TRADE LIBERALISATION AND MARKET DISCIPLINE:
Evidence from South African Manufacturing Sectors

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1.1 INTRODUCTION

Recent times have seen an increase in the number and relative significance of international organisations concerned with the regulation of international markets. One of the key recent areas of focus of international organisations such as the WTO and the Bretton-Woods institutions has been the promotion and expansion of competitive markets within member countries. A non-competitive market can generally be understood as a market in which the equality between price and marginal cost fails. Firms therefore enjoy some kind of market power, and are able to employ mark-ups, or prices above marginal costs. The assumption of the existence of competitive markets, however, is the foundation on which classical economics is built. It is crucial if markets are to be able to allocate resources efficiently and reach full employment at their maximum productive capacity. There are therefore potentially important welfare gains to be had by creating competitive markets and this is the incentive driving the push towards disciplined markets by international organisations and their member countries.

The main tool employed in the promotion and expansion of competitive markets is often simply to "expand the reach of competition legislation across members" (Kee,Hoekman,2004). Yet as Kee and Hoekman find, the relationship between the instalment of competition legislation and increased market discipline is weak and indirect. A number of researchers have turned instead towards trade liberalisation as a possible alternative means of generating market discipline.

As basic trade theory tells us, restrictions on international trade such as tariffs, quotas and other barriers serve to distort local production, impacting on domestic import and export performance. While the expected relationship between exports and trade restrictions is largely ambiguous (Hall,1998; Federkke,Kularatne,Marriotti,2003), the theoretical relationship between imports and trade restrictions is not. If the export industry is small relative to the world market then firms cannot price discriminate between foreign and domestic consumers, increased exports will therefore lead to increased competitive pressure and a decline in mark-ups. If, on the other hand, the product is differentiated (or producers can discriminate between international and domestic markets) then increased exports will increase the market size for the producer and, with economies of scale in effect, the producer can therefore increase mark-ups (Hall,1998). The disciplining effect of increased exports is therefore relatively weak, if it exists at all. While we can therefore expect both a positive and negative relationship to be found, the majority of papers have found either a weakly significant negative relationship (Foddered et al, 2003), or found the relationship to be insignificant (Hall,1998).

The relationship between imports and mark ups is expected to be a much less ambiguous one. Trade liberalisation will reduce barriers to trade hence increasing international competitive pressure through increased imports, therefore decreasing the pricing power of producers[1]. This relationship is believed to be so strongly evident that trade liberalisation is frequently suggested as an alternative to competition law, "Import liberalisation not only has a powerful and direct effect on competition, it also is a low cost policy, especially in the long run given recurrent administration enforcement and compliance costs" (Kee,Hoekman,2004).

If protectionist policies promote non-competitive markets then, "by implication, the suggestion is that trade liberalisation is a means by which inefficiency in production can be remedied" (Fedderke et al. 2003,7). A key issue that needs to be addressed is therefore whether or not trade liberalisation does in fact empirically promote market discipline. While this issue has been approached, directly or indirectly by a number of papers[2], few have dealt with this issue from the perspective of developing and middle income countries, for whom the effects of liberalisation are conceivably very different to those facing OECD countries.

In order to investigate the nature of this relationship between trade liberalisation and industry competitiveness, an accurate means of estimating domestic competitiveness must naturally first be derived. An obvious measure for competitiveness is the

[1] Assuming domestic market structure is such that barriers to entry ensure that profit taking is possible and that domestic markets are not already completely competitive.
[2] Among others, Hall 1986, 1988; 2004; Konings Cayseele and Warzynski 2001, Fedderke Kularatne and Mariotti 2003,Martins and Scarpetta 1999; Hakura 1998, Edwards and van den Winkel (2005), Goldar and Argarwal (2004).

existence and magnitude of mark-ups prevailing in a given industry. So, by looking at the relationship of pricing behaviour to costs incurred in production we get a good idea of the relative competitiveness of an industry. As Tybout (2001) points out, however, prices and marginal costs are not easily observable; hence mark-ups must be estimated indirectly. Two methodologies have been developed in the estimation of mark-ups, the first, known as the "traditional" Price Cost Margin (PCM) approach, (Hakura,1998) which primarily uses accounting data; and the more recent approach initially developed by Hall (1986 and 1988) which centres around estimates of marginal costs (which will be termed the 'Marginal Cost Approach'). This paper will carry out analysis using both these methodology, therefore providing robust and comprehensive evidence for whether trade liberalisation does indeed discipline markets in a South African context. den

The relationship between trade liberalisation and mark-ups has been investigated in the South African context by Fedderke et al (2003) and Edwards and van de Winkel (2005). Both find seemingly convincing evidence of the pro-competitive action of trade liberalisation. There are, however, some concerns with these analyses that need to be investigated. The first is the level of sensitivity found to the inclusion of intermediates in the mark-up estimation (Edwards and van de Winkel, 2004). The effect of trade liberalisation on intermediate inputs, and how this affects the mark-up on the final good has not been directly investigated in a South African context, and is one of this paper's key additions to the existing body of literature.

Another concern is that the majority of investigations of the pro-competitive effects of trade liberalisation, especially those for South Africa, have undertaken analysis at a high degree of aggregation, looking predominately at the manufacturing sector as a whole. Because of the high degree of heterogeneity at the sector level of South African manufacturing, this paper will therefore add to the existing literature by testing previous results at a much lower degree of aggregation, looking at the relationship at the level of individual manufacturing sectors.

A final concern arising from the existing literature is the choice of variable used to capture the level of trade liberalisation. As will be discussed in more detail at a later stage, the common choice of import penetration ratios is somewhat problematic. This problem will be addressed by using a number of other measures for the level of liberalisation, including collection rates, import penetration and an openness index constructed by Aron, J. and J. Muellbauer (2002).

The paper is divided into two main sections, the first dealing with the PCM approach and the second undergoing analysis using the marginal cost approach to estimation. For each section the pro-competitive effect of trade liberalisation is tested at the sector level of South African manufacturing, investigating the consistency of the findings of previous studies. This paper therefore aims to provide robust evidence for whether trade liberalisation does indeed discipline markets in South Africa's manufacturing sectors.

1.2 THEORY

One rather straightforward theoretical understanding of the relationship between trade liberalisation and mark-ups is offered by Roberts and Tybout (1996) and also discussed by Goldar and Aggarwal (2004). If we assume that the firm operates in an imperfectly competitive market and that we are dealing with static profit maximisation then the ratio of the firm's price to marginal cost is a decreasing function of the elasticity of demand:

$$\frac{p}{c} = \left(\frac{\eta}{\eta - 1}\right) \tag{1}$$

Where p is price, c is marginal cost and n is elasticity of demand. With the increase in availability of goods to domestic consumers due to trade liberalisation, so we see an increase in the elasticity of demand. With the increased elasticity of demand and increased product variety we also see a decrease in the price of these goods as faced by the domestic consumer, ultimately leading to a fall in the mark-ups of domestic producers operating in the market.

A rather more rigorous theoretical explanation is derived using strategic trade policy theory, specifically by investigating a Cournot duopoly, which is part of the more general 'reciprocal markets' framework[3]. Looking at a representative firm[4] producing an homogenous product in a Cournot oligopoly, we assume that demand for the homogenous product is given by the inverse demand function P(Q), it is further assumed that the firm's cost function is simply C(Q) and that it faces positive marginal costs that are increasing. The firm's profit is therefore simply defined by $\Pi = P(Q) - C(Q)$. It is now assumed that this firm is the domestic firm and that a foreign representative firm produces and exports the same homogenous product to the domestic market (note that it is assumed that the foreign firm exports its entire output). It is further assumed that both firms face identical cost functions and marginal cost conditions. Industry output Q is now defined as $Q_H + Q_F$ (domestic and foreign output respectively) and the demand is therefore $P(Q_H + Q_F)$. The foreign firm faces a trade barrier (t) and therefore obtains the deflated price: $P_F = P(Q_H + Q_F)/(1+t)$. The two firms' profit functions now become:

$$\Pi_H = P(Q_H + Q_F).\ Q_H - C_H(Q_H) \tag{2}$$

$$\Pi_F = P(Q_H + Q_F).\ Q_F/(1+t) - C_F(Q_F) \tag{3}$$

As we are dealing with a Cournot framework, the profit maximising choice facing a firm is centred on determining the optimum level of output, and each firm ignores the marginal response of other firms to changes in its output. Using these assumptions and then solving the first order conditions of equations 2 and 3 above, it can be shown that the trade barrier has the result of preserving a portion of the domestic market for the domestic firm as well as decreasing industry output overall (see Edwards and van de Winkel,2005). However, the key relationship to be investigated in terms of the focus of this paper is that between the trade barrier and the domestic firm's mark-up. If mark-up is defined as price over marginal cost ($\mu = \frac{P}{C'_H}$) then the relationship is described by[5]:

[3] Brander (1985) provides an excellent overview of this field and its many variations, as does Edwards and van de Winkel (2005) on specifically the Cournot and Bertrand variations.
[4] This framework can incorporate a multi-firm analysis without any change in results, see Brander (1985).
[5] See Edwards and van de Winkel (2005).

$$\frac{\delta\mu}{\delta t} = \frac{1}{C'_H}\frac{\delta P}{\delta t} - \frac{PC''_H}{{C'_H}^2}\frac{\delta Q_H}{\delta t} \tag{4}$$

To determine the nature of the relationship, the signs of the two terms on the right hand side of equation 4 need to be investigated. Looking at the first term, $\frac{1}{C'_H}$ is positive because, as discussed above, marginal cost is assumed positive and increasing. $\frac{\delta P}{\delta t}$ is equal to $P'\left(\frac{\delta Q_H}{\delta t} + \frac{\delta Q_F}{\delta t}\right)$ and with P' negative (due to the assumption of the negatively sloped inverse demand curve), and $\frac{\delta Q_H}{\delta t} + \frac{\delta Q_F}{\delta t}$ negative[6] the resultant sign is therefore positive. The first term is therefore determined positive. The second term is the impact of tariffs on marginal cost. As t increases so too does domestic production as the portion of the industry reserved for domestic produces increases. Due to the assumption of increasing marginal cost, the increase in domestic production therefore results in increasing marginal cost and the second term is therefore also positive. The impact of increased trade barriers on mark-ups is therefore unclear in terms of this analysis as, if the increases in marginal costs (second term) are larger than the increases in price (first term), $\frac{\delta\mu}{\delta t}$ will be negative[7]. Many investigations, such as Bertrand (1985), avoid this problem by assuming constant marginal cost, and are therefore able to show a positive relationship between mark-ups and trade barriers. With a number of assumptions in place, most importantly that of constant marginal cost, the Cournot model framework therefore provides an understanding of why we should expect trade liberalisation to decrease mark-ups.

[6] $\frac{\delta Q_H}{\delta t} + \frac{\delta Q_F}{\delta t} = \frac{P'Q_F + P)}{(1+t)^2}\left(-P''Q_H - P' + 2P' + P'Q_H - C''_H\right) = \frac{\left(P'Q_F + P\right)}{(1+t)^2}\left(P' - C''_H\right)$, which, with the negative $\left(P' - C''_H\right)$, is negative.

[7] The same results are found with the Betrand model where price is the optimal choice, see Edwards and van de Winkel (2005).

2. PRICE COST MARGIN (PCM) APPROACH

2.1 LITERATURE REVIEW AND SPECIFICATION

The traditional approach to measuring mark-ups takes accounting data from firms and uses it to measure mark-ups as the ratio of revenue less variable costs to revenue, known as the accounting gross Price-Cost Margin (PCM):

$$PCM = \frac{P - AVC}{P} \tag{5}$$

This method faces a number of problems however, one of which being that it requires the assumption of constant returns to scale. Furthermore, it assumes that labour and material inputs are variable costs only and that capital is a fixed cost. For these reasons it is argued that the PCM is not directly observable and that structural econometric equations should rather be used in order to accurately estimate mark-ups (Hakura,1998).

Despite these concerns, PCM data has been used in a number of valuable studies[8] related to trade and market discipline. In a collection of studies on developing countries edited by Roberts and Tybout (1996), the relationship between trade exposure and profitability is analysed using PCM data, with the various authors using almost identical approaches. In all the studies PCM is calculated as:

$$PCM = \frac{[\Pi + (r + \delta)K]}{PQ} \tag{6}$$

Where Π is economic profits, r is the competitive gross rate of return on capital and d is the depreciation rate. K is capital stock and PQ is industry level revenue (Roberts+Tybout,1996). The various studies then go on to use the following model in their investigation of the respective developing countries:

$$\text{PCM} = f(\text{H, IMP, H.IMP, KQ, DI, DT}) \tag{7}$$

Where H is the Hefindahl index (a measure of industry structure), IMP is import penetration rate, KQ is the capital-output ratio, and DI and DT are industry and time

[8] Among others, Dutz, M A in Roberts M J, Tybout J R (1996); Goldar B and Aggarwal S C (2004); Grether, J-M (1996); Hakura, D S (1998); Roberts M J(1996), Tybout J R (1996).

dummies respectively. The import penetration ratio captures the level of openness to trade and is expected to have a negative relationship with PCM. The disciplining effect of trade liberalisation is expected to be greater in more concentrated industries and hence the interaction term H.IMP is also expected to be negatively related to PCM (Federkke et al. 2003;Tybout, Roberts,1996). As the majority of studies estimated equation 7 using a panel, the dummy variables are of particular importance. Omitting the DI dummy, for instance, will cause variation to be across industries and H and KQ will register the changes in technology and degree of competition, and IMP will therefore pick up the relationship between trade exposure and PCM (Roberts,Tybout,1996). The implicit assumption here is that KQ sufficiently controls for changes in technology. Without DI, however, endogeneity becomes a real concern in the form of both omitted variable bias and simultaneity bias (due to bi-directional causality between PCM and IMP). Efficient industries may be more profitable (higher PCM) as well as better able to compete against import competition (lower IMP) hence upwardly biasing the relationship (ibid.).

The studies using this model show varied results. In Tybout's study of Chile (1996) a significant negative relationship between PCM and IMP at both firm and sector level is only found if the dummies are excluded (upwardly biasing the relationship). But, if they are included, the R^2 figure triples from 0.24 to 0.85, suggesting they do control for otherwise omitted variables, including, as Grether (1996) suggests "industrial policy, entry barriers or technical differences". With the inclusion of DI and DT, however, there is no evidence of a significant disciplining effect of IMP on PCM; if anything, the relationship appears to be positive.

These rather poor results do not comprehensively discredit the model, however, and appear to rather reflect Chile's particular industrial context where, Tybout argues, "the industrial sector is so competitive that intra-industry variations in import penetration are irrelevant" (1996). Other studies using this model show more consistent results. Both the study of Columbia by Roberts (1996) and of Mexico by Grether (1996) find a significant and negative relationship between PCM and IMP, with both the dummy variables included.

Also using the traditional, or PCM approach, Hakura (1998) uses the following model to estimate PCM and it's relationship with trade exposure at the industry level for six EU countries:

$$\Delta PCM_{cit} = B_0 + B_1\Delta[IPR_{cit} - \overline{IPR_{ci}}] + B_2\Delta(\frac{K}{Q})_{cit} + B_3\Delta(\frac{Q}{Q})_{cit} + \varepsilon_{cit}. \qquad (8)$$

Where IPR is the import penetration ratio and K/Q and Q/Q are the capital to output ratio and the percentage change in industry sales (a proxy for demand) respectively. As with the Tybout and Roberts (1996) model, import penetration is expected to be negatively related to PCM, while the proxy for demand is expected to have a positive relationship with PCM.

Using this methodology, however, produces insignificant results due in part to the problematic assumptions outlined above (constant returns to scale etc), but also due to enodogeneity problems (omitted variable and simultaneity bias). As discussed above, simultaneity becomes a problem if bi-directional causality between PCM and import competition (of a particular industry) exists. So, for instance, if efficient industries are more profitable (higher PCM) as well as better able to compete against import competition (lower IMP) then the relationship will be upwardly biased. Furthermore, omitted variable bias could become an issue if a variable not included in the estimation is correlated with both PCM and the measure of import competition. As PCM and IPR are both indirect measures of mark-ups and import competition respectively, the probability of omitted variable bias arising is high. To correct for endogeneity, Hakura uses an IV approach, using national tariff rates, national unemployment figures and transportation cost rates as instruments. This approach produces significant results with the predicted negative relationship being estimated.

The problems resulting in the assumptions made about capital and labour inputs are, however, not as easily dealt with as with endogeneity. As Hakura shows, the use of PCM figures generally biases the relationship between trade exposure and profitability, especially when compared to analysis using marginal cost estimations. Despite these issues the relationship between PCM and import competition is generally found to be a fairly strong one and in the majority of studies the estimated coefficient has been found to be the correct negative sign[9].

2.2` THE MODEL

The analysis undertaken by this study follows the Roberts and Tybout (1996) methodology in terms of the estimation of PCM figures, where it is measured as the value of output minus expenditures on labour and materials over the value of output. This equates to equation 6 above, where PCM is equivalent to economic profits plus payments to capital (assumed to be the only fixed factor) proportional to revenue. The model employed also follows that used by Roberts and Tybout discussed above:

$$PCM = f(R, IMP, KQ, R.IMP, \Delta Q/Q) \tag{9}$$

Where R is the Rosenbluth index (a measure of concentration), IMP is import penetration rate, KQ is the capital-output ratio, and $\Delta Q/Q$ is the growth rate of sector output. As this analysis will be undertaken at the sector level, the dummy variables included by Tybout and Roberts are omitted. Furthermore, the Rosenbluth index is used instead of the Herfindahl index, as the necessary firm level data is not available for South Africa. As the Rosenbluth index decreases with increasing concentration, a negative relationship between industry profitability and R should be expected (Fedderke et al, 2003).

The capital-output ratio (KQ) controls for changes in capital intensity and the relationship between PCM and KQ is expected to be positive. High capital requirements form a barrier to entry, thus increasing the market power of existing firms. Furthermore payments to capital are included in the calculation of PCM figures, again resulting in an expected positive relationship.

Output growth rates capture changes in sector demand and will also be expected to be positively related to PCM (Hakura,1998). Furthermore, a higher growth rate should

[9] Among others: Roberts (1996), Grether (1996), Hakura (1998), Goldar and Aggarwal (2004), Harrison Ann (1996).

necessitate efficiency increases, thereby increasing profitability. But, as Goldar and Aggarwal (2004) point out, the relationship is not completely unambiguous. An industry showing relatively fast growth, and therefore high demand, will attract new entrants, decreasing the concentration of the firm and hence profitability as well. Furthermore, while product price falls, input prices in a fast growing sector can be expected to rise, dampening profitability (ibid.).

Import penetration (IMP) is used as the measure of import competition; other studies have used a number of other variables such as tariff data and import coverage ratios. In the case of IMP, an inverse relationship is expected as high penetration reflects a higher degree of import competition, and should lower the profitability of domestic firms. In order to investigate the sensitivity of results, three other measures of import competition were used: Duties collected including surcharges (DUTY), Duties collected excluding surcharges (DUTYXS) and an openness index constructed by Aron, J. and J. Muellbauer (2002) (OPEN). All three measures are calculated for aggregate manufacturing and will therefore reflect aggregate liberalisation across the economy.

The interaction term R.IMP captures the sensitivity of the relationship between import penetration and PCM relative to the level of concentration in that sector. The impact of increased import competition should be greater on a highly concentrated sector's market power, and hence the expected coefficient on R.IMP is negative (Roberts,Tybout,1996).

2.3 DATA AND MODEL ESTIMATION

The main source of data for this study was the SA Standardised Industry Database (SASID) (Quantec Research,2004), which was obtained from Trade and Industrial Policy Strategies (TIPS). This was used to construct a data set consisting of a balanced panel of the 27 Standard Industrial Classification (SIC) three-digit manufacturing sectors for South Africa for 1970-2002. Also included in the dataset was data on Gross Operating Surplus (GOS), labour remuneration, intermediate inputs, fixed capital stock and consumption of capital; which was also obtained from the Quantec dataset.

The PCM estimation was calculated as GOS (Value Added minus payments to labour) over the value of Gross Output, which is equivalent to equation 6 discussed earlier. This, and all other variables were calculated at current prices. Tests for stationarity for these variables are discussed in the following section. Growth rate of sector (ΔQ/Q) is the exception as it is calculated simply as the annual percentage change in total output using real data. The Capital-Output ratio is calculated using the fixed capital stock data included in the Quantec dataset. Import penetration is calculated as the ratio of imports to domestic sales, again using data from the Quantec dataset.

The measure for concentration used is the Rosenbluth index, obtained from Fedderke and Szalontai (2003). The index is calculated as:

$$R = \left(2\sum_{i=1}^{n}(i.ms_i) - 1\right)^{-1} \tag{10}$$

Where *ms* is the market share of the *i*th ranked firm and n is the number of firms. If firms are of equal size, the index will equal 1/n and the more unequal firm sizes are, the more it will tend to 1 (ibid.).

Initial estimates of equation 9 revealed very insignificant results. Of key concern was that the capital-output ratio included in the model was consistently found to have a negative impact on PCM. Goldar and Aggarwal (2004) also encountered problems with the use of capital output ratios and instead used productivity of labour figures as a proxy. Capital intensity and labour productivity should display a strong positive correlation therefore making labour productivity a good proxy, besides the added value of capturing the effect of productivity growth on profitability that it encompasses (ibid.). This study therefore follows Goldar and Aggarwal (2004) and uses labour productivity, simply calculated as real value added per employee.

Another key concern with the initial analysis conducted was the relatively large yet insignificant and highly volatile relationship estimated between PCM and the Rosenbluth Index. Following Fedderke (2003), the Rosenbluth Index was replaced with the Gini coefficient, another measure of concentration that is related to the Rosenbluth Index by the following equation:

$$R = \{n(1-G)\}^{-1} \tag{11}$$

Where R is the Rosenbluth Index, G the Gini coefficient and n the number of firms (ibid.). The model used in subsequent analysis therefore now takes the form of:

$$\text{PCM} = f(\text{G, IMP, LP, G.IMP, } \Delta\text{Q/Q}) \tag{12}$$

The Openness Index is constructed by Aron and Muellbauer (2002), and builds on a model for import penetration, which, as is pointed out, depends on other factors such as domestic demand and the exchange rate. The model includes measures of import tariffs and surcharges, as well as quotas but also includes the effect of sanctions. The index also captures other demand side influences by including growth rate of real GDP and the log of the real exchange rate.

Most studies of the "Imports-as-Market-Discipline-Hypothesis" (Levinsohn,1991) using PCM figures estimate the model using panel regressions. However, as this study specifically focuses on the hypothesis at the sector level, simple OLS regressions are initially applied to each sector are more appropriate. Due to issues surrounding the stationarity of the variables some cointegration techniques are subsequently employed, these are discussed in Appendix 2. Due to inconsistencies in the data for 2001 and 2002, which are discussed in detail in the following section, these observations were dropped, leaving each of the manufacturing sectors with 30 observations, from 1970 to 2000.

2.3.1 TRADE VARIABLES AND LIBERALISATION HISTORY

This section gives a brief overview of the recent history of trade reform in South Africa before discussing the various trade variables included in the model.

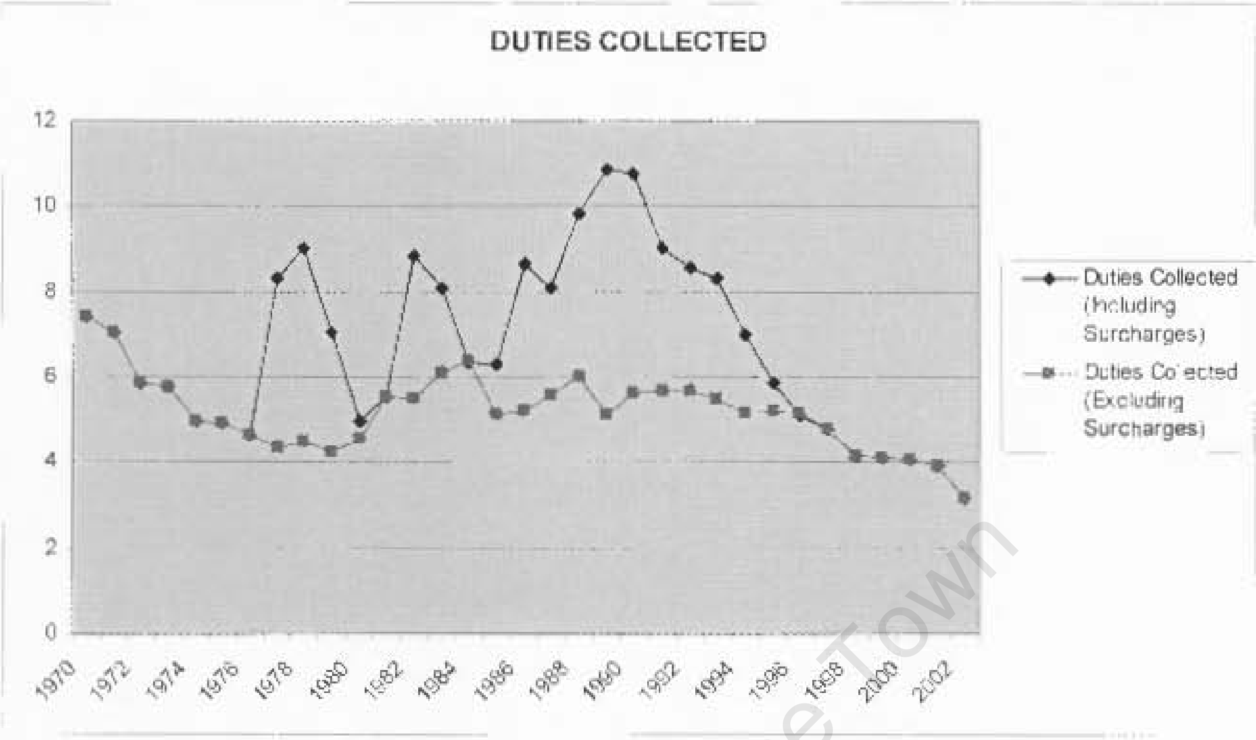
The 1970's saw the South African economy experience a natural resource boom led by dramatic increases in gold prices (Bell, Farrell and Cassim,1999). This was accompanied however, by very slow growth in exports, especially in manufacturing, due in large to the ensuing real exchange rate appreciation (ibid.). South Africa's poor export performance, coupled with the example of the rapid growth through exports of the newly industrialised Southeast Asian economies, saw South Africa begin to move away from its policy of industrialisation through import substitution (Cassim and Van Seventer, 2005; Edwards and van de Winkel,2005). This "abrupt and involuntary shift" (Cassim and Van Seventer,2005) away from import substitution towards industrialisation through export orientation emerged with a decrease in Quantitative Restrictions (QR's). Although the trade regime remained protectionist in general, the 1970's were therefore characterised by a net reduction in protection (Edwards and van de Winkel, 2005).

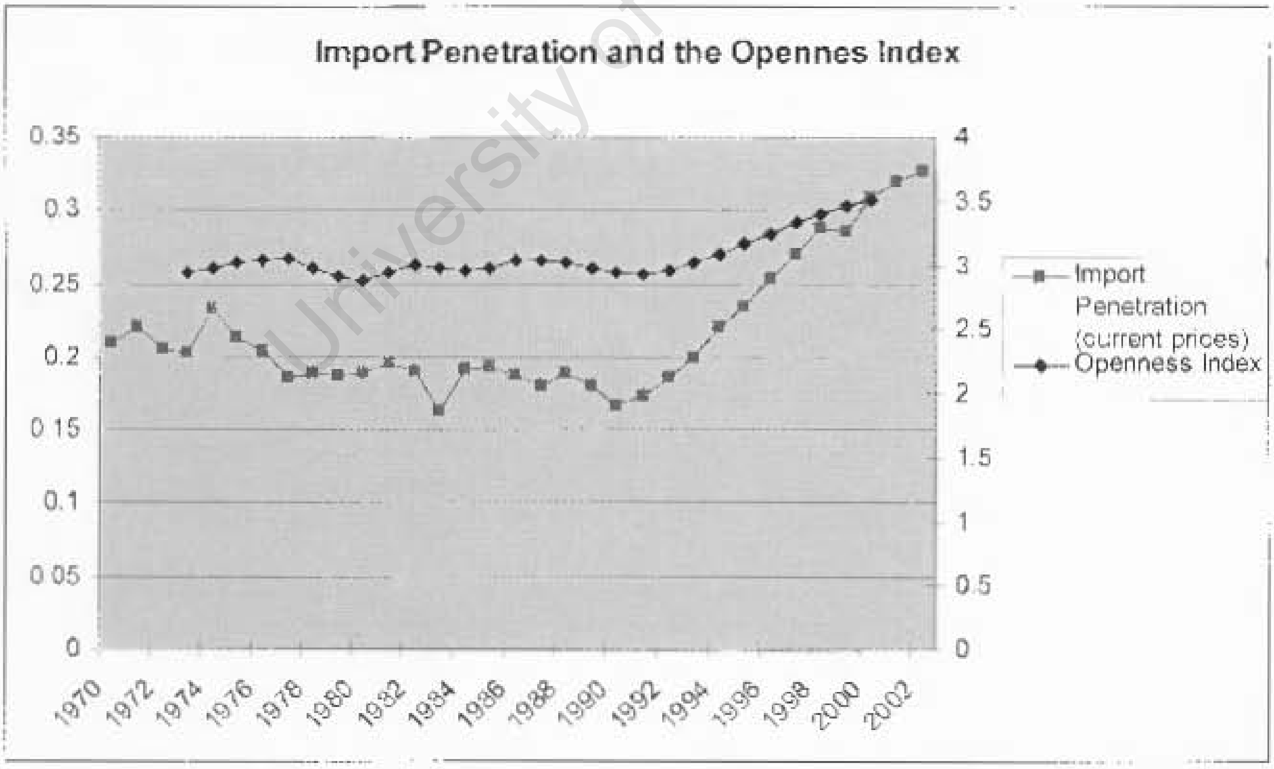
The declining gold price and subsequent depreciation in the real exchange rate of the 1980's gave strong stimulus to manufacturing exports (Bell et al, 1999). This was accompanied by the introduction of systems of duty free imports for exports (in the motor vehicle, textile and clothing sectors) as well as the continuation of the reduction of QR's (ibid.). The depreciation of the real exchange rate was however also accompanied by a debt-crisis in the mid-80's and a general economic downturn resulting in increased need for protection in the form of surcharges and *ad valorem* tariffs (Edwards and van de Winkel, 2005). The reductions in protection were therefore also accompanied by export subsidies, the implementation of import surcharges as well as an increase in applications for protection via duties (ibid.). South Africa's tariff regime also increased dramatically over this period, both in terms of level and complexity, further increasing protection. The net result of the developments of the 1980's was therefore an increase in protection.

Shortly after democracy South Africa committed to the GATT Uruguay round in 1994 and thereby a programme of tariff reform (ibid). By this stage QR's had continued to be reduced, export subsidies were also being phased out and surcharges were also abolished throughout the 1990's (Cassim and Van Seventer, 2005). While the complexity of the tariff regime has decreased significantly (see Edwards and van de Winkel (2005) for a detailed description) it still remains relatively complex. There is also considerable disagreement over the decline protection through changes in tariffs. Using effective rates of protection (ERP), which measure the impact of nominal tariffs on net production, some very different conclusions have been drawn regarding South Africa's level of protection from 1994 onwards (Fedderke and Vase, 2001 and Rangasamy and Harmse , 2004).

Fedderke and Vase argue that the liberalisation is far "less comprehensive than otherwise thought"(2001,27), showing that sectors responsible for about 50% of SA's GDP actually increased in terms of ERP and that a decrease in ERP was seen in sectors accounting for only 15% of GDP. Rangasamy and Harmse (2004) dispute these results, arguing firstly over the classification of sectors used, claiming that sectors showing increased ERP only account for between 9% and 19% of GDP. The methodology used in calculating ERP estimates is also disputed in terms of whether collection rates or statutory tariffs are used. Edwards and van de Winkel (2005) also show that the decline of protection in the 1990's is much more evident if surcharges are included. Despite these disputes, ERP are consistently estimated as higher than nominal tariff rates. Evidence for the decline of protection in the 1990's, or lack thereof, is therefore extremely sensitive to the method used to measure protection. There is generally consensus however that, at least in nominal terms, protection in South Africa did decrease from 1996 (Cassim and Van Seventer,2005).

FIGURE 1: TRADE VARIABLES INCLUDED IN MODEL.





In Figure 1 above we see the movement of collection duties over the period 1970 to 2002. The movements described in the historical overview are clearly apparent, especially when surcharges are excluded and the data is less volatile. We see a clear decline in the 1970's followed by a net increase in the 1980's before collection declines again in the 1990's. As discussed above, the decline in protection is much more evident when surcharges are included, which is evident in the graph above.

Import penetration is also consistent with the historical changes in South Africa's trade policies. It shows a decrease from high levels in the 1970's to lower levels in the 1980's as net protection increased, and then displays a sharp increase from the early 1990's as South Africa committed to GATT agreements and trade liberalisation. While the openness index shows increases in the 1970's, it shows an increasing trend in the early 1980's as well, which is inconsistent with the South Africa's net increase in protection over this period. This is also inconsistent with the effect of sanctions, formally imposed in 1985, which further decreased the openness of the economy to international trade. From 1991 onwards, however, the index shows an increase in openness, which is consistent with changes in South Africa's trade policy, as well those who argue that South Africa has indeed seen an extensive decrease in protection over this period.

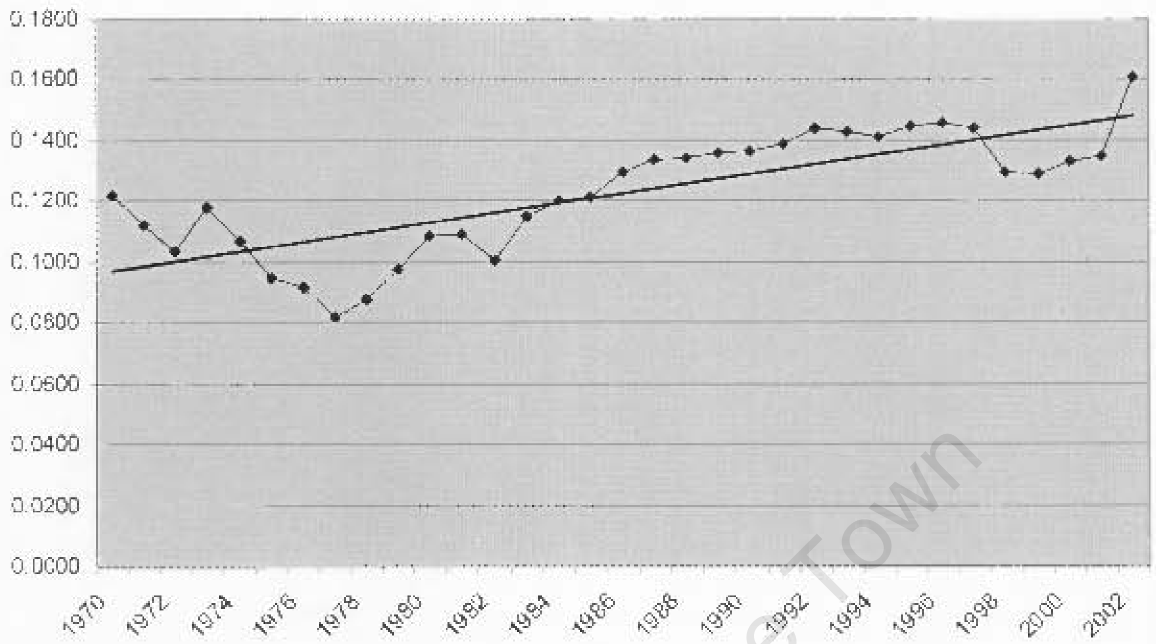
2.4 RESULTS

2.4.1 PRICE COST MARGIN ESTIMATES

In order to look at the PCM estimates at an aggregate level, the individual PCM estimates, calculated for each manufacturing sector, were simply averaged across all manufacturing sectors for each year. Results, presented in Figure 2 below, are consistent with previous studies in terms of the level of PCM and are reasonably consistent in terms of South Africa's trade liberalisation history. The magnitude of the PCM estimates are consistent with other studies[10], which also estimate PCM's to be roughly within a 10-15% bracket. As can be seen in Figure 1, the estimated aggregate PCM for manufacturing rarely falls outside of this range.

[10] Among others: Goldar and Argarwal (2004), Hakura (1998).

FIGURE 2: AGGREGATE PCM FOR SOUTH AFRICAN MANUFACTURING: 1970-2002.



In terms of South Africa's history of trade reform the estimates are largely consistent for the 1970's, where South Africa turned away from import substitution, resulting in a decrease in protection, as can be seen in Figure 2 above. The aggregate PCM estimates for the 1970's are decreasing to 1976 and below the trend line for 1973-83. The estimates remain consistent for the 1980's where South Africa embarked on a more protectionist policy. The PCM estimates for this period are consistent with this, increasing from 1981 onwards and remaining above the trend line throughout the 1980's.

Another factor resulting in the increasing trend in PCM estimates in the 1980's is the fact that South Africa experienced negative real interest rates during this period as a result of the government's efforts to make manufacturing more capital intensive. The ensuing increase in capital stock results in an increase in the estimation of PCM (in accordance with Equation 6 on page 10), and further explains the increasing PCM estimates for South African manufacturing during the 1980's.

The PCM estimates for the 1990's, however, reveal some inconsistencies. While South Africa began its programme of decreasing protection from 1990 (initially with the removing of surcharges) PCM continues to increase to 1992, and then increases again from 1994 to 1996. After 1997 the estimates are more consistent as we see a sharp decline and PCM remains under the trend line for the remainder of the decade. The increasing estimates for the early and mid-1990's are either evidence in support for Fedderke and Vase's (2001) findings, which show that the ERP did not decrease to the extent otherwise believed, or they show some discrepancy in the estimates themselves. Alternatively, the increasing PCM estimates could be determined by the upturn in growth that the South African economy experienced over this period, which may have had a greater impact on profit margins than the increased competition from a more open economy.

The extreme increase in PCM for 2001 and 2002 are of great concern and, as mentioned before, cast doubt over the validity of the data for these two observations. For this reason the years 2001 and 2002 have been excluded for the remainder of the study.

Looking at the PCM's at the sector level, Table 1 below shows the estimated figures for each sector averaged across the three key periods in terms of South Africa's trade liberalisation history, as well as averaged across the entire period 1970-2000. For all four of the averaged time periods, Tobacco, Coke and Refined Petroleum products and Other Manufacturing reveal relatively high PCM's of above 20%. For the period 1994 to 2000 Beverages and Basic Non-Ferrous Metals also increase above 20%. Roughly 63% (17 of the 27 sectors) saw a decrease in PCM from 1994 to 2000, which is consistent with the tariff liberalisation taking place at the time.

Of some concern, however is the volatility of the PCM estimates for many of the sectors. While the majority of sectors estimates remain fairly stable up to 1993/4, many show alarming volatility after this period, some (such as Basic and Non Ferrous Metals and Glass and Glass Products) fluctuating by over 20 percentage points in the latter half of the decade. Furthermore, 21 of the 27 sectors (78%) show an increase in the PCM estimate for the last two observations for the dataset, 2001 and 2002, some (Glass and Glass Products and Professional and Scientific Equipment) increasing by over 10 percentage points. SA did suffer a sharp increase in inflation for these years but this should not affect the PCM estimates with both Value Added and Total Output (from equation 1) measured in nominal terms. By excluding 2001 and 2002 it is hoped that some of the volatility and inconsistency of the PCM estimates will be alleviated.

TABLE 1: Price Cost Margin in South African Manufacturing Sectors

SECTOR	PCM (%) Average: 1970-79	PCM (%) Average: 1980-93	PCM (%) Average: 1994-00	PCM (%) Average: 1970-02
Food	0.07	0.08	0.09	0.08
Beverages	0.15	0.17	0.22	0.18
Tobacco	0.33	0.38	0.35	0.36
Textiles	0.09	0.09	0.06	0.09
Wearing apparel	0.06	0.07	0.06	0.06
Leather and leather products	0.02	0.04	0.08	0.05
Footwear	0.03	0.05	0.1	0.06
Wood and wood products	0.08	0.11	0.13	0.11
Paper and paper products	0.09	0.11	0.14	0.11
Printing, publishing and recorded media	0.09	0.11	0.12	0.1
Coke and refined petroleum products	0.23	0.32	0.25	0.27
Basic chemicals	0.08	0.09	0.16	0.11
Other chemicals and man-made fibers	0.09	0.11	0.11	0.1
Rubber products	0.12	0.13	0.12	0.12
Plastic products	0.08	0.12	0.09	0.1
Glass and glass products	0.06	0.12	0.12	0.11
Non-metallic minerals	0.13	0.13	0.19	0.15
Basic iron and steel	0.11	0.08	0.1	0.1
Basic non-ferrous metals	0.07	0.12	0.24	0.14
Metal products excluding machinery	0.07	0.09	0.11	0.09
Machinery and equipment	0.06	0.08	0.08	0.07
Electrical machinery and apparatus	0.09	0.11	0.12	0.1
Television, radio and communication	0.04	0.06	0.08	0.06
Professional and scientific equipment	0.12	0.13	0.1	0.12
Motor vehicles, parts and accessories	0.04	0.06	0.08	0.06
Other transport equipment	0.17	0.16	0.08	0.14
Furniture	0.05	0.08	0.08	0.07
Other manufacturing	0.22	0.35	0.41	0.32

2.4.2 PCM AND TRADE LIBERALISATION RESULTS

2.4.2.1 Stationarity and Cointegration Testing

If a variable's mean, variance or autocovariance is not constant then the variable is determined to be non-stationary, in other words a variable must display mean reversion and must be time invariant to be classified as (weakly) stationary. Once a variable is determined non-stationary any regressions estimated including the variable will constitute spurious regressions. Intuitively one would expect the variables in the model to be stationary as PCM, IMP and LP are all ratios and hence any upward trend in current price values is expected to be eliminated.

Analysis of autocorrelation functions as well as ADF tests were conducted on all variables included in the model (Equation 12) in order to ensure that the variables were indeed stationary. Surprisingly, PCM, IMP and LP were found to be non-stationary in 27 of the 28 sectors[11]. The non-stationarity of the variables is difficult to make sense of, as analysis of the plots of the variables reveals no apparent trends for the vast majority of sectors. It should also be noted that ADF testing is a rather weak econometric tool. As a changing mean represents a sufficient but not necessary condition for non-stationarity the results suggest inconstant variance or covariance of the variables as the reason behind the non-stationarity.

In order to be able to test for a long run relationship between PCM, IMP and LP, the Johansen Technique was used to test for the existence of a cointegrating vector for each sector[12]. Once all variables are determined to be of the same order of integration, they are included in an unrestricted VAR and tested in order to determine the appropriate lag length. The VAR is then re-parameterised in order to be able to test for r, the number of cointegrating vectors. A cointegrating vector was found for only 7 of the 28 sectors. For these sectors a Vector Error Correction Model (VECM) specification was used to estimate the long run relationship between the variables[13].

[11] With each variable found to be stationary in a different sector; for ADF tests for all sectors see Table A in Appendix 1.
[12] For a full explanation of the econometric methodology for this technique and the VECM model, see Appendix 2.1 and 2.2.
[13] See Appendix 2.1.

2.4.2.2 Vector Error Correction Model Results

TABLE 2: Long Run Relationship Results for Sectors with Non-Zero *r*. (Normalised on PCM).

SECTOR	IMP	LP
Leather and leather products	0.1899* (-0.0543)	-1.1896** (-0.6101)
Paper and paper products	0.1962** (0.0903)	-0.1443 (0.0796)
Printing, publishing and recorded media	1.4025 ** (0.5959)	1.1298 (0.8800)
Plastic products	-1.2248 ** (0.3382)	2.6987** (0.6296)
Basic non-ferrous metals	2.7465 (4.6386)	-1.9284 (4.2569)
Metal products excluding machinery	0.3288** (0.0912)	-0.9187** (0.3026)
Television, radio and communication equipment	-0.018279 (0.0192)	-0.97458 (0.48039)

Standard Errors in brackets. * denotes significance at the 5% level, ** at the 10% level.

The imposed restriction of normalising on PCM was tested using a Log-Likelihood Ratio (LR test). The restriction was found to hold in all sectors bar Basic Non-Ferrous Metals. As is evident in Table 3 above, the 'correct' sign was only found in 2 sectors for IMP and LP respectively; and was only found to be significant in one case, Plastic Products. Furthermore, the estimated coefficients for all of the 7 sectors are relatively small, some registering as low as -0.0183 (Television, radio and communication equipment).

These disappointing results, both in terms of the existence of a long-run relationship and the estimation of this relationship if it was found to exist, suggest either that there is no evidence of a long run relationship between PCM and import penetration or that there is some problem with the data or model specification. The specification of the VECM may well suffer from biases due to missing variables. Due to a lack of data and observations, however, more variables are not able to be included in the model and this potential problem cannot be addressed.

Another possible problem concerns the use of import penetration, as there is the possibility of endogeneity problems existing (Thompson,2000). If, for instance, higher mark-ups in a given industry consequently attract increased imports then simultaneity exists between PCM and IMP. In order to determine if the problem lies rather with IMP as a measure for import competition as opposed to PCM or even the non-existence of a long relationship at all, the three other more direct measures of import competition are used: Duties collected including surcharges (DUTY), Duties collected excluding surcharges (DUTYXS) and an openness index constructed by Aron, J. and J. Muellbauer (2002) (OPEN).

Analysis of Autocorrelation Functions and ADF tests reveal that all three measures are non-stationary and so the Johansen technique was again employed to determine the existence of a long run relationship[14]. The normalising restriction was again imposed on PCM for all three measures of import competition. The restriction could only be rejected for Basic and Non-Ferrous Metals (for DUTY and DUTYXS) and for Plastic Products (for OPEN). The results using these measures of import competition are even less significant than with those found using import penetration. A cointegrating relationship between DUTY, LP and PCM was only found in 2 of the 28 sectors, while 5 sectors revealed a long run relationship using DUTYXS and 4 using OPEN. For the sectors that did reveal a long run relationship, the correct sign on the estimated ECM coefficient (negative for DUTY and DUTYXS, and positive for OPEN), was found in only six instances[15]. In any event, the estimated coefficients are so small, that they cannot be deemed to be significant, and the standard errors further confirm this.

The fact that no consistently significant long-run relationship can be found between import competition and pricing behaviour, even with the use of four different measures of import competition, seems to suggest that, at least at the sector level, the relationship is not as strong as the theory predicts. Another explanation, however, is that the data may be the problem, especially in terms of the estimates for PCM, the volatility of which was discussed in the preceding section.

[14] See Appendix 3.
[15] See Appendix 4.

2.4.2.3 Short-Run Results

As no long-run relationship can be found, the analysis now turns to the evidence of the existence of a short-run relationship. Equation 12 was estimated, with each variable first-differenced, for each of the 28 manufacturing sectors. As can be seen in Table 3 below, the results do little to provide evidence of the theoretical relationship. The expected negative relationship between PCM and IMP was found for only 9 of the 28 manufacturing sectors, and this relationship was significant (at the 10% level) in only three cases. In all other sectors the relationship was found to be positive, and in one case (Basic iron and steel) the estimated coefficient is significant. Of further concern is the direction of the relationship estimated for the other variables throughout the manufacturing sectors. A significant relationship was seldom found, and for all sectors both significant positive, and negative relationships were estimated.

TABLE 3: OLS Estimates of short run relationship: 1971-2000.

Dependant variable: PCM	Independent Variables:				
SECTOR	IMP	G	LP	G*IMP	Δ Q/Q
Food	7.02	0.39	0.28	-7.89	0.02
Beverages	5.50	0.56	-0.12	-6.22	-0.01
Tobacco	-	-	-	-	-
Textiles	0.55	0.56	-1.54*	-2.05	0.05**
Wearing apparel	3.76	0.47	-0.42	-4.67	0.01
Leather and leather products	-0.69*	-0.22	-0.28	0.97*	0.01
Footwear	0.41	-0.02	-0.06	-0.61	0.01
Wood and wood products	0.54	-0.2	-0.90	-0.32	0.01
Paper and paper products	-0.28	-0.51	0.06	0.38	0.05
Printing, publishing and recorded media	0.59	0.59	0.02	-0.64	0.01
Coke and refined petroleum products	-	-	-	-	-
Basic chemicals	-1.92	-0.87	0.01	2.35	-0.02
Other chemicals and man-made fibers	2.79	0.59	0.35	-3.37	0.03
Rubber products	-1.38	-0.32	0.04	1.49	0.02
Plastic products	6.79	0.86	0.44	-8.99	0.02
Glass and glass products	1.45	0.37	-0.38	-1.75	-0.01
Non-metallic minerals	0.58	0.05	0.03	-0.83	0.01
Basic iron and steel	9.31*	-0.89	-0.26	-10.65*	0.05*
Basic non-ferrous metals	-0.19	-0.52	0.77*	0.211	0.04
Metal products excluding machinery	5.75	0.59	1.01**	-7.14	0.01
Machinery and equipment	5.46	2.86	0.06	-6.88	-0.01
Electrical machinery and apparatus	-6.47*	-1.36	0.21	7.63	0.02
Television, radio and communication equipment	0.03	-0.01	-0.01	-0.01	-0.01
Professional and scientific equipment	-0.14	-0.04	-0.09	0.04	-0.01
Motor vehicles, parts and accessories	1.97	0.49	0.34	-2.20	0.02*
Other transport equipment	-9.03*	-3.95	0.06	10.19*	-0.09*
Furniture	-5.96	-0.26	0.58	7.69	0.02*
Other manufacturing	1.7	0.06	-0.17	-2.17	-0.14**

** Denotes significance at the 10% level, * at the 5% level.

A possible cause for the poor results could be the low number of observations included in each of the regressions. Due to taking first differences, and the fact that the Gini Coefficient has so few observations[16], the number of observations for each regression was limited to just 24, which could explain the inconsistent and insignificant results. In order to address this concern, Equation 12 was estimated again in first differences, but this time with the measure of industry concentration (G), and

[16] This is due to the fact that for both measures of industry concentration (Rosenbluth and Gini), figures were unavailable for the years 1970-71 and 1996-2002.

the interaction term (G*IMP) omitted (see Table 4 below). With the number of observations increased to a more acceptable 30, the results are more persuasive in terms of the number of sectors for which negative coefficients are estimated for IMP. Now 14 of the 28 sectors register an estimated coefficient on IMP that is negative, an increase from just 9 when the Gini coefficient was included. However only three of these negative coefficients are estimated with significance. Of further concern is the magnitude of the estimates, with not a single estimate above 0.5, and the range being from 0.01 to 0.45 and the absolute average at 0.12. The fact that such small coefficients are estimated with such insignificance provides little evidence for the direction of the relationship. Rather, the evidence seems to be suggesting that no relationship exists at all.

The inconsistencies in the results are further emphasised by the estimated relationship between PCM and the two other variables in the included. Very few of the estimated coefficients are significant, and those that are both positive and negative in terms of the relationship with PCM.

TABLE 4: Short Run OLS regression results with G and G*IMP omitted:

Dependant variable: PCM	Independent variables:		
SECTOR	IMP	Δ Q/Q	LP
Food	0.15	0.26	0.89
Beverages	0.45	-0.01	0.02
Tobacco	0.03	0.12	0.15
Textiles	-0.1	0.07*	-0.01
Wearing apparel	0.16	0.02	0.3
Leather and leather products	-0.19**	0.04	0.7
Footwear	-0.02	-0.01	0.25
Wood and wood products	0.34	0.04	-1.19
Paper and paper products	0.27	0.02	0.08
Printing, publishing and recorded media	0.07	0.05**	0.41
Coke and refined petroleum products	-0.07	-0.12*	-0.06
Basic chemicals	0.1	-0.01	0.08
Other chemicals and man-made fibers	0.06	0.07*	0.04
Rubber products	-0.03	0.03	-0.19
Plastic products	0.21	0.06**	0.03
Glass and glass products	-0.24	0.01	1.19
Non-metallic minerals	-0.09	0.01	0.27
Basic iron and steel	0.05	0.05*	0.05
Basic non-ferrous metals	0.17**	0.05*	-0.15*
Metal products excluding machinery	-0.11	0.03	0.01
Machinery and equipment	0.02	0.02	0.31
Electrical machinery and apparatus	-0.19*	0.02	-0.06
Television, radio and communication equipment	-0.02	-0.01	-1.81**
Professional and scientific equipment	-0.02	0.06	0.35
Motor vehicles, parts and accessories	0.01	0.03	0.34
Other transport equipment	-0.12*	-0.8	-0.44
Furniture	-0.02	0.01	-0.02
Other manufacturing	-0.06	-0.11*	

** Denotes significance at the 10% level, * at the 5% level.

Investigating the "imports-as-market-disciplining-hypothesis" in South African manufacturing using PCM as the measure for competitiveness has therefore provided little evidence in support of the hypothesis. There is little evidence that a significant relationship between trade liberalisation and pricing behaviour exists and certainly no evidence that the relationship is negative. The paper therefore now turns to the use of a different measure of competitiveness, namely the estimated values of the mark-up using Hall's 'marginal cost' approach.

3 MARGINAL COST APPROACH

3.1 THEORY AND LITERATURE REVIEW

3.1.1 HALL'S MARGINAL COST APPROACH

The second approach to estimating mark-ups to be utilised was developed initially by Hall (1986,1988), and focuses rather on the estimation of marginal cost. The methodology used draws on the work of Solow in his investigation of technical progress and the business cycle, but with one key difference: while Solow assumes the equality of price and marginal cost in order to calculate technical progress, Hall makes assumptions about technical progress in order to calculate the relationship between price and marginal cost (Hall,1986).

The main assumption that Hall makes is that technological progress "can be viewed as random deviations from an underlying constant rate" and that the residual is therefore uncorrelated with the business cycle and not pro-cyclical, as Solow assumes (Hall,1986,291). By making this assumption Hall is then able to investigate the changing input and output levels over the business cycle and estimate marginal costs from these fluctuations. Hall measures and then eliminates input costs, concentrating on the ratio of change in costs to change in output in order to calculate marginal cost. "The comparison of movements of inputs with movements in output is at the heart of the calculation" (Hall,1986,922) and with changes in output inextricably linked to the business cycle, the calculation of marginal costs is clearly very closely connected to issues of productivity and the business cycle. In this regard, Hall makes a number of assumptions that allow him to estimate marginal cost as:

$$x = w\Delta N / \Delta Q - \theta Q' \tag{13}$$

or:

$$x = w\Delta N / \Delta Q \tag{14}$$

Where x is marginal cost, w is hourly wage, N is hours worked, Q is output and θ is technological progress. The inherent assumption of equation 14 is that there is constant technological progress. Besides this assumption, Hall also assumes a constant level of capital stock (1988). By making these assumptions, a measure of marginal cost can be estimated and, importantly for Hall, he argues that the residual will now be uncorrelated with the business cycle.

Using this method to calculate marginal cost, Hall then estimates competitiveness by calculating industry mark-ups as the ratio of price over marginal cost. A perfectly competitive industry will therefore naturally yield a mark up ratio (μ) of 1, while industries in which firms enjoy some kind of market power will have a μ of greater than 1. Using the equation below, Hall is then able to estimate μ:

$$\Delta q = \mu \alpha \Delta n + \theta + u \qquad (15)$$

(where α is labour's share of revenue).

3.1.2 UPWARD BIAS OF ESTIMATES

The estimated mark-up values Hall presents are still implausibly high, however, with the statistically significant estimates close to, and often above, 100%. Hall attempts to account for these results by drawing on the example of a Chamberlinian economy where separation of markets and barriers to entry make monopolistic production the equilibrium outcome (Hall,1986). With firms operating on the downward section of the average cost curve, marginal costs are kept below price allowing for the coexistence of profit taking and free entry. As Martins and Scrapetta (1999) point out however, this theoretical explanation cannot account for the majority of markets, which are not characterised by the two key conditions of market structure for a Chamberlinian economy, and furthermore most empirical studies indicate low profits, especially in OECD countries. Rather, the problematic nature of these results can be explained by an upward bias due to endogeneity problems, and a number of adaptations have consequently been made to correct for this.

Hall's methodology suffers from endogeneity in a number of ways, the most obvious of which due to the fact that the explanatory variables in equation 10 are correlated with productivity shocks, which are captured in the error term (Fedderke et al,2003).

This leads to an upward bias on estimates of μ, helping to explain Hall's implausibly high results.

Another source of endogeneity results from cyclical measurement errors of capital and labour inputs. Hall (1986,310) himself concedes that the error in labour input measurement is likely to be counter-cyclical, with respect to both its measurement in terms of the standard 40-hour week (itself a problematic unit of measurement) and in terms of fluctuating intensity of work effort. Similarly, capital input measurement error is also highly correlated with the business cycle as Hall uses availability of capital as a proxy for actual capital use (Hall,1986). With availability of capital highly correlated with the business cycle, clearly the estimates of μ will be biased upwards due to cyclical measurement error and the resulting endogeneity.

Hall recognised the endogeneity problem and uses the Instrument Variable (IV) approach to correct for this. This involves using an instrument that is correlated with factor inputs but not technological change (captured in the error term). The variables used include real GNP, military expenditure, world oil price and other "pure aggregate demand shifters" (Fedderke et al,2003,4). Other papers have used additional IV's such as lagged values of output data (Konings et al,2001), growth rates in government spending and the political party of the president. Estimates of μ, however, remain implausibly high (ibid.).

A further reason for the upward bias of estimates of μ lies not with endogeneity but instead with the use of value added data as a measure of output (Martins et al,1999,4). As Basu and Fernald (1995) argue, the impact of intermediate inputs must be taken into account even if the production function of the model used is in terms of value added (ibid.). In order to correct for this bias, Basu and Fernald (1995) derived a relationship between weighted growth rates of inputs and the mark up and the growth of real value added which accounts for the impact of shifts in intermediate inputs on value added (ibid.). The relationship is defined by the equation below, where V is value added and s_{ym} is share of material inputs in revenue:

$$\frac{dV}{V}=dv=\frac{1}{1-s_{ym}}dy-\frac{s_{ym}}{1-s_{ym}}dm \qquad (16)$$

3.1.3 THE ROEGER ADAPTATION

Even with the use of IV's and the 'dv' treatment of value added discussed above, estimates of μ are still generally implausibly high. As discussed by Martins and Scarpetta (1999) the principal problem here is that the instruments used by Hall and subsequent papers are likely to be correlated with the productivity shocks as well, the endogeneity problem, in other words, is not resolved and the upward bias persists. Roeger consequently moved away from the IV approach, using a method that "requires more data and is less straightforward" (Konings et al,1998,847).

Roeger deals with both sources of upward bias in his adapted methodology. In order to eliminate the endogeneity problem, Roeger notes that both the primal Solow residual (SR) and the dual of the Solow residual (DSR) can both be related to the mark up μ (Martins et al,1999):

$$SR = \Delta q - \alpha.\Delta l - (1-\alpha)\Delta k = (\mu - 1)\alpha.(\Delta l - \Delta k) + \theta \qquad (17)$$

$$DSR = \alpha.\Delta w - (1-\alpha)\Delta r - \Delta p = (\mu - 1)\alpha.(\Delta w - \Delta r) + \theta \qquad (18)$$

All lower case letters indicate logs; q,l and k are in terms of real value added; α is labour's share in real value added and θ is technological progress. "The basic intuition of Roeger is that both the primal and the Solow residuals contain the same productivity term which can be cancelled out if one residual is subtracted from the other" (ibid.). This simple subtraction gives us the nominal Solow residual (NSR), which is now free from the endogeneity problems caused by the θ term:

$$NSR = (\mu - 1).\alpha.[\Delta(w + l) - \Delta(r + k)] \qquad (19)$$

While the endogeneity problem is eliminated, the other source of the upward bias, namely the use of value added, persists. In order to address this problem Martins and Scarpetta (1999,7) first show that, by easing the restrictive assumption of constant returns to scale, equation 19 becomes:

$$NSR = (\frac{\mu}{\lambda} - 1).\alpha.[\Delta(w+l) - \Delta(r+k)] \tag{20}$$

Where λ denotes the degree of returns to scale (average over marginal costs), and was implicitly assumed to be one in equation 14. If increasing returns to scale are present (λ>1) then clearly the mark ups estimated using this method will be biased downwards and should be interpreted as lower-bound values (ibid.).

To correct for the upward bias caused by using value added data, Martins and Scarpetta (1999,8) demonstrate how intermediate inputs can easily be incorporated into Roeger's approach, giving us an equation that can be estimated using OLS:

$$NSR^{GO} = \Delta(p^{GO} + q^{GO}) - \alpha^{GO}.\mathrm{X}(w+l) - \mathrm{B}^{GO}.\Delta(p_m + m) - (1 - \alpha^{GO} - \mathrm{B}^{GO})\Delta(r+k)$$

$$= (\mu - 1).[\alpha^{GO}.\Delta(w+l) + \beta^{GO}.\Delta(p_m + m) - (\alpha^{GO} + \beta^{GO})\Delta(r+k)] \tag{21}$$

Where the superscript GO denotes gross output, m and Pm denotes intermediate inputs and their prices and alpha and B denote the share of labour and intermediate inputs in gross output.

Rearranging equation 16 gives us an equation with μ on the LHS:

$$\mu - 1 = \frac{\Delta(p^{GO} + q^{GO}) - \alpha^{GO}.\mathrm{X}(w+l) - \mathrm{B}^{GO}.\Delta(p_m + m) - (1 - \alpha^{GO} - \mathrm{B}^{GO}).\Delta(r+k)}{\alpha^{GO}.\Delta(w+l) + \beta^{GO}.\Delta(p_m + m) - (\alpha^{GO} + \beta^{GO})\Delta(r+k)} \tag{22}$$

The equation above now compensates for the upward bias arising from both endogeneity and the use of value added data and now importantly only requires nominal values. However, as Martins and Scarpetta (1999,7) point out, "the treatment of capital costs still requires a separate computation for the growth rate of the rental price of capital, *R*. Since there is no good measure of the rental rate of capital, the Roeger's approach may still present a drawback for its implementation". Even so, empirically Roeger's approach produces much more plausible estimates for μ and is far more reliable than Hall's initial approach.

3.2 THE MODEL

Hakura (1998) incorporates trade variables into his accounting gross Price Cost Margin model (Equation 8), but because of the endogeneity issues, the equation needs to be transformed by the Roeger approach, resulting in the following functional form:

$$NSR_{it} = \mathrm{B}_0 + \mathrm{B}_1 MUP_{it} + \mathrm{B}_2 T * MUP_{it} + \varepsilon_{it} \tag{23}$$

Where MUP is $\alpha.[\Delta(w+l) - \Delta(r+k)]$, T is the trade variable and ε_{it} is the error term[17]. Hakura (1998) and Fedderke et al (2004) use import penetration ratios (IPR) as the trade variable and incorporate it as the deviation from its mean ($\overline{IPR}$) as follows:

$$\begin{aligned} NSR_{it} &= \theta_0 + \theta_1(\alpha.[\Delta(w+l) - \Delta(r+k)])_{it} + \\ &\theta_2[IPR_{it} - \overline{IPR_i}](\alpha.[\Delta(w+l) - \Delta(r+k)])_{it} + \\ &\theta_3[IPR_{it} - \overline{IPR}](\alpha.[\Delta(w+l) - \Delta(r+k)])_{it} + u_{it} \end{aligned} \tag{24}$$

Where $\overline{IPR_i}$ denotes the mean import penetration for the i0th industry, and $\overline{IPR}$ denotes the mean import penetration across all industries. Thus θ2 captures the impact of within-industry variation of import penetration, and θ3 the between-industry variation in import penetration on the mark-up (ibid.).

Edwards and van de Winkel (2005) use a similar functional form to (23), but instead of just IPR a number of other measures for protection are used as well. The robustness of results using tariff data is tested using nominal and effective protection rates (including and excluding surcharges).

The specification used in this paper will follow that used by the papers mentioned above (equation 23) but the focus will be at the sector level and not on the relationship at the aggregate economy level.

[17] From equation 18 we see that the average level of the mark up is therefore calculated by taking the partial derivative of *NSR* with respect to *MUP*: equal to $\mathrm{B}_1 + \mathrm{B}_2 T$. Additionally, the effect of a 1% change in *T* on mark ups is given by: $\partial\left(\frac{\partial NSR}{\partial MUP}\right) \Big/ \partial T = B_2$.

3.3 DATA AND MODEL ESTIMATION

As with the PCM section, the main source of data was the SA Standardised Industry Database (SASID) (Quantec Research,2004), which was obtained from Trade and Industrial Policy Strategies (TIPS). From this dataset measures for Gross Operating Surplus, labour remuneration, intermediate inputs, fixed capital stock, consumption of capital and gross domestic fixed investments were calculated. The time period remains 1970 to 2000, with 2001 and 2002 omitted due to concerns over the consistency of the data.

In order to calculate the MUP term (equation 23), r, the nominal return to capital needs to be calculated. This is equivalent to fixed capital stock times the rental price of capital. Data for fixed capital stock is acquired from the Quantec Database and Martins and Scarpetta's (1999) approach is followed for the calculation of the rental price of capita, where:

$$r = ((i - \Pi_E) + \delta).p_k \qquad (25)$$

i is the long-run interest rate; Π_E is the expected inflation rate; δ is the depreciation rate and p_k is the price deflator for investment.

Fedderke et al (2003) impose a common depreciation 5% and 10% across all sectors, however this paper follows Edwards and van de Winkel (2005) who calculate the depreciation rate as the consumption of capital as a ratio of capital stock, specific to each sector. Edwards and van de Winkel (2005) are again followed for the calculation of the other variables in equation 13: the rate on the SARB 10-year bond is used for i; expected inflation is calculated as the smoothed GDP deflator for manufacturing; and finally p is calculated by dividing the Gross Domestic Fixed Investment (GDFI) for Manufacturing at current prices by the GDFI at nominal prices (1995) (Edwards and van de Winkel, 2005). The variables included in equation 23 were all tested for stationarity using the ADF test and were found to be stationary[18].

The initial trade variable used to proxy the level of trade liberalization will be the same import penetration variable used in the PCM section. In order to test the

[18] See Appendix 5, Table F.

sensitivity of these results, the other measures of protection used in the PCM section are again also used. A total of 4 trade variables are therefore used, import penetration, the openness index, duties collected including surcharges and duties collected excluding surcharges.

In later analysis, a measure of import penetration in intermediates is also included in the regression model. This variable was calculated in current prices and using a weighted average.

As this paper focuses on the trade exposure-market discipline relationship at the sector level, OLS estimation of equation 18 is undertaken for each sector individually. To test the sensitivity of these static results, dynamic estimation is also undertaken using a re-parameterised Autoregressive Distributed Lag (ARDL) model, similar to that which was used for the VECM modelling in the preceding section on PCM[19]. Finally some panel estimations of groupings of the manufacturing sectors are undertaken using fixed effects estimation of equation 23.

3.4 RESULTS

3.4.1 MARK-UP ESTIMATES

In order to estimate the mark-up at the aggregated level of entire manufacturing, Equation 20 was adapted in order to estimate the relationship across all sectors:

$$NSR_i = \mathrm{B} + \mathrm{B}_1 MUP_i + \varepsilon_i \qquad (26)$$

Where MUP is $\alpha.[\Delta(w+l) - \Delta(r+k)]$ and ε_{it} is the error term (See equation 20). This modified, cross-sectional specification of the Roeger equation captures cross-section variation, allowing us to estimate the mark-up for total manufacturing for each year. The results are presented in Figure 3 below.

[19] See Sections 2.4.2.1 and 2.4.2.2 as well as Appendix 2.

FIGURE 3: Annual avearge mark-lp estimates for all manufacturing.
(Including Intermediates)

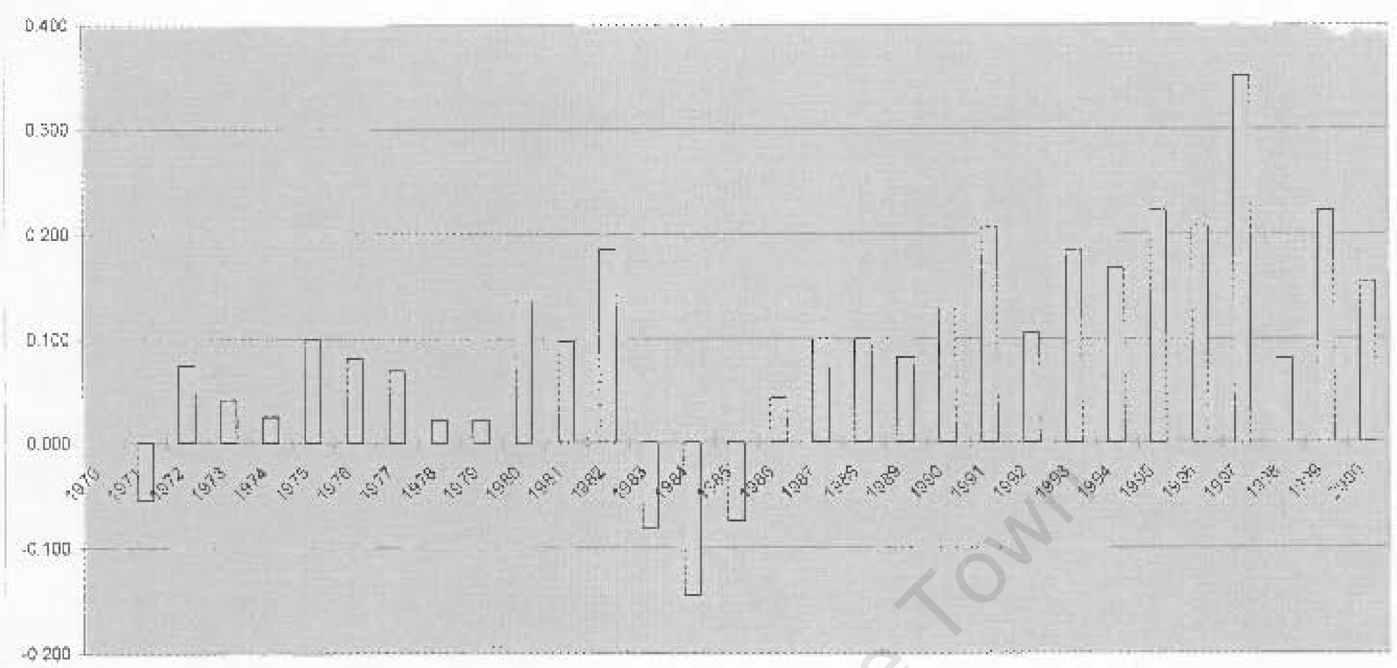


Figure 3 reveals the volatility of the mark-up estimates, even though they are aggregated across all 27 manufacturing sectors. The volatility of the cross sectional estimates is particularly evident in the years up to 1986, with massive fluctuations from -0.1 to o.97 in a three-year period (1981-1984). One possible explanation for this is that the depreciation in the rand caused intermediate input costs to increase, downwardly influencing mark-up estimates. Looking at aggregate estimates made excluding intermediates (Figure 1 in Appendix 6) however, we see that the movements seen in Figure 3 above are reproduced when intermediates are excluded, although estimate values are inflated. Furthermore, only seven of the mark-ups for the period 1970 to 1986 are estimated with significance, raising serious concerns over the reliability of these estimates, especially before 1986.

After 1986 the significance of the estimates improves with only two years (1989 and 1998) not being significant. Along with the improved significance, however, comes a distinct trend in the estimates, with the mark-up estimates increasing steadily from 1986 to the peak level of 0.35 in 1997. This upward trend is difficult to explain as South Africa's process of trade liberalisation began in earnest in 1990, and we would hence expect a downward trend in mark-up estimates for the 1990's.

In order to estimates mark-ups excluding intermediates at the sector level, the Roeger equation (equation 20) is used, simplified to:

$$NSR_{it} = \mathrm{B}_i + \mathrm{B}_1 MUP_{it} + \varepsilon_{it} \qquad (27)$$

Where MUP is $\alpha.[.\Delta(w+l) - \Delta(r+k)]$ and ε_{it} is the error term (See equation 20).

To estimate markups including intermediates equation 21 is used.

As is evident in Table 5 below, the mark-ups are estimated significantly, with only 8 sectors for both including and excluding intermediates not finding a significant estimate. Results replicate those found by Edwards and van de Winkel (1995), displaying a high degree of sensitivity to the inclusion of intermediates. In all cases, bar Leather and leather products, estimated mark-ups are larger when intermediates are excluded, by an average of 0.55 across all manufacturing sectors (see Table 5). There is also sizeable variation in terms of the level of mark-up between sectors: for estimates excluding intermediates the mark-up ranges from 4% to 332.4%; and for including estimates the range is from 4.5% to 28%.

Table 5: Average Mark-up for 1970-2000: Manufacturing sectors

SECTOR	INCLUDING INTERMEDIATES		EXCLUDING INTERMEDIATES	
	B_1		B_1	
Food	0.086	**	0.565	**
Beverages	0.180	**	1.045	**
Tobacco	0.111		3.324	**
Textiles	0.141	**	0.505	**
Wearing apparel	0.069	**	0.100	
Leather and leather products	0.051	*	0.041	**
Footwear	0.071	**	0.118	
Wood and wood products	0.153	**	0.324	
Paper and paper products	0.162	**	0.802	**
Printing, publishing and recorded media	0.138	**	0.299	**
Coke and refined petroleum products	0.183	**	2.308	**
Basic chemicals	0.100	**	0.900	**
Other chemicals and man-made fibers	0.134	**	0.639	**
Rubber products	0.144	**	0.317	**
Plastic products	0.158	**	0.499	**
Glass and glass products	0.142	**	0.469	**
Non-metallic minerals	0.168	**	0.514	**
Basic iron and steel	0.105	**	0.439	**
Basic non-ferrous metals	0.125	**	0.679	**
Metal products excluding machinery	0.088	**	0.342	**
Machinery and equipment	0.085	**	0.245	**
Electrical machinery and apparatus	0.192	**	0.658	**
Television, radio and communication equipment	0.054	**	0.162	
Professional and scientific equipment	0.219	**	0.865	**
Motor vehicles, parts and accessories	0.075	**	0.434	
Other transport equipment	0.045		0.083	
Furniture	0.074	**	0.198	**
Other manufacturing	0.277	**	2.016	**

** Denotes significance at the 10% level, * at the 5% level.

Looking at movements in the level of mark-up over time at the sector level, Table 6 presents the average mark-ups for each sector for each of the three broad periods of South Africa's recent liberalisation history. Only 6 sectors show the expected increase in mark-up from the 1970's to the 1980 to 1994 average. Furthermore, only 3 sectors show an average decrease post 1994 where we would expect a greater impact from South Africa's increased tariff liberalisation. The estimates are slightly more consistent excluding intermediates, with 9 (of the 27) sectors showing an average increase from the 1970's to 1994 and then showing an average decrease afterwards[20]. There is therefore some inconsistency in terms of the movement of mark-up estimates at the sector level. One possible explanation is that rising domestic demand has offset the downward pressure on mark-ups due to increased competition as South Africa

[20] See Table G in Appendix 7.

liberalised its trade. However, this explanation assumes a procyclical mark-up which not necessarily the case. In fact Fedderke et al (2006) find that the mark-up for South African manufacturing is in fact countercyclical.

Table 6: Average Mark-up for key periods: Manufacturing sectors. (Including intermediates).

SECTOR	1970's	1980-1994	1994-2000
Food	0.087 **	0.074 **	0.106 **
Beverages	0.218 **	0.124 *	0.289 **
Tobacco	0.612	-0.184	0.606 **
Textiles	0.180 **	0.115 **	0.163 **
Wearing apparel	0.125 **	0.075 **	0.034 *
Leather and leather products	0.032 **	0.024 **	0.140
Footwear	0.045 **	0.044 **	0.151 **
Wood and wood products	0.118 **	0.099 **	0.274 *
Paper and paper products	0.057	0.137 **	0.267 **
Printing, publishing and recorded media	0.153 **	0.124 **	0.129
Coke and refined petroleum products	0.155 **	0.164 **	0.257 **
Basic chemicals	0.108 **	0.090 **	0.189 **
Other chemicals and man-made fibers	0.103	0.092 **	0.215 **
Rubber products	0.162 **	0.159 **	0.104
Plastic products	0.137 **	0.129 **	0.198 **
Glass and glass products	0.099 **	0.095 **	0.242 **
Non-metallic minerals	0.219 **	0.134 **	0.226 **
Basic iron and steel	0.096 **	0.072 **	0.148 **
Basic non-ferrous metals	0.054 **	0.074 **	0.269 **
Metal products excluding machinery	0.118 **	0.071 **	0.113
Machinery and equipment	0.100	0.048 **	0.170 **
Electrical machinery and apparatus	0.114 **	0.095 **	0.254 **
Television, radio and communication equipment	0.044 **	0.043 **	0.061
Professional and scientific equipment	0.139 **	0.143 **	0.276 **
Motor vehicles, parts and accessories	0.038 *	0.063 **	0.146 **
Other transport equipment	0.179	0.055	-0.051
Furniture	0.022	0.079 **	0.132 *
Other manufacturing	-0.065	0.371 **	0.564 **

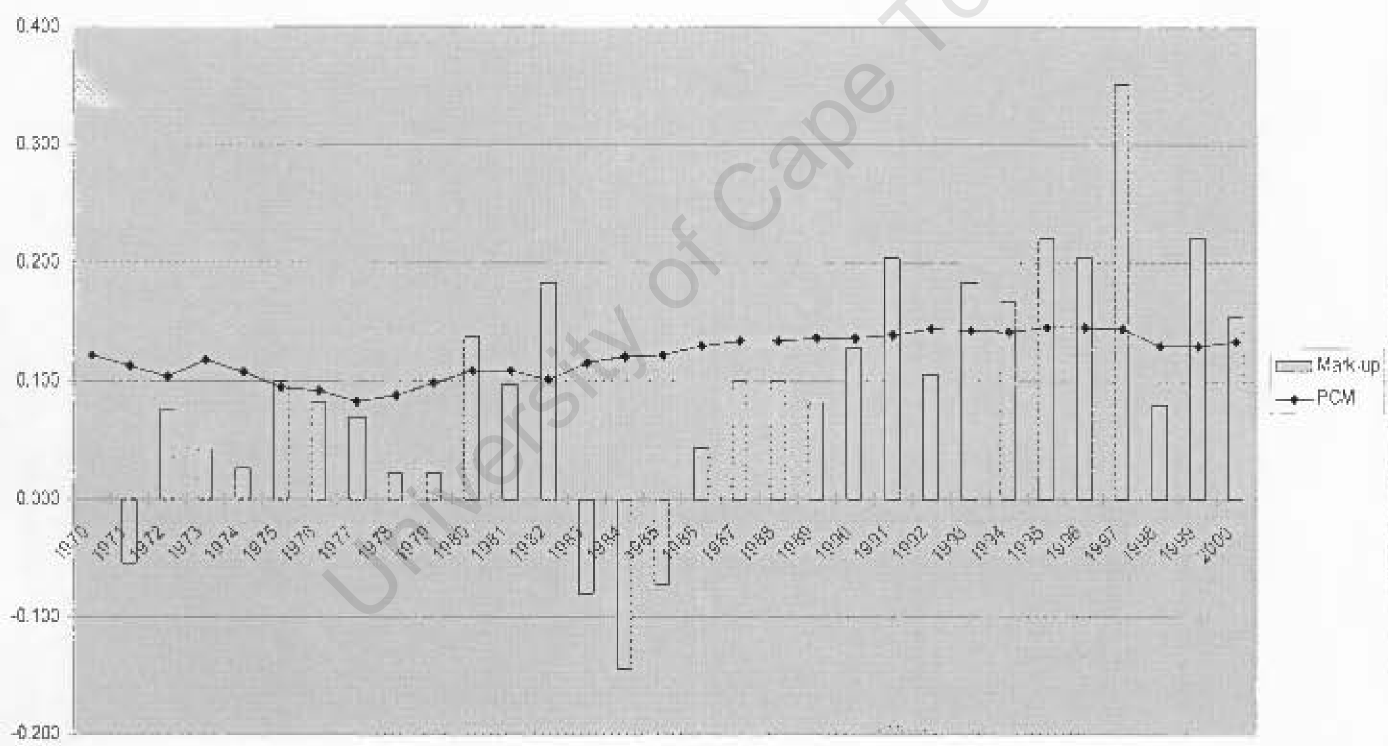
** Denotes significance at the 10% level, * at the 5% level.

3.4.2 COMPARSION WITH PCM ESTIMATES:

Figure 4 below shows the annual averages for PCM across all sectors compared with mark-up estimates across all sectors for each year. In terms of the different ranges of the estimates, the results depicted in Figure 4 below are consistent with the findings of Hakura (1998), who also found mark-up estimates to be broader than those using the PCM methodology. The concerns over the volatility of mark-up estimates are clearly apparent in Figure 4 when compared to the PCM figures. As was discussed in the preceding PCM section, the PCM estimates are by no means stable themselves, indicating that severe volatility exists in the mark-up estimates.

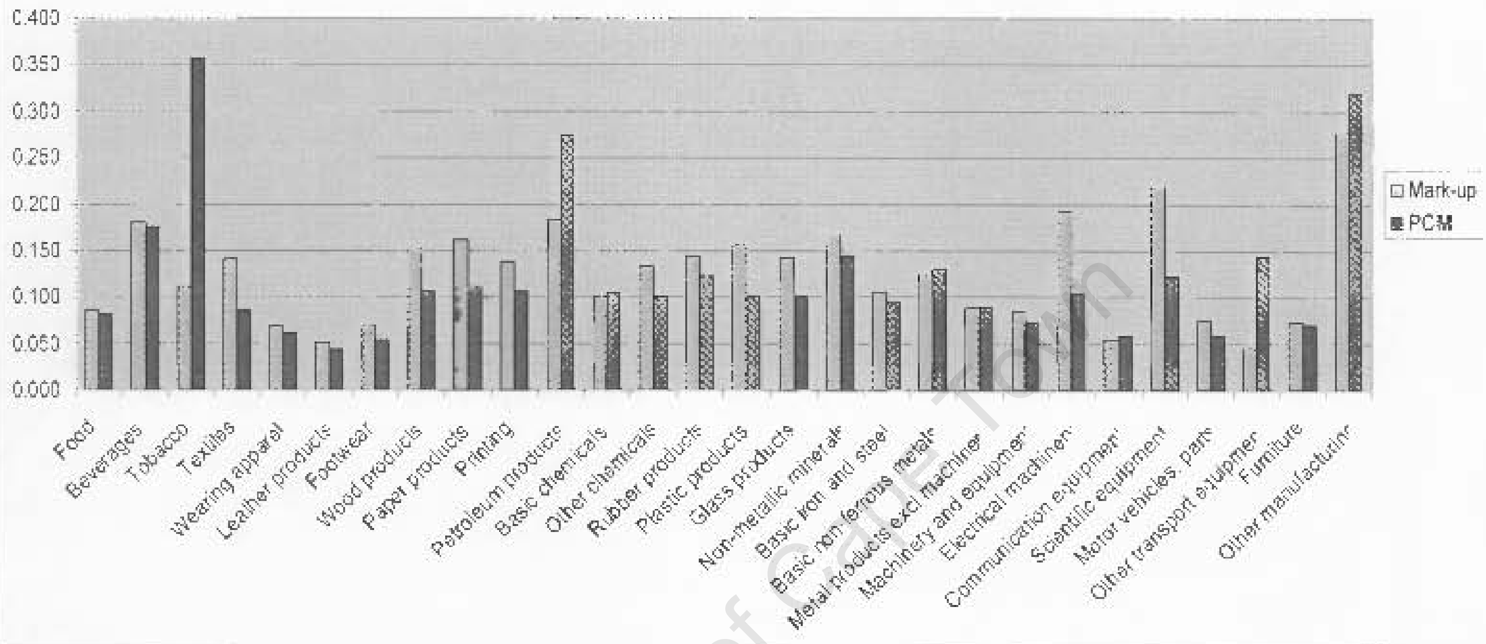
Because these measures are calculated using different approaches it can be argued that comparisons in terms of magnitude are perhaps not as relevant as comparisons in terms of trend. Looking at trends therefore, the steady increase in average PCM from 1982 to 1996 is consistent with the rather more rapid increase in mark-up over the same period; both measures also show a decreasing trend in towards the end of the 1990's. While the volatility of mark-up estimates makes comparison at the aggregate level rather difficult, there is still therefore some consistency between the two measures.

FIGURE 4: PCM and Mark-up annual avearges across manufacturing sectors.



Comparing the two measures at the sector level, Figure 5 below presents the averages over the entire period 1970-2000 for each sector. Here we see much more consistency between the two measures with estimates of roughly the same magnitude for most sectors. Only five sectors (Tobacco, Coke and refined petroleum products, Electrical machinery, Scientific equipment and Other transport equipment) show a difference in estimate of more than 5%. The average difference between the two measures across all manufacturing sectors shows mark-up estimates to be 0.5% larger, and with tobacco excluded (as the PCM estimate is 25% greater), the average discrepancy increases to 1.4%. A simple correlation test between the two measures gives a correlation coefficient of 0.55.

FIGURE 5: Average PCM and Mark-up estimates for 1970-2000.



3.4.3 TRADE LIBERALISATION AND MARK-UPS

This paper will now turn to the investigation of the relationship between trade liberalisation and mark-ups, and attempt to determine whether there is evidence in support of the 'imports-as-market-disciplining-hypothesis' at the sector level of South African manufacturing. In order to do this, equation 23 is estimated:

$$NSR_{it} = B_0 + B_1 MUP_{it} + B_2 T * MUP_{it} + \varepsilon_{it} \tag{23}$$

Where MUP is $\alpha.[\Delta(w+l) - \Delta(r+k)]$, T is the trade variable and ε_{it} is the error term

The initial trade variable included in the estimation is import penetration (IMP), but in order to test the sensitivity of the protection-mark-up relationship, the other measures of protection used in the PCM section are also used[21].

3.4.3.1 <u>IMPORT PENETRATION</u>

Table 7 below presents the estimates of equation 23, specifically B_2, the coefficient of interest which measures the impact of a 1% increase in import penetration on the level of mark-up. For the results including intermediates only 8 of the 27 sectors show the expected negative coefficient and only 3 of these are significant. For results excluding intermediates, 12 sectors show a negative relationship and 4 of these are significant. The initial results displayed in Table 4 therefore display little evidence for the market disciplining effect of trade liberalisation, in fact, they show fairly strong evidence that the relationship is positive. For estimation including intermediates, 18 of the 27 sectors (roughly 67%) show positive coefficients and 13 of these are significant.

[21] Namely the openness index constructed by Aron, J. and J. Muellbauer (2002) (OPEN); Duties collected including surcharges (DUTY), Duties collected excluding surcharges (DUTYXS).

Table 7: Estimates for Mark-up-Import Penetration Relationship

SECTOR	INCLUDING INTERMEDIATES B_2		EXCLUDING INTERMEDIATES B_2	
Food	0.16	**	0.93	*
Beverages	0.07		0.47	
Tobacco	-0.97	**	4.91	
Textiles	0.35	**	2.32	**
Wearing apparel	0.00		-0.88	**
Leather and leather products	0.24	*	1.65	*
Footwear	0.17	**	0.14	
Wood and wood products	0.17		-0.20	
Paper and paper products	0.08		0.24	
Printing, publishing and recorded media	-0.24	*	-0.89	*
Coke and refined petroleum products	-0.07		-0.51	
Basic chemicals	0.33	**	0.27	
Other chemicals and man-made fibers	0.34	**	-0.28	
Rubber products	-0.11		-0.66	**
Plastic products	0.13		-1.31	**
Glass and glass products	0.48	**	0.33	
Non-metallic minerals	0.29	**	0.15	
Basic iron and steel	0.10	**	0.24	
Basic non-ferrous metals	0.20	*	0.36	
Metal products excluding machinery	0.13	*	0.64	*
Machinery and equipment	0.32	**	0.63	
Electrical machinery and apparatus	0.14	*	0.32	
Television, radio, communication equipment	-0.01		-0.29	
Professional and scientific equipment	0.00		2.20	
Motor vehicles, parts and accessories	0.16		-0.36	
Other transport equipment	-0.27	*	-0.52	
Furniture	-0.03		-0.03	
Other manufacturing	-0.52		-1.33	

** Denotes significance at the 10% level, * at the 5% level.

In order to test the sensitivity of these results, a dynamic regression was also included in order to allow for lagged responses to changes in import penetration. Dynamic estimations were implemented by including the variables in equation 23 in an Auto-regressive Distributed Lag (ARDL) model. The ARDL was then re-parameterised as[22]:

$$\Delta y_t = \gamma_0 + \gamma_1 y_{t-1} + b_1 \Delta x_t + b_2 x_{t-1} + u_t \qquad (28)$$

[22] The regression model is therefore described by:

$$\Delta NSR_t = \gamma_0 + \gamma_1 NSR_{t-1} + .. + \gamma_p NSR_{t-p} + b_1 \Delta MUP_t + b_2 MUP_{t-1} + ... \\ + b_q MUP_{t-q} + \lambda_1 MUP * T_t + ... + \lambda_z MUP * T_{t-z} + \mu_t$$

where $\gamma_1 = \alpha_1 - 1$ and $b_1 = B_1 + B_2$. Now the long run solution is defined by $\frac{b_2}{-\gamma_1}$ and the short run relationship is simply b_1. Lag order (p,q,z) was selected using the Akiake Information criterion.

Table 8 below presents the results of these estimations for including intermediates. In terms of the number of sectors for which a negative coefficient was estimated significantly, the results are consistent with the static estimations in Table 7, with only three of the 27 sectors showing a significantly negative relationship in the short run. Furthermore, 12 of the 27 sectors display a significantly positive relationship. Turning to the long run relationship, only 7 sectors reveal a significant long run relationship of which only one is negative. The lag length selection was not sensitive to the choice of criterion.

SECTOR	LAGS	Short-Run Coefficient		Long-Run Coefficient	
Food	0 0 0	0.11	**	-	
Beverages	0 1 1	-0.24		-0.89	**
Tobacco	0 0 0	-1.09	**	-	
Textiles	2 1 1	0.23	**	0.23	
Wearing apparel	1 1 1	-0.02		0.14	
Leather and leather products	3 2 2	-0.08		0.05	
Footwear	3 3 3	0.07		0.34	**
Wood and wood products	0 0 0	0.33	**	-	
Paper and paper products	3 0 3	0.08		0.00	
Printing, publishing and recorded media	0 2 0	-0.19		-	
Coke and refined petroleum products	0 3 0	-0.11		-	
Basic chemicals	2 0 0	0.35	**	0.52	*
Other chemicals and man-made fibers	0 0 0	0.33	**	-	
Rubber products	0 0 0	-0.13	*	-	
Plastic products	3 0 0	0.10		0.08	
Glass and glass products	2 0 0	0.21	*	0.32	*
Non-metallic minerals	0 0 0	0.25	**	-	
Basic iron and steel	2 3 3	0.08	**	0.33	*
Basic non-ferrous metals	3 2 0	0.26	**	0.27	*
Metal products excluding machinery	0 0 0	0.20	*	-	
Machinery and equipment	2 3 3	0.43	**	1.07	**
Electrical machinery and apparatus	2 2 1	0.22	**	0.10	
Television, radio, communication equipment	1 3 3	-0.04		0.02	
Professional and scientific equipment	0 0 0	0.00		-	
Motor vehicles, parts and accessories	3 0 0	0.21		0.15	
Other transport equipment	0 1 0	-0.27	*	-	
Furniture	0 0 0	-0.03		-	
Other manufacturing	0 0 0	-0.45		-	

Table 8: Dynamic Estimation: Including Intermediates.

If the same estimations are made excluding intermediates then results in terms of the long run relationship improve (see Table 9 below). Now 14 sectors (roughly 52%) show a negative long run relationship although only 4 of these are significant. The short run estimates remain largely unchanged with 15 sectors finding a negative coefficient but only 3 of these are significant.

Table 9: Dynamic Estimation: Excluding Intermediates.

SECTOR	LAGS	Short-Run Coefficient		Long-Run Coefficient	
Food	0 1 1	0.51		-0.28	
Beverages	0 1 2	-1.93		-6.15	*
Tobacco	1 0 3	8.24		14.44	
Textiles	0 0 0	1.97	**	-	
Wearing apparel	0 3 0	-1.29	**	-	
Leather and leather products	3 3 3	0.19		-0.72	*
Footwear	2 1 1	-0.25		-1.77	
Wood and wood products	2 3 2	-1.04		-1.43	
Paper and paper products	0 3 0	-0.05		-	
Printing, publishing and recorded media	0 3 3	-0.23		0.62	
Coke and refined petroleum products	0 0 0	-0.63		-	
Basic chemicals	0 0 0	1.03		-	
Other chemicals and man-made fibres	3 0 0	-0.47		-0.32	
Rubber products	1 2 0	-0.75	**	-0.55	**
Plastic products	3 1 1	-0.70		-2.07	
Glass and glass products	2 0 0	0.16		0.23	
Non-metallic minerals	3 3 2	0.32		-2.59	
Basic iron and steel	1 1 0	0.01		0.00	
Basic non-ferrous metals	3 1 2	0.39		-1.03	
Metal products excluding machinery	0 0 0	0.63		-	
Machinery and equipment	3 3 0	1.75	**	0.92	**
Electrical machinery and apparatus	3 3 3	1.81	**	-0.33	
Television, radio, communication equipment	1 3 2	-0.15		0.14	
Professional and scientific equipment	3 0 0	5.07	*	2.88	*
Motor vehicles, parts and accessories	3 2 0	1.84		1.13	
Other transport equipment	2 1 0	-0.99	**	-0.73	*
Furniture	0 2 2	-0.01		0.27	
Other manufacturing	3 3 3	-2.56		-6.58	

** Denotes significance at the 10% level, * at the 5% level

3.4.3.2 <u>OPENNESS INDEX</u>

As with the PCM section, the other variables that capture import competition more directly are used instead of import penetration in order to determine if this is where the problem lies. The openness index is the first of these trade variable (T in equation 23) to be used and Table 10 below presents the results. Again the results do not provide any consistent evidence of the market disciplining impact of trade liberalisation. For including intermediates, only 4 sectors estimate a negative relationship and only 2 of these negative coefficients are significant. Conversely, 23 sectors estimate the relationship to be positive, and 17 of the total 27 sectors (63%) show this positive relationship to be significant. When intermediates are excluded, the results improve in terms of the number of sectors that estimate a negative relationship (14); although only 4 sectors estimate the negative relationship as significant. As with the results using import penetration, there is therefore little evidence for the market-disciplining effect of trade liberalisation, although the results improve somewhat when intermediates are excluded.

Table 10: Estimates for Mark-up-Openness Index

SECTOR	INCLUDING INTERMEDIATES		EXCLUDING INTERMEDIATES	
	B_1		B_1	
Food	0.13		0.41	
Beverages	0.57	**	2.26	
Tobacco	2.38	**	-11.22	
Textiles	0.18		2.36	**
Wearing apparel	-0.22		-1.79	**
Leather and leather products	0.48	**	3.55	**
Footwear	0.34	**	-0.41	
Wood and wood products	0.53	**	-1.68	
Paper and paper products	0.36	*	1.49	
Printing, publishing and recorded media	-0.11		-0.75	*
Coke and refined petroleum products	0.17		-3.06	
Basic chemicals	0.52	**	1.45	
Other chemicals and man-made fibers	0.36	**	-1.17	
Rubber products	-0.41	**	-1.60	**
Plastic products	0.19		-1.57	
Glass and glass products	0.40	**	1.03	*
Non-metallic minerals	0.56	**	-0.46	
Basic iron and steel	0.24	**	0.16	
Basic non-ferrous metals	0.57	**	-1.11	
Metal products excluding machinery	0.45	**	1.69	**
Machinery and equipment	0.38	**	-0.13	
Electrical machinery and apparatus	0.18		-0.10	
Television, radio and communication equipme	0.18		-0.99	
Professional and scientific equipment	0.57	**	4.27	**
Motor vehicles, parts and accessories	0.37	**	2.12	
Other transport equipment	-0.61	*	-2.65	**
Furniture	0.35	**	0.40	
Other manufacturing	0.61		4.01	

**Denotes significance at the 10% level, * at the 5% level

Looking the dynamic results presented in Table 11 below, we see a very similar picture as to that which was found using import penetration. Only 3 sectors display significant negative short-run coefficients, and of the 6 negative long run coefficients found, only one is significant. As with results using import penetration, when intermediates are excluded the results improve somewhat in terms of providing evidence of the market disciplining effect of trade liberalisation[23]. The number of sectors that estimate a negative short run coefficient increases to 8, 4 of which are significant. In terms of the long run relationship, 14 are now estimated as negative, 7 of which are significant.

Table 11: Dynamic Estimation: Openness Index Including Intermediates.

SECTOR	LAGS	Short-Run Coefficient		Long-Run Coefficient	
Food	1 0 0	0.22	**	0.28	**
Beverages	0 0 0	0.59	**	-	
Tobacco	0 0 0	7.85	**	-	
Textiles	1 0 0	0.31	**	0.39	*
Wearing apparel	3 2 1	1.26	**	1.22	**
Leather and leather products	4 1 1	-0.06		-0.20	
Footwear	4 4 4	0.79	**	-1.76	
Wood and wood products	1 3 4	-0.11		-1.46	
Paper and paper products	4 4 4	0.62	*	0.53	*
Printing, publishing and recorded media	4 4 4	0.99	**	0.52	*
Coke and refined petroleum products	0 0 0	0.17		-	
Basic chemicals	4 4 0	-2.34	**	1.49	
Other chemicals and man-made fibers	0 0 0	0.37	**	-	
Rubber products	4 2 4	-0.58	*	-0.03	
Plastic products	3 3 3	0.57	**	0.91	*
Glass and glass products	2 0 0	0.31	**	0.56	**
Non-metallic minerals	0 4 4	0.50	**	-1.58	*
Basic iron and steel	4 0 3	0.41	**	0.42	
Basic non-ferrous metals	4 3 2	0.81	**	-0.01	
Metal products excluding machinery	0 0 0	0.47	**	-	
Machinery and equipment	2 1 1	0.59	**	0.98	**
Electrical machinery and apparatus	4 0 0	0.33		0.18	
Television, radio, communication equipment	0 4 4	-0.21		0.09	
Professional and scientific equipment	4 3 4	0.96	**	1.05	**
Motor vehicles, parts and accessories	0 4 0	0.45	**	-	
Other transport equipment	0 0 0	-0.61	*	-	
Furniture	4 4 4	0.90	**	1.24	**
Other manufacturing	4 4 3	1.39	**	3.05	**

**Denotes significance at the 10% level, * at the 5% level

[23] See Table H in Appendix 8.

For both import penetration and the openness index little evidence therefore exists for the predicted negative relationship between trade exposure and market profitability. While results improve slightly when intermediates are excluded the general picture, for both static and dynamic analysis, is not particularly convincing.

3.4.3.3 DUTIES COLLECTED

The third trade variable to be used is duties collected, both including and excluding surcharges. The results for the static estimation of equation 23 are presented in Table 12 below. For both including and excluding surcharges the number of sectors that estimate the expected positive relationship increases if intermediates are excluded (from 10 to 18 for excluding surcharges, and from 10 to 15 for including). Importantly however, the number of sectors that estimate this positive relationship as significant remains unchanged for excluding intermediates (1 for excluding surcharges and decreasing from 2 to 1 for including). In general the only series of estimations that shows any kind of significance in terms of results is with Duties collected excluding surcharges and including intermediates, where 10 of the 27 sectors show a significant relationship. However, 8 of these 10 significant relationships show duties collected to have a negative marginal impact on mark-ups, showing little evidence of the market disciplining impact of trade liberalisation.

Table 12: Estimates for Mark-up-Duties Collected Relationship

SECTOR	INCLUDING SURCHARGES				EXCLUDING SURCHARGES			
	INCLUDING INTERMEDIATES		EXCLUDING INTERMEDIATES		INCLUDING INTERMEDIATES		EXCLUDING INTERMEDIATES	
	B_1		B_1		B_1		B_1	
Food	-0.025		-1.554		-0.13	**	-1.02	*
Beverages	0.001		1.346		-0.11		-0.475	
Tobacco	-0.638		10.112		-1.18	**	4.272	
Textiles	-0.067		-2.426		-0.19	**	-1.557	**
Wearing apparel	0.015		1.617		0.01		0.723	
Leather and leather products	-0.029		1.561		-0.14		0.329	
Footwear	-0.035		0.632		-0.22	**	-0.058	
Wood and wood products	-0.027		1.917		-0.08		1.058	
Paper and paper products	-0.025		0.048		-0.11		-0.478	
Printing, publishing and recorded media	0.088		1.419		0.23	**	0.716	
Coke and refined petroleum products	-0.084		3.338		0.01		1.394	
Basic chemicals	-0.016		0.943		-0.92		0.016	
Other chemicals and man-made fibers	-0.009		2.279		-0.02		0.828	
Rubber products	0.038		2.096		0.14	*	0.815	
Plastic products	-0.032		2.889		-0.16		1.524	
Glass and glass products	-0.128		-0.296		-0.35	**	-0.135	
Non-metallic minerals	-0.076		-0.15		-0.43	**	-0.711	
Basic iron and steel	-0.063		-0.406		-0.25	**	-0.701	
Basic non-ferrous metals	-0.026		0.045		-0.08		0.579	
Metal products excluding machinery	-0.009		-0.892		-0.11		-0.749	
Machinery and equipment	-0.067		-0.373		-0.19	**	-0.009	
Electrical machinery and apparatus	0.038		1.499		0.15		0.858	
Television, radio and communication equipm	0.034		1.661	**	0.06		0.706	*
Professional and scientific equipment	0.119		0.349		0.20		-0.026	
Motor vehicles, parts and accessories	-		-		-		-	
Other transport equipment	0.032		-0.355		0.33		0.622	
Furniture	0.06	**	0.347		0.03		0.066	
Other manufacturing	0.027		-0.105		0.15		-1.424	

**Denotes significance at the 10% level, * at the 5% level

Once again the trade variable of interest was included in a series of dynamic ARDL estimations and the results are presented below in Table 13. The results are poor with a combined 7 significant relationships of the expected sign out of a total 108 regressions (6%). For including surcharges, 8 positive short-run relationships were estimated, 2 of which are significant; and 10 positive long-run relationships were estimated, 3 of which are significant. For excluding surcharges results show 15 positive short-run relationships (2 significant) and 8 positive long-run relationships (none of which are significant).

Table 13: Dynamic Estimation: Duties Collected; Including Intermediates

SECTOR	INCLUDING SURCHARGES					EXCLUDING SURCHARGES				
	LAGS	Short-Run Coefficient		Long-Run Coefficient		LAGS	Short-Run Coefficient		Long-Run Coefficient	
Food	0 0 0	-0.014		-		1 0 0	-0.109	**	-0.131	*
Beverages	3 0 0	0.242		0.206		0 0 0	-0.091		-	
Tobacco	2 4 2	-4.699	**	-2.954	**	0 2 2	-1.362	**	-0.583	
Textiles	0 0 0	-0.059		-		0 0 0	-0.059		-	
Wearing apparel	4 3 3	0.278		-6.181		0 4 4	-0.082		0.094	
Leather and leather products	4 0 0	-0.023		-0.006		4 0 0	-0.084		-0.023	
Footwear	2 0 3	0.161		0.855		2 3 3	-0.152		8.649	
Wood and wood products	0 0 0	-0.469		-		3 3 3	0.114		0.553	**
Paper and paper products	4 0 3	0.14		0.108		4 0 3	-0.085		0.008	
Printing, publishing and recorded media	0 2 2	0.117		-0.581		0 2 0	0.186	*	-	
Coke and refined petroleum products	2 4 4	-0.177		1.029		2 3 4	0.325		1.172	
Basic chemicals	0 3 0	0.211		-		0 0 0	-0.086		-	
Other chemicals and man-made fibers	0 2 2	0.179		-0.049		0 4 3	0.223		0.346	*
Rubber products	0 1 1	0.357	*	-0.249		4 4 0	0.078		0.026	
Plastic products	4 3 3	-0.291	*	0.088		3 0 0	-0.101		-0.087	
Glass and glass products	2 0 0	-0.225		-0.351		2 0 0	-0.122		-0.184	
Non-metallic minerals	0 0 0	-0.314		-		0 0 0	-0.356	**	-	
Basic iron and steel	4 1 0	-0.16		-0.099		4 4 4	-0.211	**	-0.301	**
Basic non-ferrous metals	3 3 2	0.659	**	0.583		2 0 0	-0.074		-0.052	
Metal products excluding machinery	3 3 3	0.245		-1.782		0 0 0	-0.148		-	
Machinery and equipment	2 2 2	-0.419	**	-0.815	**	2 1 0	-0.226	**	-0.235	*
Electrical machinery and apparatus	0 4 4	0.053		0.494		0 4 4	0.053		0.494	
Television, radio, communication equipment	1 2 0	0.112		0.062		4 4 3	-0.006		0.196	*
Professional and scientific equipment	2 4 3	-0.277		-0.885	**	2 0 4	-0.095		0.051	
Motor vehicles, parts and accessories	0 0 0	0.048		-		3 0 0	-0.66		-0.55	
Other transport equipment	0 0 1	-0.083		-0.032		0 0 0	0.0402	*	-	
Furniture	0 0 0	0.109		-		0 0 0	-0.163	**	-	
Other manufacturing	0 0 0	0.402		-		0 0 0	0.091		-	

**Denotes significance at the 10% level, * at the 5% level

If the dynamic estimations are made excluding intermediates[24] then results improve in terms of the number of sectors that estimate a positive long- and short-run relationship, but not in terms of significance. In terms of regressions, a total of 60 out of 108 (56%) estimate a positive relationship (either long- or short-run solutions) but only 17 of these (16%) are significant. Results therefore improve when intermediates are excluded but not to the degree that we can conclude that they provide satisfactory evidence for the 'imports-as-market-disciplining-hypothesis'.

[24] See Appendix 8, Table I.

3.4.3.4 IMPORT PENETRATION IN INTERMEDIATES

With all the results discussed above we find a greater number of sectors with the expected coefficient when intermediates are excluded. Furthermore we find that the reasonably strong evidence of a positive relationship between import penetration (as well as the openness index) and mark-ups found when including intermediates is no longer apparent when intermediates are excluded. The inclusion or exclusion of intermediates therefore clearly influences results.

One explanation for the weakening of the positive relationship when intermediates are excluded is that increasing trade liberalisation reduces the cost of intermediate inputs in production and hence total production costs. In other words, increased competition in imports is in fact placing proportionally more downward pressure on intermediate prices than on finished good prices, and hence resulting in an aggregate increase in mark-ups by domestic producers. If this is indeed the case then the previous estimates of B_2 (from equation 23) will be biased if intermediates are included, but not controlled for in the regression model.

STATIC REGRESSIONS:

In order to test this hypothesis a measure of import penetration in intermediates is included in the regression model, which is now:

$$NSR_{it} = B_0 + B_1 MUP_{it} + B_2 T^* MUP_{it} + B_3 INT^* MUP_{it} + \varepsilon_{it} \qquad (29)$$

Where MUP is $\alpha .[.\Delta(w + l) - \Delta(r + k)]$, T is the trade variable, INT is import penetration of intermediates[25] and ε_{it} is the error term. Coefficients B_2 and B_3 in equation 27 are of key interest, with B_2 estimating the relationship between mark-ups and import competition (expected to be negative), and B_3 estimating the relationship between import penetration in intermediates and costs when trade liberalization increases in general, it is hoped that the upward bias of B_2, that persisted before

[25] INT is measured by $\sum a_{ij} t_i$ where $i \neq j$ and a_{ij} is the intermediate input coefficient of sector j.

$B_3 INT * MUP_{it}$ was included, will be removed. Equation 29 is estimated using import penetration, the openness index and duties collected (excluding surcharges) as the trade variable, the results are presented in Table 14 below.

Looking at the results for import penetration first, we see a moderate increase in the number of sectors that estimate the correct sign for the coefficients B_2. Now 11 sectors estimate the relationship as negative, as opposed to 8 when intermediates are included. Furthermore, 17 of the 27 sectors estimate the relationship between import penetration in intermediates and the mark-up (B_3) as positive. This positive estimated relationship indicates that sectors with higher import penetration in intermediates experience decreasing input costs and this in turn has had a positive effect on the mark-up. We also find that with the inclusion of import penetration in intermediates, the estimates for B_2 decreased in 15 sectors. Similar results are found using the openness index as the trade variable. Now 12 sectors find a negative B_2 estimate (as compared to 4 when intermediates were included) and 19 of the 27 sectors estimated B_3 to be positive. We also find that estimates for B_2 decreased in 15 sectors when import penetration in intermediates is included. Finally, looking at results for duties collected, we again see similar trends. We find that the number of sectors that estimate B_2 as positive (the expected sign) increases from 11 to 19, and that 18 of the estimates for B_2 increased with the inclusion of import penetration in intermediates in the regression equation.

Table 14: Import Penetration in Intermediates: Manufacturing Sectors

SECTOR	IMPORT PENETRATION				OPENNESS INDEX				DUTIES COLLECTED			
	B2		B3		B2		B3		B2		B3	
Food	0.49		0.26		1.05		0.24		-0.04		0.37	
Beverages	-0.72		2.61		5.53		0.56		0.45		2.86	
Tobacco	4.83		-0.84		-41.49		5.35		1.43		-6.75	
Textiles	2.20	**	-0.36		3.76		1.20		-0.77		1.88	**
Wearing apparel	-1.39	**	0.44		-7.34	**	0.64		0.38	**	-0.52	
Leather and leather products	-0.58		2.84	**	17.17	**	-2.02	*	-0.72	**	0.55	
Footwear	-0.05		0.05		-2.95		0.45		1.73		0.12	
Wood and wood products	-0.38		0.14		-8.73		1.78		1.04	**	-1.09	
Paper and paper products	-0.53		2.32		1.03		1.64		0.25		2.57	*
Printing, publishing and recorded media	-0.16		-0.49		-3.12		0.35		0.31		0.30	
Coke and refined petroleum products	-0.32		-0.77		-13.22		-2.46		0.37		-0.65	
Basic chemicals	1.19		0.24		5.55		0.39		-0.20		-0.48	
Other chemicals and man-made fibers	0.16		-0.76		-5.06		0.75		0.72	**	1.09	
Rubber products	-0.80	*	0.68		-8.17	**	1.45		0.30		-0.39	
Plastic products	-1.35		1.72		-9.12	*	1.60		0.23		-0.15	
Glass and glass products	0.69		-1.29	*	3.27	*	-0.79		-0.16		-1.26	*
Non-metallic minerals	0.05		0.14		-1.48		-0.06		0.04		0.13	
Basic iron and steel	0.16		0.04		-0.02		-0.34		-0.03		-0.30	
Basic non-ferrous metals	0.12		-1.14		-10.49	*	-2.57	*	-0.04		-1.22	
Metal products excluding machinery	0.61		0.03		5.24		0.02		0.04		0.45	
Machinery and equipment	0.83		-0.46		-2.10		0.47		0.08		0.31	
Electrical machinery and apparatus	2.31	**	-2.82	*	-3.51		1.06		0.33		1.15	
Television, radio, communication equipment	-0.79		1.29		-4.59		0.46		0.22		0.16	
Professional and scientific equipment	0.86		5.88		6.02		5.10		0.12		6.79	**
Motor vehicles, parts and accessories	-1.32		1.42		5.65		0.35		0.49	*	1.71	*
Other transport equipment	-0.47		-1.15		-12.96	**	1.30		-0.20		-2.08	**
Furniture	-0.07		0.27		1.68		-0.13		0.02		0.18	
Other manufacturing	0.38		-4.32	*	9.46		-3.88	*	-0.72		-6.21	**

**Denotes significance at the 10% level, * at the 5% level

While there does therefore appear to be some evidence of falling intermediate prices exerting upward pressure on mark-ups, the results discussed above are not entirely convincing due to the low level of significance with which they are estimated. Of all the estimated coefficients presented in Table 10, only 30 (out of 162, roughly 19%) are significant; and of the 30 significant estimates, only 14 are of the expected sign.

DYNAMIC REGRESSIONS:

We are able to test the sensitivity of the static results in a dynamic context by including the interaction term $INT * MUP_{it}$ (from equation 29) and its lags as a third explanatory variable in the dynamic regression model described by equation 28. The results are presented in Table 15 below.

Table 15: Dynamic Estimation: Import Penetration and Import Penetration in Intermediates.

SECTOR	IMPORT PENETRATION					IMPORT PENETRATION IN INTERMEDIATES			
	LAGS	Short-Run Coefficient		Long-Run Coefficient		Short-Run Coefficient		Long-Run Coefficient	
Food	0 1 1 0	0.48		-0.235		-0.628		-	
Beverages	0 0 3 3	-3.409		-3.488		-2.745		-2.172	*
Tobacco	0 0 3 0	6.402		9.049	**	5.953	**	-	
Textiles	0 0 0 0	1.871	**	-		-0.447		-	
Wearing apparel	1 2 0 0	-1.467	**	-0.997	**	-0.511	**	-0.347	**
Leather and leather products	3 3 3 3	0.392		-0.406		2.015		-0.181	
Footwear	0 2 0 3	0.139		-		0.321		0.997	**
Wood and wood products	2 2 3 2	-0.533		0.127		-1.528		-3.369	**
Paper and paper products	0 3 0 0	0.104		-		0.522		-	
Printing, publishing and recorded media	2 1 2 2	0.297		-1.133	**	-1.565	**	-0.802	**
Coke and refined petroleum products	0 0 0 0	-0.384		-		0.154		-	
Basic chemicals	2 2 2 0	0.383		-0.188		-0.533		-0.539	
Other chemicals and man-made fibers	3 0 0 0	-0.373		-0.249		-0.739		-0.494	
Rubber products	1 2 0 0	-0.759	**	-0.558	**	0.034		0.025	
Plastic products	3 2 1 3	-0.697		-1.189		-0.405		-0.759	**
Glass and glass products	2 0 0 2	0.233		0.346		0.122		1.001	**
Non-metallic minerals	3 3 2 2	0.722		-1.33		0.257		-0.384	
Basic iron and steel	2 1 0 1	0.31		0.125		0.847	**	-0.096	
Basic non-ferrous metals	3 0 0 3	1.593	**	1.215	**	1.685	**	-0.299	
Metal products excluding machinery	2 3 3 3	-0.544		-1.721	**	-0.251		-0.308	**
Machinery and equipment	3 3 0 0	1.680	**	0.861	**	-0.556		-0.284	
Electrical machinery and apparatus	3 1 3 1	2.025	**	0.353		0.319		0.598	**
Television, radio, communication equipment	1 3 2 3	-0.066		0.266	**	-2.411	**	-1.206	**
Professional and scientific equipment	3 0 02	6.889	**	3.989	*	-1.302		-0.294	
Motor vehicles, parts and accessories	3 2 0 0	2.058		1.177		-0.686		-0.392	
Other transport equipment	3 0 2 2	-1.168	**	-0.967	*	3.235		-1.192	
Furniture	2 2 0 3	-0.121		-0.065		-1.251		-0.489	
Other manufacturing	3 3 3 0	-2.917		-8.484		-0.187		-0.249	

**Denotes significance at the 10% level, * at the 5% level

The expected the relationship is not consistently estimated when dynamics are included along with import penetration in intermediates. Of the 27 sectors only 12 estimate a negative short run relationship between import penetration and mark-ups and 14 estimate a negative long run relationship. Of these sectors, only 8 are estimated with significance. Another inconsistency is the fact that more relationships are estimated as positive than are negative even though import penetration in intermediates is controlled for. These results are mirrored by those produced when using the openness index is used as the trade variable instead of import penetration, with more sectors showing significant positive coefficients than negative, for both the short- and long-run relationships[26]. For both sets of estimations, the results display such considerable inconsistencies that it is difficult to make use of them as evidence

[26] See Table J, Appendix 9.

for any theoretical relationship between pricing behaviour and trade liberalisation. They certainly do not constitute strong evidence of trade liberalisation disciplining domestic markets.

3.4.3.5 MANUFACTURING GROUPS:

As was discussed in the preceding section including PCM, a major cause for concern with the majority of estimations undertaken is the lack of observations. With as little as 26 observations in some cases, the possibility remains that this is the cause behind the insignificant estimation results. Another possible explanation for the poor results is the fact that too much heterogeneity exists within the aggregated sectors.

In an attempt to address these concerns, panel estimations are attempted, thereby imposing homogeneity as well as greatly increasing the number of estimations. Manufacturing sectors were grouped into four panels according to criteria that produce some level of homogeneity within each panel, hopefully minimising the costs of imposing homogeneity. The groupings are described in Table 16 below:

Table 16: Manufacturing Groups.

SECTOR	Manufacturing Group
Food	Beneficiated Agriculture
Beverages	Beneficiated Agriculture
Tobacco	Beneficiated Agriculture
Textiles	Labour Intensive
Wearing apparel	Labour Intensive
Leather and leather products	Labour Intensive
Footwear	Labour Intensive
Wood and wood products	Beneficiated Agriculture
Paper and paper products	Beneficiated Agriculture
Printing, publishing and recorded media	-
Coke and refined petroleum products	Beneficiated Minerals
Basic chemicals	Beneficiated Minerals
Other chemicals and man-made fibers	Beneficiated Minerals
Rubber products	Beneficiated Minerals
Plastic products	Beneficiated Minerals
Glass and glass products	Beneficiated Minerals
Non-metallic minerals	Beneficiated Minerals
Basic iron and steel	Beneficiated Minerals
Basic non-ferrous metals	Beneficiated Minerals
Metal products excluding machinery	Metal products
Machinery and equipment	Metal products
Electrical machinery and apparatus	Metal products
Television, radio and communication equipm	Metal products
Professional and scientific equipment	Metal products
Motor vehicles, parts and accessories	Metal products
Other transport equipment	Metal products
Furniture	Labour Intensive
Other manufacturing	-

If the number of time series data is relatively large and conversely the number of cross sectional units is not, as is the case with the manufacturing groups above, then the Fixed Effects regression model is preferable (Gujarati, 2003). The regression equation now becomes:

$$NSR_{it} = \alpha_i + \mathrm{B}_1 MUP_{it} + \mathrm{B}_2 T * MUP_{it} + \varepsilon_{it} \qquad (30)$$

With Fixed Effects panel regressions the data is pooled and slope coefficients are assumed constant across sectional units, intercepts however, are allowed to vary (ibid.). While intercepts are allowed to vary they are assumed to be time-invariant, imposing a constant intercept for the time period. In order to capture the various intercepts for each cross sectional unit, 'differential intercept dummies' (α_i) are included in the regression, thus allowing for varying intercepts within the context of pooled data (ibid.). The Fixed Effects approach is therefore utilised as α_i captures sector-specific effects, thereby accounting for missing variables. This approach therefore captures some heterogeneity across the individual sectors, which would not be accounted for using, for instance, the Random Effects approach. Using the Random Effects approach, and therefore not including α_i, would therefore result in the estimated coefficients being biased.

Table 17 below displays the fixed effects estimation results using both import penetration and the openness index as well as including and excluding import penetration in intermediates.

TABLE 17: Manufacturing Groups Estimations: Static Results (1970-2000)

STATIC RESULTS				
Manufacturing Group	Import Penetration		Import Penetration in Intermediates	
Beneficiated agriculture	-0.43		-	
Labour	0.13	*	-	
Beneficiated mineral	0.23	**	-	
Metal products	-0.15		-	
All Manufacturing	-0.03		-	
Beneficiated agriculture	-0.55	**	1.40	**
Labour	0.12	*	-0.13	
Beneficiated mineral	0.31	**	0.30	
Metal products	-0.17	*	0.16	
All Manufacturing	-0.02		0.16	**
	Openess Index		Import Penetration in Intermediates	
Beneficiated agriculture	-0.85		-	
Labour	2.59	**	-	
Beneficiated mineral	-2.76	**	-	
Metal products	-3.49	**	-	
All Manufacturing	-1.87	**	-	
Beneficiated agriculture	-1.04		1.37	**
Labour	3.24	**	-0.31	*
Beneficiated mineral	-0.89	*	0.04	
Metal products	-1.61	**	0.41	*
All Manufacturing	-2.15	**	0.19	**

Looking first at the static results with import penetration as the trade variable we see that the only significant coefficients estimated are positive (for the Labour Intensive and Beneficiated Minerals groups). When import penetration in intermediates is included the significance of the estimates improves but the relationship is of the expected direction for only two of the groups. Comparing these static results to those found when the openness index is used, we see a slight improvement in results but still some inconsistencies persisting. Now all manufacturing groups besides Labour Intensive show the expected sign of the relationship between trade liberalisation and mark-ups.

When import penetration in intermediates is included only the Labour Intensive group does not show a negative relationship. However, for all groups besides beneficiated Agriculture we see that the coefficient estimated for the openness index increases with the inclusion of import penetration in intermediates, against expectations.

Furthermore the manufacturing group Labour Intensive consistently shows a significant and positive estimated relationship for the index and mark-ups and a negative relationship between penetration in intermediates and the mark-up. One explanation for the results found for the Labour Intensive group is that sectors with relatively low value added are being forced to close down as they fail to survive the increased competition from international competition. The remaining sectors are therefore those that have a higher value added, hence resulting in the relationship between liberalisation and mark-ups being estimated as positive. Here we see the limitations of dealing with aggregated data as, even with the use of the Fixed Effects approach, the heterogeneity of sectors within the groups can not be sufficiently controlled for, hence biasing estimated coefficients.

Table 18: Manufacturing Group Estimations: Dynamic Results (1970-2000)

Manufacturing Group	Import Penetration				Import Penetration in Intermediates			
	Short Run		Long Run		Short Run		Long Run	
Beneficiated agriculture	-0.42		-0.66		-		-	
Labour	0.06		-0.15	*	-		-	
Beneficiated mineral	0.22	**	0.11		-		-	
Metal products	-0.07		0.00		-		-	
All Manufacturing	-0.03		-0.01					
Beneficiated agriculture	-0.53	*	-0.79	*	1.40	**	1.17	
Labour	0.04		-0.16	*	-0.21		-0.18	
Beneficiated mineral	0.28	**	0.19		0.30		0.45	*
Metal products	-0.10		-0.03	**	0.22		0.26	
All Manufacturing	0.00		0.02		0.20	**	0.23	**
	Openess Index				Import Penetration in Intermediates			
	Short Run		Long Run		Short Run		Long Run	
Beneficiated agriculture	-1.09		-7.78		-		-	
Labour	1.30		-1.59		-		-	
Beneficiated mineral	-3.20	**	-5.16	**	-		-	
Metal products	-2.30	*	-1.25		-		-	
All Manufacturing	-2.18	**	-3.53	**				
Beneficiated agriculture	-3.52		-8.93	*	1.23	**	0.97	
Labour	1.93	*	-1.30		-0.27	*	-0.08	
Beneficiated mineral	-3.35	**	-5.31	**	0.05		0.32	
Metal products	-3.73	**	2.40		0.40	**	-0.38	*
All Manufacturing	-2.49	**	-3.87	**	0.18	**	0.20	**

Turning now to the dynamic estimation of the manufacturing groups[27] presented in Table 18 above, we see that only one group reveals a significant short run coefficient on import penetration and it is positive (Beneficiated Minerals). For the long run solutions, again only group shows a significant relationship, with the Labour Intensive group revealing a negative long run relationship. When intermediates are excluded and import penetration in intermediates is included we see that results remain extremely inconsistent in the short run with one significantly negative and on significantly positive coefficient being estimated respectively. For the long run however, we see that all significant results (three of the four groups) show the expected negative relationship between mark-ups and import penetration.

Using the Openness index instead of import penetration in the dynamic equations, we see that results are again largely insignificant although the estimated coefficients that are significant are of the correct sign. When import penetration in intermediates is included we that the Labour Intensive group again shows a significantly positive coefficient while Beneficiated Minerals and Metal products show significantly negative short run relationships. The two significant long run coefficients are of the correct sign.

The inconsistencies that were hoped to be eliminated by analysing this relationship at a broader level have persisted. Results continue to provide little concrete evidence of the market disciplining effect of trade liberalisation. In fact, especially with the results produced using import penetration, evidence for the relationship being a positive one is as strong as that for trade liberalisation decreasing mark-ups. While we see a slight improvement with the use of the openness index, the results produced with manufacturing groups are therefore generally characterised by inconsistency and insignificance estimation.

[27] A lag length of one was imposed on all variables.

4. CONCLUSION

Following its inclusion into GATT in 1994 and subsequently into the WTO, South Africa has followed the international movement, particularly for developing countries, towards considerable liberalisation in terms of barriers to international trade. One of the central arguments behind this global move to trade liberalisation is the expected dynamic welfare gains that opening up to international markets will bring. Behind most of these dynamic welfare gains is the key catalyst of increased competition. With increased competition come efficiency and productivity gains, increases in variety and quantity of inputs, increases in market size and ultimately industry growth. If South Africa is to benefit from its increased openness to international trade then it therefore must see the expected increases in competitiveness. This paper analyses this question by looking at the relationship between trade liberalisation and the pricing behaviour of the South African manufacturing industry.

Previous papers looking at this field have primarily approached this question at the level of the aggregate economy, or at the industry level. This paper focuses specifically on the relationship at the level of manufacturing sectors. Furthermore two empirical methodologies are employed in the analysis, allowing for the ability to test the sensitivity of results. A number of measures for level of openness are utilized, including import penetration, duties collected and the openness index constructed by Aron, J. and J. Muellbauer (2000), which has not yet been used in this specific context to present knowledge. The concerns arising from the sensitivity of results to the inclusion of intermediates were dealt with through the use of a variable capturing import penetration in intermediates. The paper is therefore a comprehensive analysis of the relationship between trade exposure and pricing behaviour of South African manufacturers at the sector level.

Using the Price Cost Margin (PCM) approach, aggregate estimates for the mark-up are produced that are consistent with studies for other countries in terms of magnitude, and are also generally consistent with South Africa's history of trade liberalisation since the 1970's. Of some concern, however, was the volatility of the estimates at the sector level.

The Tybout and Roberts (2001) model was used to estimate the relationship between the PCM estimates and openness to trade, initially using import penetration as the 'trade' variable. Due to the non-stationarity of the variables, the Johansen technique was used to test for a long run relationship. Only 7 of the 27 sectors displayed a long run relationship and these were included in a Vector Error Correction Model (VECM). Only one sector estimated the expected negative coefficient with statistical significant and estimations using the other trade variables were not able to improve these poor results.

With the lack of evidence of a significant long run relationship, the paper then turned to analysing the short run relationship between PCM and import penetration. Again no statistically significant results were found with only three sectors estimating the relationship as negative with statistical significance. To test if the poor results were caused by a lack of observations, the interaction term was omitted, increasing observations to thirty. This had no improvement on results. Finally the other trade variables were used instead of import penetration and again no consistent results were found.

In section three the marginal cost approach to estimating mark-ups is used. Mark-up estimates are produced following the Roeger (1995) methodology. Besides some minor differences, Edwards and van de Winkel's (2005) results are reproduced, showing the same sensitivity to the inclusion or exclusion of intermediate inputs. Analysing the movement of mark-up estimates at the sector level produces some inconsistencies in terms of South Africa's recent trade history, with only three sectors showing an average decrease from 1994.

Comparison between these estimates and those using the PCM approach are consistent with the comparison undertaken by Hakura (1998) in terms of the respective ranges. However, the extreme volatility of the marginal cost mark-up estimates, especially when compared to the relatively volatile PCM estimates, is of concern.

The relationship between openness to trade, measured by the same variables as were used for the PCM section, and pricing behaviour is again analysed, this time using the estimates produced using the marginal cost approach. The static results are poor for all of the four variables used when intermediate inputs are included. The highest number of sectors showing statistically significant evidence of import competition disciplining pricing behaviour is found when using import penetration, with only three sectors. Furthermore in the case of all four trade variables, there is fairly strong evidence that the relationship between mark-ups and trade liberalisation is positive. These results are confirmed by dynamic analysis using a re-parameterised ARDL functional form.

Analysis of results produced when intermediate inputs are excluded (for both static and dynamic estimation) show that the evidence of the positive relationship found with earlier results decreases dramatically. Furthermore, the number of sectors estimating the relationship as significantly negative increases. To test if import penetration in intermediates is resulting in upward pressure on mark-ups, and hence the source of the inconsistent results, a measure for it is included in the regression model. Results show that there is some weak evidence that this is the case, but are not conclusive due to lack of statistical significance.

Finally, groups of manufacturing sectors are formed in order to further test the sensitivity of results. Static and dynamic regressions are made using both import penetration and the openness index. Again the estimated relationship is not consistently of the expected sign or significant.

With the use of four different measures of trade liberalisation and two different empirical methodologies for estimating mark-ups, a consistently significant relationship can therefore not be found at the sector level of South African manufacturing. Other studies that have found strong evidence of the market disciplining effect of trade liberalisation in South African manufacturing have undertaken their analysis at primarily the aggregate industry level[28]. The findings of this paper therefore indicate that while empirical evidence of the "imports-as-market-disciplining" hypothesis may exist at the aggregate level, the relationship breaks down when analysed at the sector level in South Africa.

[28] Edwards and Golub (2005); Edwards and van den Winkel (2005); Fedderke et al (2001); Fedderke et al (2003).

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6. APPENDICES

APPENDIX 1:

Table A: ADF tests for non-stationarity

	VARIABLE:					
SECTOR	PCM	DPCM	IMP	DIMP	LP	DLP
Food	-1.1836 (-2.975)	-3.7310 (-2.9798)	-1.2215 (-2.975)	-5.3427 (-2.9798)	-.013295 (-2.975)	-4.7103 (-2.9798)
Beverages	-.70947 (-2.975)	-3.6839 (-2.9798)	-2.4827 (-2.975)	-4.5003 (-2.9798)	-1.6048 (-2.975)	-4.0663 (-2.9798)
Tobacco	-1.5779 (-2.975)	-3.0080 (-2.9798)	-2.0596 (-2.975)	-6.7517 (-2.9798)	-1.2631 (-2.975)	-3.6785 (-2.9798)
Textiles	-1.0618 (-2.975)	-4.1377 (-2.9798)	-.19012 (-2.975)	-8.2128 (-2.9798)	-1.9732 (-2.975)	-4.7836 (-2.9798)
Wearing apparel	-2.4618 (-2.975)	-5.1674 (-2.9798)	.34384 (-2.975)	-3.5683 (-2.9798)	-2.0692 (-2.975)	-6.3086 (-2.9798)
Leather and leather products	-.48144 (-2.975)	-7.9887 (-2.9798)	-.31001 (-2.975)	-5.8327 (-2.9798)	-2.1716 (-2.975)	-3.7749 (-2.9798)
Footwear*	1.9974 (-3.5867)	-3.6740 (-3.5943)	-.49169 (-3.5867)	-4.0433 (-3.5943)	-1.8335 (-3.5867)	-4.5527 (-3.5943)
Wood and wood products	-1.7363 (-2.975)	-4.2060 (-2.9798)	-2.4358 (-2.975)	-3.7976 (-2.9798)	-2.7900 (-2.975)	-6.5381 (-2.9798)
Paper and paper products	-1.1513 (-2.975)	-5.6485 (-2.9798)	-2.6095 (-2.975)	-7.6927 (-2.9798)	-2.3363 (-2.975)	-3.0157 (-2.9798)
Printing, publishing and recorded media	-2.0110 (-2.975)	-3.4039 (-2.9798)	-2.5136 (-2.975)	-6.2093 (-2.9798)	.76156 (-2.975)	-4.0317 (-2.9798)
Coke and refined petroleum products	-2.0110 (-2.975)	-4.1688 (-2.9798)	-3.7616 (-2.975)	-8.7282 (-2.9798)	-.96351 (-2.975)	-5.3245 (-2.9798)
Basic chemicals	-.13635 (-2.975)	-4.2706 (-2.9798)	-1.4409 (-2.975)	-6.5014 (-2.9798)	.84405 (-2.975)	-3.6369 (-2.9798)
Other chemicals and man-made fibers	-1.9206 (-2.975)	-5.1607 (-2.9798)	-2.0031 (-3.5867)	-5.7196 (-2.9798)	-2.3521 (-3.5867)	-5.0410 (-2.9798)
Rubber products	-3.1492 (-2.975)	-4.9862 (-2.9798)	.31993 (-3.5867)	-6.2271 (-2.9798)	-2.5858 (-3.5867)	-6.2904 (-2.9798)
Plastic products	-1.9104 (-2.975)	-3.4046 (-2.9798)	-.96909 (-3.5867)	-5.5730 (-2.9798)	-1.6224 (-2.975)	-4.4368 (-2.9798)
Glass and glass products	-1.4191 (-2.975)	-4.2032 (-2.9798)	-.91746 (-2.975)	-6.3076 (-2.9798)	.99287 (-2.975)	-5.0760 (-2.9798)
Non-metallic minerals*	-1.7701 (-3.5867)	-3.8947 (-2.9798)	-.45989 (-3.5867)	-4.0768 (-2.9798)	2.2688 (-2.975)	-2.2819 (-2.9798)
Basic iron and steel	-2.6645 (-2.975)	-5.6063 (-2.9798)	-1.8903 (-2.975)	-5.9701 (-2.9798)	4.7993 (-3.5867)	1.5139 (-2.9798)
Basic non-ferrous metals*	-1.2389 (-3.5867)	-4.5877 (-2.9798)	-3.5185 (-3.5867)	-6.2313 (-2.9798)	2.5501 (-3.5867)	-3.5867 (-2.9798)
Metal products excluding machinery	-1.6155 (-2.975)	-1.6155 (-2.9798)	.065399 (-2.975)	-5.7363 (-2.9798)	-1.4597 (-2.975)	-4.4384 (-2.9798)
Machinery and equipment	-1.0782 (-2.975)	-6.3141 (-2.9798)	-1.6440 (-3.5867)	-5.2850 (-2.9798)	-2.2911 (-2.975)	-5.6887 (-2.9798)
Electrical machinery and apparatus	-1.5362 (-2.975)	-4.4257 (-2.9798)	-2.1759 (-3.5867)	-4.9555 (-2.9798)	-2.1237 (-2.975)	-4.5640 (-2.9798)
Television, radio and communication equip	-2.1420 (-2.975)	-10.7243 (-2.9798)	-1.0161 (-3.5867)	-4.2489 (-2.9798)	-2.3359 (-2.975)	-6.8324 (-2.9798)
Professional and scientific equipment	-1.8047 (-2.975)	-4.5707 (-2.9798)	-.33979 (-2.975)	-5.1605 (-2.9798)	-1.0245 (-2.975)	-3.9870 (-2.9798)
Motor vehicles, parts and accessories	-1.1896 (-2.975)	-3.5932 (-2.9798)	-2.3905 (-2.975)	-6.7007 (-2.9798)	-1.1067 (-2.975)	-4.2630 (-2.9798)
Other transport equipment	-1.8150 (-2.975)	-6.1679 (-2.9798)	-1.6210 (-3.5867)	-6.0125 (-2.9798)	-1.1107 (-2.975)	-4.0142 (-2.9798)
Furniture	-2.5050 (-2.975)	-3.9443 (-2.9798)	1.9899 (-3.5867)	-4.3853 (-2.9798)	-2.1953 (-2.975)	-3.9766 (-2.9798)
Other manufacturing *	-2.3768 (-3.5867)	-3.7577 (-2.9798)	-2.1730 (-2.975)	-5.9171 (-2.9798)	-2.2644 (-3.5867)	-4.0149 (-2.9798)

Test statistics, critical values in brackets. Maximum lag length is 4.
*Only four sectors revealed trend, hence the differing critical values.

APPENDIX 2: Econometric Methodology

2.1.1 Autoregressive Distributed Lag (ARDL) model:

By combining a distributed lag model (of order q) and an autoregressive process (of order p) the following ARDL (p,q) model is formed:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + ... + \alpha_p y_{t-p} + \mathrm{B}_1 x_t + \mathrm{B}_2 x_{t-1} + ... + \mathrm{B}_q x_{t-q} + u_t \qquad \text{(I)}$$

which can be estimated using OLS. If y_t is stationary then the long run solution is defined as: $$y_t = \frac{\alpha_0}{1 - \sum_{i=1}^{p} \alpha_i} + \frac{\sum_{i=1}^{q} \mathrm{B}_i}{1 - \sum_{i=1}^{p} \alpha_i} . x \qquad \text{(II).}$$

The basic ARDL (1,1) model can also be re-parameterised as:

$$\Delta y_t = \gamma_0 + \gamma_1 y_{t-1} + b_1 \Delta x_t + b_2 x_{t-1} + u_t \qquad \text{(III)}$$

where $\gamma_1 = \alpha_1$-1 and b_l=$\mathrm{B}_1 + \mathrm{B}_2$. Now the long run solution is defined by $\frac{b_2}{-\gamma_1}$ and the short run relationship is simply b_1.

2.1.2 VECM modelling:

The underlying econometric model for the VECM is a *p-th* order vector autoregressive distributive lag (VAR) model, similar to I above, but in vector notation:

$$z_t = A_1 z_{t-1} + ... + A_p z_{t-p} + \Psi D_t + \varepsilon_t \qquad t=1,2.....\mathrm{T} \qquad \text{(IV)}$$

Where z_t is the k×1 vector of stochastic I(1) variables and D_t is a vector of non-stochastic I(0)variables, such as dummy variables for instance, and ε_t denotes a white noise process. In this case therefore, $z_t = \begin{pmatrix} PCM \\ IMP \\ LP \end{pmatrix}$, and no I(0) variables were included. In order to separate short run dynamic effects from the long run (cointegrating) relationship, equation (IV) can be re-parameterised, via the 'cointegrating transformation', as:

$$\Delta z_t = \Pi z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta z_{t-i} + \Psi D_t + \mu + \varepsilon_t \qquad \text{(V)}$$

where Π is a *kxk* long run multiplier matrix, Γ_i are coefficient matrices capturing the short-run dynamic effects, ψ is the matrix of coefficients on the I(0) exogenous variables (Pesaran and Pesaran,1997). If there are no cointegrating relationships then $\Pi = 0$ and (II) represents a stationary VAR for Δz_t (Edwards and Willcox,200?). If, however, the variables are I(1) and cointegrated with *r* cointegrating vectors then there are *r* cointegrating relations (combinations of z_t that are I(0)). If this is the case then the rank of Π is therefore *r*.

The matrix Π can then be represented as $\Pi = \alpha\beta'$ where α is a *kxr* matrix and β' is a *rxk* matrix, both of rank *r*. The rows of matrix β' form the *r* cointegrating vectors, there can therefore be at most $r = k - 1$ cointegrating vectors. α is the coefficients of the error correction term, which reflect the speed of adjustment towards equilibrium. Substituting this into (V) we obtain:

$$\Delta z_t = \alpha\beta' z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta z_{t-i} + \Psi D_t + \varepsilon_t \qquad \text{(VI)}$$

where $\beta' z_{t-1}$ represents the cointegrating relationships and α is a matrix of 'adjustment coefficients' measuring how the deviations from equilibrium ($y_t = \beta' z_{t-1}$) feed back to adjustments in Δz_t (Edwards and Wollcox,200?).

In order to control for deterministic trends and restricted intercepts, the implicit VAR model for the I(1) exogenous variables:

$$\Delta x_t = a_{0x} + a_{1x} t + \sum_{i=1}^{p-1} \Gamma_i \Delta z_{t-i} + \Psi D_t + \varepsilon \qquad \text{(VII)}$$

Where a_{0x} is the drift coefficient or intercept and $a_{1x}t$ controls for a linear time trend.

is combined with (VI) then the following equation is obtained:

$$\Delta z_t = a_0 + a_1 t - \alpha\beta z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta z_{t-i} + \Psi D_t + \varepsilon_t \qquad \text{(VIII)}$$

Where t is a time trend term (Pesaran and Pesaran,1997).

Without the inclusion of a trend term, deterministic trends would not be controlled for and would be determined by k-r quadratic trends and will not lead to unique estimates of B (ibid.). However, as no quadratic trends are evident in the data, no time trend was included, with the model therefore being:

$$\Delta z_t = a_0 - \alpha\beta z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta z_{t-i} + \Psi D_t + \varepsilon_t \qquad \text{(IX)}$$

Returning to testing for the existence of cointegration, the rank of Π (r) in (V) reveals whether cointegration exits or not (Edwards and Wollcox,200?). Once the number of cointegrating vectors has been determined (discussed in more detail in the following section) identifying restrictions are needed in order to make sense of the estimated relationships in terms of structural economic equations. "If there are r cointegrating vectors, exact identification requires r independent restrictions on each cointegrating vector" (ibid.). However, if r =1 (which the data revealed for all sectors where a cointegrating relation was found at all) then the restriction needed is viewed as only the 'normalising restriction' (Pesaran and Pesaran, 1997). While it can be applied to any of the variables in the cointegrating relation, economic theory, especially in terms of the relationship being tested by this paper, determines that the relationship was normalised on PCM.

So for sectors where a cointegrating relation was found, the long run relationship can be represented as:

$$\Pi z_{t-1} = \begin{bmatrix} \alpha_{11} \\ \alpha_{12} \\ \alpha_{13} \end{bmatrix} \begin{bmatrix} 1 \beta_{12} \beta_{13} \end{bmatrix} \begin{bmatrix} PCM \\ IMP \\ LP \end{bmatrix} \qquad \text{(X)}$$

2.2 Johansen Technique:

1 In order to test for stationarity or more importantly that all variables are I(1), the Augmented Dickey Fuller (ADF) test was used. For the vast majority of sectors no trend was evident in the data and hence no term was included. If a trend was however evident, then the ADF test including a drift and trend term was used.

2 In order to determine the lag length of the VECM, an unrestricted VAR model was estimated starting with a sufficiently high 4 lags. The Shwarz Bayesian criterion (SBC), Akaike information criterion (AIC), LR and Adjusted LR tests were used in order to determine the suitable lag length. As the Adjusted LR test is more reliable for small samples, this was given preference if conflicting lag lengths were suggested by the various tests. Furthermore, again because of the short time series, the lower number of lags suggested was accepted in order to avoid over-parameterisation (Pesaran and Pesaran, 1997). The VAR was then re-estimated with the selected number of lags and residuals were checked for evidence of serial or auto correlation. For all sectors with all variables I(1) the lag length was selected at 1 and no evidence of serial correlation was found.

3 To determine the number of cointegrating vectors (r) the maximal eigenvalue and trace tests were used. If the tests revealed a different suggested number of cointegrating vectors (CV) then the information criteria (AIC,SBC,HQC) were used as a further guide.

4 Just identifying and over-identifying restrictions are then imposed. As mentioned in the preceding section only 1 CV was found if any, and so the only restriction imposed was the normalising restriction, which was imposed on PCM following the economic theory. This restriction is then tested using a log-likelihood ratio (LR) test statistic , which asymptotically distributed as a chi-squared, and with degrees of freedom equal to r. Residuals of the VECM were also tested for autocorrelation.

APPENDIX 3

Table B:

ADF TESTS FOR STATIONARITY:
Test statistics, critical value in brackets.

VARIABLE:					
DUTY	DDUTY	DUTYXS	DDUTYXS	OPEN	DOPEN
-2.1375 (-2.975)	-4.3609 (-2.9798)	-2.2372 (-2.975)	-5.4898 (-2.9798)	-2.8123 (-2.975)	-6.3311 (-2.9798)

APPENDIX 4

Table C: ECM Results for sectors with cointegrating VAR using DUTY:
(Normalised on PCM, Standard Errors in brackets)

SECTOR	DUTY	LP
Footwear	-0.0048 (.0044)	-0.0603 (1.8926)
Basic non-ferrous metals	-0.0119 (0.0086)	-0.1891 (0.4868)

Table D: ECM Results for sectors with cointegrating VAR using DUTYXS:
(Normalised on PCM, Standard Errors in brackets)

SECTOR	DUTYXS	LP
Footwear	-0.0406 (0.0382)	-2.8518 (4.4958)
Basic non-ferrous metals	0.1056 (0.5348)	3.0098 (14.9965)
Machinery and equipment	-0.0167 (0.0077)	3.4589 (1.0706)
Electrical machinery and apparatus	0.031 (0.0204)	6.1504 (3.8262)
Other manufacturing	-0.0529 (0.0256)	-0.1107 (0.1107)

Table E: CM Results for sectors with cointegrating VAR using OPEN:
(Normalised on PCM, Standard Errors in brackets)

SECTOR	OPEN	LP
Footwear	-0.0429 (0.15184)	0.7261 (1.4944)
Plastic products	3.2415 (5.6175)	-8.5925 (11.4580)
Furniture	-0.2027 (0.0647)	1.6105 (0.7831)
Other manufacturing	-0.5635 (0.2709)	-0.4563 (0.0813)

APPENDIX 5:

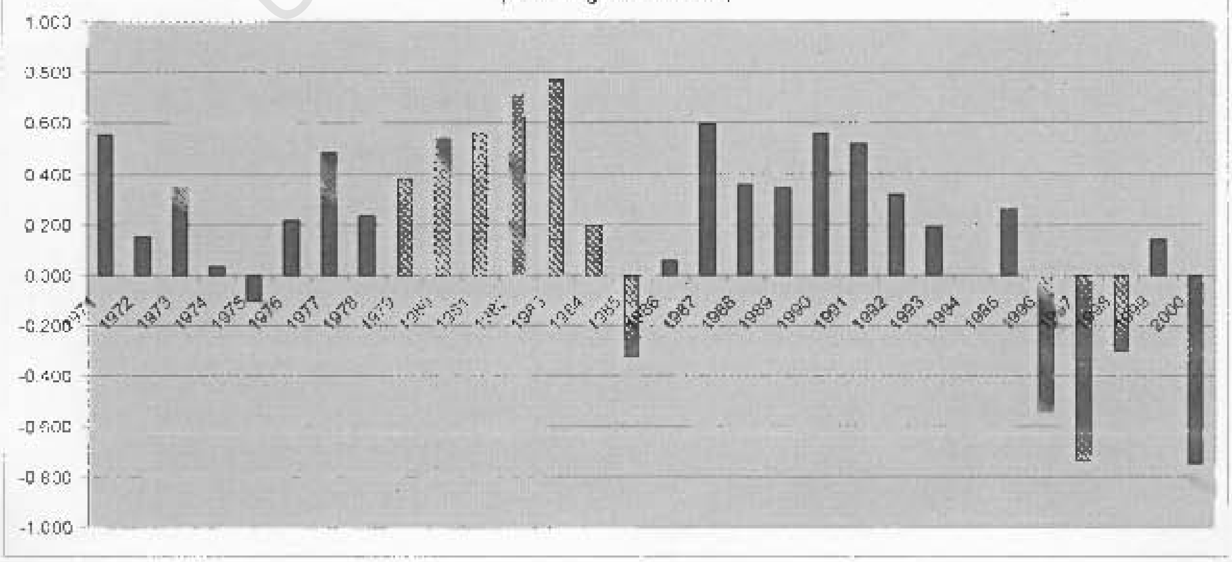
Table F:

ADF TESTS FOR STATIONARITY:

	VARIABLE:					
SECTOR	NSR	NSRX	MUP	MUPX	IMP*MUP	IMP*MUPX
Food	-3.8297	-3.8297	-4.9435	-5.4905	-4.8993	-5.4358
Beverages	-6.1555	-5.2413	-7.8334	-5.2905	-7.7935	-5.1923
Tobacco	-4.5335	-4.4675	-4.8619	-7.5282	-5.0047	-7.6174
Textiles	-3.8154	-3.5884	-5.9672	-6.1122	-5.5611	-5.8837
Wearing apparel	-4.1058	-4.0028	-7.0978	-6.0151	-6.7275	6.0584
Leather and leather products	7.3490	-7.8508	-6.2095	-5.2923	-5.9094	-4.6847
Footwear	-6.0809	-5.7904	-6.7353	-7.1548	-5.9258	-6.9885
Wood and wood products	-5.9380	-5.5034	-5.5376	-4.4323	-5.3329	-4.4444
Paper and paper products	-5.3403	-4.8941	-4.0340	-3.5355	-3.7859	-3.4169
Printing, publishing and recorded media	-4.5617	-4.6048	-4.0258	-3.6091	-4.1261	-3.7026
Coke and refined petroleum products	-5.7544	-5.6178	-6.1452	-5.8615	-7.3126	-6.9984
Basic chemicals	-7.0658	-5.4702	-5.1036	-6.2185	-4.5312	-5.6451
Other chemicals and man-made fibers	-6.8931	-6.7730	-6.0573	-6.5664	-5.8329	-6.3511
Rubber products	-4.6726	-4.5183	-4.8310	-5.1646	-4.1011	-4.3979
Plastic products	-4.0863	-3.9750	-3.4231	-4.1455	-3.5323	-3.8865
Glass and glass products	-3.1604	-3.0428	-4.2830	-4.5104	-4.1851	-4.3037
Non-metallic minerals	-4.7204	-4.4925	-5.8746	-6.7327	-5.5560	-5.8637
Basic iron and steel	-4.8978	-4.5427	-5.7765	-6.6909	-5.7411	-6.2044
Basic non-ferrous metals	-4.8303	-4.8815	-4.8744	-6.1526	-4.8221	-6.0891
Metal products excluding machinery	-5.6102	-5.5715	-4.5795	-5.2651	-4.6956	-5.3018
Machinery and equipment	-5.6102	-5.5715	-4.5795	-5.2651	-4.6956	-5.3018
Electrical machinery and apparatus	-4.2956	-4.1958	-5.0161	-5.6276	-4.4675	-4.8785
Television, radio and communication equi	-7.0469	-6.4738	-7.0171	-4.1763	-6.2188	-4.2013
Professional and scientific equipment	-5.3387	-5.8460	-5.9053	-4.9352	-7.6384	-4.7088
Motor vehicles, parts and accessories	-4.6345	-4.7568	-5.5490	-4.9868	-5.5220	-4.9189
Other transport equipment	-5.3274	-5.3619	-4.6961	-5.7019	-4.8470	-5.7627
Furniture	-4.2583	-4.6194	-5.5597	-4.3326	-5.5335	-4.5901
Other manufacturing	-5.3037	-4.9504	-4.9635	-3.9945	-4.8801	-3.8444
	TEST STATISTIC:		-2.9706			

APPENDIX 6:

Figure I: MARK UP: AVERAGE FOR MANUFACTURING
(Excluding Intermediates)



APPENDIX 7:

Table G: Average Mark-up for key periods: Manufacturing sectors. (Excluding intermediates).

SECTOR	1970'S	1980-1994	1994-2000
Food	1.170**	0.471**	0.546**
Beverages	0.889	1.013**	1.557**
Tobacco	7.110**	3.889	2.479
Textiles	0.854**	0.277**	1.049**
Wearing apparel	0.416**	0.189**	-0.193
Leather and leather products	0.072	0.151**	0.742
Footwear	0.141**	0.091**	0.402
Wood and wood products	0.506	0.423**	0.178
Paper and paper products	0.508*	0.755**	1.256
Printing, publishing and recorded media	0.438**	0.315**	0.228
Coke and refined petroleum products	1.809**	2.536**	2.669*
Basic chemicals	1.065**	0.755**	1.259
Other chemicals and man-made fibers	1.105	0.533**	0.806
Rubber products	0.484**	0.472**	0.047
Plastic products	0.491*	0.577**	0.183
Glass and glass products	0.396**	0.363**	0.685**
Non-metallic minerals	0.945**	0.494**	0.668
Basic iron and steel	0.561**	0.325**	0.666
Basic non-ferrous metals	0.611**	0.501**	1.147
Metal products excluding machinery	0.731**	0.272**	0.492
Machinery and equipment	0.059	0.243**	0.439
Electrical machinery and apparatus	0.586	0.389**	1.169*
Television, radio and communication equipment	0.167	0.233**	0.087
Professional and scientific equipment	0.247	0.486**	1.882*
Motor vehicles, parts and accessories	0.368**	0.409*	0.806
Other transport equipment	0.745**	0.311**	-0.46
Furniture	0.489	0.165**	0.163
Other manufacturing	1.909**	1.960**	4.192**

** Denotes significance at the 10% level, * at the 5% level.

APPENDIX 8:

Table H: Dynamic Estimation: Openness Index Excluding Intermediates.

SECTOR	LAGS	Short-Run Coefficient		Long-Run Coefficient	
Food	4 1 4	0.882		-0.169	
Beverages	4 0 0	1.923		1.426	
Tobacco	4 0 0	-29.493	**	-59.113	
Textiles	1 0 0	3.392	**	4.383	**
Wearing apparel	3 4 4	-0.794		7.803	**
Leather and leather products	4 1 1	1.629	**	-0.381	
Footwear	4 1 1	-0.828		-2.181	**
Wood and wood products	0 4 4	-2.472	**	-16.828	**
Paper and paper products	4 3 3	1.756		1.788	**
Printing, publishing and recorded media	4 4 3	1.367	*	2.186	**
Coke and refined petroleum products	0 4 1	-9.839	**	-19.882	**
Basic chemicals	4 2 4	0.248		-2.294	*
Other chemicals and man-made fibers	3 4 4	1.551		-4.329	
Rubber products	4 0 3	-1.941	**	-0.793	**
Plastic products	3 0 2	-1.638		-1.884	
Glass and glass products	3 4 0	1.539	**	6.595	
Non-metallic minerals	4 4 4	1.818	**	-4.216	**
Basic iron and steel	4 4 4	1.267		-0.942	
Basic non-ferrous metals	3 2 2	0.493		-8.729	**
Metal products excluding machinery	0 0 0	1.75	*	N/A	
Machinery and equipment	2 3 3	2.651	*	8.874	**
Electrical machinery and apparatus	3 1 1	2.115		-0.744	
Television, radio, communication equipment	1 4 4	0.586		3.159	
Professional and scientific equipment	2 1 0	8.285	**	4.371	**
Motor vehicles, parts and accessories	3 2 0	2.452		1.624	
Other transport equipment	0 2 2	-2.304	**	0.479	
Furniture	0 2 2	0.237		1.989	
Other manufacturing	4 3 3	10.534	**	40.369	

** Denotes significance at the 10% level, * at the 5% level.

Table I: Dynamic Estimation: Duties Collected, Excluding Intermediates.

SECTOR	INCLUDING SURCHARGES					EXCLUDING SURCHARGES				
	LAGS	Short-Run Coefficient		Long-Run Coefficient		LAGS	Short-Run Coefficient		Long-Run Coefficient	
Food	4 4 4	0.558		0.071		4 4 0	-0.676		-0.308	
Beverages	4 2 2	0.356		-2.286	**	0 4 4	4.339	*	-6.499	
Tobacco	2 1 4	4.641		-2.914		2 4 0	14.283		19.104	
Textiles	0 0 0	-1.045	**	-		0 2 2	-1.96	*	-5.495	**
Wearing apparel	1 3 2	0.815	**	-2.449		3 2 3	2.361	**	-6.332	
Leather and leather products	4 0 0	-1.487	**	-0.509	**	4 1 1	3.812	**	0.085	
Footwear	4 4 4	0.189		-0.775	*	2 4 0	1.025		6.219	
Wood and wood products	2 1 1	2.148	**	2.576	**	4 1 1	7.462	**	9.425	**
Paper and paper products	4 4 4	-1.837	*	-3.441	*	4 4 4	-0.152		-0.528	
Printing, publishing and recorded media	4 4 4	0.37		-2.324	**	0 2 2	1.159	*	-1.221	
Coke and refined petroleum products	0 0 0	1.157		-		0 0 0	2.126		-	
Basic chemicals	0 0 0	-0.838		-		0 0 0	-0.835		-	
Other chemicals and man-made fibers	0 4 4	1.483	**	0.295		3 0 0	2.789	**	1.729	**
Rubber products	4 2 2	0.881	**	-0.449		4 4 3	2.273	**	1.269	
Plastic products	3 2 0	0.809		0.867		1 4 4	1.981	*	-2.097	
Glass and glass products	3 4 0	-0.535		-2.019		2 0 4	-0.859		-2.335	
Non-metallic minerals	0 2 3	-0.487		1.741		4 2 4	0.252		2.977	
Basic iron and steel	4 04	-1.048	*	-0.159		4 1 0	-0.411		-0.143	
Basic non-ferrous metals	2 0 0	0.429		0.313		2 1 4	-0.158		2.386	
Metal products excluding machinery	0 0 0	-0.866	*	-		3 2 3	1.935		-4.516	
Machinery and equipment	3 0 0	0.215		0.111		2 4 4	1.799		-1.846	
Electrical machinery and apparatus	3 0 0	0.069		0.04		3 0 0	0.513		0.297	
Television, radio, communication equipment	1 3 0	0.387		0.238		1 1 3	0.918		0.162	
Professional and scientific equipment	4 0 0	0.761		0.895		4 0 0	0.721		0.805	
Motor vehicles, parts and accessories	3 2 0	0.296		0.211		0 2 2	1.271		-1.142	
Other transport equipment	2 1 0	2.334	**	2.11	**	2 1 0	-0.423		-0.262	
Furniture	0 2 2	-0.082		-1.301	**	0 2 2	0.113		-2.812	**
Other manufacturing	0 1 1	-2.016		-0.115		0 0 0	-1.094		-	

** Denotes significance at the 10% level, * at the 5% level.

Appendix 9:

Table J: Dynamic Estimation: Openness Index and Import Penetration in Intermediates.

SECTOR	IMPORT PENETRATION					IMPORT PENETRATION IN INTERMEDIATES			
	LAGS	Short-Run Coefficient		Long-Run Coefficient		Short-Run Coefficient		Long-Run Coefficient	
Food	0 0 0 0	0.62		-		-0.819		-	
Beverages	3 0 2 2	1.319		1.192		-0.659		-1.2	
Tobacco	3 2 2 2	-15.559	*	-0.178		4.353	**	5.613	**
Textiles	0 0 0 0	2.563	**	-		-0.456		-	
Wearing apparel	0 2 2 0	-0.982	**	3.00	**	-0.363	**	-	
Leather and leather products	3 1 1 3	2.138	**	-0.328		3.695	**	-0.661	*
Footwear	0 2 0 3	0.525		-		0.258		1.08	**
Wood and wood products	3 2 2 3	-2.101	*	-0.999		-0.622		-1.414	
Paper and paper products	3 3 3 2	3.489		8.834	**	1.921		1.872	**
Printing, publishing and recorded media	1 3 3 3	1.027	*	9.941	**	0.641		0.807	
Coke and refined petroleum products	0 1 1 0	-5.536	*	-13.176	**	0.867	**	-	
Basic chemicals	3 3 3 3	-4.913	**	0.412		3.942	**	0.352	*
Other chemicals and man-made fibers	1 3 3 2	1.991		-10.995	**	-3.852	**	-0.909	
Rubber products	1 3 3 0	-1.52	**	2.622		0.636	*	0.41	*
Plastic products	3 3 3 3	-2.929	*	23.275		0.332		-1.994	
Glass and glass products	2 0 0 2	1.106	*	1.659	*	-0.399		0.635	
Non-metallic minerals	3 2 3 2	1.954	**	-2.665	*	0.541		0.489	
Basic iron and steel	2 3 3 2	2.323	**	1.704	**	1.305	**	-0.104	
Basic non-ferrous metals	3 2 2 0	0.751		-8.085	**	-0.286		-0.201	
Metal products excluding machinery	0 0 0 0	1.916	**	-		-0.343		-	
Machinery and equipment	2 3 3 0	2.696	*	8.713	*	-0.228		-0.153	
Electrical machinery and apparatus	3 0 0 0	0.636		0.367		0.689		0.398	
Television, radio, communication equipment	2 2 3 3	-0.088		0.419		-1.672	*	-1.59	**
Professional and scientific equipment	3 0 2 2	7.409	**	3.253	**	-0.154		-0.259	
Motor vehicles, parts and accessories	3 0 0 0	3.507		2.773		0.592		0.268	
Other transport equipment	0 3 3 1	-5.203	**	-14.958	**	-2.273		-6.409	**
Furniture	2 0 2 3	-0.691		-0.272		-2.399	*	-0.467	**
Other manufacturing	3 3 3 3	10.362	**	97.355		1.532	**	0.835	

** Denotes significance at the 10% level, * at the 5% level.