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**INDUSTRIAL ORGANIZATION AND
INTERNATIONAL TRADE:
METHODOLOGICAL FOUNDATIONS FOR
INTERNATIONAL FOOD AND
AGRICULTURAL MARKET RESEARCH**



**Organization
and Performance
of World Food
Systems: NC-194**

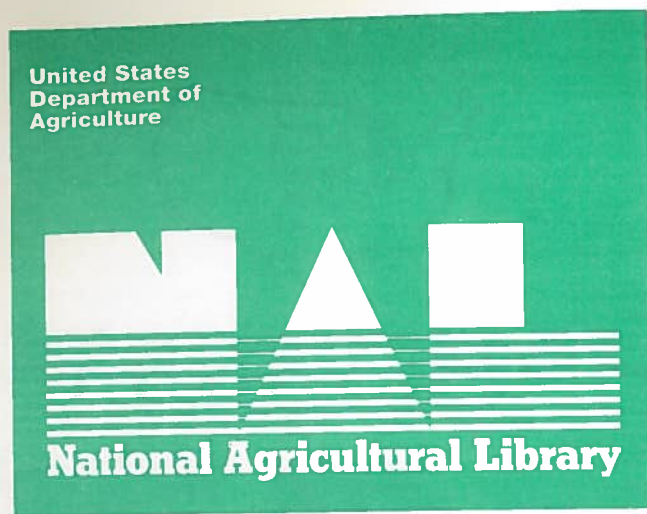
Ian M. Sheldon and Dennis R. Henderson, editors

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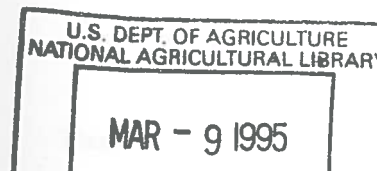
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Proceedings of a Workshop On Industrial Organization and International Trade

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Chapter 6: Summary of Issues and Comparison of Methodologies

Lester H. Myers and Dennis R. Henderson

6.1 Introduction

The preceding papers were thoughtfully developed and clearly presented. Many important issues have been covered. Marvel examined both the new industrial organization and the new international trade paradigms from the perspective of the received theories that they aim to displace. In doing so he challenged those working at the interface of international trade and industrial organization theories to demonstrate that the new work both improves on the traditional factor endowment explanation for trade, and reconciles with empirical observation, sensible challenges by any measure. Pagoulatos demonstrated that international trade and industrial organization theories are not yet well integrated; trade theory is primarily concerned with how imperfect competition affects the structure of and gains from trade; the fundamental concern of industrial organization theory rests with the implications of international trade on domestic market behavior and performance. Perloff, Sheldon, and Davis and Mitchell provide excellent and detailed descriptions of three major quantitative tools for conducting empirical analysis at the nexus between industrial organization and international trade.

Our purposes herein are to identify a number of research issues relating to the international trade-industrial economics interface from the perspective of policy-relevant research, and to examine each of the three methods--econometrics, simulation, and experiments--in the context of these issues. We end with some challenges to the research community.

6.2 Issues

Explaining international trade is incredibly challenging because of the possibilities of complex interactions between government trade policies, industry structure and individual firm behavior. Krugman (1989) identified five main themes driving the current research that draws on industrial organization theory to explain

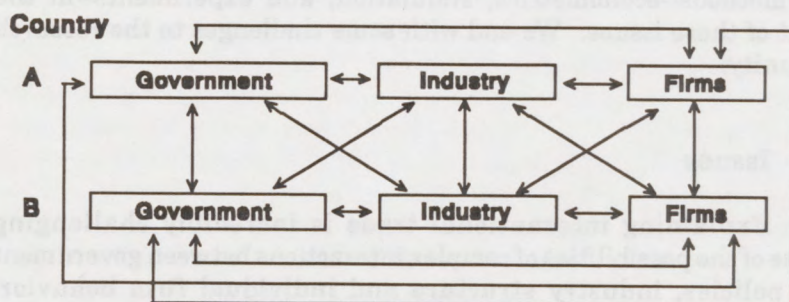
international trade (Krugman, p.1181). These are:

- (i) The role of economies of scale as a causal factor in trade.
- (ii) The relation between market power of domestic firms and the ability of governments to achieve domestic and international policy objectives.
- (iii) The role of price discrimination and "dumping" in international markets.
- (iv) The possibility that government action can play a strategic role in creating international advantage for domestic firms when engaging in oligopolistic competition.
- (v) Determining whether industrial organization theory provides arguments favoring protectionism.

A sixth issue, which was not explicitly discussed by Krugman, is the ability of industrial organization theory to explain the behavior of governments in developing trade policy and in negotiating bilateral and multilateral trade agreements.

Collectively, these six issues imply a set of complex relationships between firms, industries, and governments (**Figure 6.1**). These interactions can lead to methodological problems that are commonly associated with using cross-section, inter-industry data for empirical studies of industrial organization. That is, there may not be enough exogenous, instrumental variables to identify the relationships that need to be estimated (Schmalensee, 1989, p.952). In reality, empirical work can only address a subset of the relationships in any given study. **Figure 6.1** can be viewed as a framework for identifying relationships that fall within the scope of the industrial organization-international trade research agenda.

Figure 6.1.
Industrial Organization - Trade Linkages



The formulation of trade policy involves assumptions about how trade flows will be altered under different policy scenarios. If industrial organization affects trade flows, then analyses based on wrong assumptions regarding industry structure and/or behavior, either domestic or foreign, could lead to wrong conclusions about the resulting trade response. Similarly, the use of trade restrictions, agreements, subsidies, and other regulations could alter the structure of domestic industries and, ultimately, firm conduct in international trade.

Ideal research, from the policy perspective, would produce results having the following characteristics:

- (i) *Statistics which have unambiguous interpretations.* This requires a foundation of well-developed underlying economic models, the ability to statistically identify the parameters of interest, observed variables which are consistent with theory, and the use of estimation techniques which produce estimates containing desirable properties, i.e., consistent, asymptotically efficient and robust.
- (ii) *Statistics which are robust.* The results should be generalizable (e.g., across industries or countries) and reasonably invariant to sample selection. If different researchers obtain different, perhaps conflicting, estimates, the possible reasons should be made clear. Care should be taken to be explicit about the limitations of using the results to draw conclusions about situations where the underlying assumptions might differ from those used to generate the results.
- (iii) *Empirical models should account for possible reactionary behavior by foreign firms and/or governments.* Models which assume competing firms or countries are passive to behavioral or policy initiatives may not be consistent either with the real world or with an assumed structure used in the model. This implies, among other things, that empirical models may have to be flexible enough to handle discontinuous functions or oligopolistic structure and behavior.
- (iv) *Underlying assumptions should approach "real world" situations.* If simplifying assumptions need to be made to make estimation feasible, then definitive information on the sensitivity of results to particular assumptions should be provided; at the least, limitations to interpretation of findings as a result of such assumptions should be explicitly recognized.
- (v) *Estimates which are of believable magnitude and sign.* Although the object of research is to uncover "surprises",

results have to be defensible in the minds of policy officials and the public at large. This does not imply that the results must conform to *a priori* biases of policy makers or anyone else. It does mean the results should be explainable in logical and realistic terms.

Meeting all of these criteria in industrial organization research, as with almost all economic research, is probably impossible. But, these goals serve as a framework for conducting research. It is the attempt to stay within the framework that leads us to the set of research tools discussed in the preceding papers. The particular quantitative tool needed to address a specific empirical issue depends on several factors, including:

- (i) The nature of the underlying economic model which specifies the behavioral framework generating the parameters of interest and the hypotheses to be tested.
- (ii) The availability of data and the particular characteristics of the observed data.
- (iii) The ultimate use of the results.

Each of the three major techniques discussed during this workshop has advantages and disadvantages, depending on the problem being studied and the ultimate empirical objective. Of the three, econometric methods provide the foundation. Econometric studies utilize observed data to estimate unknown parameters of behavioral equations that represent how firms establish prices and quantities. Thus, conduct is manifest in specific parameters, and alternative hypotheses about conduct can be explicitly stated and tested (Bresnahan, 1989, p.1012). Structural specifications and measurement permit a very explicit formulation of the linkages between structure, conduct and performance based on economic theory. Empirical measures derive directly from observed data and are not necessarily *a priori* constrained to a particular assumption of structure or behavior. With time-series data, dynamic adjustments can be measured, either assuming fixed or time varying parameters. We view econometric models as the preferred means for generating the basic empirical estimates of the behavioral parameters to be used in simulation models. They also provide measures of the preciseness of the estimates.

There are, however, at least five classes of problems associated with econometric studies. First, they require the researcher to be very precise in model specification, otherwise estimates can be

misinterpreted and the results may be misleading. Second, econometric techniques are data intensive. They require a large number of observations, either cross-sectional or time series. Third, especially with time-series data, they often require many exogenous instrumental variables to identify systems which can be highly endogenous. Limiting the research scope is necessary to escape the joint dependence problem, but then the model is subject to specification error. Fourth, it is difficult, although not impossible, to deal with discontinuous functions. Finally, econometric estimation by itself does not provide a complete set of tools to validate parameter estimates or models.

Simulation techniques provide the means to use a set of interrelated functions that describe various behavioral relationships to ascertain how a system reacts to shocks. The design of such a system demands, as does econometric modeling, very precise specifications of the behavioral relationships and underlying assumptions. Because structure and behavior are forced to be explicit, it may be even a better tool than econometrics for disciplining researchers to "think" about the problem they are addressing. So-called econometric models are often really reduced-form models where the underlying structure is never specified and, in some cases, may not be fully recognized by the researcher.

Simulation models also provide a way to add a validation dimension to parameter estimates. Stability properties and the interactive effects across equations can be evaluated by simulating econometrically-estimated models. Simulation models may also be used to trace adjustment time paths following initial period shocks and to test the sensitivity of model outcomes to alternative parameter specifications.

A common practice with simulation models is to design the economic relationships in a way that the results of particular shocks of interest can be tested. The required parameters, such as elasticities, are often obtained from other studies, rather than estimated econometrically by the researcher. For a given model, parameter estimates originating from several different sources might be used and each might be estimated under a different set of behavioral assumptions than those that underlie the simulation model. Since simulation results are conditioned by the parameters, as well as the structural formulation, these inconsistencies could lead to misleading results. The preferable approach would be to specify the model, estimate it using econometric tools based on consistent assumptions, and then simulate alternative scenarios.

Some reservations can be raised regarding the common practice

of "calibrating" equilibrium models to a data set from a specific time period or observed situation. This practice ignores the fact that estimated parameters are usually derived from stochastic, not deterministic models. There is no guarantee that the estimated equations pass through all the data points used to calibrate the model. Statistical error may, therefore, be embodied in the parameter which is "derived" in such a way as to force calibration. At the least, one should look at the sensitivity to different calibration points.

Simulation models can, however, provide researchers with a great deal of latitude in specifying very complex economic functions. Analyses can be run to determine how sensitive the model outcomes are to the various parameter and functional form assumptions.

Data requirements inherent in econometric analysis make experimental economic techniques especially attractive. If we could conduct controlled experiments which measure behavior under theoretically consistent rules, it should be relatively inexpensive to evaluate various theories and their implications. Plott (1989), for example, argues that "experimental studies demonstrate clearly that market institutions and practices can influence market performance" (p.1169). Experimental economic studies are attractive because the researcher can "set up" the economic environment desired. The nature of experiments is such that only relatively simple special cases can be examined in a given experiment. The key is, as articulated by Plott, "to make the study of simple special cases relevant to an understanding of the complex" (p.1165).

Theory itself is an abstraction; therefore, it could be that experimental economics provides the most ideal way to "test" theory. In other words, if a theory is general it must explain behavior in special cases, such as in an experiment; otherwise, it should be rejected. Another advantage of experimental economics is the ability to test the sensitivity of performance to changes in institutions. This seems especially attractive to the study of industrial organization and trade because the very nature of trade policy is to change institutions. It could take years to accumulate the observed market data needed to evaluate the impacts of institutional changes. One current example is assessing effects of the proposed U.S.-Mexico free-trade agreement.

Criticism of experimental economics often focuses on:

- (i) The possibility of "rigging" the results through the specification of behavioral relationships used in the experiment.
- (ii) The irrelevancy of an experimental situation in duplicating "real world" conditions.

The paper herein by Davis and Mitchell and the review paper elsewhere by Plott adequately address the concerns and clearly identify experimental economics as a relevant tool for researchers working on industrial organization and trade.

None of the three techniques provides all the answers. But, each can provide useful information if applied in appropriate ways. More than being independent and alternative tools, they can perhaps best be viewed as complementary techniques for generating information which can be combined to more fully analyze issues of concern.

6.3 Challenges

To understand the determinants and consequences of international commerce in the food sector requires an understanding of industrial organization: how industries are structured, how firms therein behave in response to strategic moves by their rivals and in response to changes in public policy. Fortunately, economic thought at the nexus between industrial organization and international trade offers insight into tractable and testable hypotheses; methods have been developed that facilitate such testing. Yet, there are a number of challenges that must be considered by researchers, both in terms of strengthening the underlying paradigms and analytical techniques, and in terms of issues relevant to the policy making process. These include:

- (i) Cross-sectional studies of market power-international trade linkages are highly desirable, if not essential, in order to obtain generalizable findings with unambiguous policy implications. Theoretical relationships evidenced at this point deal largely with the impacts of trade on market power. Yet, industrial organization theory is robust in implications of imperfect competition and market power for economic performance. Are there theoretically tractable implications of imperfect competition in home markets for external or international market performance? Can these be validated empirically?
- (ii) Econometric studies of industrial organization and international trade have many highly desirable properties. One significant limitation of such studies under conditions of imperfect competition is the difficulty of accurately specifying strategic interaction among rival oligopolistic firms. Can

- experimental economic techniques be used to develop quantitative measures of such strategic behavior that are representative of actual firm strategies? How can simulation models best be used to test the sensitivity of trade patterns in imperfectly competitive industries to alternative specifications of strategic competitive interaction?
- (iii) To what extent is strategic interaction among firms in an imperfectly competitive industry affected by market size? For example, as barriers to international commerce fall through multilateral trade liberalization or formation of free trade blocs, do firms respond by behaving more, or less competitively?
 - (iv) Is it possible to generate more accurate projections of firm behavior in international markets using assumptions of economic motivations other than profit maximization, e.g., revenue maximization subject to a minimum profit constraint? It is not entirely clear, for example, that international behavioral models such as pricing to market--a potentially important concept in understanding industrial organization determinants of one-way trade--can be rationalized with a profit maximization objective function.
 - (v) Given that simulation models are calibrated using actual data, what methods can be used to validate these models out of sample, in terms of their ability to predict international market behavior and performance under specified conditions?
 - (vi) How do product characteristics affect strategic behavior in international markets? As foods become "endogenized" to reflect ethnic and cultural distinctions in international markets, do firms become increasingly specialized or do they meet as rivals in an increasing number of product and geographic markets?
 - (vii) What are the market performance and economic welfare implications of international commercial activities other than product trade? Who are the gainers, losers from investment in foreign facilities, international licensing of production technology, brand names and other intangible assets; international franchising?
 - (viii) Finally, we must turn our attention to data. It is trite to say that empirical data are needed for empirical analysis. Yet, countries differ greatly in how they collect, interpret and report economic and market information, as well as in their perceptions of the dividing line between public disclosure and the right to privacy. Means need to be established to collect

and compile consistently defined data for industry studies that cross national borders. Effort must be made on an international basis to standardize and rationalize the conceptualization, description, collection and dissemination of crucial and observable industrial organization variables such as quantities produced and traded, prices, costs, economies of scale and scope, buyer and seller concentration, market power, vertical control, strategic alliances, and product differentiation.

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