Estimation of trade elasticities in the presence of trade barriers, multinationals and imperfect competition

Fredoun Z. Ahmadi-Esfahani†

Recent research highlights the role that multinational trading companies may play in impeding price transmission. In markets characterised by imperfect 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, we demonstrate the potential for market structure to affect price transmission and trade elasticities, and challenge the presumption that only government intervention can impact upon price transmission, with examples supporting why theory would suggest otherwise.

Key words: elasticity of price transmission, imperfect competition, trade barriers, transnational companies.

1. Estimation issues

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 the 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 presented as the weighted sum of elasticities of net import demands for the (homogeneous) good:

\[ E_{Xa} = \sum_{k \neq a} \left( E_{Dk} \frac{Q_{Dk}}{Q_{Xa}} - E_{Sk} \frac{Q_{Sk}}{Q_{Xa}} \right), \]  

(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 \( Q_{Xa} \) = level of Australian exports.

† Fredoun Z. Ahmadi-Esfahani (email: f.ahmadi-esfahani@usyd.edu.au), Agricultural and Resource Economics, University of Sydney, New South Wales, Australia.
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 concerned. 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 that are consistently below those derived through the synthetic method (Gardiner and Dixit 1986). The discrepancy has largely 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 Equation (1).

Once the assumption of perfect price transmission is dropped, the more general relation between the elasticities takes the following form:

\[
E_{Xa} = \sum_{k \neq a} \left( E^D_{Pk} E^D_{Dk} \frac{Q_{Dk}}{Q_{Xa}} - E^S_{Pk} E^S_{Sk} \frac{Q_{Sk}}{Q_{Xa}} \right), \tag{2}
\]

where \( E^D_{Pk} \) = elasticity of transmission for consumer price in country \( k \) and \( E^S_{Pk} \) = 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). This 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, p.54) suggests: ‘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’.

Abbott’s observation reflects the concerns of Gardiner and Dixit (1986) who reports 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 1979, 1988; Sullivan 1990; Tyers and Anderson 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 briefly reviewing the evidence (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 significance 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 reform.

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 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 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 among markets. In particular, transnational trading companies may dominate one market by threatening retaliatory action in markets of their rivals (Scoppola 1993).

Vertical integration on an international scale plays an integral part in product differentiation. Goldsborough (1981) finds that the estimated price
elasticity of products distributed among 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). The operation of state and private trading companies within the Asian markets, for example, has been identified as a major barrier to market penetration of the processed food market (Lloyd 1982; McCalla and Schmitz 1982; United Nations 1985). 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 be lost to transnational trading companies with market power over producers or consumers.

These issues pose concern about 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:

$$\tau_t = (1 + e_{at}^p)(1 + e_{bt}^p)(1 + e_{ct}^p).$$ (3)

The price elasticity of the nominal rate of protection $e_{ct}^p$ is defined as the elasticity of landed price with respect to import price. In principle, $(1 + e_{ct}^p)$ is the appropriate measure for 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 that 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 marketing margins $e_{at}^p$. This reflects transport costs, insurance and 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 $e_{bt}^p$.

From Equation (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).

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? Several sources of price insu-
lation, each of which presumes some degree of monopoly power, are sug-
ggested below.

We may compare price transmission under two assumptions: perfect com-
petition and monopoly. In the latter case, we assume that 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: \( \frac{bq}{ad+aq} \)

Transmission elasticity under monopoly: \( \frac{ab-aq}{ad+aq} \)

The elasticity of price transmission will be less under monopoly than per-
fect 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 con-
straints, 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 mar-
gin 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 domes-
tic prices. In the former case, however, the barrier to market entry
would be the high entry costs relative to the market and not govern-
ment 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. 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
export price a monopoly price will emerge. 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 \( q_2 \). Furthermore, constrain the firm’s planning
horizon so that total sales over both periods are equal to total output over
the two periods:

\[ x_1 + x_2 = y_1 + y_2. \quad (4) \]

Three more equations are derived from the conditions for intertemporal
profit maximisation; namely:
As 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 \( p \)). Using the linear demand and supply equations, the solution is as follows:

\[
x_1 - y_1 = y_2 - x_2 = \frac{q_2 - q_1}{2d}
\]

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

\[
p_2 = p_1 = \frac{2a(d + b) - b(q_1 + q_2)}{2(d + 2b)}.
\]

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. If the number of firms is sufficiently small 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. This leads to a situation in which the local price may be constant for wide variations in the international price. 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.

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

4. Conclusion

The single most important conclusion emerging from this analysis is that the relationship among different stages of the distribution channel needs to be quantified in order to rigorously determine the extent to which market struc-
ture and trade policy explain price transmission differentials across industries, sectors and countries. An attempt was made here to canvass some of the theoretical issues and highlight the need for a more thorough investigation into the sources of imperfect price transmission. A significant step in empirical estimation of reliable export demand elasticities and assessing the impact of trade reform is the consideration of market structure as an alternative source of imperfect price transmission. The findings of this paper add weight to the use of the synthetic method to derive these elasticities. There is no reason why trade reform should necessarily lead to more competitive markets, while market power is shifting from governments to transnational companies. This finding will be of increasing importance as more countries proceed down the path of trade liberalisation.

References


