Trade Elasticities:

The Significance of Trade Barriers, Multinationals and Market Structure

Fredoun Ahmadi-Esfahani

and

Glenn Michael Anderson

Department of Agricultural Economics
The University of Sydney
New South Wales 2006
Australia

Contributed paper presented at the 43rd Annual Conference of the Australian Agricultural and Resource Economics Society. Held at the Christchurch Convention Centre and Town Hall (20-22 January 1999). This paper stems from a project supported by the Rural Industries Research and Development Corporation.

Trade Elasticities:

The Significance of Trade Barriers, Multinationals and Market Structure

Fredoun Ahmadi-Esfahani and Glenn Michael Anderson

The elasticity of price transmission measures the extent to which a change in world prices will be transmitted to an importing country, with an elasticity of less than one being attributed to trade barriers. Recent research highlights the role that multinational trading companies may play in impeding price transmission. Further, in markets characterised by monopolistic competition an estimate of the partial elasticity of demand may be of limited practical value if no account is taken of the reaction of competitors. In this paper the potential for market structure to affect price transmission and trade elasticities is demonstrated. The elasticity of price transmission has been central to a revised approach to estimation of trade elasticities and has been used to measure the impact of endogenous trade policy. The presumption that only government intervention can impact upon price transmission is challenged with examples demonstrating why theory would suggest otherwise. While we review some recent evidence of imperfect markets, a full assessment of the empirical significance is left to future research. The paper is part of on-going research into the impact of multinationals on Australia's trade performance and is intended to motivate further research into the impact of imperfect competition on trade elasticities. The ultimate goal is to provide policymakers with more reliable estimates of trade elasticities.

Keywords: elasticity, price transmission, trade barriers, monopolistic competition.

1. Introduction

The elasticity of export demand is defined as the percentage change in demand for a country's exports in response to a one percentage change in its border price. In a general equilibrium framework export demand will depend upon the supply and demand conditions abroad which in turn depend on the preferences, technology and endowments of these countries. In a trade model in which producers sell directly to consumers, markets clear in each period (that is, the absence of stock adjustment) and changes in the world price are fully transmitted to each of the importing markets, the elasticity of demand for exports from a country such as Australia could be written as the weighted sum of elasticities of net import demands for the (homogeneous) good:

$$E_{Xa} \equiv \sum_{k \neq a} \left(E_{Dk} \frac{Q_{Dk}}{Q_{Xa}} - E_{Sk} \frac{Q_{Sk}}{Q_{Xa}} \right) \tag{1}$$

where E_{Xa} = elasticity of Australian export demand,

E_{Dk} = elasticity of demand in country *k*,

E_{Sk} = elasticity of supply in country *k*,

Q_{Dk} = level of demand in country *k*,

Q_{Sk} = level of supply in country *k*, and

Q_{Xk} = level of Australian exports.

A number of approaches to the estimation of export demand elasticities have been identified by Gardiner and Dixit (1986) including the "synthetic method" and the "direct approach" to estimation. The synthetic method involves estimating the producer and consumer elasticities and substituting these into equation (1)— or equation (2) below—in order to derive the elasticity of export demand for the country concern. Within the same framework, the more pragmatic Delphi technique draws on previous studies and informed judgement to derive the original foreign elasticities (Abbott, 1988). Both approaches contrast with the 'direct approach' which estimates the direct response of export volumes to border price(Gardiner and Dixit, 1986).

In practice, the direct approach has yielded estimates which are consistently below those derived through the synthetic method (Gardiner and Dixit, 1986). The discrepancy has mainly been attributed to government policies which have the effect of insulating internal prices from variations in the international prices(Abbott, 1979, 1988). Governments intervene directly through such measures as variable tariffs and quotas or indirectly through state-trading agencies. When world price movements are not fully transmitted to domestic markets, the import-demand becomes less elastic, with respect to international prices, than the local consumer and producer elasticities would suggest through formula (1).

Once the assumption of perfect price transmission is dropped the more general relation between the elasticities is as follows:

(2) $$E_{Xa} \equiv \sum_{k \neq a} \left(E^{D}_{Pk} E_{Dk} \frac{Q_{Dk}}{Q_{Xa}} - E^{S}_{Pk} E_{Sk} \frac{Q_{Sk}}{Q_{Xa}} \right)$$

where E^{D}_{Pk} = elasticity of transmission for consumer price in country *k*, and

E_{Pk}^{S} = elasticity of transmission for producer price in country *k*.

The elasticity of price transmission is the response of the domestic (consumer or producer) price to a change in the Australian price and can range between zero (complete insulation) and one (perfect transmission).

The elasticity of price transmission has been at the heart of the debate over the appropriate method for estimating trade elasticities. In summarising the state of the art in so far as the estimation of trade elasticities is concerned Abbott (1988) wrote: "Unfortunately, our state of knowledge on U.S. agricultural export demand elasticities is poor for most commodities. There is wide variability in estimates of these parameters. A variety of methods have been proposed to estimate these parameters. Differing methods have yielded substantially different results, however."(p4)

Abbott's comment reflects the concerns of Gardiner and Dixit (1986) who report numerous inconsistencies in estimated trade elasticities. For instance, the long run export demand elasticities for US wheat ranged between 0.23 and 5.00. An estimate for total coarse grains was found to be 1.5 which was irreconcilable with an estimate of 0.5 for corn which accounted for the bulk of grain exports. The elasticity of price transmission has also been an important measure of endogenous (that is, price-responsive) trade policy. (Abbott, 1978, 1988; Sullivan, 1989; Anderson and Tyers, 1992). Policies such as variable tariffs have been used extensively in the past to insulate domestic economies from the variability in world prices. Nevertheless, the fact that price insulation has in part been achieved through the exercise of state-sanctioned market power poses an issue which has not been adequately addressed: the impact of imperfect markets upon price transmission. Will private trading companies, exporters or importers, with a degree of market power, find it profitable to take actions which effectively insulate a local economy from international price movements?

After reviewing the evidence for the impact of market structure on trade elasticities (section 2), we examine the impact market structure may have on price transmission (section 3). We conclude with a call for empirical research into the relative importance of market structure for

price transmission not just for its importance for the formulation of exporting strategy, but also in the assessment of the welfare implications of trade reforms.

2. Imperfect Markets and the Interpretation of Imperfect Price Transmission

To date, most of empirical studies and welfare assessments have operated on the premise that there is only one significant source of price insulation; namely, endogenous trade policy. In this and the next section we consider whether imperfect competition can be associated with price insulation and the extent to which this is likely to be a significant problem.

In principle there can be three general reasons why a country's domestic prices may not reflect variability in international prices: trade policy, segmented markets and natural barriers to price transmission (Sinclair, 1989). Further, even under perfect competition and no government intervention, there is no reason to expect a price transmission elasticity of unity if the marketing channel involves significant processing and if there is some degree of substitution in production (Gardner, 1975).

Not all trade policies have a price-insulation component. An *ad valorem* tariff will permit full transmission while variable levies, specific tariffs and quotas will inhibit price transmission. Market insulation requires the nominal rate of protection to change when international prices change (Abbott 1979; Anderson, 1986); hence the term *endogenous* trade policy. Natural barriers can include geographical and cultural barriers. Nepal and inland China provide examples where geography inhibits price transmission (Sinclair, 1989). The strength of traditional ties among Japanese distributors is considered to be a barrier to market entry for foreign companies (Czinkota and M. Kotabe, 1993). While segmented markets could be seen as either the cause or result of these factors, for our purposes, the important point is that high costs of spatial arbitrage may allow transnational companies to price discriminate between markets. In particular, transnational trading companies may dominate one market by threatening retaliatory action in markets of their rivals (Scoppola, 1993).

There has been a steady flow of studies indicating the impact of imperfect competition on trade elasticities. Apart from price-stabilisation policies, export demand elasticities have been found to be significantly influenced by product differentiation (Goddard, 1988) and the structure of international trade (Goldsbrough, 1981). Further, a number of studies indicate the importance of imperfect market structure in a number of agricultural markets. Goddard (1988) shows how

falsely assuming product homogeneity may bias estimates of a country's elasticity of export demand. She finds that in every case estimators which assume product homogeneity significantly over-estimate the country-specific export demand elasticities.

Vertical integration on an international scale can play an integral part in product differentiation. Goldsbrough (1981) finds that the estimated price elasticity of products distributed between affiliates of the one transnational company is less than for products delivered to an external, unknown importer. This supports the notion that some firms will want greater control over the distribution of their product in order to enhance product differentiation through improved delivery and services (Ethier, 1986).

A number of studies have concluded that agricultural markets are not perfectly competitive (see, for example, studies in Carter, McCalla and Staples, 1990 and Sheldon and Abbott, 1996). Recently, Mohanty, Wesley, Peterson and Kruse (1995) model and estimate price linkages between the U.S. and other exporting countries in the wheat export market. They confirm previous findings of U.S. price leadership in the wheat market. Further, they find that not only are competitors' responses asymmetric according to whether the US price rises or falls but also the nature of the asymmetry is reversed among competing exporters: "Argentina and the European Union show a greater response to falling prices than to rising prices, while the opposite is true for Canada and Australia." (p355).

The issue of growing concentration and imperfectly competitive markets is of particular importance for agriculture. The grain trade is highly concentrated. For example Cargill Ltd is reported to control 25 percent of the international grains trade (Kneen 1990; Scoppolla, 1993) while the operation of state and private trading companies within the Asian markets has been identified as a major barrier to market penetration of the processed food market (Loyd, 1982; McCalla and Schmitz, 1982; United Nations 1984). With liberalisation, it has also been suggested that state influence in the distributional channels will be replaced by the influence of a few large transnationals (Dholakia and Hayashida, 1993). This raises the prospect that at least some of the anticipated gains from trade liberalisation may soon be lost to transnational trading companies with market power over producers or consumers.

The issues raised return us to our primary concern: the interpretation of imperfect price transmission. Algebraically, the price transmission elasticity can be derived from the price

elasticities of two key marketing margins as well as the nominal rate of protection (see (3), below).

$$\tau_t = \left(1+\varepsilon_t^{\alpha}\right)\left(1+\varepsilon_t^{\rho}\right)\left(1+\varepsilon_t^{\beta}\right) \tag{3}$$

The price elasticity of the nominal rate of protection, ε_t^{ρ}, is defined as the elasticity of landed price with respect to import price. In principle, $\left(1+\varepsilon_t^{\rho}\right)$is the appropriate measure government intervention in the form of variable tariffs or quotas. However, most studies of international price transmission appear to use export border price (for example, Tyers and Anderson, 1992) which implicitly assumes the marketing margin between border prices is fixed.

However, the transmission of export price changes to import prices will depend on the elasticity of international market margins, ε_t^{α}. This reflects transport costs, insurance as well as quality differences (for example, due to services rendered by the transporting company). Further, the transmission of landed price to domestic (consumer or producer) prices will depend on domestic marketing margins and how they respond to landed prices, ε_t^{β}.

From (3) it is evident that imperfect price transmission may result from 'endogenous' marketing margins as well as endogenous trade policy. Under the assumptions of fixed proportions in production, the only source of imperfect price transmission under competitive markets will be government intervention (Gardner, 1975). In the next section we ask whether market structure can significantly influence price transmission.

3. Imperfect Competition as a Source of Imperfect Price Transmission

Why would firms themselves effectively choose to insulate a country or region from international price movements? Four sources of price-insulation, each of which presumes some degree of monopoly power, are suggested below.

First, we may compare price transmission under two assumptions: perfect competition and monopoly. In the later case we assume the company imports the good at the international price, *q*, and distributes the good at the domestic price, *P*. The functions for demand and marginal cost are assumed to take the following forms:

Demand $P = a - bX$

Supply $MC = q + dX$

After solving for price under perfect competition and monopoly, we can derive the respective elasticities of price transmission:

Transmission elasticity with competitive markets: $\frac{bq}{ad + bq}$

Transmission elasticity under monopoly: $\frac{bq}{ab + ad + bq}$

The elasticity of price transmission will be less under monopoly than perfect competition unless demand is infinitely elastic (that is, b=0).

Time may play a significant role particularly for transport companies with high fixed costs and low variable costs. Short-run capacity constraints, along with high entry costs, can be an inducement for firms involved in storage and handling to smooth volumes over time according to normal capacity. This may be achieved through a variable profit margin or rationing. In either case international price variability would not be fully transmitted to the domestic market. The effect is analogous to a state-trading agency charged with the responsibility of stabilising domestic prices. In the former case, however, the barrier to market entry would be the high entry costs relative to the market and not government regulation.

Perhaps, a more interesting way in which time may enter is through storage. A trading company with monopoly power will generally have an incentive to smooth sales over time if storage costs are not too high. This is illustrated below with the help of Figure 1. There are two marginal cost curves representing marginal cost for two consecutive periods (that is, MC_1 and MC_2,). The slope of each marginal cost curve is determined by the cost of marketing and distributing the imported good. The international price of the good determines the intercept (that is, q_1 and q_2 respectively).

As we have shown algebraically above, even if the firm is constrained to maximise profits in every period without any carry-over of the export good, price transmission is reduced. In this

case, with a rise in the price of the export from q_1 to q_2, monopoly price rises from p_1 to p_2 (Fig. 1). However, there is an opportunity to profit further from storage.

Assume two periods. In the first period the price of the import is q_1 and in the second period the price is q_2. Further, constrain the firm's planning horizon so that total sales over both periods are equal to total output over the two periods:

(4) $$x_1 + x_2 = y_1 + y_2$$

Three more equations are derived from the conditions for intertemporal profit maximisation. Namely,

(5) $MC_1=MC_2=MR_1=MR_2$.

Figure 1: Imperfect Price Transmission under Monopoly

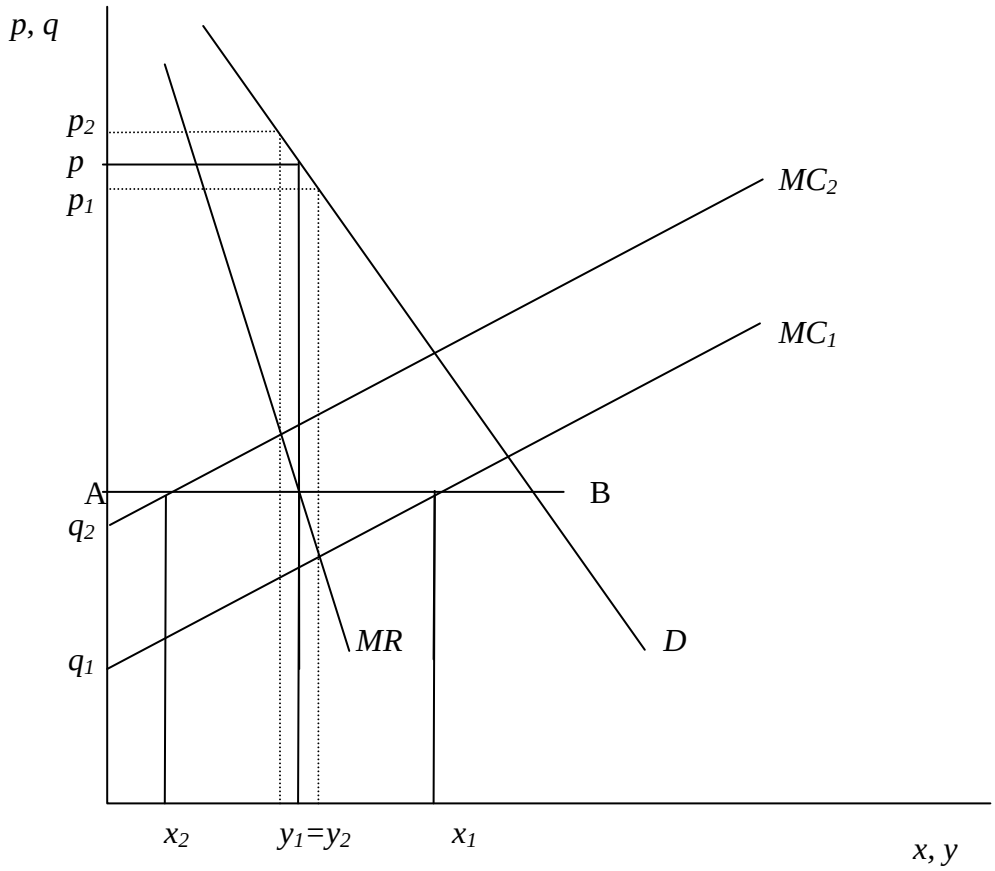
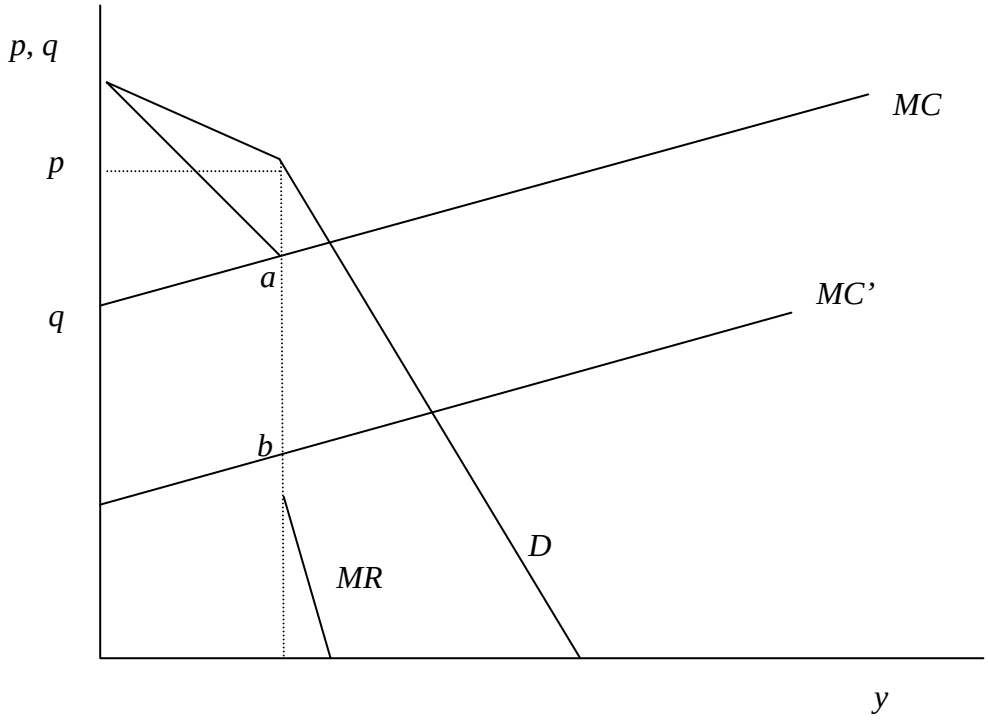


Figure 2: Imperfect Price Transmission under Monopolistic Competition



Since none of the parameters for the demand equation has changed, equating marginal revenue over both periods implies equating sales over both periods (that is, $y_1=y_2$ and the price at which the good is sold is p). Graphically (Fig. 1), the solution must be where the points of intersection between a horizontal line (AB) and the marginal cost curves are of equal distance from the intersection of AB with the marginal revenue curve. Using the linear demand and supply equations above, the solution is as follows:

(6a) $$x_1 - y_1 = y_2 - x_2 = \frac{q_2 - q_1}{2d}$$

(6b) $$y_2 = y_1 = \frac{2a - (q_1 + q_2)}{2(d + 2b)}$$

(6c) $$p_2 = p_1 = \frac{2a(d + b) - b(q_1 + q_2)}{2(d + 2b)}$$

The profit-maximising firm will maintain local prices at the same level despite movements in the international price. The firm's market power allows it to buy low and sell high. An extended analysis would need to take into account fluctuations in demand (Young and Schmitz, 1984) and the costs of storage (Williams and Wright, 1991) . In particular, in periods of relatively high interest rates, price transmission (and therefore local price variability) would tend to be higher than for extended periods of comparatively low interest rates.

The familiar case of monopolistic competition provides another illustration of how imperfect competition may affect price transmission (Fig. 2). If the number of firms is small enough to allow any one firm to have a perceptible impact on the revenues of others, then firms will need to formulate a pricing strategy. For instance, each firm may want to protect market share in response to price reductions by a rival, while not responding to any rise in a rival's price. As illustrated below (Fig. 2) this leads to a situation in which the local price may be constant for wide variations in the international price. If initially, the price of the export is q and the price at which it is resold is p, then a fall in price of the export by more than the distance ab (in Fig. 2) is required before the trading company has an incentive to pass on to the change to consumers. It is not unreasonable to expect large variations in the international price of a good distributed

through highly concentrated marketing channels *not* to be accompanied by similar variations in the domestic market.

To conclude, endogenous trade policy may not be the only significant force impeding price transmission. Monopolistic competition in market channels, may prevent domestic prices from fully responding to world price movements.

4. Concluding Remarks

An important step in estimating reliable export demand elasticities and assessing the impact of trade reform will be the consideration of market structure as alternative source of imperfect price transmission. The conclusions of this paper add weight to the use of the synthetic method to derive export elasticities, given the fluctuating state of competition as well as government policy. Further, a more accurate assessment of the welfare implications of trade reform may arise out of an empirical analysis of the impact of market structure on price transmission.

Recent studies have emphasised that the benefits of trade liberalisation are not unambiguous when market structure is taken into account (McCorriston and Sheldon, 1996). There is no reason why trade reform should necessarily lead to more competitive markets (Hwang and Mai, 1992), while the possibility of market power shifting from governments to private trading companies requires serious attention. The issue will be of increasing importance as more countries proceed down the path of trade liberalisation.

Therefore, there is a need to quantify the relationship between prices at different stages of the distribution channel and determine the extent to which market structure and trade policy explain price transmission differentials across industries, sectors or even countries. This paper has been an attempt to canvass some of the theoretical issues and highlight the need for a more thorough investigation into the sources of imperfect price transmission.

References

Abbott, P.C. 1979, 'Modelling international grain trade with government controlled markets', *American Journal of Agricultural Economics*, 61, pp22-31.

Abbott, P.C. 1988, 'Estimating U.S. Agricultural Export Demand Elasticities: Econometric and Economic Issues' in C. A. Carter and W.H. Gardiner *Elasticities in International Trade*, Boulder & London: Westfield Press.

Anderson, K. 1986, 'Economic growth, structural change and the political economy of protection' in K. Anderson and Y. Hayami, eds. *The Political Economy of Agricultural Protection: East Asia in International Perspective* Sydney: Allen & Unwin, 1986.

Carter, C.A., McCalla, A.F. and Sharples, J.A. 1990, *Imperfect Competition and Political Economy: the New Trade Theory in Agricultural Trade Research* Boulder, Colorado: Westview Press.

Czinkota, M.R. and Kotabe, M. 1993, 'Distribution and trade relations between the United States and Japan: an overview and assessment' in M.R. Czinkota and M. Kotabe eds. 1993, *The Japanese Distribution System*, Chicago:Probus Publishing Company.

Dholakia, N. and Hayashida, H. 1993, 'Structural issues in an import-intensive channel: the case of fish distribution in Japan' in M.R. Czinkota and M. Kotabe eds. 1993, *The Japanese Distribution System*, Chicago:Probus Publishing Company.

Ethier, W. J. 1986, 'The multinational firm' *Quarterly Journal of Economics*, pp805-33.

Gardiner, W.H. and Dixit, P.M. 1986, 'Price elasticity f export demand: concepts and estimates', *ERS Staff Report*, No. AGES860408, Economic Research Service, U.S. Department of Agriculture.

Gardner, B. 1975, 'The farm-retail price spread in a competitive food industry' *Journal of the American Statistical Association*, Vol. 70, pp399-409.

Goddard, E. 1988, 'Export demand elasticity in the world market for beef' in C.A. Carter and W.H. Gardiner eds. *Elasticities in International Agricultural Trade*. Boulder & London: Westfield.

Goldsbrough, D. 1981, 'International trade of multinational corporations and its responsiveness to changes in aggregate demand and relative prices' *IMF Papers*.

Hwang, H. and Mai, C.C. 1988, "On the equivalence of tariffs and quotas under duopoly" *Journal of International Economics*, Vol. 24, pp273-380.

Kneen, B. 1990, *Trading Up: How Cargill, the World's Largest Grain Trading Company, Is Changing Canadian Agriculture*, Toronto: NC Press Ltd.

Lloyd, P.J. 1982, 'State trading and the theory of international trade' in M.M. Kostecki (ed.) 1982, *State Trading in International Markets: Theory and Practice of Industrialised and Developing Countries*, London: Macmillan.

McCalla, A.F. and Schmitz, A. 1982, 'State trading in grain' in Kostecki, M.M. (ed.) 1982, State trading in International Markets: Theory and Practice of Industrialized and Developing Countries, London: Macmillan.

McCorriston, S. and Sheldon, I.M. 1996, "Changes in firm behaviour and alternative trade policy instruments" in I. M. Sheldon and P.C. Abbott 1996 *Industrial Organization and Trade in the Food Industries* Boulder, Colo. : Westview Press.

Menon, J. 1996, *Exchange Rate and Prices*: *The Case of Australian Manufactured Imports* Berlin, Heidelberg, New York: Springer-Verlag.

Mohanty, M., Wesley, E., Peterson, F. and Kruse, N.C. 1995, 'Price asymmetry in the international wheat market' *Canadian Journal of Agricultural Economics*, Vol. 43, pp355-66.

Scoppola, M. 1993, 'Trade policies and the strategies of multinationals in the international grain market', *Agribusiness*, Vol. 9, pp189-204.

Sheldon, I..M and Abbott, P.C. 1996, *Industrial Organization and Trade in the Food Industries*, Boulder Colorado: Westfield Press.

Sinclair, T. 1989, 'Introduction' in *Food Price Policy in Asia: A comparative study*, Ithaca and London: Cornell University Press.

Sullivan, J. 1990, 'Price transmission elasticities in the trade liberalization database', US Department of Agriculture, ERS Staff Report AGES 9034, Washington DC.

Tyers, R. and Anderson., K. 1992, *Disarray in World Food Markets: A Qualitative Assessment*, Cambridge University Press.

United Nations 1985, Transnational Trading Corporations in Selected Asian and Pacific Countries, USCAP/UNCTC Publication Series No.6.

Williams, J.C. and Wright, B.D. 1991, Storage and Commodity Markets Cambridge, UK ; New York : Cambridge University Press.

Young, L. and Schmitz, A. 1984, ‘Storage under a Carter’ in G.C. Storey, A. Schmitz and A.H. Sarris, 1984 eds., International Agricultural Trade, Boulder and London: Westfield Press.