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Elasticity of Export Demand for Australian Sugar: Accounting for Regional and Seasonal Effects

by

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ABSTRACT

The elasticity of export demand for Australian sugar is an important measure for devising sugar export marketing strategies and considering the impact of various policies on the industry. Updated and more explicit elasticities of export demand for Australian sugar are reported in this paper. The elasticities are calculated using an adaptation of the formula approach published by Cronin (1979). Initially elasticities are reported for Australia without accounting for regional and seasonal effects. These effects are then introduced and the consequences for the revised elasticities analysed. The importance of export market share by region and season is emphasised. Comparisons of the elasticities with other studies highlight the value of the formula approach to deriving export demand elasticities.

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Introduction

Australia's sugar industry is strongly export-oriented. More than 80 percent of the output of the industry is sold abroad. As a consequence, understanding the nature of export demand for Australian sugar is vital for export marketing and policy analysis concerning the industry. In a recent review of the industry, the public interest in retaining single-desk selling in the export market was assessed. This depended critically on the estimates of elasticities of export demand employed in such analysis.

In this paper a method of deriving export demand elasticities drawing on Cronin (1979) is developed and extended. His elegant and widely applicable model is extended to provide updated estimates of elasticities of export demand for Australian sugar. The method of this paper is focused on how regional and seasonal effects alter the export demand elasticity for Australian sugar within a selling season - a topic rarely considered in most export demand studies with annual data.

The method reported in this paper is highly complementary to econometric studies of export demand and supply. However, econometric estimates of export demand have their pitfalls and alternative methods of deriving important policy parameters (and cross-checking the econometric findings) are needed (Thursby and Thursby 1988; Abbott 1988). This paper provides a comparatively simple method of deriving export demand elasticities (and other trade demand and supply elasticities) which potentially has wide application in trade and policy analysis.

The Nature of the World Sugar Market

Numerous authors have documented the nature of the world sugar market (Wong, Sturgiss and Borrell 1989; Thompson, McNeill and Eales 1990; Borrell, Quirke and Vincent 1991; Roberts and Whish-Wilson 1991; Hafi, Connell and Sturgiss 1993; Tyers and Anderson 1993; Landell Mills Commodities Studies 1993 and 1994). Generally, the picture emerges of a market which is imperfectly competitive, some calling the market 'corrupt'. By imperfectly competitive, it is implied that individuals or participants have sufficient market power to influence price.

For many years, internationally commodity markets have been portrayed as imperfectly competitive, see Johnson (1991), McCalla and Josling (1981 and 1985), Miller (1985), Carter, McCalla and Sharples (1990) and Tyers and Anderson (1993). The world sugar market is imperfectly competitive, because of the following:

- a comparatively low responsiveness to price in retail demand
- a comparatively low responsiveness to price in producer supply

- distorting trade and domestic policies which insulate domestic sugar markets from the world market, thus severing or weakening the links between domestic and world prices
- considerable concentration in processing and trading of sugar and sugar products
- state trading agencies and the presence of long-term price contracts
- short-run locational and logistical factors which deliver market power to key players from time-to-time

Imperfectly competitive markets can have within them well-functioning markets and systems of commodity exchange. However, there are some peculiarities with the raw sugar futures market (Thompson, McNeill and Eales 1990) and the world sugar market is dominated by some large trading houses and state trading agencies.

Locational and logistical factors are very important in affecting the nature of export demand for Australian sugar. Two important considerations are:

- Australia's sugar harvest is in the period July-December, similar to that of competing southern hemisphere sugar exporters and major producers. However, it is out of season with the main northern hemisphere sugar producers, including those of Asia, whose harvest falls mainly in the first half of the year. This implies that Australia holds a much higher share of exports of sugar to Asia in the second half of the year, than in the first six months.
- In the short run, Australia's location can offer some advantages in exporting sugar to the rapidly growing Asian markets. The main competing export suppliers of raw sugar to Asia are from Latin America and Africa during Australia's main shipping season. Since the Asian market is a net importing region from the rest of the world, Australia can capitalise on a locational advantage.

The pattern of trade in raw sugar by region and by season during 1995 is presented in Table 1. This suggests strongly that Australia has a dominant market share of the Far East export market for raw sugar during the July-December period. While the picture for sugar overall is shaped by white as well as raw sugar, Australia is the dominant supplier of sugar to the region during these months. Note also how Thailand dominates the Asian export market during the January-June period.

Deriving Export Demand Elasticities for Australian Sugar

The Cronin (1979) Formula Approach

The method for estimating export demand elasticities is taken from Cronin (1979). A feature of his paper was extending the formula for measuring export demand in the

TABLE 1
Trade in Raw Sugar Between the Far East and Western Hemisphere, January-June and July-December 1995

From	'000t	'000t	'000t	'000t
Far East	2,992	342	3,068	930
Western Hemisphere	1,496	2,272	657	2,135
TOTAL	4,498	2,614	3,725	3,065
<i>Of which:</i>				
Australia	844	267	2,296	825
Thailand	2,084	75	636	86
Fiji	54	0	125	19
Cuba	822	895	26	63
Brazil/Colombia	192	1,062	281	1,772
Southern Africa	0	0	270	93

Source: C. Czarnikow Sugar and ISO (1995).

Note: This excludes the shipments from Cuba to the Former Soviet Union, shipments to fill the US quota and shipments from ACP countries.

face of imperfectly competitive markets. This included price transmission elasticities which measure the percentage change in price in one level of the market associated with a percentage change in price at another level. For markets with considerable policy intervention, the elasticities of price transmission between the domestic retail price and world prices and between the domestic producer price and the world price may be very low, or even zero. With Cronin's method, these policy distortions are accounted for in the formula approach.

The basic formula reported by Cronin (1979) for calculating export demand elasticities is presented in Appendix A, equation 1. However, there is a difficulty in directly applying Cronin's formula to calculating an export demand elasticity. That is that the elasticities of price transmission in the formula are those for the retail price in various countries relative to the Australian export price and for producer price relative to the same export price. More commonly, price transmission elasticities are calculated for various commodities and countries relative to a reference world price, as in Tyers and Anderson (1992).

This paper contains an extension of Cronin's (1979) method in Appendix A. This extension was made so that the formulae for calculating export demand elasticities contain the price transmission elasticities in their most-commonly reported form. Using the extended model, the main factors affecting export demand for Australian sugar are (Appendix A, equation 5):

- the responsiveness of farm supply of sugar to producer price in all producing countries (most countries produce either cane or beet or both)
- the responsiveness of retail demand for sugar to retail price in all sugar-consuming countries (all countries of the world)
- the elasticity of transmission of producer prices in all sugar producing countries with respect to the world price of sugar
- the elasticity of transmission of retail prices in all sugar consuming countries with respect to the world price of sugar
- the elasticity of price transmission between the Australian export price and the world price.

The Nature of Export Demand for Australian Sugar

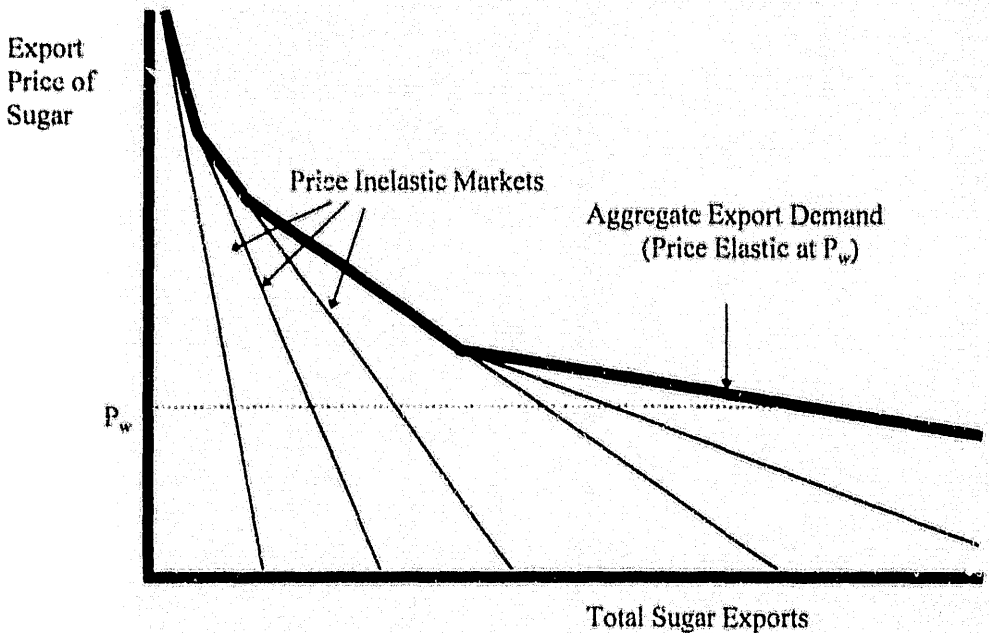
The export demand for Australia's sugar exports in aggregate is the sum of the net export demand for Australian sugar of all countries of the rest of the world. This is the sum of the net export demand of all sugar importing countries less the net export supply of all competing exporters (the negative of net export supply is net export demand). The difference between what is demanded by importers and supplied by competing exporters is net export demand for Australian sugar.

Note that export demand for Australia's sugar is influenced by shifts in demand or supply of sugar in all sugar importing countries as well as in all competing exporter countries. This occurs even when Australia is not trading sugar with the particular country where the shift occurs.

In the same way that export demand is the sum of net export demand for sugar of all countries, the elasticity of export demand for Australian sugar is the sum of all the net export demand elasticities of all countries in the rest of the world (for the detailed algebra see Appendix A). Note also that the net export demand for Australian sugar is affected by the net export supply of competing sugar exporters. The more responsive their net export supply to world prices, the more responsive will be the aggregate export demand for Australian sugar. Thus the aggregate elasticity of export demand for Australian sugar is the sum of all the individual country or region demand and supply elasticities, adjusted for the the price transmission elasticities linking domestic markets to the world and Australian export markets.

As indicated in Figure 1, some importing countries or regions may be relatively unresponsive to price, while others may be highly responsive. The Figure emphasises that the aggregate elasticity of export demand may be highly elastic with respect to the export price while for some markets the opposite is the case.

Figure 1. The Nature of Export Demand for Australian Sugar



Long-Run Elasticity of Export Demand for Australian Sugar

Initially, the long-run elasticity of export demand for Australian sugar was calculated using long-run elasticities of supply and demand for sugar for different countries. In the long-run, net stockholding demand is effectively zero and need not enter this part of the analysis. The long-run elasticities were calculated using levels of production, consumption and trade in sugar for the 1994 year. Data were drawn primarily from International Sugar Organisation sources.

Key Parameters

The elasticities of export demand calculated in this study were based on the demand and supply elasticities and the price transmission elasticities reported in Tyers and Anderson (1993) and Hafi, Connell and Sturgiss (1993). Several modifications to the elasticity parameters were made in light of known changes of sugar policy:

- The elasticity of price transmission between the producer price of sugar in the European Union and the world price was set to 0.16 on the basis of calculations done on the shares of A Quota, B Quota and C Quota sugar and assuming that only C quota sugar price moves closely with world prices. In Tyers and Anderson (1993) zero price transmission was assumed and this does not reflect reality.

- The elasticity of price transmission between the world sugar price and US domestic prices was lowered to reflect the changes to the US sugar program during the 1980s.
- For the Former Soviet Union and some developing countries, the elasticities of price transmission between domestic prices and the world price were assumed to have increased as these countries have deregulated and become more open.

A summary of the key parameters employed in calculating the elasticities is presented in Tables 2 and 3. In addition to the parameters for particular countries and regions employed in the analysis, global averages are reported. These are calculated as weighted averages of the individual parameter values, using production, consumption and trade weights as appropriate.

Results

The calculated long-run elasticity of export demand for Australian sugar for 1994 is presented in Table 4. In addition to the calculated export demand elasticity for Australian sugar, the elasticity of net import demand for each country or region with respect to the world price is reported.

The long-run elasticity of export demand for Australian sugar is calculated to be -10.3. This figure can be compared with Tyers and Anderson (1988, Table 9.1) who reported a long-run export demand elasticity of -13.3. These magnitudes imply that an increase in supply of Australian sugar exports to the world market would have little impact on the residual world price. Roughly, the above elasticity implies that if Australian export supply of sugar were to increase by 10%, the world price would decline by approximately 1%.

Although aggregate export demand for Australian sugar is price elastic, in certain markets demand for sugar imports is highly price inelastic over the long run. That is, the level of sugar imports is relatively unresponsive to the export prices offered by Australia. Countries that are calculated to be highly price inelastic include Japan, Korea, Malaysia and Canada.

Comparison with ABARE Results for the Medium Run

The findings above can be compared with results obtained by econometric analysis and reported in Hafi, Connell and Sturgiss (1993, Table 24). For example, they found that the medium run elasticity of raw sugar export supply for the world was 0.31 and that for white sugar exports was 0.83. For sugar in aggregate, the long-run export supply elasticity implied is 1.1. The import demand medium-run elasticities from the same study for the world were -0.24 and -0.01 for raw and white sugar, respectively. For sugar in aggregate, the long run import demand elasticity implied is -0.25. Thus the econometric results imply that the long run net import demand elasticity for sugar

for the world would be approximately -1.35, which is similar to the result reported in Table 4 in the second column.

TABLE 2
Short-Run and Long-Run Own-Price Elasticities Employed in the Analysis, by Country or Region

Region	Short-Run	Long-Run	Short-Run	Long-Run
Australia	.10	.50	-.09	-.18
Other Oceania	.10	.40	-.09	-.18
Japan	.10	.50	-.03	-.05
South Korea	-	-	-.40	-.80
China	.15	.88	-.75	-1.50
Taiwan	.20	.40	-.40	-.80
Thailand	.35	1.50	-.35	-.70
Malaysia	.10	.20	-.30	-.60
Philippines	.13	.68	-.70	-1.40
Indonesia	.30	.59	-.60	-1.20
India	.12	.46	-.40	-.80
Persian Gulf	.10	.32	-.25	-.50
Other Asia	.10	.20	-.50	-1.00
South Africa	.10	.30	-.30	-.60
Swaziland	.17	.30	-.30	-.60
Zimbabwe	.17	.51	-.40	-.80
Other Africa	.17	.51	-.30	-.60
FSU	.11	.21	-.40	-.80
E. Europe	.05	.08	-.40	-.80
Turkey	.10	.20	-.25	-.50
EU	.10	.50	-.07	-.14
Other W. Europe	.16	.32	-.06	-.12
USA	.07	.28	-.10	-.20
Canada	.10	.50	-.04	-.08
Mexico	.15	.45	-.43	-.85
Cuba	.13	.68	-.43	-.85
Brazil	.40	.80	-.30	-.60
C. America	.30	.59	-.30	-.60
Other America	.30	.59	-.30	-.60
Other	.23	.46	-.31	-.61
Global Average	.18	.55	-.30	-.60

Source: Tyers and Anderson (1992), Hafi, Connell and Sturgiss (1993).

Note: Several modifications to the published parameters have been made. These include elasticities for the EU, USA and FSU.

TABLE 3
*Short-Run and Long-Run Price Transmission Elasticities Employed in the Analysis,
by Country and Region*

Australia	.49	.54	.10	.20
Other Oceania	.30	.40	.25	.50
Japan	.01	.01	.05	.10
South Korea	.	.	.02	.20
China	.19	.30	.05	.20
Taiwan	.10	.20	.51	.73
Thailand	.50	.75	.02	.80
Malaysia	.10	.20	.20	.30
Philippines	.31	.41	.31	.41
Indonesia	.02	.20	.02	.20
India	.10	.20	.09	.30
Persian Gulf	.20	.40	.15	.20
Other Asia	.20	.40	.30	.40
South Africa	.30	.50	.30	.50
Swaziland	.30	.50	.15	.50
Zimbabwe	.15	.17	.15	.17
Other Africa	.15	.17	.15	.17
FSU	.05	.20	.04	.20
E. Europe	.05	.10	.04	.20
Turkey	.15	.40	.15	.50
EU	.08	.16	.05	.10
Other W. Europe	.04	.10	.05	.10
USA	.10	.20	.10	.20
Canada	.07	.25	.12	.60
Mexico	.05	.10	.05	.10
Cuba	.10	.20	.10	.20
Brazil	.24	.90	.24	.30
C.America	.07	.20	.20	.30
Other America	.07	.40	.30	.40
Other	.07	.35	.20	.31
Global Average	.15	.34	.12	.26

Source: Tyers and Anderson (1992), Hafi, Connell and Sturgiss (1993).

Note: Some elasticities have been modified to reflect more realistically recent policy.

TABLE 4
*Calculated Long-run Elasticities of Export Demand for Australian Sugar Using
 1994 Quantities*

Country or Region		
Australia	-0.336 ^{*2}	n.a.
Other Oceania	-0.021	-0.003
Japan	-0.004	-0.0006
Korea	-0.032	-0.005
China	-0.940	-0.134
Taiwan	-0.086	-0.012
Thailand	-1.284 [*]	0.184
Malaysia	-0.034	-0.005
Philippines	-0.393 [*]	0.056
Indonesia	-0.229	-0.033
India	-1.017	-0.145
Persian Gulf	-0.004	-0.0006
Other Asia	-0.327 [*]	0.047
South Africa	-0.165 [*]	0.024
Swaziland	-0.026 [*]	0.004
Zimbabwe	-0.019 [*]	0.003
Other Africa	-0.012 [*]	0.002
FSU	-0.431	-0.062
E. Europe	-0.009	-0.001
Turkey	-0.138 [*]	0.020
EU-12	-0.335 [*]	0.048
W. Europe	-0.002	-0.0003
USA	-0.169	-0.024
Canada	-0.018	-0.003
Mexico	-0.128	-0.018
Cuba	-0.153 [*]	0.022
Brazil	-2.386 [*]	0.341
Other America	-0.172 [*]	0.025
Rest of World Accounting Row	-1.729	-0.247
TOTAL	-10.3	-1.47
of which competing exporters	-4.9	0.78
of which Asian-Pacific or African	-2.0	0.29

Note:

* Denotes a country or region which was a net exporter of sugar in 1994. Based on parameters taken from Tyers and Anderson (1993) and Hafi, Connell and Sturgles (1993); derived using formula (5) of Appendix A.

¹ The individual country or regional elasticities are simply sub-totals used in calculating the overall elasticity of export demand.

² Australia's net export supply elasticity (a negative net export demand) is also reported for information purposes, but is not included in the total.

Short-Run Elasticities of Export Demand

The relevant time frame for considering export marketing strategies that can be pursued in practice is the short run. Any attempt to price without consideration of the short-run realities of the market would be disadvantageous. In the short run, two important changes occur to the elasticity of export demand:

- storage demand and supply become relevant
- locational and logistical factors become relevant.

Generally, the presence of storage demand and supply will make the short run elasticities of export demand more price responsive than without the storage options. In contrast locational and logistical factors will make export demand for sugar more inelastic for particular niches of the market.

The demand and supply of storage are likely to be responsive to price in the short run. When prices rise, the cost of stockholding will rise. Holders of stocks will seek to lower them and fewer in the market will hold stocks. When prices fall, the opposite will occur. Stock holding behaviour is more complicated than this in the short run because of potential for speculative gains and losses that arise from holding physical stocks and related potential gains and losses in futures.

Elasticities of sugar stocks demand were reported in Hafi, Connell and Sturgiss (1993, Table 30). For the world as a whole, the short run elasticity of sugar stocks demand to world price was reported to be -0.18. For particular countries, the elasticity of stocks demand was highly unresponsive to price (zero or near zero) in Singapore, Malaysia, South Korea, Japan, the United States, Eastern Europe, North Africa and the Persian Gulf. Greater responsiveness to price was reported for major sugar exporting countries and for some large producing and consuming countries, including China and the countries of the Former Soviet Union

The short-run elasticities of export demand for Australian raw sugar were calculated using the formula in Appendix A, equation 6. This included the elasticities of stocks demand with respect to the world price, which were taken from Hafi, Connell and Sturgiss (1993, Table 30). Stock levels were those reported by the ISO as ending stocks at August 1994. Short-run elasticities of supply, demand and price transmission were employed as documented in Tables 2 and 3 of this report.

The short-run elasticities of export demand were calculated on the basis of the Far East premium markets and Western Hemisphere and other Asian markets being segmented. In the calculation of short-run elasticities no competing supplier effect across the two regions was included to reflect the markets being segmented. As well, the elasticities were calculated for the two separate marketing seasons, January to June and July to December, and overall. The results are reported in Table 5.

TABLE 5
*Short Run Elasticities of Export Demand for Raw Sugar from Queensland,
 by Region and Season, with Respect to Export Price*

	January-June	July-December	Overall
Far East Premium Markets ¹	-1.4 ²	-0.4	-0.6
Western Hemisphere & other Asian Markets	-1.9	-4.3	-3.0
Overall	-3.3	-4.7	-3.6

Source: Spreadsheet Calculations.

¹ The Far East Premium Markets are: Japan, Korea, China, Taiwan, Thailand, Malaysia, Philippines and Indonesia.

² The elasticity of export demand for Queensland raw sugar is much more price responsive in January - June because Queensland's market share is low (18%).

Several points can be noted from Table 5. Firstly, the overall elasticity of export demand for the short-run is -3.6, compared to the long-run elasticity of -10.3 (in Table 4). Secondly, during January-June, the elasticity for the Far East markets differs little from that for the Western Hemisphere and other Asian markets. This is because Thailand is the dominant export supplier to the Asian premium markets during the first half of the year. Australia's share of total raw sugar exports to these markets for this period is just over 20%. In contrast Australia sells more than 70% of total exports to the premium Asian markets in the second half of the calendar year. Thirdly, a discernible difference exists between the export demand elasticities by region in the July-December period (-0.4 in Far East premium markets compared with -4.3 in the Western Hemisphere and Other Asian markets).

When competing supplier effects are added to the export demand elasticity estimates by region and by season, considerably greater responsiveness of export demand to price might be expected. The short-run elasticity under these more competitive circumstances was not calculated for this paper in the interests of brevity. Sugar is presumed to follow the logic of price determination in other commodity markets when competing supplies enter the region (Smith 1977). By segmenting markets and managing the flow of exports between markets Australia can actively shape the nature of the short-run elasticity of export demand for sugar. When regional price premiums in the Asian markets are sufficiently high to meet the extra costs of shipping supplies of sugar from more distant suppliers, notably Latin America, the short-run elasticity of export demand for Australian sugar will become much more responsive than reported in Table 5.

Conclusions

A method of calculating elasticities of export demand for a commodity has been developed and presented in this paper. The approach involved a simple extension of the formula method of deriving export demand elasticities. The method reveals considerable information about the nature of export markets and their responsiveness to price under various conditions. As well, it offers considerable scope to assess how the nature of the market is changing under different assumptions concerning policies, market share and changing responsiveness to price. It is a method which complements other tools for trade and policy analysis, including econometric analysis, and provides a useful cross-checking device. Sugar is one of many commodities whose export demand (or import supply) could be analysed using methods similar to those above.

The evidence suggests that the long-run elasticity of export demand for Australian sugar is highly price responsive in the residual and competitive world market. However, export demand for sugar appears to be price inelastic in some major sugar-importing countries, notably in the Far East. This is largely because of policies in these countries which divorce domestic sugar prices from world prices. It also arises because domestic demand for sugar and domestic supply are also relatively unresponsive to price. Australia's export demand elasticity varies considerably between market segments (regions) and by season in the short run. This raises some very interesting issues concerning export marketing and policy for Australian sugar. Marketing and policy analysis will benefit from exploring more deeply the nature of the world sugar market, especially taking account of how it operates seasonally and by region. The same probably applies to a number of other commodity markets.

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Appendix A

Deriving the Elasticity of Export Demand for Australian Sugar

Long-Run Elasticity of Export Demand

From Cronin (1979, equation 5)

$$e_{xa} = \sum_i \eta_i \phi_{ia} C_i / X_a - \sum_j \varepsilon_j \theta_{ja} S_j / X_a \quad (1)$$

- where e_{xa} is the elasticity of export demand for sugar of country a (where a denotes Australia)
 η_i is the own-price elasticity of retail demand for sugar and sugar products in country i .
 ε_j is the own-price elasticity of producer supply of sugar in country j
 ϕ_{ia} is the elasticity of the consumer (retail) price in i to the export price in a
 θ_{ja} is the elasticity of the producer (farm) price in j to the export price in a
 C_i is the consumption of sugar and sugar products in country i
 X_a is the level of net exports of sugar of country a
 S_j is the production of sugar in country j

By definition

$$\phi_{ia} = \frac{dP_i^r}{dP_a^x} \cdot \frac{P_a^x}{P_i^r} \quad (2)$$

- where P_i^r is the retail price in country i
 and P_a^x is the export price of country a .

ϕ_{ia} of equation (2) can be expanded to become

$$\phi_{ia} = \frac{dP_i^r}{dP_w} \cdot \frac{dP_w}{dP_a^x} \cdot \frac{P_a^x}{P_w} \cdot \frac{P_w}{P_i^r} \quad (3)$$

where P_w is the reference world price of sugar

$$= \frac{dP_i^r}{dP_w} \cdot \frac{P_w}{P_i^r} \cdot \frac{dP_w}{dP_a^x} \cdot \frac{P_a^x}{P_w} = \phi_{iw} \cdot \phi_{wa}$$

$$\text{Also } \theta_{ja} = \frac{dP_j^f}{dP_a^x} \cdot \frac{P_a^x}{P_j^f} \quad (4)$$

where P_j^f is the producer price in country j .

θ_{ja} of equation (4) can be expanded similarly to become

$$\begin{aligned} \theta_{ja} &= \frac{dP_j^f}{dP_w} \cdot \frac{dP_w}{dP_a^x} \cdot \frac{P_a^x}{P_w} \cdot \frac{P_w}{P_j^f} \\ &= \frac{dP_j^f}{dP_w} \cdot \frac{P_w}{P_j^f} \cdot \frac{dP_w}{dP_a^x} \cdot \frac{P_a^x}{P_w} = \theta_{jw} \cdot \theta_{wa} \end{aligned}$$

Thus the formula for the elasticity of export demand for Australian sugar is expanded into a form more compatible with the parameter estimates available, as follows:

$$e_{sa} = \sum_i \eta_i \phi_{iw} \phi_{wa} C_i / X_a - \sum_j \varepsilon_j \theta_{jw} \theta_{wa} S_j / X_a \quad (5)$$

Short-Run Elasticity of Export Demand for Australian Sugar

Using similar methods to those above, the short-run elasticity of export demand for Australian sugar is

$$e_{sa} = \sum_i \eta_i \phi_{iw} \phi_{wa} C_i / X_a - \sum_j \varepsilon_j \theta_{jw} \theta_{wa} S_j / X_a + \rho_j \theta_{wa} K_j / X_a \quad (6)$$

where ρ_j = elasticity of stocks demand in country j with respect to the reference world price

K_j = level of stocks in country j .