving these equations given an increase in the domestic price of the processed agricultural good yields a rise in the price of the mobile factor and a fall in the price of the factor specific to the nonagricultural good. The effect of the rise in the price of good 2 due to the export subsidy on the return to the specific factor in the primary agricultural sector is ambiguous because of the conflict between the effect of a rise in w on production and on trade of good 1. Specifically,

\[
\hat{r}_1/\hat{r}_2 \geq 0 \text{ if } \\
\Theta_{KL3}\lambda L3\sigma 3 + \lambda L2\sigma 2 + \Theta_{KL1}[\lambda L1 + (q1/C1)\Theta L1]\sigma 1 \geq |\Theta_{KL3}\Theta L1(X1/C1)e^*|. \tag{15}
\]

As the export market becomes more elastic - or sensitive to an increase in \(p_1\) - the chances of the export subsidy raising the return to the factors specific to the primary agricultural sector, such as land, are reduced.

If another sector-specific factor is allowed in industry 2, as done initially, similar results are obtained. The return to the mobile factor rises, while that for the factor specific to the nonagricultural sector \((r_3)\) falls. The increase in the domestic price of good 2 raises the price of the sector-specific factor \((\hat{r}_2 > 0)\). The effect of the increase in the processed agricultural
good's price on the return to the factor specific to the primary agricultural sector is ambiguous due to the effect of an increase in \( w \) on trade of good 1:

\[
\hat{\epsilon}_1/\hat{p}_2 \leq \frac{1}{2} \left[ (\lambda_L \sigma_3 + \lambda_L \Theta K_1 \sigma_2 K) \sigma_2 p \right. \\
\left. + \left( (q_1/C_1) \Theta L_1 \lambda_L \sigma_2 K \right)^{\sigma_1} \leq \left| \lambda_L \sigma_2 K \Theta L_1 (X_1/C_1) \right| \right].
\] (16)

As in (15), the relationship between the elasticities of substitution and the excess demand elasticity for good 1 is critical to the impact of the export subsidy for good 2 on the price of the specific factor in sector 1. The more elastic excess demand is, the greater the chance that the return to factors specific to good 1 – farmers and land – will fall. This occurs because a price-responsive excess demand limits the rise in the price of good 1 associated with the subsidy on good 2.

Briefly summarizing the results when all sectors are competitive suggests:

1. If the country cannot affect the world price of good 1, an export subsidy on good 2 – HVP – will lower the factor price of the factor specific to sector 1.

2. If the country is a "large country" in the market for the primary agricultural good, the effect of the policy to promote exports of the processed agricultural good on the price of the factor specific to primary agriculture is ambiguous. This ambiguity occurs because of the conflict between the output and trade effects for the mobile factor price. The more elastic the excess demand, the more likely that conditions (15) and (16) yield a decline in the factor price. Thus, in the competitive case, the argument that favoring an HVP export promotion policy leads to gains for farmers and landowners is not necessarily valid. Rather, the argument holds if the country can influence world prices and as the excess demand becomes more inelastic.

**Conceptual Results: Economies of Scale**

The situation is more complicated if economies of scale are introduced. In general, the presence of scale effects introduces an indirect subsidy through increases in output (Chipman; Jones). Another way to view this issue is that as an industry expands it may move down its learning curve (Brander).

One way to incorporate scale effects into the model is to modify the technical coefficients used previously. Let the new technical coefficient \( \alpha_{ij} \) be the original coefficient
multiplied by an adjustment for output level. For this analysis, the scale effects are assumed to be confined to the processed agricultural good and to the nonagricultural good. The primary agricultural good continues to be produced under constant returns to scale. This assumption reflects research that suggests that beyond one- or two-person farms there are few economies of scale (Miller). For sectors 2 and 3, the new technical coefficients are

\[ a_{i2} = a_{i2}(\cdot) \cdot \beta_2(q_2); \quad i = L, K, 1 \]  

(17)

\[ a_{i3} = a_{i3}(\cdot) \cdot \beta_3(q_3) \quad i = L, K. \]  

(18)

When on the unit isoquant \((q_j = 1\) and \(j = 2, 3\), then \(\beta_j(q_j) = 1\). When returns to scale are increasing, an increase in \(q_j\) lowers the technical requirements \((\beta_j < 0, j = 2, 3)\). Consequently, the differentials of the complementary slackness conditions become:

\[ \hat{\theta}_{L1} \hat{w} + \theta_{K1} \hat{r}_1 = \hat{p}_1 \]  

(19)

\[ \hat{\theta}_{L2} \hat{w} + \theta_{K2} \hat{r}_2 + \theta_{12} \hat{p}_1 = \hat{p}_2 + \eta_2 \hat{q}_2 \]  

(20)

\[ \hat{\theta}_{L3} \hat{w} + \theta_{K3} \hat{r}_3 = \hat{p}_3 + \eta_3 \hat{q}_3 \]  

(21)

where \(\eta_j = -(d\beta_j/dq_j) \cdot (q_j/\beta_j); \ j = 2, 3\).

Note that in (20) and (21) an increase in output is viewed as a price increase; hence, there is an indirect effect of the export subsidy on factor prices through the induced changes in output.

Differentiating the market-clearing condition for the mobile factor and using the definition of the elasticity of substitution yields:

\[-(\lambda_1 \sigma_1 + \theta_{K1} \lambda_2 \sigma_{12} \sigma_{2p} + \lambda_3 \theta_{K3} \sigma_3) \hat{w} + (\lambda_1 \sigma_1 + \lambda_2 \theta_{12} \sigma_{2p} \theta_{K1}) \hat{r}_1 \]

\[ + \lambda_2 \theta_{K2} \sigma_{2p} \hat{r}_2 + \lambda_3 \theta_{K3} \sigma_3 \hat{r}_3 + \lambda_2 (1 - \eta_2) \hat{q}_2 + \lambda_3 (1 - \eta_3) \hat{q}_3 = 0. \]  

(22)
The last two terms of (22) capture the scale effects on the mobile factor market. Because of the assumption that increasing returns to scale lowers the factor requirement and because there are no free goods, \( \eta_j < 1 \) where \( j = 2, 3 \).

From the differentials of the specific factor clearing conditions for sectors 2 and 3, the following expressions can be obtained:

\[
(1 - \eta_3) \hat{q}_3 = -\theta_{L3} \sigma_3 (\hat{w} - \hat{r}_3)
\]

\[
(1 - \eta_2) \hat{q}_2 = -[(q_1/C_1) \theta_{L1} \sigma_1 + (X_1/C_1) e^{*} \theta_{L1} + \theta_{K1}(\theta_{L2} + \theta_{K2}) \sigma_{2p} - \theta_{K2} \sigma_{2K} \hat{w} + [(q_1/C_1) \theta_{L1} \sigma_1 - (X_1/C_1) e^{*} \theta_{K1} + (\theta_{L2} + \theta_{K2}) \theta_{L1} \sigma_{2p} \hat{r}_1 - \theta_{K2} \sigma_{2K} \hat{r}_2]
\]

\[
(1 - \eta_2) \hat{q}_2 = [-\theta_{K1} \sigma_{2p} + (\theta_{L2} + \theta_{12}) \sigma_{2K} \hat{w} + \theta_{12} \theta_{K1} \sigma_{2p} \hat{r}_1 - (\theta_{L2} + \theta_{12}) \sigma_{2K} \hat{r}_2.
\]

Although the system of equations (19) through (25) cannot be solved in a tractable manner, some conclusions about the effect of increasing returns to scale can be drawn. First, the differentials of the complementary slackness conditions suggest that with scale effects in the agricultural processing sector only, the increase in unit costs due to the export subsidy for good 2 will exceed that obtained in the constant returns to scale case. Hence, if the price of the primary agricultural good is fixed by the world market price, the decline in the price of factors specific to that sector will be greater. If, however, there are scale effects in the nonagricultural sector, then a subsidization expansion of sector 2 and the associated contraction of sector 3 causes an ambiguous change in the price of the mobile factor. This occurs because the decline in output of nonagricultural goods is the equivalent of a price decrease for that good that puts downward pressure on the price of the mobile factor. Which effect dominates depends on the relative magnitude of the scale parameters and the unit cost share of the
mobile factor. If the contractionary effects from the nonagricultural sector dominate, then the price of the mobile factor could fall. In that instance, the return to factors specific to the primary agricultural sector could rise even in the small country case. In the large country case, the downward pressure on the mobile factor price suggests that $r_1$ is more likely to rise.

Conceptual Results: Excess Profits

Brander and Spencer have demonstrated that an export subsidy may benefit a nation if it is given to a firm earning excess profits on export sales. In their analysis, two additional restrictions are important. First, the firm does not supply the domestic market. Second, it competes with an oligopolistic rival in a third country market. In effect, the export subsidy allows a nation to gain a greater share of global excess profits at the expense of foreign rivals (see Grossman and Richardson for a graphical analysis and a survey of this literature).

To illustrate their argument, assume that industry 2 is now an oligopolist in world markets and that it receives a subsidy of $S_2$ on each unit of exports. Denoting the home country as country 1, the export profit-maximizing problem can be written as:

$$\pi_{12} = p_2(\sum_{i=1}^{m} X_{i2})X_{12} + S_2X_{12} - C_{12}(X_{12})$$  (26)

where there are $m$ oligopolists, $p_2(\cdot)$ is the inverse excess demand function facing the oligopolists, and $C_{12}(X_{12})$ is the cost function for the oligopolist in country 1. The first order condition for the optimal level of export sales is given as:

$$p_2(\sum_{i=1}^{m} X_{i2})X_{12} + X_{12}[\partial p_2/\partial(\sum_{i=1}^{m} X_{i2})] + \sum_{i=2}^{m} (dX_{i2}/dX_{12})] + S_2 - (\partial C_{12}/\partial X_{12}) = 0$$  (27)

where the term $\sum_{i=1}^{m} (dX_{i2}/dX_{12})$ gives the first country's oligopolist's conjecture of the response by rivals to a change in its export volume.
Assuming constant returns to scale in the industry, the marginal cost is given by unit cost as shown in (4). Rearranging the first order condition (27) yields:

\[ p_2 = a L_2 w + a K_2 r_2 + a_{12} p_1 - X_{12} \left[ \frac{\partial p_2}{\partial (\sum X_{i2})} \right] \\sum_{i=1}^{m} \sum_{i=2}^{m} (dX_{i2}/dX_{12}) - S_2. \]  

(28)

Two important features emerge from (28). First, the fourth term represents a rent from the oligopolist's international market power. As the excess demand becomes more elastic, the derivative approaches zero and that rent vanishes. Secondly, the subsidy appears as a cost reduction to the oligopolist. If the world price falls by less than the increase in the subsidy, then either costs rise, or the rent rises, or both. Because costs are in effect reduced, the oligopolist can be expected to expand export sales and capture a greater share of the market.

Output expansion implies that sector 2 will offer a higher price for the mobile factor to induce that factor to shift sectors - again \( \hat{w} > 0 \). Consequently, the price of the factor specific to the nonagricultural sector falls if \( \hat{p}_3 = 0 \). Similarly, if \( p_1 \) is fixed via a small country assumption, then the price of the factor specific to the primary agricultural good falls. If the price of the primary agricultural good is not given, as it rises, so can the specific factor price. But the increase is limited by the desire of the oligopolist to bid the subsidy into a higher rent. Thus, while the existence of excess profits offers the potential for increased national welfare, particularly if the welfare of consumers is ignored, it is not apparent that the export promotion policy will raise returns to factors specific to the primary agricultural sector.

Some Other Issues

Several other general issues connected with promotion of high-value exports merit a comment but are outside of the framework previously developed. These issues illustrate the difficulty of implementing a policy of promoting exports of HVPs.

The model developed ignores foreign policy and retaliation. Typically, protection increases as the degree of processing increases (USDA/ERS 1987). For example, although world oilseed
trade is relatively free, trade in fats and oils faces a greater number and wider variety of barriers. Also, livestock products usually face larger import barriers than do feedstuffs.

As Brander discusses, the nature of retaliation is critical to the potential gains from an export subsidy, especially when oligopolists interact. If an export subsidy results in behavior overseas that complements the subsidy, then additional gains can be obtained through such strategic interaction. However, if rivals react to neutralize the effects of the policy, the gains may be dispersed and losses incurred. Spencer comments that the effect of a subsidy to "level the playing field" may indeed level it, albeit at a lower level of gain to the players.

Another problem with an export promotion policy is that it may cause overexpansion of capacity and drive down the price in the long run (in the model this issue could be considered by allowing $K_2$ to increase). If firms already having capable of earning excess profits, a policy to enhance their market share by expanding capacity may be unwise. In these circumstances, the policy is redistributing income to industries already having supernormal profits and may encourage overexpansion.

The HVP export promotion policy relies on the public sector to pick the candidates for subsidization. Conceptually this is a difficult task because high-value-added content may reflect risk, high research and development costs, or inefficiency. Notwithstanding these problems, the public sector may be poorly suited to identifying which sectors will have future comparative advantages (Cline).

Another factor not considered in the model is transportation. Transportation costs have tariff-like effects when introduced into a model. Processed commodities have shipping costs well in excess of bulk commodities for several reasons, including added handling costs, refrigeration, and spoilage. In addition, the USDA/ERS (1983) survey of major importers of HVPs shows that the United States is at a locational disadvantage relative to the European Community - the leading exporter of HVPs. To compete with the Europeans in these markets, the United States would need to accept lower rates of return for other factors to compensate
for the transportation cost disadvantage. Also, by promoting the export of HVPs, the United States would be shifting its focus toward products that are relatively costly to ship abroad.

Finally, projections for the year 2000 suggest that the greatest opportunities in international markets are for feed grains and for oilseeds (Ronigen and Liu). The United States has traditionally met this need. A policy deemphasizing these products in favor of uncertain prospects in HVP trade seems unwise.

Conclusions

Despite calls for a policy to promote HVP exports, this paper suggests that owners of factors specific to the primary agricultural sector will not benefit much, if at all. If the country is a "small country," a policy to subsidize exports of the processed agricultural good will reduce the return to factors fixed in the primary agricultural sector — farmers, landowners, farm machinery, and the like. The exception to this conclusion is when there are increasing returns to scale in the nonagricultural good that exceed those in the processed agricultural good. In that case, the overall demand for the mobile factor is reduced and the return to the specific factor in the primary agricultural sector can rise.

If the country is a "large country" in the world market for the primary agricultural good, then the return to the specific factor in that sector can rise in response to the export subsidy for the processed agricultural good. This occurs because the subsidy can raise the price of the primary agricultural good. The critical parameter that controls the outcome of the subsidy is the excess demand elasticity. The more elastic this relation is, the less likely the subsidy will benefit primary agricultural-specific factors.

If there are supernormal profits in the agricultural processing sector, there exists the possibility of a welfare gain. Although the processing industry benefits from an export promotion policy in the presence of excess profits, the gain to owners of specific factors in the primary agricultural sector is less clear. This ambiguity occurs because the price of the mobile factor rises as do rents in the processing sector.
There are several other issues that suggest that a policy to promote high-value-added exports is of dubious benefit to farmers and landowners. First, the level of protection rises as the degree of processing rises. Second, retaliation by other nations can eliminate many of these gains. Third, a high-value-added content may reflect high or risky input costs. Fourth, it is likely that excess capacity will result as the industry expands to capture subsidy rents. The United States is at a locational disadvantage, and transportation costs for processed commodities tend to exceed those for bulk goods. Finally, projections for the next two decades suggest growth in world feedgrain and oilseed trade where the United States already has a comparative advantage.

These observations, however, do not suggest that the United States should ignore promotion of HVP exports. Rather, they suggest a cautious approach based on solid empirical analysis.
References


