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Imperfect Competition and Strategic Trade Theory: Evidence for International Food and Agricultural Markets

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Imperfect Competition and Strategic Trade Theory: Evidence for International Food and Agricultural Markets*

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Abstract

Strategic trade theory offers a way of conceptualizing and testing for strategic government interventions in imperfectly competitive international markets. This survey critically assesses recent empirical evidence, with a focus on food and agricultural markets. One finding is that while many international markets are characterized by oligopoly, price-cost markups tend to be small, and the potential gains from intervention are modest at best. In turn, empirical work has turned up few examples in which government intervention has been optimal in a strategic trade sense. Nonetheless, governments are found to frequently intervene on behalf of domestic firms and play a major role in shaping the nature of international competition. Suggestions for future research are made.

KEYWORDS: imperfect competition, oligopoly, protectionism, strategic trade

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1. Introduction

International markets for food, raw agricultural products, and agricultural inputs are often characterized by oligopoly. Trade is commonly controlled by a small number of private firms or state-trading enterprises. Economic theory tells us that such markets have excess economic profits or rents to be captured by the traders involved. A branch of the economics literature known as ‘strategic trade theory’ shows that in certain circumstances a government can take actions to increase a country’s share of these rents. This possibility has generated much interest and controversy as it seems to explain certain features of real world markets, on the one hand, but seems to call into question economists’ general support of free trade, on the other.

The key study to demonstrate the concept of strategic trade policy is a 1985 article by Brander and Spencer. The approach envisions two exporting countries selling to a third country that does not produce the product. If the government of one of the exporters makes an aggressive commitment to subsidize sales abroad, and the foreign government does not retaliate, the foreign competitor has to reduce its output and the home firm obtains a larger share of sales and profits. In effect, the export subsidies are ‘rent-shifting’ policies: they shift oligopoly profits from the foreign firm to the domestic firm. The intervening country sees a national welfare gain despite its subsidization of the foreign importer.

This finding would appear to justify policies that divert national resources to local firms and institutions that compete in oligopolistic international markets. As a result, a large literature has developed that examines the potential for and existence of strategic trade policy in various markets. This article is a survey of recent developments in the empirical literature, with special attention to international food and agricultural markets. These markets are of particular relevance to strategic trade since international market power is often concentrated among a few firms and since GATT/WTO agreements allow for a wide variety of interventions that may be strategic in nature.

Our survey takes as a starting point several early syntheses of the strategic trade literature. In a volume edited by Carter, McCalla, and Sharples (1990), Krishna and Thursby review the theoretical literature and stress that ‘optimal’ strategic trade policy is sensitive to the details of the market. They highlight the need for empirical research that examines issues of market structure and appropriate policy for imperfectly competitive agricultural markets. Segments of the literature are also reviewed in Krugman (1989), Corden (1992), Chang and Katayama (1995), and van Berkum and van Meijl (2000). The most important survey of the literature, however, is Brander (1995), who focuses mainly on the theoretical literature. In his conclusions on p. 1449 he comments on the trend towards empirical work, but does not review any of it.

As a whole these studies caution against the practical implementation of strategic trade policy, even when free trade itself is not optimal. This is because the models do not account for potential problems such as lobbying and retaliation, and optimal policies often depend on intricacies of a market that will be unknown to policy-makers. This latter issue is less of a problem with traditional trade theory, for example, with its focus on perfectly competitive markets and simplified characterizations of firm behavior.

While these are important points to make – and indeed, the strategic trade literature should not be viewed as a broad justification for protectionist measures – we believe the urge to communicate these points has overshadowed the role that strategic trade research can play in the positive analysis of markets. Strategic trade theory has shed light on many aspects of international competition, and offers an explanation for the evolution of certain industries for which competitive trade models have little to say. Government intervention in imperfectly competitive international markets is persistent and strategic trade theory offers a way of conceptualizing and testing for these interventions. The empirical strategic trade literature has helped settle some of the debates from the theoretical literature and is addressing positive questions such as whether strategic trade behavior does occur, despite the normative prescriptions of economists.

The time is ripe for taking stock of the empirical literature, and we organize our survey around three distinct questions that are addressed by these studies. First, does strategic trade theory have any relevance to international food and agricultural markets? To answer this we review studies that investigate the extent and form of non-competitive behavior in international markets. Second, of those markets with strategic trade characteristics, what are the potential gains from government intervention? To address this we assess the results of simulation models that employ a mix of econometrics and calibration in confronting strategic trade theories with data. Third, can hard evidence of strategic trade interventions be found in the real world, including food and agricultural markets? We review studies that directly address this question for markets with characteristics similar to the one originally considered by Brander and Spencer (1985).

Before surveying the evidence on these questions, we summarize the intuition behind strategic trade theory and discuss the controversy surrounding this literature. In wrapping up our synthesis of the empirical literature we draw general conclusions and offer suggestions for future research.

2. What is Strategic Trade Theory?

Strategic trade theory is distinct from other rationales for deviating from free trade. One rationale is the ‘terms of trade’ argument, wherein a trade restriction can benefit an individual nation that is large enough to influence world prices.

Another rationale is the theory of the second best, which suggests that free trade may not be efficiency-enhancing in the presence of other distortions in the economy.

These rationales have their flaws, and strategic trade theory has its share as well, but the distinctive feature of strategic trade theory is its focus on oligopoly in international markets as the rationale for government intervention. While 'strategic trade' can mean different things to different people, this survey focuses on Brander's (1995, p. 1397) characterization, which is that strategic trade applies to settings in which firms have a mutually recognized interdependence. More specifically, the profits of one firm are directly affected by the choices of other firms. Thus there will be little focus on other characterizations of strategic trade, such as when government promotes industries that generate technological externalities (e.g., Japanese promotion of the semiconductor industry and European support of aircraft manufacturing).

The strategic component of the analysis comes through firms trying to convince each other of their aggressiveness. The key ingredient is a credible pre-commitment that supports the domestic firm. The pre-commitment may take the form of subsidies, tariffs, quotas, voluntary export restraints, R&D subsidies, capacity building, or any other policy instrument that alters the payoffs of rival firms. The pre-commitment is typically modeled as an intervention by government.

In practice the impetus for government intervention is likely to come from a narrowly focused interest group that has a stake in an industry. However, most models characterize the optimal policy as maximizing some measure of national economic welfare. This is possible given the other assumptions that are typically made. For example, domestic consumption of the product is often ignored to focus on the competition for excess returns in the international marketplace. Thus in contrast to traditional competitive trade models, gains on the consumption side play no role. Other distortions are ruled out, such that the marginal cost of each firm is also the social cost of the resources it uses. As a result, national welfare can be identified with the profits earned by the firm, less the subsidies from the government.

The standard model is set up as a two-stage game. In the initial stage the home government is able to enact an export subsidy for the home firm's output of the homogenous product. In the second stage the firm of each country chooses the quantity to produce and sell to the third country (they are Cournot competitors). Each firm takes the other's output as given when maximizing profit. The domestic government's first-mover advantage is transmitted to the domestic firm such that the latter becomes a Stackelberg leader.

The subsidy lowers the home firm's cost and makes it want to export more for any given export level of the rival. Since the home and foreign products are

strategic substitutes (i.e., reaction functions are downward sloping), the foreign firm must reduce its equilibrium output. As the domestic export subsidy increases, aggregate quantity rises, price falls, and the profits of the domestic firm rise while foreign profits decline. In effect, rents are shifted from the foreign firm to the home firm.

The sharpness of Brander and Spencer's analysis encouraged the extension of their approach to a wide variety of related topics. A laundry list of contributions includes analysis of intermediate inputs in vertical markets (Spencer and Jones, 1991; Ishikawa and Lee, 1997; Ishikawa and Spencer, 1999), trade in differentiated products (Gruenspecht, 1988), capacity investment (Dixit, 1984), countervailing duties (Dixit 1988a; Qiu, 1995), rent shifting (Fung, 1995; Hamilton and Stiegert, 2000), rent shifting under incomplete information (Maggi, 1996; Brainard and Martimort, 1996), transnational technology differences (Neary, 1994), endogenous government control (Goldberg, 1995b; Karp and Perloff, 1995; Maggi, 1996), non-equivalence of tariffs and quotas (McCorriston and Sheldon, 1997; Levinsohn, 1989) and cross ownership of firms (Dick, 1993; Hamilton and Stiegert, 2000).

3. Objections to Strategic Trade Theory

While Brander and Spencer (1985) mainly try to explain the existence of certain protectionist policies, their approach appears to have strong normative implications that challenge the conventional wisdom on free trade. Perhaps for this reason their study was subjected to rigorous scrutiny immediately upon arrival. As researchers tried to derive similar results under a wider range of assumptions, the 'optimal' policy was found to change as one deviates from the three-country, partial-equilibrium, quantity-choosing situation envisioned by Brander and Spencer.

Perhaps the best known and most important critique is Eaton and Grossman (1986), who show that if the firms happen to be price-setters (Bertrand competitors) instead of quantity-setters (Cournot competitors), the optimal policy changes to an export tax. By contrast, if firms' conjectures about each other's behavior are consistent with the actual responses of firms (consistent conjectures), then free trade is optimal. The optimal policy is clearly sensitive to the form of game being played, which itself is difficult to determine for any given market. In short, a given strategic trade model is unlikely to have broad applicability across sectors of an economy.

Other studies point out additional qualifications and shortcomings. Dixit and Grossman (1986) focus on the fact that Brander and Spencer's partial equilibrium setting ignores the existence of competition among different sectors for scarce resources. A subsidy to the favored sector will cause the marginal costs of other

sectors to rise, which complicates the design of welfare-improving policy. Horstmann and Markusen (1986) focus on Brander and Spencer's assumptions on production technology. In the case of increasing returns to scale, subsidies and tariffs will promote entry by less efficient firms and raise the industry's average cost. In turn, Dixit (1984) shows that the optimal policy is sensitive to the number of firms that are exporting.

Dixit and Kyle (1985) argue that it is important to consider the question of who is behaving strategically with respect to whom. The standard approach allows for strategic interactions between two firms, but potential responses – such as retaliation by the foreign government and changes to market structure – are ignored. In effect, government policy is reduced to an exogenous influence on market conduct instead of the product of an intimately linked strategic process (Marvel, 1992).

Another issue is that one nation's citizens may own stock in both domestic and foreign firms. Thus the notion of a 'domestic' firm is less meaningful in a world of international capital movements. Dick (1993) quantifies the sensitivity of the Brander and Spencer welfare results to assumptions about international ownership of assets. Existing levels of U.S. cross-ownership, for example, reduce the average optimal subsidy by 47% relative to a prediction based on the Brander and Spencer assumptions. So while cross-ownership does not nullify the Brander-Spencer prediction, it will tend to weaken it.

Existing approaches also overlook certain realities of the policy-making process. Instead of assuming that government is responsive to the preferences of all constituents and provides efficient policy, it might be more realistic to assume that governments respond to interest group pressure. In turn, it would be more realistic to acknowledge that in demonstrating its willingness to shift rents, a government may soon find itself overwhelmed by interests that seek those rents (Marvel, 1992).

Another issue is that the implementation of strategic trade policy would require extensive information on firm costs, consumer demands, and the nature of market structure. National governments are unlikely to have the analytical capacity to make such determinations. For example, government is unlikely to know whether firm behavior is Cournot, Bertrand, collusive, or some other possibility.

4. The Shift to Empirical Analysis

The above makes clear that the case for strategic trade interventions is weak at best. However, this does not imply that strategic trade approaches are not useful for the positive analysis of imperfectly competitive markets. The empirical literature has been sparked by this fact and a number of other considerations.

First, the theoretical literature offers a robust finding in that international oligopolists *always* have an incentive to unilaterally deviate from free trade (Brander, 1995). Empirical work is necessary to test for such interventions and evaluate their effects. Strategic trade theory has great intuitive appeal and appears to offer an explanation for the evolution of certain imperfectly competitive industries. There is much interest in understanding whether government intervention may give an initial advantage to particular firms and nations in certain situations. In turn, a program of empirical research offers a means of overcoming some of the key shortcomings of the theoretical literature. Empirical analysis makes it possible to operationalize certain models that lack a neat closed-form solution. Empirical work is also useful for eliminating special cases that are not worth analyzing; for instance it can reveal whether firms are quantity- or price-setters, thus limiting the number of cases to examine. In short, going to the data has proven useful for resolving questions that are ambiguous in a purely theoretical setting and carrying out positive analysis of strategic trade interventions.

As outlined in the introduction, the empirical literature that is reviewed here concerns: (1) the existence of imperfect competition in international markets, (2) empirical models of specific industries for which strategic trade interventions are plausible, and (3) evidence that certain government interventions are actually optimal strategic trade interventions.

5. Evidence on Imperfect Competition in International Markets

The example of a competitive market that one finds in undergraduate economics textbooks is often an agricultural commodity such as wheat. The view of agricultural markets as perfectly competitive – and thus having no rents to fight over – sometimes carries over from teaching to research. For example, in developing an analytical framework by which to interpret agricultural export subsidies, Bagwell and Staiger (2001) suggest that strategic trade theory offers a foundation by which to interpret them, except that it is applicable only for imperfectly-competitive (namely, Cournot) markets. They view agriculture as perfectly competitive, and as a result develop a competitive market model with political economy features to explain the subsidies.

While perfect competition may be a reasonable approximation for agricultural production, it is much less appropriate at downstream stages. For example, U.S. food processing and distribution is often marked by product differentiation, high concentration, and imperfectly competitive behavior (Sexton, 2000; Connor et al. 1985). International markets are increasingly characterized by these features as well. Trade in processed, differentiated, high-value food and agricultural

products is growing and now accounts for the majority of agricultural export value, including for the U.S.

International trade in undifferentiated primary commodities is also often imperfectly competitive. Consider international corn and soybean export markets, for example. Within the U.S., three firms control 81% and 65% of all exports of corn and soybeans, respectively, and these same firms own the vast majority of U.S. country, sub-terminal, and terminal elevators (Hendrickson and Heffernan, 2002). Since the U.S. has 63% and 53% of the world market for corn and soybeans, respectively, these three firms have significant global reach.

While U.S. commodity marketing is essentially a private sector system, in other countries the government may be a single-desk marketer and engage in day-to-day operations. So-called state-trading enterprises (STEs) are pervasive in international agricultural markets, and many have considerable market power. For example, the Canadian Wheat Board (CWB) and Australian Wheat Board are among the world's major wheat exporters, with each supplying approximately 15% of the world market for this commodity. STEs also operate on the other side of the market as importers of agricultural and food products. Important single-desk buyers of food and agricultural products include the JFA (Japanese Food Agency) and COFCO (the China National Cereals, Oils and Foodstuffs Imports and Export Corporation).

Due to high levels of concentration in international agricultural markets, they have long been modeled as imperfectly competitive. Examples include: McCalla (1966), Sheldon, Pick, and McCorriston (2001), Carter and Schmitz (1979), Sarris and Freebairn (1983), Karp and McCalla (1983), Paarlberg and Abbott (1986), Kolstad and Burris (1986), and Kallio and Abbott (2000).

Of course, the existence of high concentration and nationalized sellers does not imply that mark-ups are high. For example, there may be efficiency benefits such as economies of scale in information handling and risk sharing (Patterson and Abbott, 1994). Yet the point is that oligopoly is often a better characterization of international food and agricultural markets than perfect competition.

5.1 Testing Methods

To understand the literature that tests for imperfect competition in international markets, it is useful to classify the empirical methods that are typically used. Studies that test for the presence and nature of imperfect competition generally take one of three forms. One is the 'pricing-to-market' approach, which tracks pricing decisions by exporters across markets as bilateral exchange rates change (Krugman, 1987; Knetter, 1989). If an exporter holds the export price in the domestic currency constant, or lowers (raises) it for an importer who has realized

a domestic currency appreciation (depreciation), then price discrimination has occurred. The pricing-to-market approach has the advantage of not requiring data on quantity adjustments associated with the price changes. However, it reveals little about the extent of market power and type of game played by firms. Another drawback is that in general it fails to distinguish price discrimination from other phenomena such as product differentiation.

Another approach to detecting imperfectly competitive behavior are New Empirical Industrial Organization (NEIO) methods. These focus on structural models of supply and demand and on measuring mark-ups over marginal cost. A common NEIO approach is to estimate conjectural variations, wherein the first-order conditions incorporate terms that represent the anticipated responses of rivals (i.e., conjectures). This approach nests various forms of behavior, but has fallen out of favor, largely because it forces dynamic behavior into a static model. Nonetheless, evidence suggests that it can be a reliable indicator of the size of economic rents (Genesove and Mullin, 1998). Some NEIO studies take a dynamic approach to conjectural variations since this can account for adjustment costs in production or storage and capital accumulation. Other NEIO studies estimate residual demand elasticities since fewer data are required.

The above approaches can distinguish imperfect competition in a general sense but reveal little about the behavioral game being played. Unfortunately, this is what really matters. Economists rarely know whether Bertrand, Cournot, or some other form of behavior prevails. It is sometimes thought that the Bertrand model is most relevant when marginal costs are flat, while the Cournot model describes situations with steep marginal costs. Yet this is only a crude indication at best.

An approach that addresses this issue directly is the 'menu' approach. Here, the nature of the game is imposed upon the structure of the econometric model and tested against alternatives. In particular, one estimates specific models such as Cournot and Bertrand then discriminates among them using non-nested hypothesis tests. This approach is particularly useful for eliciting firm behavior in imperfectly competitive international markets.

5.2 Evidence on Market Structure: Specific Commodities

What are the results of applying the above methods to specific international markets? This section provides a detailed overview of the evidence, organized mainly by commodity.

Consider the international rice trade. Karp and Perloff (1989) develop a dynamic NEIO approach to examine the structure of the rice export market. Thailand, Pakistan, and China are modeled as oligopolists, and all other countries are treated as a competitive fringe. The econometric evidence confirms that this

market is oligopolistic but suggests that it is closer to competition than collusion. Yumkella, Unnevehr, and Garcia (1994) use a pricing-to-market approach to show that U.S. and Thai exporters of certain varieties of rice are imperfectly competitive.

Karp and Perloff (1993) study whether the two largest coffee exporters – Brazil and Colombia – are price takers, oligopolists, or in collusion. As with their rice study they employ a dynamic, quantity-setting homogeneous-product model. The coffee export market is found to be oligopolistic, but mark-ups are nonetheless small. Buschena and Perloff (1991) find that the Philippines exercises substantial market power in the coconut oil export market. In a dynamic analysis, Deodhar and Sheldon (1996) find that the German banana import market is best characterized by a Cournot-Nash equilibrium.

Using an NEIO approach, Arnade, Pick, and Gopinath (1998) report that the U.S. meat processing industry is oligopolistic in domestic and foreign markets, but mark-ups are not statistically different than zero. They do find statistically significant mark-ups in the rice milling and cigarette industries.

Using the menu approach, Carter and MacLaren (1997) examine Australian and U.S. beef sales into the Japanese market. Six oligopoly games are considered: Bertrand, Cournot, Stackelberg with U.S. price leadership, Stackelberg with Australian price leadership, Stackelberg with U.S. quantity leadership, and Stackelberg with Australian quantity leadership. A Vuong test indicates that the Stackelberg model with price leadership by Australia best fits the data. In another application of the menu approach, Dong, Marsh, and Stiegert (2006) find statistical evidence that the global malting barley market operates as a quantity-setting oligopoly.

Using a pricing-to-market approach, Pick and Park (1991) find evidence for price discrimination by U.S. wheat exporters among importing countries. Likewise, Patterson and Abbott (1994) find statistical evidence of price discrimination and hence market power by U.S. wheat exporters, although the margins are small. Anania, Bohman, and Carter (1992) report that excess profits are absent from the international wheat market.

Deodhar and Sheldon (1997) examine market power in the world market for soybean meal exports. Although the extent of country participation makes this market oligopolistic, the authors conclude that mark-ups are at competitive levels. By contrast, Pick and Park (1991) obtain ambiguous results on soybean meal exports when using the pricing-to-market approach. These authors also find ambiguous results on soybean oil and cake, but reject a hypothesis of price discrimination across destination markets for soybeans, cotton, and corn. With regard to this latter commodity, Patterson and Abbott (1994) find statistical evidence of price discrimination, although the markup is small.

In a residual demand elasticity analysis, Glauben and Loy (2003) find that competitive conduct characterizes German exports of beer, cocoa powder, chocolate, and sugar confectionery. When these authors redo their analysis using a pricing-to-market approach, however, they find evidence of market power in German exports of beer to North America, in exports of sugar confectionery to the UK, and in exports of cocoa powder to Italy. A possible explanation for the discrepancy is use of a fixed contract, which may be invariant to changes in exchange rates and thus would invalidate the results of the PTM approach.

Surprisingly few studies examine the competitive structure of international markets for non-agricultural products and services. One example is Brander and Zhang (1990, 1993), who estimate Cournot, Bertrand, and cartel models for the airline industry. They find that the data are most consistent with Cournot behavior.

The overall message of this literature is that oligopoly and hence strategic behavior is pervasive in international markets. This does not automatically imply that governments intervene in a strategic manner. However, since firms are small in number and are readily identifiable, there is potential for such behavior. In turn, these markets are likely better characterized by oligopoly and strategic trade approaches than by traditional competitive trade models.

6. Calibrated Strategic Trade Models

Conceptual oligopoly modeling can give rise to a vast array of outcomes, and to tie down the results one must typically make a large number of strong assumptions. An alternative is to confront strategic trade models with data, and this has typically taken the form of calibrated simulation models. These are used to elicit the effects of strategic trade interventions, and have a somewhat normative perspective. Calibrated strategic trade models are sometimes referred to as 'Industrial Policy Exercises Calibrated to Actual Cases' or IPECACs for short (Krugman, 1989). They are the numerical implementation of theory, and in this sense are similar to Computable General Equilibrium (CGE) models. As with CGE models, econometric estimation of the entire system of behavioral equations is usually impossible due to model complexity and limited data. In turn, few if any hypotheses can be tested statistically. CGE models are different, however, in that they generally employ the simplifying assumption of perfect competition, which eliminates the difficult task of modeling the behavior of oligopolistic firms.

A seminal calibrated strategic trade study is Dixit (1988b), who examines optimal tariff and subsidy policies in the context of the U.S. automobile market. Instead of maintaining a single characterization of firm behavior he tries to calibrate the model to Bertrand as well as Cournot behavior. However, the data turn out to be inconsistent with either one. Instead of imposing one of these pre-

determined structures, Dixit employs a conjectural variations approach. Optimal production subsidies and tariff rates are calculated to fall in the low double-digit range. The resulting welfare gains are nonetheless quite small. Ultimately, the study yields little support for strategic interventions by the U.S. government in the automotive market.

One shortcoming of Dixit's study is that products are treated as homogeneous, so there is no distinction between small and large cars, for example. With this in mind, Krishna, Hogan, and Swagel (1994) extend Dixit's model to allow for product differentiation and certain other important features of the automobile market. Special consideration is given to how choice of functional form influences the derivation of the optimal tariff. While this enables a richer analysis than Dixit's, the gains from activist policy are again demonstrated to be quite small.

In an agricultural example, Thursby and Thursby (1990) examine competition between U.S. exporters and the Canadian Wheat Board with respect to wheat sales to Japan. As in Dixit (1988b) the behavioral assumption is Nash equilibrium with conjectural variations that are calibrated to be consistent with market data. A methodological improvement is that demand elasticities are first estimated, which opens up an avenue for a degree of sensitivity analysis. However, there is a lack of data in certain respects, and the approach consequently incorporates a large number of maintained assumptions that are left unevaluated. Thursby and Thursby's policy experiment involves the removal of Japanese import restrictions and U.S. and Canadian producer subsidy equivalents. A key result is that if U.S. firms have Cournot conjectures about other U.S. firms, they are likely to have Bertrand conjectures with respect to the Canadian Wheat Board. While this is a useful result by itself, the analysis does not extend much beyond this, and no welfare effects are calculated.

In a variation on this strand of research, McCorriston and Sheldon (1991) empirically implement a strategic trade model of the UK fertilizer industry. They investigate whether there is any justification for government intervention (such as tariffs) in a market that is characterized by importers who sell at low prices due to production subsidies by their governments. A significant feature of McCorriston and Sheldon's study is their attempt to account for changes in strategic behavior and market structure over time. They demonstrate that optimal policy must be continuously updated, and that failure to do so leads to significant welfare losses. They further find that the net welfare effects of an optimal intervention are in any case small.

Other interesting strategic trade simulation models have emerged in the literature, including a number in a volume edited by Krugman and Smith (1994). Among the industries to receive attention in the broader literature are airlines (Klepper, 1994; Norman and Strandenes, 1994), telecommunications (Kahai,

Kasserman, and Mayo, 1996), 16K random access memory (Baldwin and Krugman, 1988), and the international automobile market (Smith, 1994; Feenstra, Gagnon, and Knetter, 1996; Goldberg, 1995a; McCorrison and Sheldon, 1997).

Ultimately, this strand of the literature shows that even in industries with strategic trade characteristics, it is far from certain that aggressive pre-commitments by an exporting government will have a positive payoff in the end. Even when a net gain appears to be possible, it tends to be small. Clearly, these studies do not constitute a strong case against free trade. Indeed, they often end with a warning against taking their results too literally. For example, Krishna, Hogan, and Swagel (1994) suggest their study's results 'should be interpreted with extreme caution ... it remains vital not to oversell such models to policymakers' (p. 36).

At the same time, by placing imperfect competition and strategic interactions front and center, these studies show how governments can change the nature of competition among firms in these markets. Calibrated strategic trade approaches offer a richer perspective on imperfectly competitive international markets than commonly used alternatives such as CGE models. In turn, they have rooted the theoretical literature more firmly in real world contexts by eliminating special cases, gauging the magnitude of competing effects, and incorporating features that are too costly to model analytically.

7. Direct Tests of Strategic Trade Theory

The above-surveyed calibrated studies are normative in nature and do not provide evidence on the existence of *actual* strategic trade interventions. Rather, the results are contingent upon numerous maintained assumptions about industry structure and firm behavior. This section considers studies that seek direct evidence of government rent-shifting interventions in markets that fit the plausibility requirements for strategic trade theory. International trade in food and agricultural products is marked by pervasive government intervention, yet it is far from clear that any of this is optimal in a strategic trade sense. What has recent research found?

We first consider an interesting non-agricultural example by Clougherty (2002), who examines U.S. airline concentration. Clougherty highlights that on-going concentration within the world airline industry is not fully explained by market power and efficiency rationales, and that certain governments encourage domestic consolidation as a way to build a 'national champion' airline and penetrate international markets. He argues that such a strategy may be detected by testing whether the following effects are evident in the data. First, home-nation share of international markets should *increase* with higher concentration at

home. Second, home-nation share of international markets should *decrease* with higher concentration in foreign countries.

Clougherty motivates his specifications with the Brander and Spencer framework, which he argues is a good characterization of the international airline industry. As evidence he cites Brander and Zhang (1990, 1993), whose econometric results suggest that Cournot is a reasonable approximation of actual airline competition. In turn, Clougherty points out that a strategically protected airline industry is unlikely to raise the cost structure of other industries, which eliminates the Dixit and Grossman critique of Brander and Spencer's approach. In addition, he argues that concerns about entry by small firms operating too low on the returns-to-scale curve are unlikely to be relevant, mitigating the Horstmann and Markusen critique of Brander and Spencer.

A 1983-1992 panel data set covering 21 country-pair markets is employed for regressing international market share on home-nation and foreign-nation domestic concentration and a host of other factors. Using instrumental variable techniques, Clougherty finds that concentration at home is positively related to penetration by home airlines on routes with an international connection. For example, in the case of Canada the domestic Herfindahl-Hirschman index rose from 2618 in 1984 to 5000 in 1992. For this change the model predicts that the percentage of passengers flown by a Canadian airline to international destinations rose by 5.5% on average. The data also statistically support the second criterion, namely that increased concentration among a foreign country's airlines tended to negatively impact the market share of other countries' carriers on connections to that country. Unfortunately, some aspects of Clougherty's results are hard to interpret. Certainly one would not want to conclude that a case for 'national champion' airlines has been made. A better interpretation is that strategic trade concepts are relevant to the world airline industry, and are a possible determinant of consolidation among domestic airlines.

Winters (1994) tests for strategic behavior in international markets using a novel approach unlike any other in the literature. He has no formal model but examines a dataset containing detailed information on volumes, prices, and origins of European Community imports before and after the imposition of import surveillance. The idea is that collecting information on import flows (e.g., on a monthly basis) sends a signal to foreign exporters that their actions are being monitored and they might face some kind of restriction in the future. Winters argues that import surveillance should not matter for a competitive industry. However, the behavior of exporters must be strategic if they alter their exports upon the introduction of import surveillance. For example, overseas producers as a whole face an incentive to exercise voluntary restraint so as to avoid imposition of some type of quantitative restriction. The fewer the exporting firms, the more likely they will reach such an agreement. Winters' data suggests that the

imposition of import surveillance did indeed curtail imports in the 1970s and 1980s, and that the effects were long-lasting. While there are too many confounding factors to make this a definitive proof of the existence of strategic behavior, it suggests there is merit in looking for it in international markets.

In this spirit we turn to agricultural and food markets, which are marked by relatively explicit forms of government intervention. A number of recent studies gauge the extent to which government involvement is motivated by explicitly strategic concerns. This literature can be classified into two strands depending on the form of the intervention. One concerns the general use of export subsidies by leading exporters such as the U.S. and the European Union. Another concerns state-trading enterprises, which are ubiquitous in international agricultural markets yet are little understood by outsiders.

7.1 Export Subsidies

We first consider export subsidies by major agricultural exporters such as the U.S. and European Union. GATT Article XVI allows for export subsidies for primary products such as agricultural goods, provided the subsidy received does not displace the exports of another member. Farmers, landholders, and agribusiness are among the direct beneficiaries of these subsidies. Under the U.S. Export Enhancement Program (EEP) exporters receive cash payments that allow them to sell at prices below the cost of acquisition. Other U.S. programs support farmers through loan deficiency payments, counter-cyclical payments, marketing loan gains, crop insurance programs, and direct payments. In the U.S., most of this support goes to five crops: corn, soybeans, cotton, wheat, and rice. By contrast, European Union support is often directed towards the exports of processed products such as wheat flour and pasta.

In contrast to what one might expect under well-designed strategic trade policy, U.S. export subsidies have been far more sensitive to domestic budget constraints and the volatility of world wheat prices than to foreign subsidy programs. The EEP, for example, reflects the competing interests of U.S. farm constituents, Congress, and the executive branch, and is consequently ad hoc in its design (Busch, 1999). A number of studies suggest that such policies are more about complementing domestic farm program objectives than maximizing national welfare under the guise of strategic trade policy. For example, Alston, Carter, and Smith (1993) argue that export subsidies are used because they reduce the budgetary costs of price support programs.

Leathers (2001) builds on their work by evaluating this argument in conjunction with a strategic-trade rationale for export subsidies. He does not follow the two-stage 'rent-shifting' framework of Brander and Spencer, but models two countries (the United States and European Union) as operating

competing export subsidy programs. The central premise is that export subsidies serve to reduce the government's cost of agricultural price supports. In turn, a government might use the subsidies to intimidate the other exporter into curbing its subsidy program. Agricultural output is fixed in each country, and producer price and output is the same under all circumstances. The game has one stage in which government picks an optimal export subsidy given that farm level prices are supported at a pre-determined level. Producer surplus is fixed beforehand and not considered. The government planner weighs consumer surplus against government payments for farm support and expenditures on export subsidies. There is a tension between government spending and non-government surplus.

Leathers (p. 213) shows that in a consistent conjectures game, under certain conditions export subsidies can be justified by the model since they encourage a reduction in the competitor's subsidy level. However, when parameters are calibrated such that the model replicates known criteria, this justification for export subsidies no longer holds. The model's remaining rationale for export subsidies is to minimize the costs of price support policies.

A strength of Leathers' approach is that strategic interventions can be availed by more than one government at a time. This is a step that the broader strategic trade literature has generally failed to take. On the down side, firm-level responses to changing levels of government pre-commitment are not considered, as output choices are fixed beforehand. The rent-shifting rationale for strategic intervention is ruled out.

The passage of the 1996 Federal Agricultural Improvement and Reform (FAIR) act effectively eliminated price supports and acreage restrictions in favor of direct income payments. The continuation of EEP might seem to invalidate the idea that it exists to reduce government costs. Leathers argues that the EEP program is merely kept 'on the books' and can be brought back should price supports recur. It is noted, however, that EEP's supporters argue along strategic lines, contending that abandonment of the program would constitute a 'disarmament' in the global 'battle' for market share. In turn, the U.S. and European Union have considerable market power, and since it resides among a few firms, policy-setting necessarily incorporates strategic deliberations (Abbott and Kallio, 1996).

7.2 State Trading Enterprises

The literature on state-trading enterprises (STEs) is growing since they have become quite common in international agricultural markets and are a potential vehicle for strategic interactions. GATT Article XVII is the main body discussing the conditions under which STEs are allowed to operate. Although this article requires that STEs maintain a degree of transparency concerning their operations,

little is known about the nature of their operations relative to programs such as the EEP.

Hamilton and Stiegert (2002) and Dong, Marsh, and Stiegert (2006) argue that STEs fit the plausibility requirements associated with strategic trade theory in several ways. The former examines the Canadian Wheat Board (CWB) in the international durum market; the latter examines the CWB and Australian Barley Board (ABB) in the malting barley market.

Recall that a market must meet a number of criteria for strategic trade theory to apply. One condition is an imperfectly competitive market characterized by a small number of players. Hamilton and Stiegert (2002) observe that the CWB controls 40-60% of the world durum market and is the only STE in operation. In turn, the CWB and ABB are the two major players in the global malting barley market (Dong, Marsh, and Stiegert, 2006). Time-series studies of international grain prices are broadly consistent with some form of STE leadership in these markets (e.g., Goodwin and Schroeder, 1991).

Another sign of strategic trade activity is a unilateral pre-commitment by a government. This criterion is met in the durum and malting barley markets as producers in Canada and Australia receive an initial payment substantially below the market price. This can be viewed as a mechanism for attaining a Stackelberg leadership position. The delayed payment system is completed with a lump-sum final payment.

Another consideration is that STEs maintain legal and exclusive control over the instruments of strategic trade and the quantity traded. This gives them an advantage over independent firms, which may also have strategic delegation issues and asymmetric information problems. Markets with STEs are also fairly transparent, which facilitates the sending of signals to rivals, and thus Brander-Spencer-type interventions. As government agencies, the CWB and the ABB are partially insulated from many of the typical political economy issues facing a national government. They also have a great deal of autonomy in setting initial prices, bargaining in export markets, and managing storage and carryover decisions. Indeed, if a government were interested in providing strategic international advantage, using an STE such as the CWB could be, in many ways, the best of all possible structures.

Optimal rent shifting by the CWB in Hamilton and Stiegert (2002) is empirically modeled with an isoelastic demand equation and estimated conjectural variation parameters. Based on 1971-1995 data on the durum wheat market, actual pre-commitment payments are not statistically different from optimal pre-commitment payments in 77% of the sample years in which a positive payment is observed. This is consistent with active strategic trade intervention in durum wheat markets.

In contrast, no such evidence arises in the international malting barley market according to Dong, Marsh and Stiegert (2006). This market is different in that it has two important STEs (the ABB and CWB) and product homogeneity is less evident. As a result, the authors incorporate product differentiation and pre-commitment by both nations in their test for strategic trade interventions. Based on a bootstrapped estimation of a Bayesian system of reaction functions, the authors find that actual pre-commitment payments are below optimal levels. In essence, the prepayment system does not effectively function to shift rent, and strategic trade policies – if there are any – are not optimal. A likely reason is that malting barley is relatively differentiated and the STEs may be focused on building niche markets as a source of market power. Once properly differentiated, premiums can be extracted from the world market irrespective of the prepayment system. The existence of two functioning STEs, both with a below-market prepayment system, may preclude the development of effective strategic trade policy.

Taken together, these studies would seem to confirm the conclusion of the theoretical literature that optimal intervention is sensitive to the specifics of the market. While the world durum market shows signs of effective strategic trade interventions, the malting barley market does not. The former is a very special case of a single STE controlling 50% of a market for a fairly homogenous product. The malting barley market, by contrast, is less concentrated and has more product differentiation. The pre-commitment mechanism that shifts rent in the homogeneous-product duopoly setting fails to do so in the differentiated-product market having less concentration. On some levels these findings reflect the fragility of results that Eaton and Grossman (1986) uncover when re-examining Brander and Spencer's (1985) results.

8. Conclusions and Avenues for Future Research

Economists tend to discourage the practical application of strategic trade theory due to information constraints and the dynamic, retaliatory nature of international markets. International agreements are often written with an eye towards discouraging efforts to promote domestic firms and create 'national champions.' Nonetheless, WTO rules allow for a variety of government interventions in international markets, and many of these – including export subsidies, state-trading operations, subsidized R&D, product standards, and tax and investment policies – are potentially strategic in nature. Other interventions may be illegal but difficult to define, detect, and deter. Strategic trade theory offers a way of conceptualizing and testing for these interventions in imperfectly competitive international markets.

In this study we synthesize recent developments in the positive analysis of strategic interactions. We emphasize empirical work and divide it into three strands that parallel the development of the literature. The first involves relatively general tests of market structure and behavior in international food and agricultural markets. These studies universally find that price-cost markups are small or nonexistent in most markets. Nevertheless, these markets are typically oligopolistic in nature, with firms appearing to play a Cournot, Bertrand, or more complex game.

The second strand of the literature concerns studies that confront strategic trade models with data. These models assess the potential gains from strategic trade policy, and have a somewhat normative perspective. The general consensus of this literature is that carefully designed tariffs or subsidies can improve upon free trade in certain markets. However, no study suggests that the gains will be large. Indeed, all of the studies caution against interpreting their results as pro-interventionist.

The third strand of the literature looks for evidence of strategic trade policy in existing markets. International trade in food and agricultural products is marked by pervasive government intervention, yet it is unclear whether this is optimal in a strategic trade sense. One international market for which convincing evidence of strategic trade activity is found is the durum wheat market. It has characteristics that closely mimic the strategic trade setting envisioned by Brander and Spencer, including homogeneous products, concentrated market power, and a visible pre-commitment mechanism by a state-trading enterprise. While the malting barley market has similar characteristics, a related study finds that interventions are non-optimal for shifting rents. The difference may be explained by the malting barley market's relatively strong product differentiation and lower firm concentration. This pattern of outcomes reflects the sensitivity of results to be found in the theoretical strategic trade literature. Other studies in this literature find evidence of strategic behavior by government in industries such as airlines. The balance of evidence suggests that strategic interventions are common in international markets, although rarely optimal in the sense of shifting rents such that national welfare is actually maximized.

The demand for intervention on behalf of agricultural export interests remains strong. The GATT Uruguay Round left the door open to a large variety of export promotion mechanisms for food and agricultural export interests. The recent Doha round would have offered only moderate progress towards liberalization even if it had been successful. In this light, future research can trace out the effects of specific instances of strategic trade interventions, especially ones that are more subtle than obvious candidates such as export subsidies. For example, do interventions such as product standards and R&D subsidies serve a strategic rationale? Are interventions simply a form of protection for special interests or

do they play a role in overcoming market imperfections? Have attempts to increase market share lead to retaliation and ever lower prices for all exporters, thereby counteracting the purpose of intervention? Examination of specific forms of intervention may require taking a relatively narrow, case study approach than typically done in traditional trade research.

Future research can also address what would happen if such interventions are phased out over time, say, under new rounds of global trade negotiations. Who would be the big gainers from such reform? Consumers and taxpayers from the countries that currently maintain the policies? Other food and agricultural exporters without interventionist policies? Poor households in developing countries?

To make progress on such questions, a number of methodological issues must be confronted. A key problem is the specification of the objective function associated with strategic interventions. Should it be a social welfare function, as most academic economists are prone to specify? It may be unrealistic to assume that government is responsive to the preferences of all constituents and provides efficient policy. By contrast, government involvement is more likely to arise from interest group pressure, which may warrant a political economy approach to the study of strategic interventions.

Another key difficulty is finding a conceptually satisfying means of characterizing producer behavior that is empirically tractable. Here the challenges parallel those of the broader empirical industrial organization literature. Reaction-curve oligopoly models have well-known shortcomings yet few viable alternatives exist. Although dynamic analysis is inherently difficult, it may be worth considering recently developed numerical techniques for simulating dynamic interactions in imperfectly competitive settings, such as that of Doraszelski and Pakes (2006). This may enable a more realistic portrayal of the interactions among government, market structure, and firm behavior over time. By allowing the timing of the moves by market participants to be endogenous, for example, the dynamic effects of strategic interventions may overwhelm and overturn the static effects of such interventions. This would help in clarifying what role the government has – if any – in these markets.

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