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TRENDS IN THE U.S. FOOD PROCESSING INDUSTRY: IMPLICATIONS FOR MODELLING AND POLICY ANALYSIS IN A DYNAMIC INTERACTIVE ENVIRONMENT

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The evolving changes in demand, industry structure and technology evident in the U.S. food processing industry and identified by Connor, Heien, Kinsey, and Wills (1985) and Sanderson and Schweigert (1985) have significant implications for agricultural economic analysis. It is evident that food processing industry is increasingly dynamic, interacts extensively with the farm and consumer sectors, is being integrated into nonagricultural industries and continues to expand its international dimensions. Equally important as these trends in shaping the future are constraints imposed by micro and macro policies. Given industry dynamics and complex policy interactions, it is likely that traditional static competitive models for evaluating firm and industry performance may be inappropriate. This paper examines the implications of industry dynamics for economic analysis of the food processing industry, and develops a framework of the interactive policy environment in which the industry operates. Within this framework implications of some key policy variables are explored to suggest their importance to empirical models.

MODELLING INDUSTRY DYNAMICS

Structure and Performance

Largely as a result of mergers and acquisition involving both food processing companies and nonfood conglomerates, a new pattern of industry structure is emerging. There remain, of course, many smaller specialized firms in food processing with developed market niches. Industry structure is dominated by larger economic entities with multiproduct production

functions, significant scale economies, and what Baumol (1982) has termed "economics of scope." The economic implications of these recent conglomerate mergers have not been explored and traditional neoclassical models, particularly those which estimate societal impacts, appear inadequate as suggested by Connor et al. (1985). Past analysis of performance has tended to abstract from the dynamic competitive process by relying on single-dimensional structural and performance indicators. While these have been judged inadequate for many years, static analyses, given the rate at which structural change is occurring, are equally inappropriate for evaluating a dynamic system. Competition must be modelled as a dynamic process looking beyond numbers to the behavioral dimensions (Hammonds and Eiler 1979).

Baumol, Panzar, and Willig (1982) offer the theory of contestable markets as an alternative to the traditional competitive market models, to facilitate more accurate portrayal of market behavior in the presence of large-scale multiproduct, cost minimizing firms. Critical assumptions include free entry and free exit, both complete and reversible, with such costs being zero. From a policy perspective, the authors consider the theory more applicable to the real world since even the threat of free entry can serve to reduce or even eliminate any monopoly profits in industries where concentration ratios may be very high. Thus, according to Baumol et al. (1982) social efficiency may still be served within emerging firm structures. Shepherd (1984) in critiquing the ultra-free entry aspects of this theory, points out that extensive theoretical and empirical testing is required. While the hypotheses of this model are yet

to be empirically investigated, it has already initiated serious debate concerning assumptions of efficiency in industry performance.

Technical Change

Sanderson and Schweigert (1985) describe the developing basic science and technologies that promise to impact the food industry in the future. Technical change is inherently a dynamic concept defining the rate and nature of change over time. The rate of technological change is uncertain depending upon research and development expenditures, capital costs, relative prices, resource availability, existing capital stock and new capital requirements. As Sanderson and Schweigert (1985) point out, the shape technology takes will depend, as well, on demographics and consumer preferences. Food safety policy and economic regulation are other critical variables. These uncertainties produce risk which must be considered in analysis of adoption decisions.

A further complexity analysis should recognize is the unintended negative externalities from technology. Traditional firm models consider private returns from technology ignoring the externalities and resulting social costs. This model is incomplete for considering the public benefits and costs associated with new technology.

Demand Trends

Demand trends outlined by Connor et al. (1985) and suggested by Tomek (1985) clearly indicate their dynamic nature; changing tastes and preferences, demographic changes among age groups, work force composition and ethnic mix all have implications for modelling the food processing industry. Their comments suggest possible advantages in disaggregating some key variables for analysis.

THE INTERACTIVE POLICY ENVIRONMENT

The food processing industry operates within a complex dynamic policy environment. Structural, technical and demand trends will be motivated and constrained not only by policies specific to the industry but by farm and consumer policies as well as by a broader array of economic and social policies. The interactions among these policy sets are neither sequential nor symmetric. An appropriate policy framework must accurately represent interactions between producers, food processors, and consumers. It must capture as well the full array of national industry and macro economic policies (see Timmer, Pearson, and Falcon 1983).

Figure I depicts this environment for the U.S. food processing industry. Three principal policy sets are defined: (1) Farm and Food Sector Policy; (2) National Industry Policy; and (3) National Macro Economic Policy. Agricultural economists typically divide the Farm and Food sector into three components: farm production, food processing and consumption. While distinct policies for each exist, they are not independent. Clearly farm policy for commodities affects relative and absolute prices of both program and nonprogram commodities by influencing the level, composition and location of agricultural production. Similarly other policies for the farm production sector including those on research, credit, and resources impact the industry. This subset of Farm and Food sector policy is identified as the sphere surrounding the farm sector.

But is it not a one-way influence. Clearly, food industry policies such as grading, standards, and selected food safety requirements (which derive from the consumer sector) impact the food sector as well as having

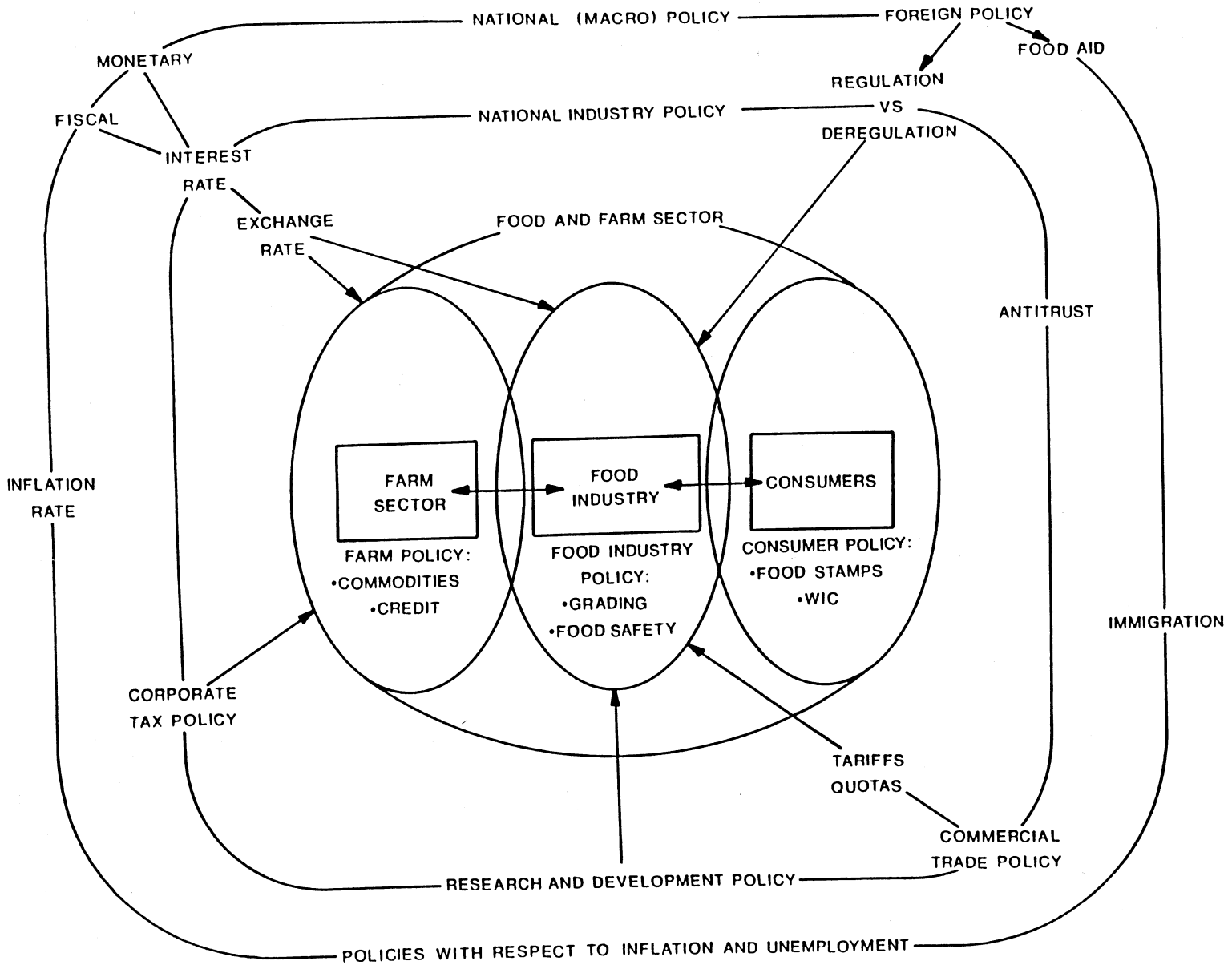

Figure I. The Policy Environment: Its Multiple Dimensions

direct impacts on the farm sector. This is indicated by the intersection of policy subsets in Figure I.

A third policy subset within the Food and Farm Sector are policies explicitly directed toward consumption. These include the Food Stamp program, surplus food distribution, feeding programs (e.g., school lunch programs, WIC, etc) and nutrition education which influence the level and composition of food demand. These intersecting subsets of sectoral policy have the most direct impact on the Food Industry by encouraging, altering or impeding its evolution. In turn, these variables are subject to some degree of control by the food processing industry; they are not wholly exogenous to the industry.

As shown in Figure 1, the food processing industry operates within a broader policy environment. The set identified as national industry policies (the next outer ring in Figure 1) encompasses "generic" industry policies with respect to: general economic and social regulation, anti-trust, corporate taxation, commercial trade policy regarding industry-specific tariffs, quotas and export subsidies and government sponsored research and development policies. Here the effects of industrial policy variables on the food processing industry are likely much stronger than the ability of the food industry to control or influence them.

The third policy set encompasses national (macro) policies relating to: (1) fiscal and monetary policies which influence interest rates and exchange rates; (2) policy with respect to inflation and employment which influences wage rates, input and potentially product prices. These policies clearly influence incomes and food demand and the cost of capital

which affects supply; (3) immigration policy influences labor supply and ways; (4) foreign policy, particularly as it relates to food aid, foreign assistance, and trade, is an important variable for food processing; and (5) environmental and other welfare improving policies directly affect costs, technology, products and profits. This third policy sphere clearly determines the economic environment within which the Food Industry operates; from the firm's perspective they are critical yet exogenous variables. When these macro policy variables were relatively stable (circa 1950s and 1960s) they could be assumed exogenous in food policy analysis. As international economic interdependence increases instability and the pace of change accelerates, their importance to economic policy analysis becomes critical. It is the interactions of events in a dynamic food processing industry and a changing policy environment which will determine the future character of the industry.

IMPLICATIONS OF POLICY TRENDS FOR FOOD PROCESSING

The Farm and Food Sector

Policy trends influence economic outcomes and must be included in analysis of firm decisions. This section examines several policy areas to underscore their importance in policy analysis for the food processing industry.

Farm Policy

That U.S. farm policies directly and indirectly effect the food processing industry is clear. Commodity programs for wheat, feed grains, and dairy, for example, establish levels of price support and acreage reductions affect output. At the extreme, the dairy program fixes minimum prices and defines a perfectly elastic government demand at the support

price. These direct effects of commodity programs, while of prime importance to processors of grain and milk, are likely less significant than the indirect effects on other types of food processors. The feedgrain program clearly influences livestock production costs which affect the level and stability of raw product prices for meat processors. These same farm commodity programs, through regional and inter-regional commodity substitution distort relative prices and influence acreages of other crops planted.

If policy becomes more "market oriented" by phasing out price supports and acreage limits, output in the short-run would increase and prices of program commodities would fall; price instability would likely increase. There would be a spill-over effect on nonprogram commodities, also lowering and destabilizing their prices. Food processors would face less stable raw product markets. Alternatively, a program of production control, high support prices and export subsidies both raises and stabilizes internal program commodity prices. Together with the indirect effects on other commodity outputs and prices, food processors would face higher raw product prices for program commodities and lower prices for nonprogram commodities. Continuing present programs will result in less policy-induced price change.

While there are obvious influences exerted by farm policies on food processors, the impacts can be diminished. For those directly affected by basic commodity policies, better management of price risks through futures trading and other financial instruments alleviates part of the greater price instability. Those processors affected indirectly by commodity programs find value-added products becoming a greater part of their

activity and, therefore, the significance of raw product prices is diminishing. Furthermore, they can continue to shift uncertainty onto raw product producers through use of contracts.

Consumer Policy

U.S. policy goals for consumers have been consistent over time although the weights change: access to an ample, nutritious and safe food supply. Consumer and producer policy have never been separable because of their dynamic interactions. While farm policy has historically been defended as benefiting consumers, farm policy such as price supports and supply control can result in higher food prices as pointed out by Cochrane (1985). Food assistance programs, especially those linked to distribution of surplus commodities, have helped raise farm incomes.

Food assistance programs have operated for over five decades and with periodic changes in eligibility criteria, they will likely continue. The level of funding for and to some extent the need for such programs are linked to general macro economic conditions. Food assistance programs are all demand-expanding, but programs have different implications for the food processing industry. Cash subsidies for food provide for more consumer choice in regular market channels while targeted feeding affects demand selectively.

There is a commitment to improve nutrition both as a long-run aid to break the poverty cycle and to reduce public health care costs. Demographics and national health care policy also affect these programs. A priority is to educate consumers about the relationships between diet and health. The 1980 Dietary Guidelines for Americans (USDA 1980) have

clear implications for demand for processed foods. There is emerging evidence of the effect of these programs (Kinsey and Heien 1985).

There are strong links between nutrition, food safety policy and food processing regulation. Adoption of cost-minimizing technology is not always consistent with food safety and nutrition goals. Industry goals thus interact with consumer goals often resulting in regulation.

The Food Processing Industry Policy

Industry specific policy affects all stages of production starting with the grading of raw product. It standardizes marketing and helps establish prices paid. Federal inspectors monitor plant sanitation, check for disease, and product contamination. Food safety policy with regard to technology and production processes impacts costs, technology and products. As Knutson, Penn, and Boehm (1979) point out, food safety is not only of concern to consumers but of great interest to food producers whose continued existence depends upon maintaining product integrity. U.S. food safety policy embodied in laws and legislation specifies the degree to which economic and health benefits of a given technology are to be weighed against its risks. Policy recognizes that the cost of reducing risk from sanitation and contamination to zero are unrealistic and tolerates certain levels. Regular inspections of facilities and production records are considered sufficient to keep the risk of disease from process failures such as with pasteurization to acceptable levels. The "zero-risk" policy for carcinogens, however, requires that all additives with "known" carcinogenic properties be prohibited.

As processing technology has become more sophisticated and the scientific base of knowledge increases, development of an appropriate food

safety policy has become more difficult. More information on food contents, nutritional value and processing technology is demanded by consumers as is evidenced by past changes in labelling laws and the current debate over irradiation. Determining acceptable risk levels is complicated by an increasing scientific measurement capability not paralleled by advances in toxicology. Dose-response relationships between chemicals and human health effects have not been determined; the validity of extrapolating from animal studies continues to be debated. These issues have surfaced in the current debate over the Food Safety Modernization Act.

The regulatory decision process itself generates costs for both food processors and the government which cannot be excluded in analysis. Because of the lack of consensus and uncertainty over true risks, crises often stimulate quick decisions such as with EDB contamination of processed grains and the ban on cyclamates. These lags in the decision process, coupled with lack of a consistent food safety policy, generate a highly uncertain policy environment for both processors and consumers. This is the environment in which applications of biotechnology, new packaging materials and new processes will occur.

NATIONAL INDUSTRY POLICY

Regulation and Deregulation

Economic deregulation can potentially increase operating efficiencies and lower prices. It also provides incentives to increase size and can result in increased levels of risk and uncertainty (Sorenson, 1984). In recent years, the dominant form of mergers have been conglomerate and concentric (McCorkle 1985) facilitated in part by less stringent

enforcement of anti-trust laws. It has invited entry of firms into new lines of business as well; as is evident in food processing. Deregulation of banking and current financial policies are equally likely to affect industry structure.

Commercial Trade Policy

Despite the fact that the general thrust of U.S. Trade policy is towards liberalization (reduction) of trade barriers through multi-lateral trade negotiations, import restrictions are applied selectively by commodity and industry. The current mood of the Congress is protectionist while the Administration continues to espouse free trade. Should protectionist forces gain strength, the food processing industry may face retaliation against products the U.S. exports. On the other hand, any reduction in trade barriers should work to the advantage of American food processors.

NATIONAL (MACRO) POLICY

The outside ring of Figure 1 identifies several macro economic policies which influence the food industry. Fiscal and monetary policies in an era of floating exchange rates are particularly significant. Clearly, the impacts of policies leading to high interest rates and a strong dollar have been significant in increasing the cost of doing business and, in general, contracting demand. A strong dollar makes U.S. exports more expensive and competing imports cheaper which has a significant negative impact on an export oriented Farm and Food Sector.

A result of the interaction of macro instability and structural change is that larger diverse firms have increased resource flexibility which allows them to better cope with a dynamic economic environment. A

changed nature of capital holdings (leasing physical plant for example) and a balance between in-house and contracted activities has further increased flexibility.

Future projections of the macro environment and how it will effect the food processing industry are extremely hazardous. It is not difficult, however, to predict with some degree of confidence that the macro environment will continue to be dynamic and unstable as a result of floating exchange rates, a highly integrated international capital market and a much more interdependent international economy. The implications for the Food Industry are clear--more uncertainty, fluctuating costs of capital and unstable international markets. The necessary hall mark would seem to be flexibility and prudence. The bottom line is that the U.S. food industry is surrounded by a complex dynamic economic and policy environment which will, in all likelihood, modify internal industry trends.

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