Market Relevance in a Small Open Distant Economy

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Abstract

Estimated Armington elasticities are shown to be a useful addition to the arsenal of tools at the disposal of competition authorities when deciding on the relevant geographic market definition to assess the exercise of market power. In South Africa, these elasticities are shown to be low in relation to developed countries, supporting the view that this economy, because of its distance from its major trading partners, has inadvertently provided domestic producers with a significant degree of protection and the ability to exercise market power and thereby increase mark-ups. The paper also shows that there is a positive relationship between the Armington elasticity and exchange rate pass-through. Exchange rate pass-through is also low in South Africa, and given the recent trade liberalization it is by no means clear what has happened to that part of the tariff reduction that has not been passed on to consumers.

Introduction

Competition analysis usually commences by defining the relevant market preparatory to assessing market power. Firms and competition authorities have to grapple with the concept of the defined market with disagreements as to its extent. Firms typically argue for the broadest definition, while the authorities tend to favour a narrower definition. The relevant market is also defined for the product, as well as geographically, with the analysis for each following a similar methodological approach.

The relevant geographical market in a small open economy which has recently experienced considerable trade liberalization, such as South Africa, raises the issue of effective competition policy. This paper addresses the problem of market definition by applying Armington elasticities to handle product differentiation, tariff and transport cost issues. This approach provides insights into why many cases that have appeared before the competition authorities have defined the relevant geographical market as national rather than international, despite the openness of the economy.

Theoretical approaches for determining the relevant geographic market

The methods used for determining the relevant geographic market are similar to those for the determination of the relevant product market. They focus mainly on the SSNIP test, namely a small but significant non-transitory increase in price or the hypothetical monopolist test.

In order to set the scene for understanding the SSNIP test in a small open economy, we need to revisit the pricing decision rules that firms apply under different market structures.

As is well known, a monopoly will apply the following rule:

$$\frac{P - MC}{P} = \frac{1}{\left|\varepsilon_f\right|} \qquad (1)$$

MC is the firm's marginal cost and P is its price. The left hand side of the equation is known as the Lerner index and equation 1 shows that the Lerner index, the measure of market power, is inversely related to the absolute value of the firm's own price elasticity of demand.

In a market where homogeneous goods are exchanged but where the monopolist, a dominant firm in reality, now faces competition "on the fringe", this firm will have to take into account the actions and responses of the fringe. In an open economy, the competitive fringe would be represented by the many exporters from other countries who supply to a small economy such as South Africa at constant prices and conditions. These exporters act as a constraint on the pricing behaviour of the monopolist firm such that the following equation can be derived:

$$\left|\varepsilon_f\right| = \frac{\left|\varepsilon_D\right| + (1-S)\varepsilon_R}{S} \qquad (2)$$

showing that the absolute value of the firm's elasticity of demand is positively related to the absolute value of the elasticity of demand in the market and the supply response on the part of the competitive fringe ε_R. In addition, the larger the dominant firm's market share, *S*, the smaller is the elasticity of demand facing the dominant firm. The derivation of equation 2 follows Kaplow and Shapiro (2007).

If this equation is translated into open economy terms, it indicates that the larger the share of imports in the composition of domestic demand, the greater is the absolute value of response of imports for a given elasticity of supply. If the elasticity of supply of imports is particularly large, much as is assumed in theoretical trade policy models for the small open economy, the greater the disciplining effect of imports. In these models, the elasticity of supply of imports is assumed to be infinite and therefore acts as a complete restraint on the exercise of market power. Referring to equation 2, the elasticity of demand for the dominant firm goes to infinity in the limit. As the South African economy has been dogged by dominant firms, there is the view that this model is a good reflection of the behaviour of such firms facing import competition[1].

Given that the model is developed for homogeneous products, the introduction of differentiated products is worthy of investigation. Putting the model into its open economy context, and assuming Bertrand type competition with differentiated products, equation 3 shows the markup for each firm such that,

$$\frac{P_i - MC_i}{P_i} = \frac{1}{\left|\varepsilon_i\right|} \qquad (3)$$

[1] See Holden (2005) for a discussion of the behaviour of such firms in their applications for antidumping duties

The Bertrand equilibrium is described as a Nash equilibrium whereby firms endeavour to set their prices simultaneously.

Assuming a two-firm model, one domestic and the other international, and symmetric marginal costs in a symmetric Bertrand equilibrium, it can be shown that the Bertrand price for each firm is equalized at,

$$P_B = \frac{A + MC}{2 - \alpha} \qquad (4)$$

where A is a constant term in the two demand equations, and α is what is termed the diversion ratio (Kaplow and Shaplow, 2007). The diversion ratio measures the extent to which each firm loses sales when price is increased under the assumption that the other firm keeps price constant. The more substitutable the two products are for each other, the greater is the diversion ratio, and the greater the impact on the Bertrand price in reducing it to a level closer to the more competitive level. Similarly, the lower the diversion ratio, the closer is the outcome to the monopoly price. The diversion ratio therefore measures the degree of substitutability between the two goods, domestic production and the imported product.

To express the diversion ratio in elasticity form, the diversion ratio is defined as follows:

$$\alpha_{ji} = (dX_j / dP_i) / (-dX_i / dP_i) \qquad (5)$$

This expression can be converted into elasticities such that,

$$\alpha_{ji} = \frac{\varepsilon_{ji}}{|\varepsilon_i|} \frac{X_j}{X_i} \qquad (6)$$

and

$$\varepsilon_{ji} = \frac{dX_j}{dP_i} \frac{P_i}{X_j} \qquad (7)$$

which represents the cross elasticity of product *i* with respect to the product *j*.

The details of these derivations can be found in Kaplow and Shapiro (2007). From the perspective of this paper and what follows, it noteworthy that the exercise of market power between the domestic market is limited by the degree of substitutability between imports and domestic production.

Tests for the determination of the relevant geographic market

Having established the theoretical underpinning for the determination of the relevant geographic market, the next task is to examine the usual approaches used by competition authorities.

(1) The SSNIP test

SSNIP test, an acronym for a small, significant, non-transitory increase in prices, is used to examine whether the two products, imports and domestic production, belong in the same geographic market. If the price of domestic production is increased by between 5 to 10 percent, and imports substitute for this production capturing market share in the domestic market and reducing domestic profitability, both products would be included in the same geographic market. This shows that imports act as a constraint on the behaviour of domestic producers.

When implementing the SSNIP test in defining a particular market, own price elasticity, cross price elasticities, price correlations and price differences are typically used (Motta, 2004). In the determination of the relevant geographic market in addition to these price tests other information is also considered.

Unfortunately, the SSNIP test alone is insufficient when defining markets and can lead to too broad a definition. The well-known "Cellophane Fallacy" could be operating. For example, in the case of a dominant exporting firm domestic price may

be set at such a high level that domestic consumers will seek cheaper substitutes increasing own price elasticity.

(2) Shipment Tests

Shipment tests have been proposed by various writers such as Elzinger and Hogarty(1973). The tests have two aspects: they are symmetrical in the sense that imports should only account for a small proportion of domestic consumption, and exports a small proportion of domestic production for the market to be defined as national.

The literature suggests that the shipments test is biased as insignificant amounts of trade may not indicate that the markets are separate (Motta,2004). Trade theory observes that similar prices and low transport costs would not lead to trade, but if prices were to rise in one country, the producers in the other country could act as a constraint on the exercise of market power by exporting into the national market.

(3) Transportation costs

Because of distance from the major markets, transportation costs are often cited as a barrier to trade in South Africa. Holden and MacMillan (2006) show that although distance from markets has had a less adverse effect on trade since 1994, it remains a significant deterrent. There is a differential impact on exports and imports as it was found that the effect of distance on exports is twice as adverse as it is for imports. This result lies in the nature of the composition of trade. South Africa is a major exporter of lower value per unit bulk goods, while importing high value goods that are relatively cheaper to transport (Holden and MacMillan, 2006).

Whether export sectors in South Africa are less integrated into the world economy than imports is an important question. The impact of transport costs without consideration of market structure can lead to misleading conclusions. However,

distance from world markets does allow dominant exporters to exert some measure of market power. Holden (2005) shows theoretically that the ability to segment markets can permit a dominant firm to price discriminate between the domestic and world markets giving these firms considerable market power.

(4) Differences in tastes

The impact of differences in tastes between countries is well known for their effect on trade. If taste preferences for certain geographic products is sufficiently strong, imports of what may appear to be similar products will not act as a constraining factor on the exercise of market power by the domestic producers despite the similarity of prices, suggesting a narrower definition of the market.

To summarize, all tests can be shown to be biased and should not be the sole criteria in defining the relevant geographic market. The following section develops a test that incorporates all of these approaches.

Armington approach

Despite trade liberalization and greater integration into the world economy, many markets for tradable goods have been defined as national in South African competition analysis. The various tests that are used by authorities to determine the relevant geographic market have of necessity been multifaceted. Armington elasticity provides an elegant solution to this problem. This is supported by the close relationship between the size of the elasticity and the pass-through of exchange rate changes into domestic prices.

The Armington elasticity was theoretically developed by Paul Armington (1969). It is used in computable general equilibrium models to calibrate the elasticity of substitution between imported and domestic goods in trade policy problems. The Armington contribution distinguishes goods by their country of origin. Goods are categorized as

imperfect substitutes for domestic goods by virtue of their distance from the domestic market and product differentiation. The Armington elasticity is typically estimated by assuming that in the Armington system there are weakly separable preferences and that there is a composite good consisting of the domestic and imported goods such that the demand for the composite good (q) can be represented by a CES function such that when this is maximized subject to the budget constraint, the following first order condition results show the relationship between the ratio M/D and the relative prices as,

$$M / D = \left[(\beta /(1-\beta))(p_d / p_m)\right]^{\sigma} \qquad (8)$$

where M is the quantity of the imported good, and D the quantity of the domestic good, with the parameters β and б. β weights the share of expenditure on the imported good relative to the expenditure on the domestic good. б represents the constant elasticity of substitution parameter in the preference function.

This equation is estimated in log linear form by regressing the log of the relative quantities on the relative price term. The coefficient on relative prices is the Armington elasticity which, because the relative prices are inverted, is expected to be positive rather than negative.[2] The estimated elasticity is therefore a share weighted response of the ratio of imports to domestic demand to relative prices.

Estimates of the Armington elasticities for South Africa have recently been performed by Gibson (2003). Although these are relatively aggregated and not suitable for antitrust purposes, the estimates are significantly lower when compared with estimates for developed industrialized countries. This provides *prima facie* evidence of the impact of transport costs.

[2] See Reinert and Roland-Holst (1992), Gallaway *et al* (2001) and Francois and Hall (1997) for the derivation.

The relationship between the Armington elasticity and exchange rate pass-through

Given the assumptions of the Armington model regarding the composite good, Warr (2005) shows a positive relationship between the exchange rate pass-through and the Armington elasticity. This is shown in equation 9 as,

$$H_m = S_m(\sigma + \eta^D)/(\xi_d^S + \sigma S_m - \eta^D S_d) \qquad (9)$$

where

H_m is the elasticity of the domestic price to import price

S_m is the share of the imported good in domestic expenditure

σ is the Armington elasticity

η^D is the elasticity of demand for the composite good

ξ_d^S is the own price elasticity of supply of the domestic good

S_d is the share of the domestic good in domestic expenditure

From equation 9, H_m, which represents the pass-through of the exchange rate, will be less than or equal to one, and is an increasing function of the Armington elasticity and the share of imported goods in domestic expenditure for that particular product market.[3] In addition, the higher the elasticity of supply of the domestic good, the lower is the pass-through of the exchange rate and the higher the elasticity of demand for the composite good, the higher is the exchange rate pass-through.

In Indonesia, Warr (2005) found that pass-through elasticities of 0.27 and 0.37 were associated with Armington elasticities of 2.6 and 4.1 for rice.

[3] Note that the estimated Armington elasticity coefficient in the empirical work incorporates the share of the imported good in domestic expenditure.

Estimated Armington Elasticities for South Africa

Gibson (2003) and Naude *et al* (1999) have calculated Armington elasticities for South Africa. Gibson's estimates are at a more disaggregated level covering a later period and are shown in Table 1.

Table 1: Armington Elasticities for South Africa 1970 – 2001

Industry	Armington Elasticity
Agriculture, forestry and fishing	1.273 (0.000)
Coal Mining	2.771 (0.095)
Food	0.937 (0.066)
Beverages	1.570 (0.000)
Tobacco	1.350 (0.000)
Textiles	1.262 (0.000)
Wearing Apparel	1.164 (0.000)
Leather and leather products	1.474 (0.000)
Footwear	2.040 (0.004)
Wood and wood products	1.205 (0.000)
Paper and paper products	0.789 (0.000)
Printing, publishing and recorded media	0.083 (0.819)
Coke and refined petroleum products	0.730 (0.004)
Basic chemicals	0.677 (0.035)
Other chemicals and man made fibres	0.792 (0.020)
Rubber products	1.135 (0.000)
Plastic products	0.275 (0.281)
Glass and glass products	0.942 (0.019)
Non-metallic minerals	0.655 (0.207)
Basic iron and steel	0.447 (0.516)
Basic non-ferrous metals	0.595 (0.177)
Metal products excluding machinery	0.747 (0.000)
Machinery and equipment	0.490 (0.280)
Electrical machinery and apparatus	0.944 (0.002)
Television, radio and related equipment	0.441 (0.502)
Professional and scientific equipment	0.505 (0.194)
Motor vehicles, parts and accessories	0.786 (0.002)
Other transport equipment	0.932 (0.250)
Furniture	1.075 (0.065)
Other manufacturing	0.417 (0.132)
Electricity, gas and steam	1.437 (0.079)
Building construction	0.584 (0.018)
Civil engineering and other construction	1.280 (0.001)
Catering and accommodation services	0.420 (0.030)
Transport and storage services	0.861 (0.000)
Finance and insurance	0.616 (0.025)
Business services	1.066 (0.000)
Medical dental and veterinary services	1.135 (0.000)

Notes:

(1) Source: Gibson (2004)
(2) Standard errors in parentheses

The estimates shown in Table 1 establish that the degree of substitutability between imported and domestic goods is low. Those sectors where the Armington elasticity was estimated to be greater than one were as follows:

Agriculture, forestry and fishing
Coal mining
Beverages
Tobacco
Textiles
Wearing apparel
Leather and leather products
Footwear
Wood and wood products
Rubber products
Furniture
Civil engineering
Electricity, gas and steam
Business services
Medical, dental and veterinary services

In only two sectors, coal mining and footwear, were Armington elasticities greater than two. Lower values of the elasticity can be associated with less substitutability between imported and domestic products due to greater product differentiation and higher transport costs. As the size of the elasticity is an indication of sector integration into the world economy, these results suggest that the South African economy fails to be integrated sufficiently into the world economy.

The extent to which South Africa differs from more developed countries that are closer to markets, such as the United States is shown in Table 2. These include estimates for South Africa by Gibson (2003) and Naude *et al* (1999) and for the United States by Schiells *et al* (1986).

Table 2: Comparison of Armington estimates

Industry	Gibson: SA	Naude: SA	Schiells: USA
Tobacco	1.350*	-2.681	-16.19
Motor vehicles and parts	0.786*	1.870*	N/A
Food	0.937**	0.74**	0.31
Beverages	1.570*	2.33*	0.46**
Textiles	1.262*	-	2.58
Wearing apparel	1.164*	-0.465	1.62
Leather and products	1.474*	4.41*	4.11
Footwear	2.04*	2.03*	3.15
Wood and wood products	1.205*	0.687*	0.26
Paper and paper products	0.789*	3.665*	1.80
Printing and publishing	0.083	3.192*	2.72
Basic chemicals	0.677*	1.528*	9.85*
Rubber products	1.135*	-0.429	2.67**
Plastic products	0.275	-0.091	8.58
Pottery and ceramics	-	0.174	2.11*
Glass and glass products	0.942*	0.35	4.29
Non-metallic minerals	0.655	-0.314	1.95
Basic iron and steel	0.447	0.693*	3.05**
Metal products	0.747*	-0.425	1.54
Machinery and equipment	0.49	1.092*	3.34
Electrical machinery	0.944*	0.751	7.46
Other transport equipment	0.932	1.147	2.01
Furniture	1.075**	-0.158	-
Other manufacturing	0.417	0.946*	3.55

Notes:

(1) Sources: Naude *et al* (1999) and Schiells *et al* (1986) and reconciled by Gibson (2003)

(2) 1 per cent level of significance is represented by *
5 per cent level of significance is represented by **

The differences between the South African estimates can be explained by the time periods covered, data sources and estimating procedures. The difference between the United States and the South African estimates lies in the greater responsiveness in the ratio of imported to domestic goods to relative price changes. This can be explained by both differences in transport costs and in the composition of imports in relation to product differentiation. The United States economy is relatively closed given the low ratio of trade to GDP, but is closer to markets, trading in goods that appeal to higher per capita incomes. In South Africa, although trade-GDP ratios are higher, the impact of higher

transport costs reduces the ability of traders to profitably trade with the rest of the world and per capita incomes are lower.

The lower values of the Armington elasticities for South Africa have implications for competition policy and the definition of the relevant geographic market. Equations 1 and 2, incorporating elasticities of substitution between domestic and imported goods such as the Armington elasticities, have led to the categorization of markets as national rather than international when these are low.

The Armington substitution elasticity coefficient is estimated for each industry adjusted for the impact of the market share for imports. Therefore, a higher substitution elasticity (б) could be balanced by a smaller share of imports in domestic demand (β), due to higher transport costs, tariffs or other border costs. This combination of factors could then lead to a lower Armington elasticity where the coefficient is represented by the expression,

$$б \ln(\beta/1-\beta) \qquad (10)$$

The estimation of Armington elasticities, particularly at greater levels of disaggregation, would be useful guides for competition authorities. All aspects of border effects are captured in addition to the impact of substitution effects or product differentiation effects.

Exchange rate pass- through in South Africa

Access to published disaggregated estimates of exchange rate pass-through was difficult to obtain for the purposes of this paper. However, average pass-through elasticities provide an instructive approach supportive of the estimates for the Armington elasticities. Rigobon (2007) has estimated the following pass-through elasticities for the CPI in Table 3.

Table 3: Estimates of CPI Pass-through

Year	Pass Through	t-stat
All years	0.124	3.6
2002	0.373	2.3
2003	0.110	2.0
2004	0.178	5.4
2005	-0.046	0.7

Source: Rigobon (2007)

These pass-through coefficients were estimated for the CPI for South Africa and show that since 2002, a period during which the rand essentially appreciated from an historical low, pass-through was not only low but declining over time. The reasons for this decline are subject to different interpretations and are beyond the scope of this paper. However, in comparison to other countries, pass-through in South Africa is low (Bhundia, 2002).

Work from the IMF for South Africa corroborates this view. Bhundia (2002) finds that import price shocks on CPIX peak at just over 3.5 percent for a ten percent change in the exchange rate in the long run. [4] Pass-through in relation to appreciation and depreciation appears to be symmetrical, with Bhundia finding it low during a period of depreciation and Rigobon (2007) finding it low during a period of appreciation.

While these findings support the suppositions of the relationships between the Armington elasticities and pass-through elasticities in South Africa, they also have implications for trade policy. Feenstra (1987) finds that for the United States, the symmetry hypothesis, that the long run pass-through of tariffs and exchange rates are identical, holds. If the same hypothesis were to hold for South Africa, the implications for trade policy are somewhat bleak. While Edwards and van de Winkel (2005) find that trade liberalization had impacted on mark-ups in South Africa, this work was not an assessment of the size of the impact of the pass-through of tariff reductions. If indeed the effects are symmetrical, we can assume that a ten percent reduction in tariffs would be translated into a three and

[4] CPIX is the consumer price index targeted by the Reserve Bank in their inflation targeting regime. It excludes mortgage rates.

half percent reduction in consumer prices. This finding has implications for partial equilibrium estimates of the effect of tariffs on welfare and employment that use the assumption that pass-through of tariff reductions is complete.

Conclusion

The paper shows that estimated Armington elasticities can be a useful addition to the arsenal of tools at the disposal of competition authorities in South Africa when deciding on the relevant market definition in the assessment of markets and the exercise of power. Firstly, estimated Armington elasticities are shown to be low in relation to developed countries, supporting the view that the South African economy, because of its distance from its major trading partners, has inadvertently provided domestic producers not only with a significant measure of protection, but also the ability to exercise market power and thereby increase mark-ups. Secondly, the size of the elasticities provides competition authorities with an all encompassing measure of market segmentation. However, given that South Africa has significantly liberalized trade during the nineties, the relationship between these elasticities and exchange rate pass-through leads to the conclusion that clarity on the full extent of the tariff reductions needs to be investigated. This provides further impetus for research at low levels of aggregation, such as at the firm level, to investigate these issues.

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