Trade Liberalisation and the Impact of Regional Trade Flows on the Mark-ups in South African Manufacturing Industries

By

Tijl VAN DE WINKEL

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Faculty of Commerce

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Supervisor: Dr. Lawrence Edwards

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Abstract

Since the mid-1990s South Africa has made considerable progress in opening up its trade regime. This study presents estimates of average mark-ups for the manufacturing industries over the period 1970-2002 and further analyses the impact of trade liberalisation and regional trade flows on the internal competitiveness of South African manufacturing industries between 1988 and 2002. While several international studies have analysed the impact of trade flows, few have analysed the impact of trade liberalisation using tariff data. The theoretical relationship between trade liberalisation and mark-ups is made first of all, and then a review of the empirical methodologies used to calculate and estimate mark-ups is given. The data analysis shows that South Africa has made considerable progress in liberalising its tariff barriers from 1994, which is also reflected in strong increases in imports. In terms of average mark-ups, the estimates are found to be sensitive to the inclusion of intermediate inputs. Strong evidence for the market disciplining effects of trade liberalisation is also found and this effect is particularly strong during the 1995-2002 period. Import penetration is found to reduce mark-ups, but the impact differs according to the source of imports. The results therefore suggest that additional reductions in mark-ups can be achieved through further trade liberalisation.

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1. Introduction

The objective of this paper is to estimate the level of mark-ups and further analyse the impact of tariff liberalisation and regional trade flows on mark-ups in South African manufacturing industries between 1988 and 2002. Firstly the dissertation estimates the extent to which South African industries mark up prices above marginal cost. Secondly the dissertation analyses the disciplining effects of trade liberalisation and import penetration on the pricing behaviour of South African manufacturing industries.

The hypothesis to be tested is that increased import penetration and/or lower import tariffs increase the degree of competition and reduce mark-up pricing.

The methodology employed to estimate the mark-up levels closely follows the approach introduced by Hall (1988) and extended by Roeger (1995). To test the interaction between the trade variables and mark-ups, this paper employs panel data estimation techniques.

While several studies have analysed the impact of trade flows, particularly import penetration on mark-ups (Levinsohn, 1993; Harrison, 1994; Kee and Hoekman, 2003), few (if any) have analysed the impact of trade liberalisation using tariff data on mark-ups.

International trade restrictions affect both the pricing and output behaviour of domestic and foreign firms. How these firms respond depends crucially on the market structure within the home and foreign countries (see Helpman and Krugman, 1992). In general, international competition is expected to be a major source of market discipline, even when the markets are faced with imperfect competition. International competition reduces the market power of domestic firms and thereby reduces the ability of firms to raise prices above marginal costs. The mark-up of product price over marginal cost is commonly used as an indicator for the degree of market power.

South Africa has experienced considerable changes in its trade regime during the 1990s. Average tariffs have fallen from close to 30% in 1990 to around 10% in 2002. This increased openness of the economy is also reflected in the rising importance of trade as a share of output. Export orientation within manufacturing rose from 13% in 1990 to 29% in 2002. Import penetration within manufacturing also rose from 18% to 36% during

this period.[1] South Africa therefore provides a useful case study of the disciplining effects of trade liberalisation in an economy.

This study advances existing empirical work in a number of ways. Firstly, we use detailed sector level tariff data as one of our indicators of changes in openness. We calculate tariff levels for 26 manufacturing sectors between 1988 and 2002 using both scheduled tariff rates and collection duties. We thus test the robustness of the relationship between tariff liberalisation and mark-ups to different measures of tariff protection. Secondly, we analyse the impact of regional imports on mark-ups in the manufacturing sectors between 1988 and 2002. We consider five regional groupings: OECD High Income[2] (OECD_HI), Africa, China & India, Asia and Eastern Europe. As we show in this paper, the sectoral structure and growth of South African trade differs across these regions. We therefore test whether these regional variations in trade impact differently on mark-ups in the South African economy. Thirdly, the paper also develops the theoretical relationship between trade liberalisation and mark-up pricing. We show that the impact of trade liberalisation on mark-ups is relatively robust across theoretical frameworks (the Cournot and Bertrand models) and in most cases reduces mark-ups. In addition to these contributions, the paper presents estimates of mark-ups for the manufacturing sectors over the 1970-2002 period. In the process we update the analysis of Fedderke *et al.* (2003) from 1997 to 2002.

The plan of the paper is as follows: Section 2 develops the theoretical relationship between trade liberalisation and mark-ups and reviews the empirical methodologies used to calculate and estimate mark-ups. Section 3 presents and analyses the various indicators of openness and liberalisation used in the study. In section 4 we present the results of our analysis. First we estimate the level of mark-ups within South African manufacturing industries over the period 1971-2002 and compare these results with those of previous studies. We then estimate and present the marginal impact of trade liberalisation and regional import penetration on these mark-ups. We conclude the paper in section 5.

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[1] Export orientation is calculated as exports as a share of gross output and import penetration is measured as the share of imports in gross domestic expenditures.
[2] Consists of EU, US, Canada, Japan, Norway, Iceland, Switzerland; Australia and New Zealand.

2. Theory and empirical methodology

This section of the paper develops the theoretical relationship between trade liberalisation and mark-ups. This relationship is clarified using various models of strategic interaction between industries. In particular, the sensitivity of the relationship between mark-ups and trade liberalisation to Bertrand and Cournot competition is analysed. In general, the literature suggests that the policy recommendations are extremely sensitive to the underlying assumptions and the nature of competition assumed for the oligopolists.

After the theoretical analysis, this section reviews the empirical methodologies used to calculate and estimate the mark-ups. The methodologies used in the paper closely follow the approach introduced by Hall (1988) and extended by Roeger (1995), Martins *et al.* (1996) and Martins and Scarpetta (1999).

2.1 Trade liberalisation and mark-ups

2.1.1 Introduction

Trade liberalisation, by definition, reduces the barriers to trade. When markets are functioning effectively, the domestic price and mark-up of the liberalized good should decline by either making cheaper foreign goods available or reducing the rents that may have previously been captured by domestic producers (McCulloch *et al.*, 2001).

The impact of trade liberalisation on the economy is strongly influenced by the theoretical structure of the model used in the analysis. In Classical international trade theory, products are homogenous, markets clear and perfect competition ensures zero profits within firms, namely mark-ups are zero. Trade liberalisation will therefore alter the relative price of the good for producers and consumers and increase imports. Overall welfare increases. Besides these static gains, the elimination or reduction of trade barriers may also create dynamic gains (Dornbusch, 1992) by allowing the economy to take advantage from economies of scale and scope, create greater domestic competition, make favourable growth externalities available (like the transfer of know-how) and cause a possible shake-up of the industry, which may create a good environment for growth. Trade liberalisation will also improve the resource allocation (valuable resources are no

longer used to produce goods that can be imported at a lower price) and ensure access to better technologies, inputs and intermediate goods (higher quality and larger variety). These factors are likely to create a downward pressure on prices and mark-ups in the short and long run. Trade liberalisation will therefore benefit the consumers and the economy as a whole, because it enforces competition. The traditional trade theory therefore advocates for free trade as the optimal trade policy.

The New trade theory suggests a more complex and ambiguous outcome. New trade theory introduces increasing returns, product differentiation and market power. But although the case for free trade should be much stronger in a world with increasing returns, an individual country may have reasons not to adopt free trade (Krugman, 1996).

Over the last decades, a significant proportion of international trade takes place in imperfectly competitive markets. Krugman (1996) points out that the major obstacle to formal modelling of increasing returns in scale is the problem of market structure. In general, increasing returns are inconsistent with perfect competition. Perfect competition requires that price equal marginal cost, yet in an environment of increasing returns, marginal cost pricing will lead to universal losses. Therefore, one important aspect of imperfect competition is that the price of the good exceeds the marginal cost of production. With imperfect competition, each firm is aware of its market power and acts to profit from it and, as a result, the patterns of trade are different. Consequently, a new framework of theoretical analysis was required for a proper understanding of many issues of trade and trade policy, namely the Theory of Strategic Trade Policy (Dixit, 1984). With imperfect competition, the effects of trade liberalisation on price and mark-up are more ambiguous compared to traditional models. This arises because with imperfect markets, there is no assurance that the gains from trade will be reaped in practice, there may even be a loss from trade due to an increase in certain distortions. Thus whether trade liberalisation will be beneficial depends on the market structure under which trade occurs (Dixit & Norman, 1998). This relationship will be clarified in this section.

Our analysis forms part of the Strategic Trade Policy (STP) literature. Brander (1995: 1397) defines STP as "trade policy that conditions or alters a strategic relationship between firms". The study of strategic trade policy implies the presence of oligopoly,

because the firms involved must have a mutually recognised strategic interdependence (Brander, 1995). Therefore STP does not exist under perfect competition, because the firms' decisions are independent. The main idea of STP is that government policies may shift profits from a foreign firm to its domestic competitor and this may yield a national gain, at least provided the foreign government does not retaliate (Corden, 1997). In other words, strategic interaction between firms creates an opportunity for government action to modify the terms of that interaction (Brander, 1995: 1402).

Markusen and Venables (1988: 300) state that "the Theory of Strategic Trade Policy under conditions of imperfect competition and increasing returns to scale has reached a certain maturity ... but this does not seem to imply that we have a clear and complete understanding of either the positive or normative implications of these twin assumptions". Various papers produce a bewildering variety of policy conclusions, as a result, the contents of the various contributions do not aggregate into a coherent model (Markusen & Venables, 1988). The mathematical analysis of this paper will demonstrate how sensitive the results are to the model specifications.

Brander's (1995) review of the STP theory considers two main models of strategic interaction. In the "third-market" model two rival oligopolistic exporters from two countries compete only in a third market. In the "reciprocal-markets" model[3] on the other hand, the oligopolistic firms in two countries compete in those two countries. The "reciprocal-markets" model forms the basis of the theoretical analysis that follows.

The model is based on a duopolistic structure, where only two firms compete in the market. For a duopoly model, there are two typical cases of non-repeated interaction, the Bertrand model, where firms set their prices and the Cournot model, where firms choose the quantities they want to produce. With this kind of market structure, each firm is affected by the decisions of its rival and must consider those decisions and act strategically in determining its own price and output in order to maximise their profits (McConnel and Brue, 2002). We analyse the impact of trade liberalisation on mark-ups using both the Bertrand and Cournot models. Note that although we are dealing with segmented markets, we will only consider the effects on the home market in our analysis.

[3] Often called the intra-industry market model

Also, we are particularly interested in the impact of trade liberalisation on the mark-up and not on national welfare.

2.1.2 The Cournot duopoly "reciprocal-markets" model[4]

The model consists of two firms[5] that produce a homogenous good Q: a Domestic firm that produces Q_H for its home market and a foreign firm that sells Q_F in the home market.

The foreign firm faces a trade barrier, namely an import tariff (t). The price (P_F) received by the foreign firm is equal to the market price (P_H) deflated by the tariff rate. In short, $P_F = \frac{P_H}{(1+t)}$.

The industry demand is given by the inverse demand function $P(Q)$ where the industry output $Q = Q_H + Q_F$. Both firms have identical cost functions, namely $C_H(Q_H) = C_F(Q_F)$. We also assume that both firms have increasing marginal cost at an increasing rate, which means that $C' > 0$ and $C'' > 0$.

Under the Cournot assumption each firm maximizes its profits given the output chosen by the other firm. The profits for the home ($\prod^H$) and foreign ($\prod^F$) firm are therefore given, respectively, by:

$$\prod^H = P(Q_H + Q_F)Q_H - C_H(Q_H) \tag{1}$$

and

$$\prod^F = \frac{P(Q_H + Q_F)Q_F}{(1+t)} - C_F(Q_F) \tag{2}$$

These profit equations are assumed to be continuous twice differentiable.

Each firm maximizes its profits by choosing the optimum level of output to sell. The first order optimum conditions for the home firm are given by:

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[4] See Appendix 1 for the extensive calculations.

[5] The analysis can easily be extended to a multi-firm model without altering the main results (See Eaton & Grossman, 1986: 397).

$$\Pi_H^H = \frac{\partial \Pi^H}{\partial Q_H} = \frac{\partial P}{\partial Q}\frac{\partial Q}{\partial Q_F}\frac{\partial Q_F}{\partial Q_H}Q_H + \frac{\partial P}{\partial Q}\frac{\partial Q}{\partial Q_H}Q_H + P(Q) - \frac{\partial C_H}{\partial Q_H} = 0$$

$$= \frac{\partial P}{\partial Q}\left[1 + \frac{\partial Q_F}{\partial Q_H}\right]Q_H + P(Q) - C_H^{'} = 0$$

In a Cournot model each firm treats its rival's output as fixed and hence does not take into account the marginal response of the other firm to changes in their own output (namely $\frac{\partial Q_F}{\partial Q_H} = \frac{\partial Q_H}{\partial Q_F} = 0$). Also, because the model deals with homogeneous products, the change in one firm's output will increase total output by the same amount (namely $\frac{\partial Q}{\partial Q_H} = \frac{\partial Q}{\partial Q_F} = 1$). Hence the optimum Q_H is determined by:

$$\Pi_H^H = \frac{\partial \Pi^H}{\partial Q_H} = \frac{\partial P}{\partial Q}Q_H + P(Q) - C_H^{'} = 0 \qquad (3)$$

Similarly, the optimum output response for the foreign firm is given by:

$$\Pi_F^F = \frac{\partial \Pi^F}{\partial Q_F} = \frac{\frac{\partial P}{\partial Q}Q_F}{(1+t)} + \frac{P(Q)}{(1+t)} - C_F^{'} = 0 \qquad (4)$$

Equations (3) and (4) form a system in which the equilibrium Q_H and Q_F are determined.

For the critical point to be an optimum, the second order conditions (SOC) need to be satisfied. For the home and foreign firm, respectively, this requires:

$$\Pi_{HH}^H = \frac{\partial \Pi_H^H}{\partial Q_H} = 2P^{'} + P^{''}Q_H - C_H^{''} < 0$$

and

$$\Pi_{FF}^F = \frac{\partial \Pi_F^F}{\partial Q_F} = \frac{2P^{'}}{(1+t)} + \frac{P^{''}Q_F}{(1+t)} - C_F^{''} < 0$$

The SOC will be satisfied under most normal demand curves. Note that these conditions may not hold when we are confronted with a very convex demand function. In this case P'' could be a large positive, making the above SOC positive. But for profit maximization to take place we require the signs of the SOC to be negative. We therefore assume away a very convex demand function.

We also assume that each firms marginal revenue decreases as the output of its rival increases. In other words, the products are strategic substitutes (Brander, 1995):

$$\Pi^{H}_{HF} = \frac{\partial \Pi^{H}_{H}}{\partial Q_F} = P' + P''Q_H < 0$$

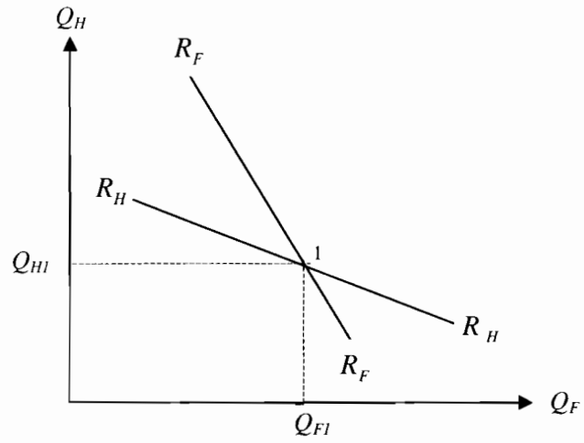
and

$$\Pi^{F}_{FH} = \frac{\partial \Pi^{F}_{F}}{\partial Q_H} = \frac{P'}{(1+t)} + \frac{P''Q_F}{(1+t)} < 0$$

These conditions imply stability and if they hold globally, uniqueness of the equilibrium (Brander & Krugman, 1983).

The solution to the system of equations (3) and (4) is neatly represented diagrammatically in Figure 1. Equation (3) determines the optimal choice of output for the home firm (Q_H) as a function of its beliefs about the foreign firm's output choice. This is represented as the reaction curve R_HR_H, which illustrates how the home firm (Q_H) will react, given the various beliefs it might have about the foreign firm's choice (Q_F). Similarly, R_FR_F determines the optimal choice of output for the foreign firm (Q_F) as function of its beliefs about the home firm's output choice (Varian, 1993). The strategic substitutes assumption ensures that the reaction functions are downward sloping. The intersection of these curves at 1, gives the Cournot free trade equilibrium point, where the home firm delivers Q_{H1} and the foreign firm delivers Q_{F1}.

Figure 1: Reaction curves of the Cournot duopoly



Source: Based on Brander 1995

Equations (3) and (4) can also be used to determine the effect of a tariff on output, prices and mark-ups.

Differentiating the First Order Conditions for a maximum of profits, we obtain:

$$\begin{bmatrix} \Pi^H_{HH} \Pi^H_{HF} \\ \Pi^F_{FF} \Pi^F_{FH} \end{bmatrix} \begin{bmatrix} dQ_H \\ dQ_F \end{bmatrix} = \begin{bmatrix} 0 \\ \dfrac{P'Q_F + P}{(1+t)^2} \end{bmatrix} dt$$

To solve the system we require the determinant of the coefficient matrix ($|J|$) to be non zero. This is the sufficiency condition of the implicit function theorem, required for equations (3) and (4) to define functions Q_H and Q_F in terms of the exogenous variables around the solution point. The $|J|$ is positive because the absolute values of Π^H_{HH} and Π^F_{FF} are both larger values than the absolute values of Π^H_{HF} and Π^F_{FH}. This is the same as saying that "own" effects on marginal revenue are greater than "cross" effects (Markusen *et al.*, 1995). The system of equations (3) and (4) therefore implicitly define functions of Q_H and Q_F in terms of the exogenous variables c, t and P.

Dividing both sides by dt, the system can be solved for $\dfrac{\partial Q_H}{\partial t}$ and $\dfrac{\partial Q_F}{\partial t}$ using Cramer's rule. This yields:

$$\frac{\partial Q_H}{\partial t} = -\frac{\left[\left(\frac{(P'Q_F + P)}{(1+t)^2}\right)(\Pi^H_{HF})\right]}{|J|} \tag{5}$$

which is positive, because $\frac{(P'Q_F + P)}{(1+t)^2}$ is positive (see appendix) and Π^H_{HF} is negative (strategic substitutes assumption). Similarly,

$$\frac{\partial Q_F}{\partial t} = \frac{\left[(\Pi^H_{HH})\left(\frac{(P'Q_F + P)}{(1+t)^2}\right)\right]}{|J|} \tag{6}$$

which is negative, because Π^H_{HH} is negative (SOC for profit maximization) and $\frac{(P'Q_F + P)}{(1+t)^2}$ is positive. These findings imply that the import tariff raises the output of the home firm, whereas the foreign firm reduces the amount it exports.

This result is shown diagrammatically in Figure 2, by analysing the effect of the tariff on the reaction curves of the home and foreign firm. The import tariff raises the marginal cost of the foreign firm and shifts its reaction curve inwards to $R'_F R'_F$. A new equilibrium is established at 2, where the output of the home firm increases from Q_{H1} to Q_{H2}, and the level of imports decreases from Q_{F1} to Q_{F2}. Thus, the import tariff has the effect of reserving some of the domestic market for the home firm.

Raising the tariff above a certain threshold will cause imports to disappear altogether, leading to a monopoly position of the home firm in the domestic market. Therefore, a reduction in tariffs brings the equilibrium closer to the free trade level, namely point 1 in Figure 2. This reduction will also bring about a net increase in output, because $|\Delta Q_F| > |\Delta Q_H|$.[6]

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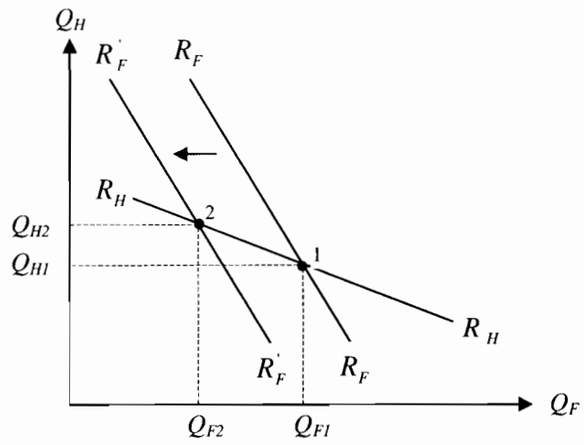
[6] $\frac{dQ_H}{dt} + \frac{dQ_F}{dt} = \frac{(P'Q_F + P)}{(1+t)^2}(P''Q_H + P' - 2P' - P''Q_H + C''_H)$

$= \frac{(P'Q_F + P)}{(1+t)^2}(P' - C''_H)$, which is negative.

Figure 2: The impact of the tariff on the firm's reaction curves (Cournot).



Source: Based on Brander 1995

To analyse the impact of the tariff on price, $P(Q)$ can be differentiated w.r.t. t. This gives $\frac{dP}{dt} = P'(\frac{dQ_H}{dt} + \frac{dQ_F}{dt})$. As shown in Footnote 6, the bracketed term is negative. Together with $P' < 0$, this implies that prices rise with the tariff.

The implication of this finding is that an increase in tariffs reduces total output and hence raises prices.

The impact of the tariff on the mark-up depends on the relationship between output and marginal cost. The mark-up is commonly expressed as the price over marginal cost, namely $u = \frac{P}{C_H'}$

Differentiating u w.r.t. t we obtain:

$$\frac{du}{dt} = \frac{\frac{dP}{dt}}{C_H'} - \frac{PC_H'' \frac{dQ_H}{dt}}{C_H'^2} \qquad (7)$$

$$= \frac{P\left(\frac{dQ_H}{dt} + P'\frac{dQ_F}{dt}\right)}{C_H'} - \frac{PC_H'' \frac{dQ_H}{dt}}{C_H'^2}$$

$$= \frac{\frac{dQ_H}{dt}}{C_H'}\left[P' - \frac{P}{C_H'}C_H''\right] + \frac{P'\frac{dQ_F}{dt}}{C_H'}$$

$$= \gtrless 0$$

The sign is therefore ambiguous.

Consider the right hand side of (7), the first term reflects the impact of the tariff on the price and is positive. The second term refers to the impact that the increased home output (from the tariff) has on marginal cost. This term is also positive as a rise in tariffs raises domestic output (Q_H), which in turn raises marginal costs. This gives us an ambiguous outcome, which will depend on the effect of the tariff on *MC* (C') and price. Thus if *MC* increases faster than price, u may fall. However, traditionally in the literature, a constant marginal cost is assumed, leading to an unambiguous increase in the mark-up of the domestic firm.

2.1.3 The Bertrand duopoly "reciprocal-markets" model[7]

In this section we assume Bertrand competition between the home and foreign firm. In this case, firms choose prices rather than output as their strategic variables (Feenstra, 2004). We maintain all the assumptions from our Cournot model, except that we assume that firms produce differentiated goods. Product differentiation allows each firm to charge different prices at the margin without losing market share. With homogenous goods, the demand would shift entirely in favour of the firm offering to sell at a slightly lower price and we would eventually end up with a perfectly competitive price and neither firm would earn profits (Bhagwati, 1998). If tariffs are imposed the home firm would be able to capture the entire market and the tariff would reflect the mark-up over marginal cost. Imposing differentiated products, prevents such an extreme outcome as each firm faces its own demand curve. Let $X(P_H,P_F)$ and $Y(P_H,P_F)$ represent the demand functions in the home market for the home and foreign firm, respectively.

[7] See Appendix 1 for the extensive calculations.

The profits for each firm are given by:

$$\prod^{H} = P_H X(P_H, P_F) - C_H X(P_H, P_F) \tag{8}$$

and

$$\prod^{F} = \frac{P_F Y(P_H, P_F)}{(1+t)} - C_F Y(P_H, P_F) \tag{9}$$

Bertrand firms select prices in order to maximize profits. However, they treat foreign prices as constant while selecting their own prices (namely $\frac{\partial P_F}{\partial P_H} = 0$).

The First Order optimum Conditions for the home and foreign firm are then given by:

$$\Pi^{H}_{P_H} = \frac{\partial \Pi^{H}}{\partial P_H} = X + X_{P_H} P_H - C_{P_H} = 0 \tag{10}$$

and

$$\Pi^{F}_{P_H} = \frac{\partial \Pi^{F}}{\partial P_F} = \frac{Y}{(1+t)} + \frac{Y_{P_F} P_F}{(1+t)} - C_{P_F} = 0 \tag{11}$$

where $X_{P_H} = \frac{\partial X}{\partial P_H}$, $Y_{P_F} = \frac{\partial Y}{\partial P_F}$, $C_{P_H} = \frac{\partial C_H}{\partial P_H}$ and $C_{P_F} = \frac{\partial C_F}{\partial P_F}$

Under standard assumptions, the Second Order Conditions are satisfied, implying that the critical points are optimal. For the home and foreign firm, respectively, this requires:

$$\Pi^{H}_{P_H P_H} = \frac{\partial \Pi^{H}_{P_H}}{\partial P_H} = 2X_{P_H} + X_{P_H P_H} P_H - C_{P_H P_H} < 0$$

and

$$\Pi^{F}_{P_F P_F} = \frac{\partial \Pi^{F}_{P_F}}{\partial P_F} = \frac{2Y_{P_F}}{(1+t)} + \frac{Y_{P_F P_F} P_F}{(1+t)} - C_{P_F P_F} < 0$$

where $X_{P_H P_H} = \frac{\partial^2 X}{\partial P_H \partial P_H}$, $Y_{P_F P_F} = \frac{\partial^2 Y}{\partial P_F \partial P_F}$ and $C_{P_H P_H} = \frac{\partial^2 C}{\partial P_H \partial P_H}$

We also assume that the cross partials $\Pi^{H}_{P_H P_F}$ and $\Pi^{F}_{P_F P_H}$ are positive.

The two FOC equations can also be used to determine the effect of a tariff on prices and the mark-up.

Differentiating the First Order Conditions for a maximum of profits, we obtain:

$$\begin{bmatrix} \Pi^{H}_{P_H P_H} \Pi^{H}_{P_H P_F} \\ \Pi^{F}_{P_F P_H} \Pi^{F}_{P_F P_F} \end{bmatrix} \begin{bmatrix} dP_H \\ dP_F \end{bmatrix} = \begin{bmatrix} 0 \\ \dfrac{Y_{P_F} P_F + Y}{(1+t)^2} \end{bmatrix} dt$$

For stability we require that $|J| > 0$. This is the case because the absolute values of $\Pi^{H}_{P_H P_H}$ and $\Pi^{F}_{P_F P_F}$ are both larger than the absolute values of $\Pi^{H}_{P_H P_F}$ and $\Pi^{F}_{P_F P_H}$. This means that the direct effect is larger than the indirect effect.

Note that $\dfrac{Y_{P_F} P_F + Y}{(1+t)^2}$ must be negative, because C_{P_F} is negative and $\Pi^{F}_{P_H} = \dfrac{\partial \Pi^{F}}{\partial P_F} =$

$\dfrac{Y}{(1+t)} + \dfrac{Y_{P_F} P_F}{(1+t)} - C_{P_F}$ must equal 0 (see Appendix for proof).

Dividing both sides by *dt*, the system can be solved for $\dfrac{\partial P_H}{\partial t}$ and $\dfrac{\partial P_F}{\partial t}$ using Cramer's rule. This yields:

$$\frac{\partial P_H}{\partial t} = - \frac{\left[\left(\dfrac{Y_{P_F} P_F + Y}{(1+t)^2} \right) (\Pi^{H}_{P_H P_F}) \right]}{|J|} \tag{12}$$

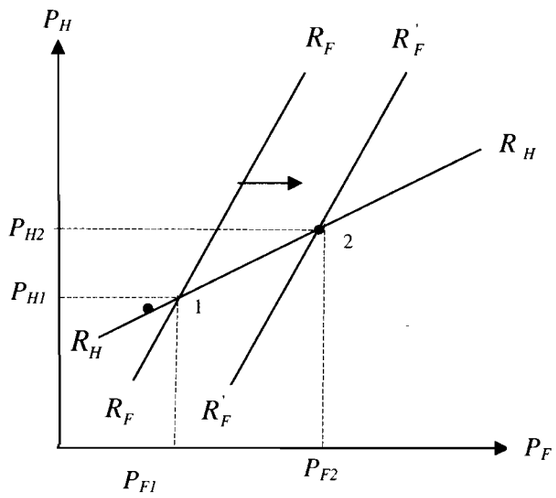
which is positive, because $\dfrac{Y_{P_F} P_F + Y}{(1+t)^2} < 0$ and $\Pi^{H}_{P_H P_F} > 0$ (under assumption). Similarly,

$$\frac{\partial P_F}{\partial t} = \frac{\left[(\Pi^{H}_{P_H P_H}) \left(\dfrac{Y_{P_F} P_F + Y}{(1+t)^2} \right) \right]}{|J|} \tag{13}$$

which is positive, because $\Pi^{H}_{P_H P_H} < 0$ (SOC for profit maximization) and $\frac{Y_{P_F} P_F + Y}{(1+t)^2} < 0$.

This result is shown diagrammatically in Figure 3 using the firms' reaction curves. Equation (10) and (11) form a system of equations in which the equilibrium P_H and P_F are determined. Equation (10) determines the optimal choice of price for the home firm (P_H) as a function of its beliefs about the foreign firm's price choice (P_F) and is represented by $R_H R_H$. Equation (11) defines the foreign firm's reaction curve $R_F R_F$. Because $\Pi^{H}_{P_H P_F}$ and $\Pi^{F}_{P_F P_H}$ are both positive, the reaction curves have a positive slope. Therefore, the Bertrand free trade equilibrium is at point 1, where the home firm charges P_{H1} and the foreign firm charges P_{F1}. The imposition of a tariff will increase the tariff inclusive import price to P_{F2}. This shifts the foreign reaction curve rightward to $R_F' R_F'$. This rightward shift induces an increase in the domestic price (P_{H2}) and a further increase in the import price (P_{F2}), with a new equilibrium at point 2.

Figure 3: The impact of the tariff on the firm's reaction curves (Bertrand)



Source: Based on Brander 1995

The impact of a tariff on the mark-up of the domestic firm can be obtained by differentiating the mark-up equation with respect to t:

$$\frac{\partial u}{\partial t} = \frac{C_{P_H}\frac{\partial P_H}{\partial t} - P_H C_{P_H P_H}\frac{\partial P_H}{\partial t}}{C_{P_H}^{'2}}$$

$$= \frac{\partial P_H}{\partial t}\frac{\left(C_{P_H} - P_H C_{P_H P_H}\right)}{C_{P_H}^{2}} \qquad (14)$$

$$= \gtrless 0$$

Consider the right hand side of (14): the first term reflects the impact of the tariff on the price and is positive (see analysis above). The first term between the brackets of the numerator ($C_{P_H} = \frac{\partial C}{\partial P_H} = C_{P_H}\frac{\partial X}{\partial P_H}$, because $C = C(X)$) is negative, while the second term $\left(\frac{\partial \frac{\partial C}{\partial P_H}}{\partial P_H}\right)$ is positive. Therefore, as found in the Cournot model, the impact on mark-ups is ambiguous and depends on the shape of the marginal cost curve. Under constant MC, mark-ups increase as is found in the Cournot model. The main difference with the Cournot model is that an import tariff can be beneficial in terms of profit, for both the home and foreign firm. This outcome depends on the relationship between the tariff inclusive foreign price ($P_F^{'}$) and the tariff (t). If $P_F^{'} > t$ the foreign firm will benefit, when $P_F^{'} = t$ the profits of the foreign firm may fall as its output decreases, and in the case where $P_F^{'} < t$ the foreign firm will experience a terms of trade deterioration (Feenstra, 2004).

2.1.4 Sensitivity analysis

Conrad (2000) points out that the main problem with STP is that "there are as many conclusions as there are models in the literature." The models may take the Cournot or Bertrand form, the marginal cost may be increasing, constant or decreasing, the goods may be homogeneous or differentiated, demands may be concave, linear or convex, the number of firms may be small or large in one or both countries, entry may be free or restricted, the markets may be integrated or separated, governments can use various types of instruments and may even retaliate or pursue a laisser-faire policy

(Bhagwati *et al.*, 1998: 381). Dixit & Norman (1998: 265) even state that "to arrive at a general theory of trade with imperfect competition is therefore impossible; the most one can hope for is a catalogue of special models."

This section briefly analyses the sensitivity of the results to changes in some of the model assumptions.

In the third-market Bertrand model, where both countries compete in a third market, the tariff imposed by the government acts to restrain competition, else both firms would produce "too much" (Markusen *et al.*, 1995). In this model, a tariff will boost profits of both firms and the consumers are the victims because they now face higher prices. In the third-market Cournot model, only the home firm will gain. This shows how sensitive the theory of strategic trade policy is to the underlying assumptions in relation to the national welfare. But in terms of the mark-up, the relationship appears quite constant, under the constant marginal cost assumption. This further confirms that the profit shifting motive for import protection is not very robust, namely the net effect on social welfare can be ambiguous. Thus, although the set-up of the Bertrand model differs from the Cournot model only in the strategic variable, the two models yield surprisingly different results.

In perfectly competitive models of trade, tariffs and quotas should be similar, in the sense that the effect of a tariff can be duplicated by an appropriately chosen quota (Brander, 1995). With imperfect competition however, a tariff and import quota that lead to the same level of imports have differing effects, with a quota leading to a higher domestic price, a lower domestic output and a higher mark-up than the 'equivalent' tariff, when Cournot competition is assumed (Helpman & Krugman, 1989). This is so because an import quota eliminates the threat of imports (substitution) and thus raises the market power of the domestic firms. A tariff on the other hand, confines this market power, because when domestic firms decide to raise their prices above a certain threshold, consumers will substitute for imports (Helpman & Krugman, 1989). Feenstra (2004, based on Harris (1985)) point out that assuming Bertrand competition with non-tariff barriers in the form of VERs leads to a more dramatic result. The fact that the foreign firm is restricted by the VER is common knowledge among both firms, therefore it is no

longer appropriate to assume that firms engage in Bertrand competition, namely treating each others prices as fixed. The home firm realizes that if it increases its price and shifts export sales towards the foreign firm, thereby leading to a demand larger than the export restraint, the foreign firm will have no choice but to raise its own price. It is almost certain that the home firm will take advantage of the export restraint and increase its price, knowing that the foreign firm will have to respond. But the striking fact is that the foreign firm also benefits from the export restraint. Krishna (1989) therefore refers to the export restraint as a "facilitating practice" because it facilitates collusive practices between the firms. The impact on mark-ups may therefore be larger with non-tariff barriers instead of tariffs.

The "reciprocal-markets" model assumes that firms make separate output decisions for both markets (segmented market). How would our results change if firms would bring all their output to the unified world market (integrated market)? This means (Bhagwati *et al.*, 1998: 414) that if we are dealing with homogeneous goods, "prices in the home and foreign markets can differ by no more than the per-unit transport cost." This also is equivalent to assuming that neither firm can dump its product in the rival's market (Fisher & Wilson, 1995). Thus the imposition of a tariff in one market influences the strategies of both firms in both markets (Fisher & Wilson, 1995). Markusen and Venables (1988) find that under the assumption of integrated markets, a small import tariff or export subsidy improves welfare less (or reduces it more) than if markets are segmented. This is so because with segmented markets, the import tariff has a greater terms of trade effect $\left(\frac{\partial P_F}{\partial t} Q_F\right)$ with integrated markets (Markusen and Venables, 1988: 313). We therefore expect that the impact of a tariff reduction in the integrated market context should have a much stronger negative impact on the mark-up.

Also note that our model is entirely partial equilibrium. It is however possible to extend the model to a simple general equilibrium framework, by assuming that another good is produced, namely a competitive numeraire good with constant returns to scale in labour (Brander, 1995: 1405). In this case, the prices are all relative prices. This extension would not affect our conclusions though.

Introducing differentiated goods instead of homogenous goods to our Cournot model also does not affect the direction of the impact of tariffs on mark-ups. The domestic price of the foreign good will rise, whereas the domestic price of the home good is unaffected. The entire burden of the tariff falls on home consumers who must pay a higher price for the foreign good and will therefore substitute for the home good. The tariff will allow the home firm to increase its price and mark-up, but not by the full amount of the tariff, else consumers will substitute for the foreign good (Bhagwati *et al.*, 1998). Thus introducing differentiated products in the Cournot model does not fundamentally alter the results.

The results are more sensitive to the assumption regarding entry and exit. Our model implicitly assumes that barriers to entry prevent new firms from entering the market. Free entry limits the market power of firms and forces profits to zero for each firm. However, allowing free entry and exit does not necessarily eliminate the profit shifting motive for trade and industrial policy: all firms may earn positive profits if fixed costs are relatively large compared with market size (Eaton & Grossman, 1986). Markusen *et al.* (1995) note that with free entry, the import tariff will result in entry of additional firms and not to an expansion of output of the existing firms. But the import tariff may increase the domestic price and, when output remains constant, the mark-up may still rise. The Cournot model of Dixit and Norman (1980), on the other hand, shows that the opening of trade leads to a world industry with fewer, larger firms, than the sum of national industries before trade, but where competition has increased. Venables (1985) paper also shows that, because the import tariff raises the profitability of the home firms and lowers the profitability of the foreign firms, entry on one side and exit on the other will result. This makes the home market more competitive and the foreign market less competitive, because protection induces entry. Therefore, free entry reduces the domestic price and mark-up. Thus with free entry and exit, trade and industrial policy is likely to affect the total number of firms in an industry, both domestically and abroad (Eaton & Grossman, 1986).

2.1.5 The role of the government

In the case where the government maximises a social welfare function and if we assume a constant marginal cost, a positive tariff is optimal (Brander, 1995). This would suggest that there is no incentive to liberalise trade. However, foreign countries also impose tariffs to maximise their own social welfare. The benefits to the policy-setting country arise only by reducing the profits of foreign firms and subsequently reducing those countries' national welfare[8]. Thus one country's gains are other countries' losses, and strategic trade policies can rightfully be called beggar-thy-neighbour policies (Brander, 1995). Since foreign firms would lose from our country's policies, as before, it is reasonable to expect retaliation by the foreign governments. However, because these policies essentially just reallocate resources among profit-making firms internationally, it is unlikely for a strategic trade policy to cause an improvement in world economic efficiency. This implies that if the foreign country did indeed retaliate, the likely result would be reductions in national welfare for both countries (Suranovic, 1997). This situation is a prisoner's dilemma game: namely, both governments have an incentive to impose an import tariff and obtain a lower total welfare as a result. Consequently, the non-cooperative equilibrium in which both governments use tariffs is normally welfare-inferior to the free trade regime where neither uses tariffs (Brander, 1995). We can therefore conclude that the cooperative agreements within the WTO framework provide an incentive for the domestic government to liberalise tariffs. This aspect is also relevant (Conrad, 2000) in that the new institutions arising in the global economy (the WTO or big regional integration areas) can be understood as an attempt to make the governments commit to specific policy paths (namely not to use certain instruments for protection objectives).

Thus from a purely domestic point of view, protection can be an attractive policy. But from an international point of view only the cost remain, one country may benefit from protection, but the resulting losses to other countries usually more than offset this gain. Thus imperfect competition gives rise to beggar-thy-neighbour incentives for protective policies. Therefore, the natural solution to this dilemma is through multilateral

[8] Except for the Bertrand "Third market" model, where both countries may gain.

negotiation and trade liberalisation, whereas unilateral trade liberalisation would not be expected (Grossman, 1994).

But it should also be clear that lacking the relevant information, the government could very likely adopt the wrong type of policy. Moreover, it is reasonable to expect that policymakers have less information than firms concerning cost, demand and nature of conduct in the industry, which are crucial in determining the appropriate policy. Presuming too much information on the part of governments is therefore one of the major objections to the theory of STP (Brander, 1995: 1422). Brander (1995) further states that since the information requirements for application of strategic trade policies are high, distortions arising from political economy considerations (such as lobbying) are a major concern. Brander (1995: 1446) concludes that "although the informational requirements are high, they are not impossibly high".

2.1.6 Conclusion

The analysis of the Cournot and Bertrand models has shown that there is a positive relationship between mark-ups and tariffs under a constant *MC* assumption. Although the results are sensitive to the underlying assumptions, it is striking to note that in almost every case, trade barriers raise the mark-ups. Although the size of the impact appears sensitive, the direction of impact appears quite robust. In contrast, the outcome on national welfare appears to be more sensitive to changes in the underlying assumptions.

2.2 Empirical methodology

This section deals with the empirical methodology used to estimate mark-ups and to identify the marginal impact of trade on these mark-ups.

2.2.1 Approaches to the Direct Estimation of Mark-ups

The major problem with estimating the mark-up of price over marginal cost arises from the fact that, while prices can be measured, marginal costs are not directly observable. Therefore, indirect measures have been developed. Hall (1988) introduced a new method for testing the equality of price and marginal cost based on the Solow

Residual (SR), which is a measure of growth in total factor productivity. The method proposed by Hall has become popular and has been extensively applied in the empirical literature.

Hall demonstrates that under constant returns to scale, the primal Solow residual can be related to the mark-up of prices over marginal costs (MC) as follows:

$$SR = \Delta q - \alpha.\Delta l - (1-\alpha).\Delta k$$

$$= (u-1).\alpha.(\Delta l - \Delta k) + \theta \qquad (15)$$

where u = P/MC, Δ denotes the first difference, lower case denotes the natural log transform, q, l and k denote real value added, labour, and capital inputs, respectively, α is the labour share in total value added, and θ is the (Hicks-neutral) rate of technical progress.

Under perfect competition (u = 1), the Solow residual is not correlated with the growth rate of the labour/capital ratio and is thus identical to the rate of technical progress. But under imperfect competition, equation (15) cannot be estimated directly because the labour/capital ratio is correlated with the productivity term and the Ordinary Least Square (OLS) estimates of u will be inconsistent and biased (Martins *et al.*, 1996). The usual way to correct for this endogeneity problem is to replace the labour/capital ratio by a set of instrumental variables[9]. For the case of the US, Hall (1988) selected the following instruments: overall real GDP, defence expenditures, oil prices and the political party of the president. But some of these instruments have been criticised as being rather implausible (see for example Roeger, 1995).

To avoid the endogeneity bias and instrumentation problems, Roeger (1995) introduced an alternative approach where the mark-up ratio can be estimated by usual econometric techniques in a consistent and unbiased way. Roeger first computed the dual of the Solow residual (DSR):

$$DSR = \alpha.\Delta w - (1-\alpha).\Delta r - \Delta p$$

$$= (u-1).\alpha.(\Delta w - \Delta r) + \theta \qquad (16)$$

[9] These variables are correlated to the growth rate of the labour/capital ratio and at the same time are not correlated with the productivity shocks (Martins *et al.*, 1996).

where w and r represent the natural logs of the wage rate and rental price of capital, respectively. Equation (16) is again subject to the same endogeneity problems. Roeger's insight was that by subtraction of equation (16) from (15), the productivity terms (θ) would cancel out, which removes the endogeneity problem. This gives us the so called Nominal Solow Residual (NSR):

$$NSR = \Delta(p+q) - \alpha.\Delta(w+l) - (1-\alpha).\Delta(r+k)$$

$$= (u-1).\alpha.[\Delta(w+l) - \Delta(r+k)] \qquad (17)$$

Martins and Scarpetta (1996) adjusted Roeger's equation, so that no specific assumption has to be made on the level of returns to scale:

$$NSR = (\frac{u}{\lambda} - 1).\alpha[\Delta(w+l) - \Delta(r+k)] \qquad (18)$$

where λ is an index of the degree of returns to scale.[10]

From equation (18) it can be seen that with increasing returns to scale (λ>1), Roeger's method produces a downward bias in the estimation of the mark-up.

A shortcoming in the original specification of Hall (1988) is that it only incorporates two inputs in the production function, namely labour and capital. However, if intermediate inputs represent a significant part of the variable costs that the firm must incur and if these costs vary in proportion to output, excluding them would lead to an upward bias in the measurement of the mark-up (Konings *et al.* 2001). Therefore, Norbinn (1993) made a slight modification to Hall's 1988 model by incorporating intermediate inputs and finds that, in contrast to Hall's findings, the estimated mark-ups are relatively small and insignificant when intermediate inputs are included. Therefore, Norbinn's estimates of u are less biased than Hall's estimates, but still subject to the endogeneity bias. Including intermediate inputs modifies equation (17) to:

$$NSR^{GO} = \Delta(p^{GO} + Q^{GO}) - \alpha^{GO}\Delta(w+l) - \beta^{GO}.\Delta(P_m + m) - (1-\alpha^{GO} - \beta^{GO}).\Delta(r+k)$$

$$= (u-1).[\alpha^{GO}.\Delta(w+l) + \beta^{GO}.\Delta(P_m + m) - (\alpha^{GO} + \beta^{GO}).\Delta(r+k)] \qquad (19)$$

[10] Note that Roeger assumes λ=1.

where p^{GO} and q^{GO} correspond to logarithms of gross output and its respective prices, and α^{GO} and β^{GO} to the share of labour and intermediate inputs in gross output value, respectively.

Studies investigating mark-ups in the US manufacturing industries have shown that the results from studies based on Hall's (1988) and Norbinn's (1993) approach are most likely to contain an upward bias due to the endogeneity and instrumentation problems, relative to Roeger's methodology. Martins *et al.* (1996), for example, found that the size of the mark-up ratio estimated by Hall is substantially higher than those calculated by Roeger, with many of Hall's significant mark-ups close to or over 100 per cent. This appears to be implausible for the US manufacturing industries, as these tend to be highly exposed to international competition (Martins et al, 1996). The estimates of Martins *et al.* (1996) are substantially lower (in the range of 10-15 per cent), and intuitively more plausible than the results of previous studies. For the South African manufacturing industries only one study has been carried out by Fedderke *et al.* (2003). They found that significant mark-ups (in the range of 77-79 per cent) are present in the South African manufacturing industries, approximately twice as large when compared to the US.

2.2.2 Estimating mark-ups and the impact of trade on mark-ups

Various approaches have been followed in estimating the impact of trade variables on mark-ups. Hakura (1998) and Fedderke *et al.* (2003) interact the trade variables with the explanatory variable, while Kee and Hoekman (2003) use the substitution approach.

First we estimate the pure mark-up equation which is the same for both the Interaction and Substitution approach:

$$NSR_{it} = \beta_0 + \beta_1 D.mup_{it} + \varepsilon_{it} \qquad (20)$$

where *NSR* and *mup* represent the nominal Solow residual and the capital/labour growth ratio ($\alpha.[\Delta(w+l)-\Delta(r+k)]$), respectively. D is a dummy variable and ε is the error term made up of $\alpha_i + u_{it}$, a time invariant component and a remainder component, which are uncorrelated over time.

Secondly, we estimate the impact of the trade variable (e.g. tariff, import ratio ...) on the mark-up, based on the interaction approach[11]:

$$NSR_{it} = \beta_0 + \beta_1 mup_{it} + \beta_2 D.Z_{it} * mup_{it} + \varepsilon_{it} \quad (21)$$

where Z represents the trade variable and ε is the error term.

Note that the level of the mark-up is not just β_1 - one also has to take into account the level of the tariff, namely $\frac{\partial nsr}{\partial mup} = \beta_1 + \beta_3 Z$

To see how the changes in the trade variable affect the mark-up, the mark-up is interacted with the trade variable, namely $\frac{\partial\left(\frac{\partial nsr}{\partial mup}\right)}{\partial Z} = \beta_3$

The hypothesis to be tested is that higher degrees of import ratios or lower degrees of tariffs induced by the trade reform during the 1990s will increase the degree of competition and reduce mark-ups. This trend should have a positive impact on the economy, since it is generally accepted that import competition disciplines domestic markets. This is particularly important for developing countries like South Africa, which have, with a few notable exceptions, small but highly concentrated markets[12]. Thus the intensified international competition will ensure that the domestic markets are forced to behave more competitively (Levinsohn, 1993). Many authors find that greater openness to trade leads to lower mark-ups. Levinsohn (1993) for example finds that price-marginal cost mark-ups fell in Turkish industries where trade was liberalised, and increased in industries where trade protection was increased. Harrison (1994) also finds that mark-ups are negatively related to import competition in the Cote d'Ivoire, and Krishna and Mitra (1998) present evidence that mark-ups fell during the trade reform period in India. Using this approach Fedderke *et al.* (2003) find that increased import penetration ratios serve to decrease industry mark-ups in South Africa. Hakura (1998) applies the approach to six European Union (EU) members and finds that import competition, particularly intra-EU competition, has strong disciplining effects on market power. Konings *et al.* (2001) also

[11] Note that the β's refer to a percentage point impact and not a percentage impact.
[12] See Fedderke (2002) for industry concentration ratios.

interact import penetration with the explanatory variable in a generalised specification of Hall's (1988) model and find no significant impact of import penetration on mark-ups in Belgium and a positive relationship in the Netherlands.

Using the substitution approach, the coefficient β_1, which equals the mark-up (μ) – 1, is substituted by a function: (μ – 1) = F(tariff, import ratio, other variables)

Taking a log linear transformation of this function we obtain:

$$(\mu - 1) = \alpha_0 + \alpha_1 ln(tariff) + \alpha_2 ln(import\ ratio) + \alpha_3 ln(other) \qquad (22)$$

Substituting this into the mark-up function ($nsr = (\mu - 1)mup$) and adding an error term we get the following function to estimate:

$$Nsr = (\mu - 1)mup_{it} + \varepsilon_{it}$$

$$= \delta + \alpha_0 mup_{it} + \alpha_1 D.ln(tariff_{it}) * mup_{it} + \alpha_2 D.ln(import\ ratio_{it}) * mup_{it} + \alpha_3 D.ln(other_{it}) * mup_{it} + \varepsilon_{it} \qquad (23)$$

The level of the mark-up is given by:

$$\frac{\partial nsr}{\partial mup} = \alpha_0 + \alpha_1 \ln(tariff) + \alpha_2 \ln(import\ \ ratio) + \alpha_3 \ln(other) \qquad (24)$$

The impact of a percentage point change in the trade variable (Z) on the mark-up is given by: $\frac{\partial\left(\frac{\partial nsr}{\partial mup}\right)}{\partial \ln Z} = \alpha_1$ (25)

Kee and Hoekman (2003) apply this substitution approach to a panel of 42 countries over 18 years. They find both domestic and foreign competition to be major sources of market discipline in concentrated markets. They also find that competition laws have an indirect effect on mark-ups by promoting the entry of a larger number of domestic firms. In the econometric analysis that follows, equations (20) and (23) represent the main specifications used to estimate the average level of mark-ups in South African industries and the marginal impact of trade (import penetration and tariffs) on mark-ups. In addition, we adjust these specifications to allow for intermediate inputs, as shown in equation (19).

3 Data and Data Analysis

3.1 Data

Our data set comprises the three-digit manufacturing sectors for South Africa, over the 1970-2002 period. For the panel data estimations the data set is limited to the 1988-2002 period, due to data availability. The main data source in this study is the South African Standardised Industry Database (Quantec, 2004) obtained from the Trade and Industrial Policy Strategies (TIPS). The Quantec database provides data on the following variables: gross operating surplus, labour remuneration, intermediate inputs, fixed capital stock and gross domestic fixed investments.

The analysis of the impact of import penetration and tariffs on mark-ups is restricted to the period 1988-2002. Disaggregated tariff data are obtained from various sources. Scheduled tariff rates at the 6-digit Harmonised System (HS) level are obtained from the Trade Analysis and Information System database (TRAINS) for 1988, 1990, 1991, 1993 and 1996. Tariff rates at the 8-digit HS level for 1994, 1998, 1999 and 2000 are obtained from the Industrial Development Corporation (IDC). Finally, 8-digit HS tariff schedules for 2001 and 2002 are obtained from TIPS. A concordance file obtained from TIPS is then used to calculate the simple average tariff rate at the more aggregated SIC 3-digit level. Tariff rates for missing years are estimated using growth rates.

In estimating the impact of regional trade on mark-ups, we consider five regional groupings: OECD High Income[13] (OECD_HI), Africa, China & India, Asia and Eastern Europe. Regional trade data at the HS8-digit level are sourced from Customs & Excise. Once again, data availability limits this analysis to the period 1988-2002. The data are valued in current prices. To convert to real prices, we use the implicit import price deflator calculated from real and nominal valued import data obtained from Quantec's SASID database. We thus impose the assumption of common import price deflators across regions and across HS8-digit product lines within each broad SASID product group. Because the product composition of trade differs across regions, this may induce

[13] Consists of EU, US, Canada, Japan, Norway, Iceland, Switzerland; Australia and New Zealand.

biases in the level and trend of real imports. Import penetration ratios are calculated by dividing imports by gross domestic expenditures.

The calculation of the *mup* term in equation (20) and (23) requires information on the nominal return to capital (R), which is equal to the rental price of capital times the fixed capital stock. Following Martins and Scarpetta (1999), the rental price of capital is calculated as

$$R = ((i - \Pi_E) + \delta).p_k$$

where i, Π_E, δ and P_k correspond to the long run interest rate, the expected inflation rate, depreciation rate[14] and price deflator for investment, respectively. The 10 year actual interest rate is obtained from SARB (Government bonds - 10 years and over), the inflation expectations are generated using a low-frequency component of the annual percentage change in the GDP deflator using a Hodrick-Prescott filter (lambda value of 7). The price deflator for investments is obtained by dividing the Gross Domestic Fixed Investment (GDFI) at current prices by the GDFI at nominal (1995) prices, both derived from SARB.

Our analysis uses the average depreciation rates of the 1990s. The mark-ups, particularly those excluding intermediates, appear to be sensitive to the choice of depreciation rate. This is where our approach differs from Fedderke *et al.* (2003), who finds that the results are not very sensitive to the choice of δ.

The mark-ups also appear to be quite sensitive to the choice of inflation and interest rate.

The panel data analyses are run with the Stata 8 software package. Table 1 displays the variables that are used in the regressions.

[14] The depreciation rate = real depreciation/fixed capital stock(t – 1) and real depreciation = fixed capital stock(t) – fixed capital stock(t – 1) – gross domestic fixed investments.

Table 1: List of Variables

Mup	Ratio of K to L growth
Mup_interm	Ratio KL growth including intermediates
Nsr	Nominal Solow residual
Nsr_interm	Nominal Solow Residual including intermediates
Tar	Simple average tariff using HS schedules
Tar_adj	Simple average tariff with 1988&92 adjusted using WTO data
Tar_surch	Simple average tariff including surcharges
IPR_SA	Total SA imports/GDE
IPR_OECD_HI	SA imports OECD High-Income/GDE
IPR_Africa	SA imports Africa/GDE
IPR_Asia	SA imports Asia/GDE
IPR_China_India	SA imports China + India/GDE
IPR_EastEur	SA imports Eastern Europe/GDE

3.2 Data Analysis

Prior to 1994, South Africa was to a large extent isolated from the rest of the world via trade boycotts, economic sanctions, disinvestment etc. These forced the government to pursue an inward oriented policy, where domestic industries were protected with a variety of tariffs and quotas. When it became apparent that the political transition would be negotiated in a peaceful manner, many countries started to normalize their trade relationships with South Africa. This meant that trade barriers began to be dismantled in 1990, and especially after the transition in 1994, the government became committed to a policy of trade liberalisation (Mboweni, 2004). For some industries, e.g. clothing and textiles, this commitment went far beyond the requirements of the GATT. This resulted in cheap clothing imports, particularly from Asian countries, which, according to some evidence forced many small and medium-sized South African clothing and textile factories to close down or cut costs, leaving thousand of workers jobless (Christian Aid, 2003).

The impact of tariffs and regional imports on the mark-ups is estimated for two sub-periods. The 1988-2002 period will indicate the general impact of increased imports and tariff liberalisation on mark-ups over our sample period, whereas the 1995-2002 sub-period will isolate the impact after the trade reforms of the 1990s. Therefore, a dummy

variable will be included for the 1995-2002 sub-period. Due to data availability the estimated period is confined to the 1988-2002 period.

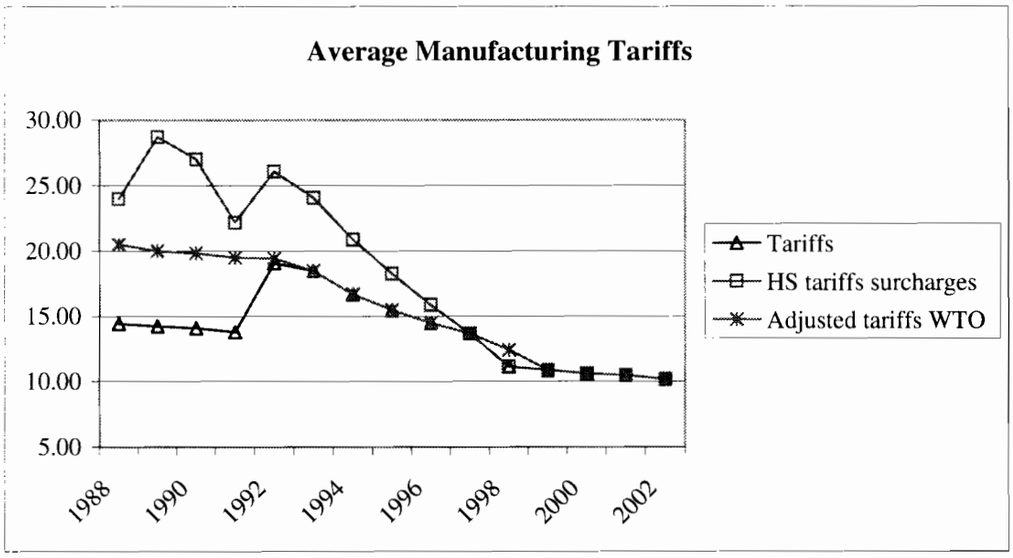
As before, the estimations will mainly focus on the mark-ups including intermediate inputs.

Figure 4 presents the average tariffs for the South African manufacturing industries over two year intervals for the period 1988-2002. According to the scheduled tariff rates, average protection in manufacturing rose from 14.42% in 1988 to 16.68% in 1994, before declining to 10.22% in 2002. However, these values under-estimate protection levels during the late 1980s and early 1990s. The values exclude surcharges imposed between 1985 and 1995 in response to the debt crisis in the late 1980s. Further, protection from quantitative restrictions on imports and formula duties are not captured. During the 1980s and early 1990s, quantitative restrictions were increasingly replaced by tariffs and by 1994 the process was largely complete and the focus of trade reform shifted to import liberalisation through tariff reductions.

To account for these effects, two further sets of tariff rates are constructed. An adjusted tariff rate schedule is constructed using additional tariff data obtained from GATT (1993) for 1988 and 1992 that includes ad valorem equivalents for formula duties. This causes the average tariff rate to increase to 20.51% for 1988 and shows a more gradual decline towards 2002. A schedule of adjusted tariff rate including surcharges is then calculated by including surcharges obtained from GATT (1993) and data from the Reserve Bank. This raises the original average tariff rate even further, namely to 23.98% for 1988, with a maximum of 28.70% in 1989 and a steeper decline towards 2002.

South Africa is a middle-income country and faces competition from both high-income and low-income countries. Therefore the impact of import competition on mark-ups is expected to differ according to the region. By disaggregating trade flows by their origin, one can determine how the strength of trade discipline varies by the origin of trade.

Figure 4: Tariff protection from 1988-2002



Source: Based on Edwards 2005.

Table 2 presents data on manufacturing imports according to region. The average real value of manufacturing imports and the share of regional imports in total South African imports are analysed over the 1988-1994 and 1995-2002 periods. Table 2 shows large differences in the level and growth of imports across regions. The average Total SA imports have tripled over the sub-periods, as did the average imports for the majority of the regional groups. OECD_HI and Asia represent the largest average share, with about 75% and 25% of total SA imports, respectively.[15] The other regional groups represent a very small share of total SA imports, but the imports from China_India and Eastern Europe have five-and ten-folded over the sub-periods, respectively.

Table 3 reports that within the Total SA Imports, OECD_HI and Africa groups, a slight majority of the industries experienced a negative growth, whereas within the Asia, China_India and Eastern Europe groups, most industries experienced a positive growth. Also, for the OECD_HI and the Africa groups, most industries report a negative growth as a share of Total SA Imports, whereas for the Asia, China_India and Eastern Europe almost every industry experienced a positive growth.

[15] Note that Japan is included in both OECD_HI and Asia.

Table 4 further indicates that within the OECD_HI, Asia, China_India and Eastern Europe group there has been little change in the structure of trade over the sub-periods. The Machinery and Motor vehicles and parts sectors represent the largest share of imports for both the OECD_HI and Asia group. These sectors are all relatively skill-intensive sectors and the shift reflects the comparative advantage of developed economies to skill-intensive sectors. The major industries within the China_India group are Clothing, Machinery, Textiles and Footwear. This is also consistent with relative factor endowments which give these economies a comparative advantage in labour-intensive products. For the Eastern Europe group, the Basic Chemicals and Machinery sectors are the largest within the group. Within the Africa group, the structure of imports has changed dramatically over the sub-periods.

Table 2: Manufacturing imports by region

	Average Value (R000)		Share of total SA imports		
	1988-1994	**1995-2002**	**1988-1994**	**1995-2002**	**Growth over periods**
OECD_HI	36.708.676	106.686.646	74%	77%	2.91
Africa	805.394	2.463.232	2%	2%	3.06
Asia	11.847.661	36.834.579	24%	26%	3.11
China_India	684.883	7.215.274	1%	5%	10.54
Eastern Europe	185.537	1.002.630	0%	1%	5.40
Total SA	**49.560.736**	**139.143.176**	**100%**	**100%**	**2.81**

Notes: Data sourced from Customs and Excise in current values. Data are deflated to 1995 prices using an import price deflator obtained from SASID (2004). OECD_HI include EU, US, Canada, Japan, Australia and New Zealand.
Source: Custom and Excise

Table 3: Number of industries that experienced positive/negative growth as a share of the Regional group and as a share of total SA Imports over the sub-periods

	Within Regional group		Share of Total SA Imports	
	Positive	**Negative**	**Positive**	**Negative**
Total SA Imports	5	6	-	-
OECD_HI	6	7	6	22
Africa	8	11	9	13
Asia	7	5	18	7
China_India	10	8	11	0
Eastern Europe	12	8	24	1

Source: Own calculations

Table 4: Major import industries within regional group (> 6%)

OECD_HI		Africa		Asia	
1988-1994	**1995-2002**	**1988-1994**	**1995-2002**	**1988-1994**	**1995-2002**
Machinery	Machinery	Food	Machinery	Motveh & parts	Motveh & parts
Motveh & parts	Motveh & parts	Printing	Food	Machinery	Machinery
Basic Chemicals	Other chemicals	Textiles	Bas n-fer met	Tv & coms eq	Tv & coms eq
Other chemicals	Basic Chemicals	Oth industr	Clothing	Textiles	Basic chems
	Tv & coms eq	Wood & prods	Othr trnsp eq		
		Metal prods	Wood & prods		
		Clothing	Textiles		

China_India		Eastern Europe	
1988-1994	**1995-2002**	**1988-1994**	**1995-2002**
Clothing	Machinery	Basic chem.	Machinery
Textiles	Tv & coms eq	Food	Basic chem
Footwear	Clothing	Machinery	Motveh & parts
Machinery	Footwear		Bas iron & st
Oth industr	Textiles		Electr mach
Petrol ref	Oth industr		Bas n-fer met
Leather prod	Basic chem		

Source: Own calculations

Of particular interest to this study is the rise in imports from 1988 and the potential impact that this has had on mark-ups in the South African economy.

From the above we can conclude that South Africa is therefore a good case study to analyse the impact of trade liberalisation and regional trade flows on mark-ups.

4 Results

4.1 Results from the direct mark-up estimations

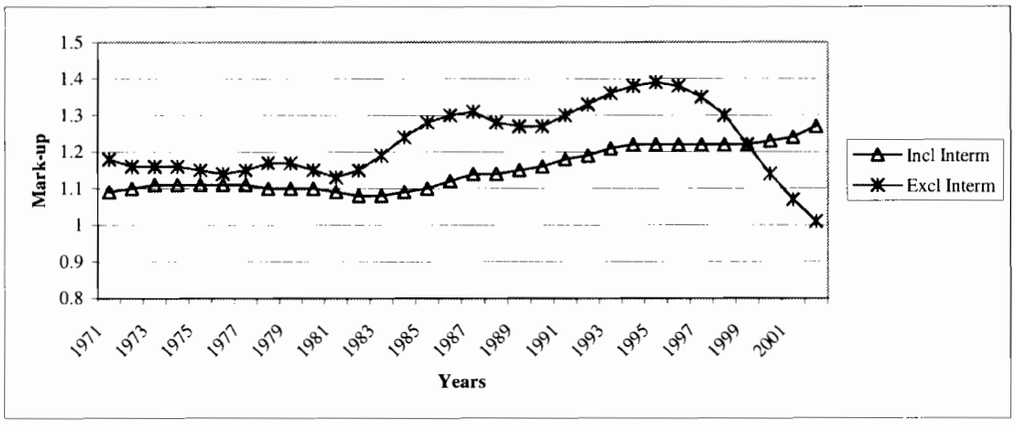
The Weighted Average[16] (WA) mark-ups across the manufacturing industries are presented in Table 5. The WA mark-ups range between 7 and 87 per cent and differ substantially across the sub-periods. Figure 5 and 6 show that the WA mark-ups reached a maximum in the mid-nineties and experienced a decreasing trend in the late 1990s for those excluding intermediates. This trend may indicate the disciplining effects of trade liberalisation and increased trade on mark-ups.

Table 5: Weighted average mark-ups SA manufacturing industries

	Including Interm		Excluding Interm	
	Narrow filter	Broad filter	Narrow filter	Broad filter
1970s	1.10	1.16	1.16	1.51
1980s	1.11	1.07	1.23	1.61
1990-94	1.19	1.17	1.33	1.85
1995-2002	1.23	1.24	1.23	1.87
1990-2002	1.22	1.21	1.27	1.86

Note: Total real output by sector between 1990 and 1999 are used as weights
Source: Own calculations

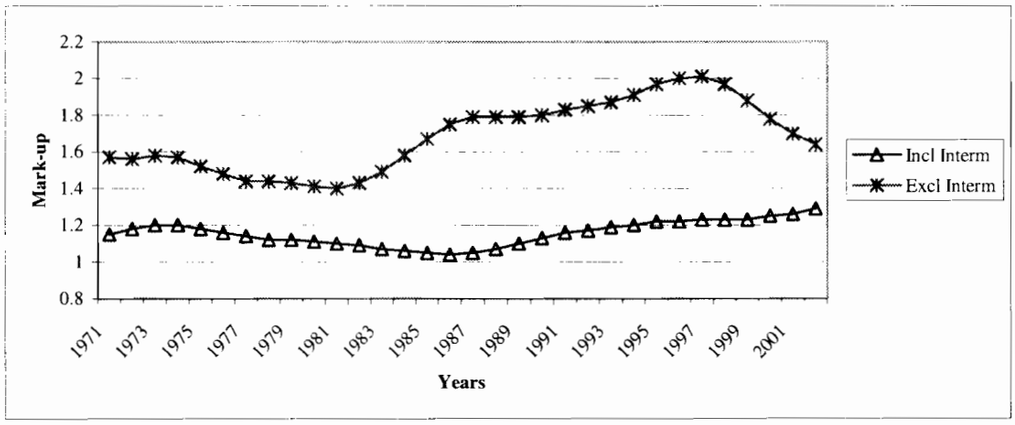
Figure 5: Weighted average mark-ups SA manufacturing industries (Narrow filter)



Source: Own calculations

[16] The mark-ups for every industry are weighted against its respective average share of GDP during the 1990s.

Figure 6: Weighted average mark-ups SA manufacturing industries (Broad filter)



Source: Own calculations

The average mark-ups of each manufacturing industry over the sample period 1971-2002, including and excluding intermediate inputs are presented in Table 6. The average mark-ups excluding intermediates for the entire economy equal 39% (Narrow filter) and 60% (Broad filter). The average sector mark-ups excluding intermediates exceed 30% in all but the following industries: Other transport equipment, TV, radio and communication equipment, Plastic products, Footwear, Leather products and Clothing. The average mark-ups including intermediates for the entire economy equal 13% (Narrow filter) and 15% (Broad). The mark-ups including intermediates are the highest in the Beverages, Tobacco and other industry sectors.

Table 6 also shows that the estimated mark-up is strongly influenced by the inclusion or exclusion of intermediate inputs. The average sector difference between 1971 and 2002 of mark-ups, including and excluding intermediates, for the narrow and broad filter, are 27% and 46%, respectively. Consistent with international results, the magnitude of mark-ups is considerably reduced with the introduction of intermediate inputs.

Our estimated average mark-ups for the South African manufacturing differ from those reported by Fedderke *et al.* (2003). They find that average mark-ups in South African manufacturing lie in the range of 72 - 79% (compared to 39% (Narrow filter) and 60% (Broad filter) for this study) when intermediate inputs are excluded, and 6-9% (compared to 13% (Narrow filter) and 15% (Broad filter)) when intermediates are

included. The differences in results are due to the use of different estimators, the longer time period of this study (1970-2002 as opposed to 1970-1997), and different estimates of the return to capital used in the calculation of the variables.

The highest mark-ups (in excess of 20%) including intermediates are found in beverages, glass products, non-metallic minerals, printing and tobacco.

Table 6: Average mark-ups in South African manufacturing industry (1971-2002)

	Including Interm		Excluding Interm		Excl. – Incl. Interm	
Industry	**Narrow filter**	**Broad filter**	**Narrow filter**	**Broad filter**	**Narrow filter**	**Broad filter**
Food	1.10	1.10	1.65	1.86	0.55	0.76
Beverages	1.30	1.34	1.44	2.25	0.14	0.91
Tobacco	1.15	1.41	-	-	-	-
Textiles	1.14	1.14	1.49	1.60	0.35	0.46
Clothing	1.08	1.08	1.04	1.08	-0.04	0.00
Leather prods	1.09	1.08	1.24	1.00	0.15	-0.08
Footwear	1.15	1.15	1.02	1.23	-0.13	0.08
Wood & prods	1.10	1.10	1.54	1.74	0.44	0.64
Paper & prods	1.16	1.16	1.55	2.29	0.39	1.13
Printing	1.10	1.27	1.33	1.33	0.23	0.06
Petrol ref	1.11	1.06	-	-	-	-
Basic chems	1.12	1.12	1.86	1.93	0.74	0.82
Other chems	1.13	1.13	1.47	2.00	0.33	0.87
Rubber prods	1.07	1.07	1.32	1.28	0.25	0.21
Plastic prods	1.12	1.12	1.16	1.14	0.04	0.02
Glass & prods	1.15	1.27	1.45	1.63	0.30	0.36
Non-met mins	1.22	1.22	1.73	1.90	0.52	0.68
Bas iron & st	1.12	1.12	1.41	1.39	0.28	0.27
Bas n-fer met	1.12	1.02	1.57	1.77	0.45	0.75
Metal prods	1.09	1.09	1.36	1.59	0.27	0.50
Machinery	1.07	1.07	1.36	1.48	0.29	0.41
Electr mach	1.10	1.10	1.50	1.53	0.40	0.42
Tv & coms eq	1.07	1.00	1.10	0.84	0.03	-0.16
Scientific eq	1.13	1.07	1.39	1.61	0.26	0.54
Motveh & parts	1.01	1.08	1.43	1.53	0.42	0.46
Oth trnsp eq	1.05	1.16	1.04	1.12	-0.01	-0.04
Furniture	1.12	1.17	1.26	1.30	0.14	0.13
Oth industry	1.49	1.38	-	3.08	-	1.70
Average	**1.13**	**1.15**	**1.39**	**1.60**	**0.27**	**0.46**

Note: - The Narrow and Broad filter indicate adjustments for mark-ups outside the –2.5/2.5 and -5/5 range, respectively.
- Due to outliers, the mark-ups excluding intermediates could not be estimated for the Tobacco, Coke and Petroleum refining and the Other industry (Narrow filter) sectors.

Source: Own calculations

The growth trends[17] of the average mark-ups in the South African manufacturing industries[18] over each sub-period are presented in Table 7. Looking at the trends, there is considerable variation in mark-ups during the different decades at the sector level. Most industries experienced growing average mark-ups in the 1970s, 1980s and 1990-1994 periods, whereas for the 1990-2002 and 1995-2002 periods the majority of industries experienced falling mark-ups, excluding intermediates and a status quo in the number of industries that experienced a negative or positive growth trend when intermediates are included. The slow-down in the increase in mark-ups appears to coincide with the accelerated tariff reduction since 1994.

Table 7: Growth trends mark-ups in SA manufacturing industry

	Including Interm				Excluding Interm			
	Narrow filter		**Broad filter**		**Narrow filter**		**Broad filter**	
Period	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
1970s	18	10	16	12	13	12	22	4
1980s	21	7	16	12	18	6	19	7
1990-94	16	12	18	10	17	8	16	10
1995-2002	18	10	17	11	7	17	8	18
1990-2002	15	13	16	12	8	16	11	15

Note: Negative and positive refer to the number of industries that experienced a negative or positive mark-up growth.
Source: Own calculations

Table 11 (See Appendix) presents estimates of the average mark-ups at the sector level for various time periods. As shown in Table 11, there is considerable variation in the average level of mark-ups across sectors and decades.

Comparing the estimated average mark-ups (including intermediate inputs) with those estimated for other countries (see Martins *et al.* (1996) and Hoekman *et al.* (2001)) we find that average mark-ups in the South African manufacturing industries are at the lower end of the range (13 – 25%). But there is little correlation in the sectoral structure of mark-ups between South Africa and a range of international countries. Sectoral differences in mark-ups may reflect the impact of domestic factors such as competition policy, openness, concentration and the number of domestic firms, which are excluded

[17] The growth trends are obtained by differencing the log of the mark-up in the beginning and the end of each sub-period.
[18] See Table 12 in Appendix for the average mark-up for each sector and sub-period.

from our analysis. But these comparisons are made with caution as the estimated mark-ups are sensitive to different empirical methodologies, time periods, data aggregation, and data measurement.

4.2 Panel estimation results for manufacturing

First we estimate the level of the mark-ups, in the second stage of the analysis, the impact of tariffs and regional imports on price-marginal cost ratios is estimated. For the latter analysis we will focus on the mark-ups including intermediates and the substitution approach. The estimations with mark-ups excluding intermediates and the interaction approach can be found in the Appendix. The sample period for the panel data estimations is limited to the 1988-2002 period, due to data availability. We will consider two sub-periods: the 1988-2002 period will give the level of the mark-up over the sample period, and the 1995-2002 sub-period will isolate the change in the mark-up over that period. Therefore, a dummy variable will be included for the 1995-2002 sub-period.

As discussed earlier, average mark-ups are estimated using the Roeger (1995) equation:

$$NSR_{it} = \beta_0 + \beta_1 D.\ mup_{it} + \varepsilon_{it}$$

where *mup* is $\alpha.[\Delta(w+l)-\Delta(r+k)]$, β_1 is the estimated mark-up, ε is the error term and D is a dummy variable equal to 1 for the 1995-2002 sub-period and equal to 0 for the 1988-1994 sub-period. The error term (ε) consists of two components (Verbeek, 2000), namely a time-invariant component α_i and a remainder component u_{it}, which is uncorrelated over time. In the fixed effects model α_i is assumed to be constant over time. In the random effects model on the other hand, the individual effects α_i are treated as random. This allows us to capture some of the sector heterogeneity. The major concern is the probable correlation between the period-specific random effect and the included independent variables. The Hausman test is often used to test the hypothesis that they are not related. Our model employs the random effects method, which means that we estimate a common mup across all sectors. This is a strong assumption, which allows us to increase the explanatory power.

The average mark-ups over the sub-periods are similar to those obtained via the direct estimation technique. Table 8 confirms that including intermediate inputs lowers

the average mark-up substantially (43%) for the 1988-2002 sub-period. We further notice that the average mark-up, excluding intermediates, decreased considerably (22%) over the 1995-2002 period. Our study will therefore investigate if this reduction is due to trade liberalisation and increased import competition over that period. As shown in Table 8, the estimated mark-up is strongly influenced by the inclusion or exclusion of intermediate inputs. When intermediates are included in our estimation however, there is an insignificant increase in the average mark-up over the 1995-2002 sub-period.

Table 8: Average mark-ups SA manufacturing industries

	Including Interm	**Excluding Interm**
Mark-up 1988-2002	0.165**	0.595**
	(0.011)	(0.053)
Mark-up 1995-2002	0.02	- 0.224**
	(0.018)	(0.09)
N	420	420
R – squared	0,493	0,268
Hausman Test	Ok	Ok

Note: ** indicate significance at 5 percent, * at the 10 percent levels. The coefficient on "Mark-up 1995-2002" measures the additional impact of tariffs on mark-ups during the second period
Source: Own calculations

Next, we present the estimates of the impact of trade liberalisation on mark-ups. To examine the marginal impact of tariff liberalisation on mark-ups based on the interaction and substitution approach, we estimate a simplified form of equations (20) and (22) which are reproduced below.

$$NSR_{it} = \delta + \alpha_0 mup_{it} + \alpha_1 D.ln(tariff_{it})*mup_{it} + \varepsilon_{it}$$

$$NSR_{it} = \beta_0 + \beta_1 mup_{it} + \beta_3 D.tariff_{it}*mup_{it} + \varepsilon_{it}$$

Note that we lose one observation because equations (17) and (19) take first differences of the variables. This implies that the estimation period starts at 1971. Also, because the mark-ups obtained via the direct estimation technique are very volatile[19] (see diagrams in Appendix), they have been adjusted for outliers outside the –2.5/2.5 (Narrow filter) and -5/5 (Broad filter) range, respectively and smoothened using a Hodrick-Prescott filter (lambda = 7).

[19] When the nominator approaches 0, the mark-up goes to infinity.

The impact of trade liberalisation on South African mark-ups is shown in Table 9. To test the robustness of the relationship to the choice of tariff data, we measure protection using three different tariff rates. The analysis is confined to the 1988-2002 period for which tariff data are available. The tariff coefficients measure a 10 per cent decline in tariff protection on the level of the mark-up. The variable "Tariff 1995-2002" captures the additional impact of tariffs on mark-ups during the period 1995-2002. The tariff coefficients appear to be insignificant, but the results are consistent in that reduced tariffs have a negative impact on the mark-ups for the 1995-2002 sub-period. The estimation results excluding intermediate inputs are significant (see Table 14 in appendix) and confirm this finding. Thus the results in Table 9 and Table 14 provide evidence for the market disciplining effects of trade liberalisation, but these effects are concentrated in the period 1995-2002. The estimates (substitution approach) suggest that a 10 per cent reduction in tariffs during the 1995-2002 period reduces average mark-ups in manufacturing by 0.3 to 0.4 percentage points. This relationship is robust to the choice of protection measure. The results therefore suggest that tariff liberalisation during the 1990s, and from 1995 in particular, lowered average mark-ups in South African sectors.

Table 9: Tariff impact on SA mark-ups (including intermediate inputs)

	Substitution			**Interaction**		
	Tariff	**Tariff_Surch**	**Tariff_Adj**	**Tariff**	**Tariff_Surch**	**Tariff_Adj**
Mark-up	0.168**	0.147**	0.174**	0.16**	0.154**	0.162**
	(0.05)	(0.055)	(0.05)	(0.018)	(0.018)	(0.018)
Tariff 1988-2002	- 0.001	0.007	- 0.004	0.000	0.001	0.000
	(0.02)	(0.02)	(0.02)	(0.001)	(0.001)	(0.000)
Tariff 1995-2002	0.038	0.028	0.04	0.001	0.0001	0.001
	(0.026)	(0.025)	(0.025)	(0.002)	(0.001)	(0.002)
N	420	420	420	420	420	420
R – squared	0,50	0,50	0,50	0,495	0,496	0,495
Hausman Test[20]	Ok	Ok	Ok	Ok	Ok	Ok

Note: ** indicate significance at 5 percent, * at the 10 percent levels.
Source: Own calculations

An alternative approach to estimating the impact of import competition on mark-ups is to use Import Penetration Ratios (IPR) instead of tariffs. As discussed above, higher import penetration reflects increased international competition, and is hence

[20] The Hausman test is valid for all the estimations, indicating that the time specific error term and the exogenous variables are uncorrelated.

expected to reduce mark-ups. In this paragraph we present the estimates of the impact of import penetration on mark-ups within manufacturing during the period 1988-2002. In addition to focussing on total import penetration, we also estimate the impact of regional import penetration on mark-ups. Above we have discussed that the composition and growth of imports differs according to the regional source. Therefore the impact on mark-ups may differ across regions, as Hakura (1998) found for the European Union.

To examine the marginal impact of regional trade flows on mark-ups based on the interaction and substitution approach, we again estimate a simplified form of equations (20) and (22) which are reproduced below.

$$NSR_{it} = \delta + \alpha_0 mup_{it} + \alpha_1 D.ln(IPR_{it})*mup_{it} + \varepsilon_{it}$$

$$NSR_{it} = \beta_0 + \beta_1 mup_{it} + \beta_3 D.IPR_{it}*mup_{it} + \varepsilon_{it}$$

Table 10 presents the impact of total import penetration and regional import penetration (including intermediate imports) on mark-ups during the period 1988-2002. The import coefficient (substitution approach) reflects the percentage point change in mark-ups arising from a 10 per cent increase in import penetration. As before, the variable "Import 1995-2002" captures the additional impact of import penetration on mark-ups during the period 1995-2002.

We find that import penetration has a strong disciplining effect on the mark-up pricing behaviour of domestic firms in South Africa. Table 10 shows that most of the import coefficients are negative and significant for all regions, indicating that increased imports reduces average mark-ups in the SA manufacturing industries. These results are similar to those of Fedderke *et al.* (2003), who also found that increased imports serve to discipline mark-ups. There is also some evidence that import penetration exerted a stronger influence on mark-ups during the period 1995-2002. We find that a 10% rise in total import penetration is estimated to have reduced average mark-ups in manufacturing by 0.85 percentage points during the period 1995-2002, compared to 0.27 percentage points during the 1988-1994 period.

We also find that the market disciplining effects of import penetration differs according to the origin of trade. Results based on the substitution method show that the

High-Income OECD countries (-0.05) have the strongest market disciplining effects followed by the Asian countries (-0.22). The coefficient of imports from China & India is significant but relatively low, which indicates the large share of imports from this region accounted for by Textiles and Clothing, for which average mark-ups are relatively low (see Table 6).

Table 10[21]**:** Impact of regional imports on SA mark-ups (including intermediate inputs)

Substitution	**Total SA**	**OECD_HI**	**Eastern Europe**	**Africa**	**Asia**	**China_India**
Mark-up	0.118**	0.134**	0.075*	0.048	0.087**	0.113**
	(0.022)	(0.024)	(0.042)	(0.069)	(0.027)	(0.012)
Import 1988-2002	- 0.027**	- 0.015	- 0.012**	- 0.021*	- 0.022**	- 0.008
	(0.011)	(0.01)	(0.006)	(0.012)	(0.007)	(0.005)
Import 1995-2002	- 0.058**	- 0.05**	- 0.004	- 0.007	- 0.023**	- 0.022**
	(0.019)	(0.017)	(0.01)	(0.017)	(0.011)	(0.009)
N	420	420	412	420	420	419
R – squared	0,536	0,523	0,513	0,503	0,534	0,516
Hausman Test	Ok	Ok	Ok	Ok	Ok	Ok

Note: ** indicate significance at 5 percent, * at the 10 percent levels.
Source: Own calculations

[21] The Hausman test is valid for most of the estimations, indicating that the time specific error term and the exogenous variables are uncorrelated.

5 Conclusion

Since the mid-1990s South Africa has made significant progress in liberalising its economy by reducing and eliminating trade barriers such as quotas, tariffs and surcharges. Trade flows have also increased. This paper estimates the impact of increased openness on the pricing behaviour (in terms of mark-ups) of South African manufacturing industries.

This study advances existing empirical work in a number of ways. Firstly, we use detailed sector level tariff data as one of our indicators of changes in openness. Secondly, we analyse the impact of regional imports (OECD_HI, Africa, China & India, Asia and Eastern Europe) on mark-ups in the manufacturing sectors between 1988 and 2002. Thirdly, the paper develops the theoretical relationship between trade liberalisation and mark-up pricing. In addition to these contributions the paper presents estimates of mark-ups for the manufacturing sectors over the period 1970-2002.

The theoretical relationship between trade liberalisation and mark-ups shows that although the results of the various models of imperfect competition are sensitive to the underlying assumptions, the impact on the mark-ups is fairly robust, namely import tariffs raise mark-ups of firms in most cases.

The data analysis shows that South Africa has made considerable progress in reducing its tariff barriers from 1994. The extent of the reduction in protection, however, is sensitive to the selection of tariff protection measure. The scheduled tariffs reveal that the average protection in manufacturing decreased from 16.68% in 1994 to 10.22% in 2002. If surcharges are included, average protection in manufacturing falls from 20.88% to 10.22% over this period. This increased openness is reflected in the rise in the average value of imports over this period. However, the composition and growth of imports differ according to the region of trade. Most of the imports come from the HI_OECD countries and in particular from the skill-intensive sectors (Machinery and Motor Vehicles); But the strongest growth in imports is from China and India with relatively labour-intensive sectors, namely Footwear, Leather, Wearing Apparel and Textiles.

The estimated average mark-ups (excluding intermediates) in this study range from 40 - 60 per cent and are slightly lower than those found by Fedderke *et al.* (2003)

(77 - 79 per cent). The estimates are sensitive to the inclusion of intermediate inputs. When intermediate inputs are accounted for, the mark-ups fall to 13-15 per cent. The average mark-ups across the manufacturing sectors show a decreasing trend from the mid-1990s. The highest mark-ups (in excess of 20%) including intermediates are found in Beverages, Glass products, Non-Metallic Minerals, Printing and Tobacco. We find that the level of mark-ups in South African manufacturing generally fall within the range of mark-ups estimated in international studies. But these comparisons are made with caution as the estimated mark-ups are sensitive to different empirical methodologies, time periods, data aggregation, and data measurement.

We find strong evidence for the market disciplining effects of trade liberalisation. This effect is particularly strong during the 1995-2002 period where a 10% reduction in tariffs is estimated to reduce average mark-ups (including intermediates) in manufacturing by 0.3 to 0.4 percentage points. This relationship is robust to the choice of protection measure. We also find that import penetration reduces mark-ups and this effect is again stronger during the 1995-2002 period. We find that a 10% rise in total import penetration is estimated to have reduced average mark-ups (including intermediates) in manufacturing by 0.85 percentage points during the period 1995-2002, compared to 0.27 percentage points during 1988-1994 period. The impact, however, differs according to the source of imports. Imports from the High Income OECD countries and Asia exert most disciplining power.

Continuing the liberalisation process and a more severe competition policy would increase the competitiveness of the South African manufacturing industries and thus reduce mark-ups.

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Appendix

The Cournot model: Extended calculations

The optimum output response for the foreign firm is given by:

$$\Pi_F^F = \frac{\partial \Pi^F}{\partial Q_F} = \frac{\frac{\partial P}{\partial Q}\frac{\partial Q}{\partial Q_H}\frac{\partial Q_H}{\partial Q_F}Q_F}{(1+t)} + \frac{\frac{\partial P}{\partial Q}\frac{\partial Q}{\partial Q_F}Q_F}{(1+t)} + \frac{P(Q)}{(1+t)} - \frac{\partial C_F}{\partial Q_F} = 0$$

$$= \frac{\frac{\partial P}{\partial Q}\left[1+\frac{\partial Q_H}{\partial Q_F}\right]Q_F}{(1+t)} + \frac{P(Q)}{(1+t)} - C_F^{'} = 0$$

$$= \frac{\frac{\partial P}{\partial Q}Q_F}{(1+t)} + \frac{P(Q)}{(1+t)} - C_F^{'} = 0$$

Differentiating the FOC (3) and (4) we obtain:

$$P^{'}dQ_H + P^{''}(dQ_H + dQ_F)Q_H + P^{'}(dQ_H + dQ_F) - C_H^{''}dQ_H = 0$$

$$\frac{P^{'}dQ_F}{(1+t)} + \frac{P^{''}(dQ_H + dQ_F)Q_F}{(1+t)} + \frac{P^{'}(dQ_H + dQ_F)}{(1+t)} - C_F^{''}dQ_F = \frac{P^{'}Q_F}{(1+t)^2}dt + \frac{P}{(1+t)^2}dt$$

This can be re-written in matrix notation to obtain:

$$\begin{bmatrix} 2P^{'} + P^{''}Q_H - C_H^{''} & P^{''}Q_H + P^{'} \\ \frac{P^{''}Q_F}{(1+t)} + \frac{P^{'}}{(1+t)} & \frac{2P^{'}}{(1+t)} + \frac{P^{''}Q_F}{(1+t)} - C_F^{''} \end{bmatrix} \begin{bmatrix} dQ_H \\ dQ_F \end{bmatrix} = \begin{bmatrix} 0 \\ \frac{P^{'}Q_F + P}{(1+t)^2} \end{bmatrix} \text{dt}$$

$\frac{(P^{'}Q_F + P)}{(1+t)^2}$ is positive because from the FOC we know that $\frac{P^{'}Q_F + P}{(1+t)} - C_F^{'} = 0$ and since $C_F^{'}$ is negative, $\frac{P^{'}Q_F + P}{(1+t)}$ must be positive for the FOC to equal 0.

Dividing both sides by *dt*, the system can be solved for $\frac{\partial Q_H}{\partial t}$ and $\frac{\partial Q_F}{\partial t}$ using Cramer's rule. This yield:

$$\frac{\partial Q_H}{\partial t} = \frac{\begin{bmatrix} 0 & P''Q_H + P' \\ \frac{P'Q_F + P}{(1+t)^2} & \frac{2P'}{(1+t)} + \frac{P''Q_F}{(1+t)} - C_F'' \end{bmatrix}}{|J|}$$

$$= -\frac{\left[\left(\frac{(P'Q_F + P)}{(1+t)^2}\right)(P''Q_H + P')\right]}{|J|}$$

$$\frac{\partial Q_F}{\partial t} = \frac{\begin{bmatrix} 2P' + P''Q_H - C_C'' & 0 \\ \frac{P''Q_F}{(1+t)} + \frac{P'}{(1+t)} & \frac{P'Q_F + P}{(1+t)^2} \end{bmatrix}}{|J|}$$

$$= \frac{\left[(2P' + P''Q_H - C_H'')\left(\frac{(P'Q_F + P)}{(1+t)^2}\right)\right]}{|J|}$$

The Bertrand model: Extended calculations

The Second Order cross partials:

$$\Pi^{H}_{P_H P_F} = \frac{\partial \Pi^{H}_{P_H}}{\partial P_F} = X_{P_F} + X_{P_H P_F} P_H > 0$$

$$\Pi^{F}_{P_F P_H} = \frac{\partial \Pi^{F}_{P_F}}{\partial P_H} = \frac{Y_{P_H}}{(1+t)} + \frac{Y_{P_F P_H} P_F}{(1+t)} > 0$$

A sufficient condition for $\Pi^{H}_{P_H P_F}$ and $\Pi^{F}_{P_F P_H}$ to be positive is $X_{P_H P_F}$ and $Y_{P_F P_H}$ to be positive, which we will assume. For example, $\Pi^{H}_{P_F P_H} > 0$ means that the foreign firm responds to a price cut by cutting its own price (Eaton and Grossman, 1986).

Differentiating the FOC (12) and (13) we obtain:

$$X_{P_H} dP_H + X_{P_H} dP_F + X_{P_H P_H} P_H dp_H + X_{P_H} dP_H + X_{P_H P_F} P_H dp_F + X_{P_H} dP_F - C_{P_H P_H} = 0$$

$$\frac{Y_{P_F} dP_F}{(1+t)} + \frac{Y_{P_H} dP_H}{(1+t)} + \frac{Y_{P_F P_F} P_F dP_F}{(1+t)} + \frac{Y_{P_F} dP_F}{(1+t)} + \frac{Y_{P_F P_H} P_F dP_H}{(1+t)} + \frac{Y_{P_H} dP_H}{(1+t)} - C_{P_F P_F} = \frac{Y}{(1+t)^2} dt + \frac{X_{P_F} P_F}{(1+t)^2} dt$$

This can be re-written in matrix notation to obtain:

$$\begin{bmatrix} 2X_{P_H} + X_{P_H P_H} P_H - C_{P_H P_H} & X_{P_F} + X_{P_H P_F} P_H \\ \dfrac{Y_{P_H}}{(1+t)} + \dfrac{Y_{P_F P_H} P_F}{(1+t)} & \dfrac{2Y_{P_F}}{(1+t)} + \dfrac{Y_{P_F P_F} P_F}{(1+t)} - C_{P_F P_F} \end{bmatrix} \begin{bmatrix} dP_H \\ dP_F \end{bmatrix} = \begin{bmatrix} 0 \\ \dfrac{Y_{P_F} P_F + Y}{(1+t)^2} \end{bmatrix} \text{dt}$$

Dividing both sides by *dt*, the system can be solved for $\frac{\partial P_H}{\partial t}$ and $\frac{\partial P_F}{\partial t}$ using Cramer's rule. This yields:

$$\frac{\partial P_H}{\partial t} = \frac{\begin{bmatrix} 0 & X_{P_F} + X_{P_H P_F} P_H \\ \dfrac{Y_{P_F} P_F + Y}{(1+t)^2} & \dfrac{2Y_{P_F}}{(1+t)} + \dfrac{Y_{P_F P_F} P_F}{(1+t)} - C_{P_F P_F} \end{bmatrix}}{|J|}$$

$$= -\frac{\left[\left(\frac{Y_{P_F}P_F + Y}{(1+t)^2}\right)(X_{P_F} + X_{P_H P_F}P_H)\right]}{|J|}$$

$$\frac{\partial P_F}{\partial t} = \frac{\begin{bmatrix} 2X_{P_H} + X_{P_H P_H}P_H - C_{P_H P_H} & 0 \\ \frac{Y_{P_H}}{(1+t)} + \frac{Y_{P_F P_H}P_F}{(1+t)} & \frac{Y_{P_F}P_F + Y}{(1+t)^2} \end{bmatrix}}{|J|}$$

$$= \frac{\left[(2X_{P_H} + X_{P_H P_H}P_H - C_{P_H P_H})\left(\frac{Y_{P_F}P_F + Y}{(1+t)^2}\right)\right]}{|J|}$$

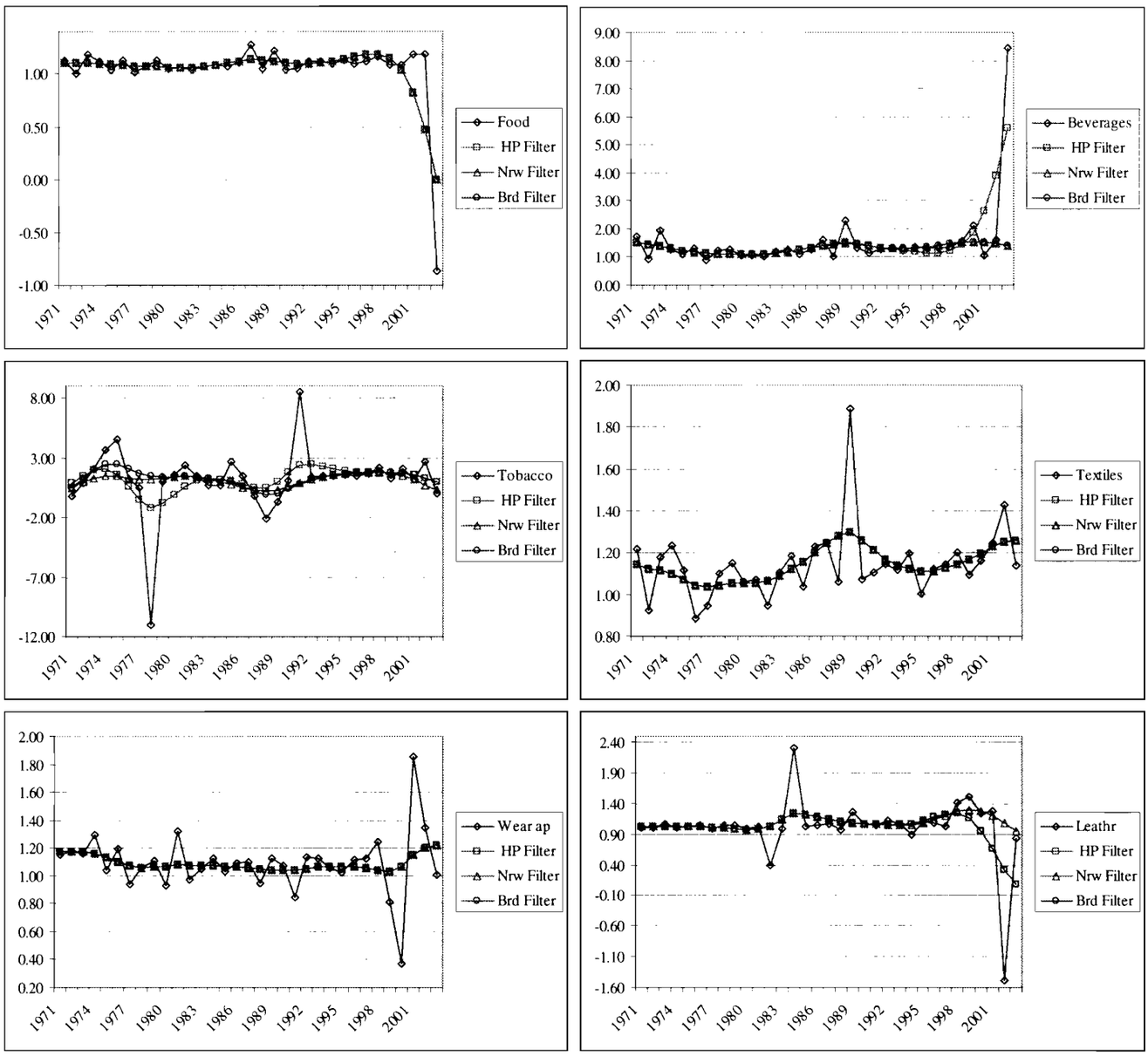
Proof that $\frac{Y_{P_F}P_F + Y}{(1+t)^2} < 0$:

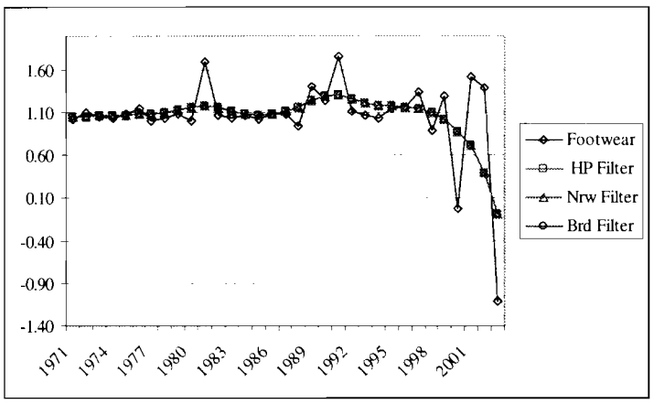
$C_{P_F} = C_H Y(P_F P_H)$

$\frac{\partial C_{P_F}}{\partial P_F} = \frac{\partial C}{\partial Y}\frac{\partial Y}{\partial P_F}\frac{\partial P_F}{\partial P_F} < 0$ because $\frac{\partial C}{\partial Y}$ is positive and $\frac{\partial Y}{\partial P_F}$ is negative. Because the First Order optimum Condition for profit maximization: $\Pi^F_{P_H} = \frac{Y}{(1+t)} + \frac{Y_{P_F}P_F}{(1+t)} - C_{P_F} = 0$,

$\frac{Y_{P_F}P_F + Y}{(1+t)^2}$ must be negative if $C_{P_F} < 0$ in order for $\Pi^F_{P_H} = 0$.

Figure 7: Average industry mark-ups

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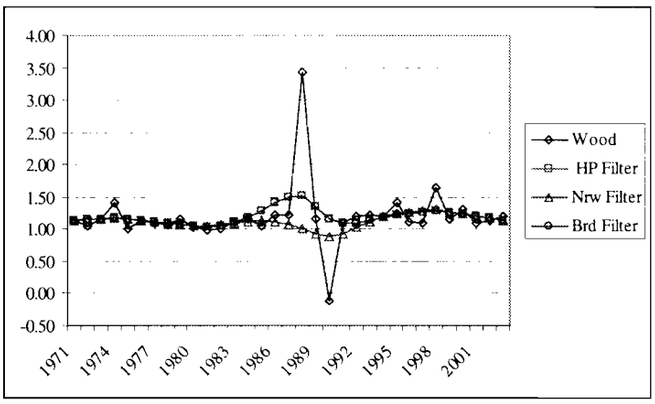
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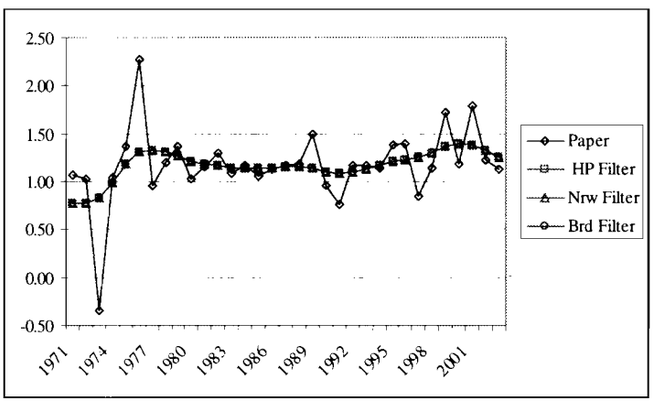
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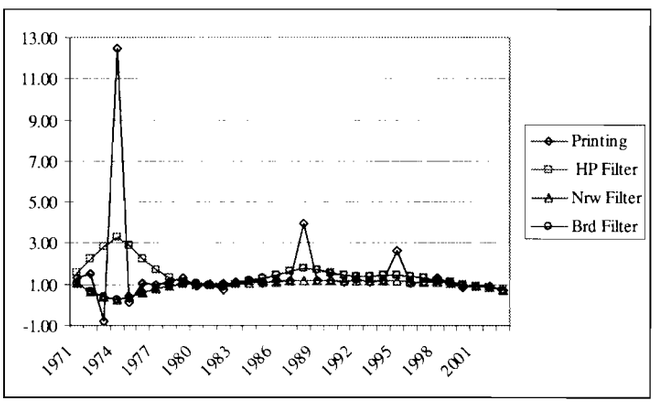
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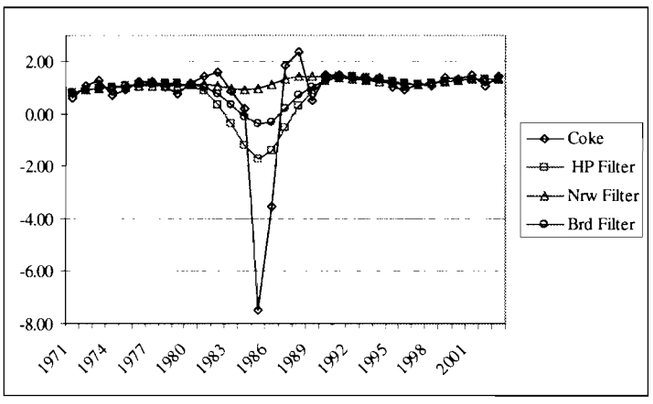
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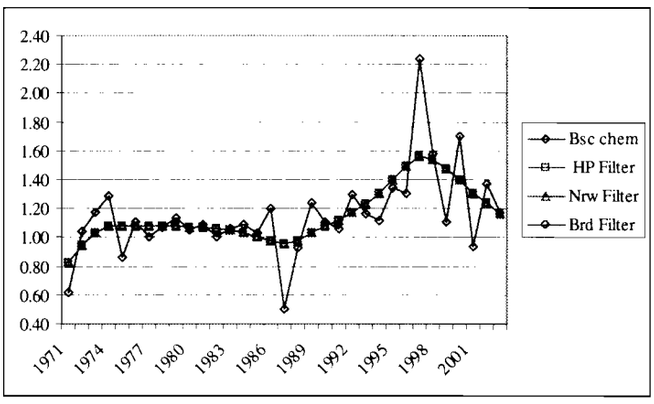
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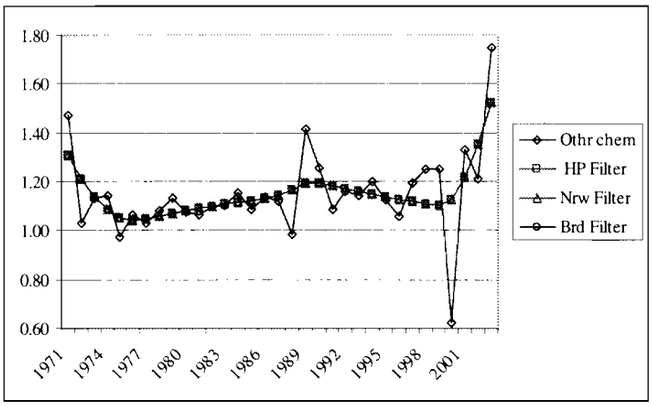
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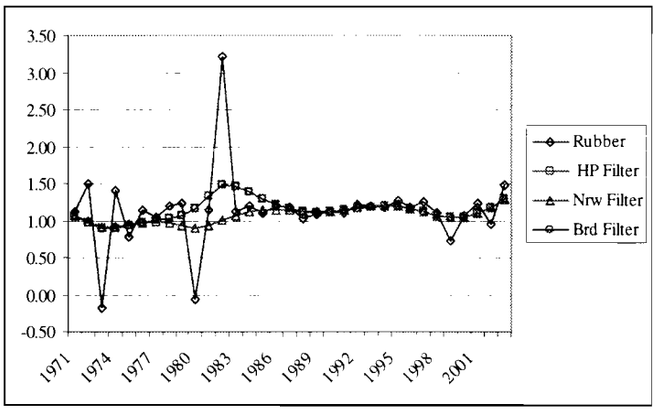
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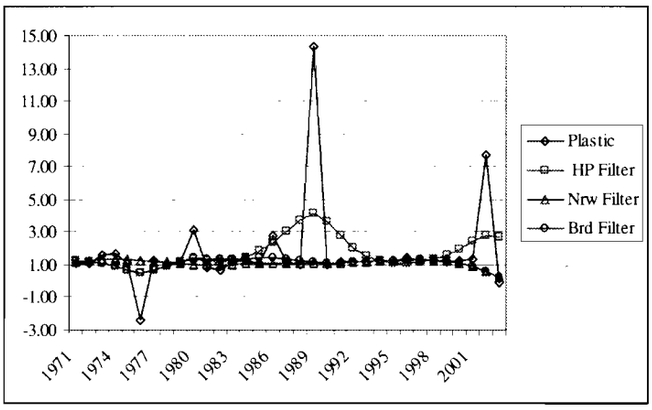
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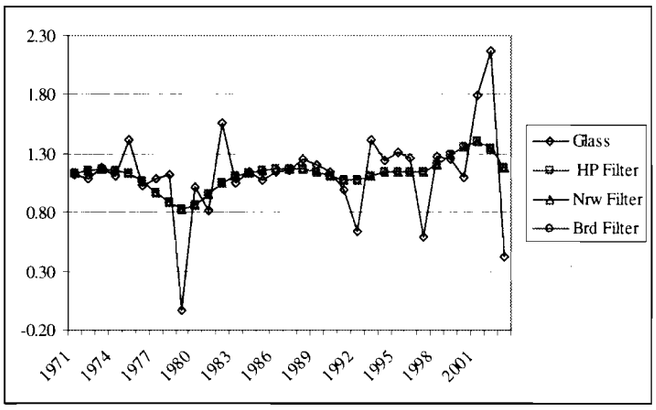
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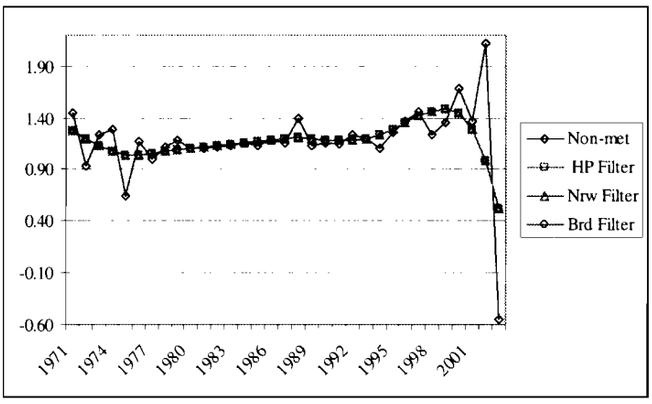
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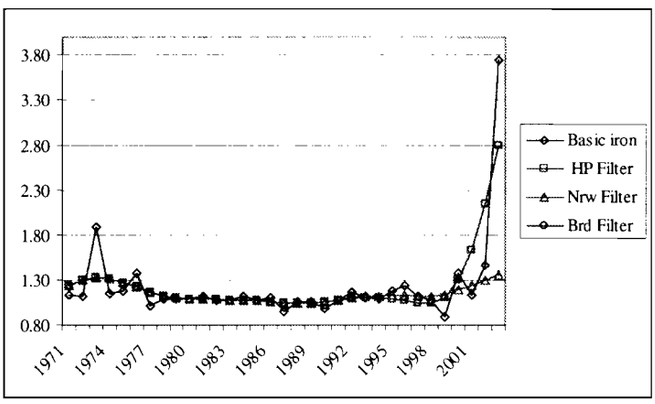
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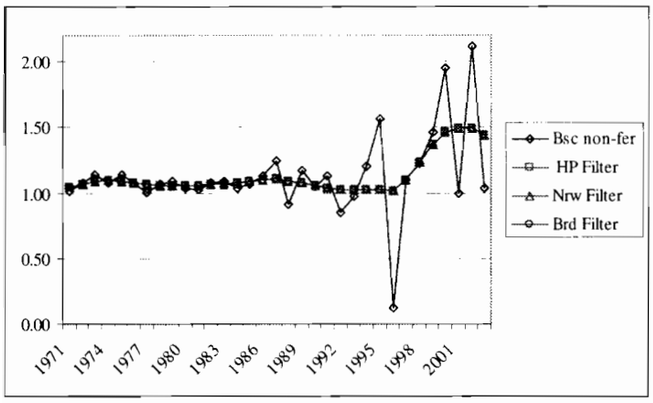
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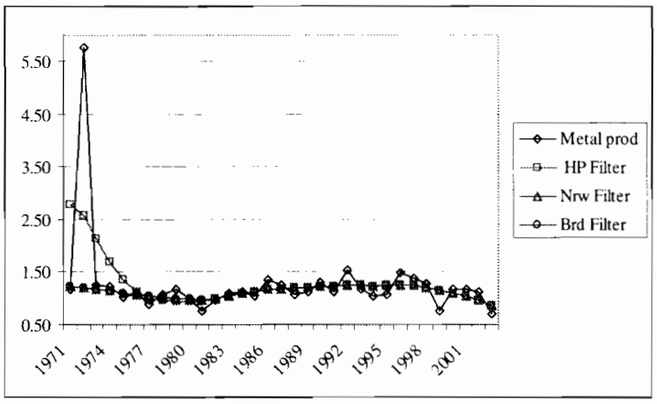
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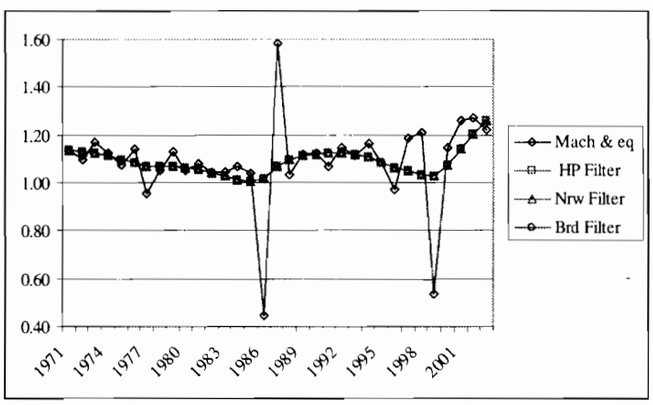
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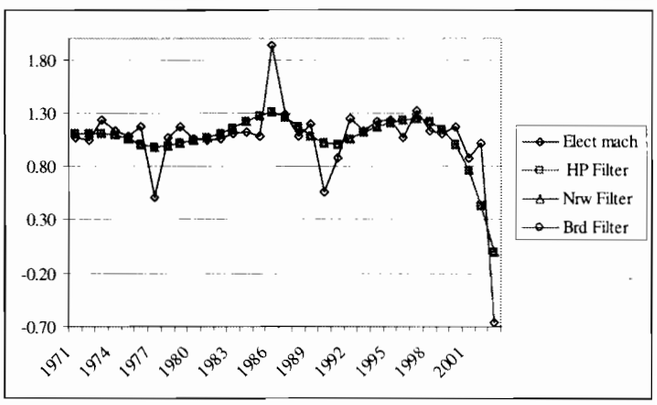
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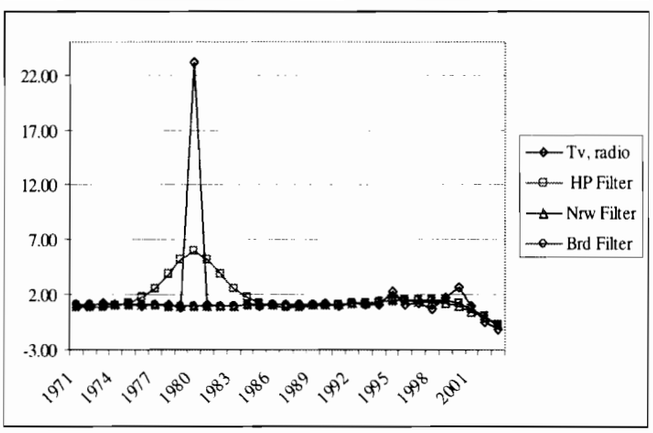
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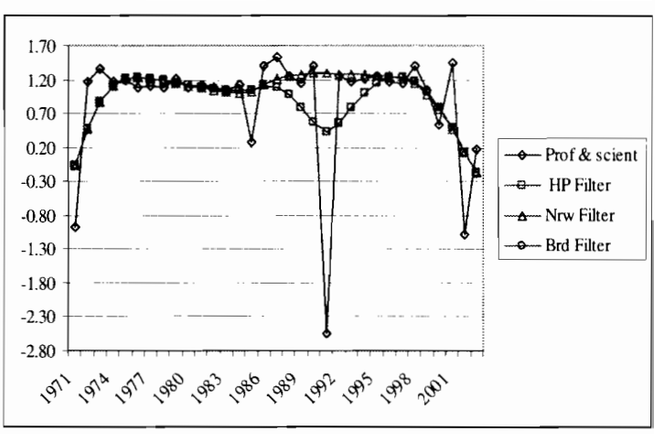
Brd Filter


1.70
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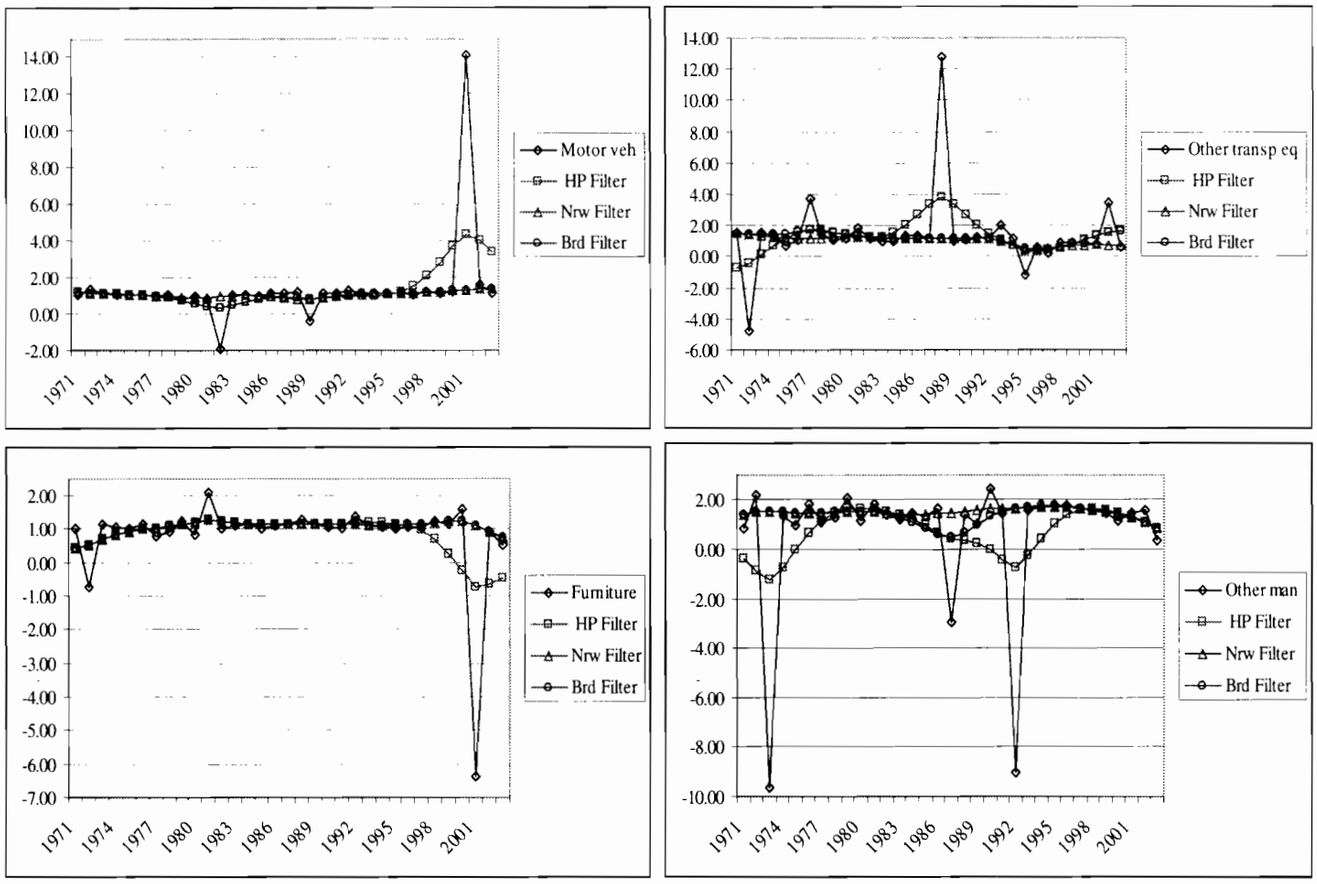

Source: Own calculations

Table 11: Average mark-ups in South African industry sub-periods

	Narrow Excluding Intermediates					Broad Excluding Intermediates				
Industry	**1970s**	**1980s**	**1990-94**	**1995-2002**	**1990-2002**	**1970s**	**1980s**	**1990-94**	**1995-2002**	**1990-2002**
Food	1.47	1.68	1.74	1.76	1.75	1.63	1.68	1.72	2.44	2.16
Beverages	0.82	1.74	2.05	1.36	1.63	1.76	2.16	2.85	2.52	2.65
Tobacco	-	-	-	-	-	-	-	-	-	-
Textiles	1.38	1.34	1.56	1.76	1.68	1.56	1.48	1.75	1.71	1.73
Clothing	1.36	1.14	1.30	0.40	0.74	0.85	1.15	1.27	1.15	1.20
Leather prods	1.19	1.17	1.26	1.37	1.33	1.19	1.16	1.44	0.32	0.75
Footwear	1.03	1.09	1.12	0.86	0.96	1.03	1.09	1.16	1.68	1.48
Wood & prods	1.31	1.59	1.89	1.53	1.67	1.46	1.80	2.08	1.76	1.88
Paper & prods	1.35	1.71	1.38	1.70	1.57	1.73	2.22	2.58	2.84	2.74
Printing	1.30	1.36	1.49	1.22	1.32	1.30	1.36	1.49	1.22	1.32
Petrol ref	-	-	-	-	-	-	-	-	-	-
Basic chems	1.93	1.83	2.00	1.75	1.84	2.03	1.88	2.50	1.53	1.91
Other chems	1.46	1.69	1.88	0.94	1.30	1.82	2.02	2.26	2.01	2.11
Rubber prods	1.68	1.20	1.59	0.89	1.16	1.72	1.20	1.71	0.62	1.04
Plastic prods	0.98	1.17	1.39	1.22	1.28	1.11	1.31	1.36	0.82	1.03
Glass & prods	1.45	1.52	1.47	1.35	1.40	1.45	1.60	1.67	1.83	1.77
Non-met mins	1.57	1.64	1.63	2.09	1.91	1.97	1.63	1.64	2.30	2.05
Bas iron & st	1.54	1.30	1.31	1.45	1.40	1.54	1.30	1.31	1.40	1.36
Bas n-fer met	1.49	1.71	1.81	1.34	1.52	1.48	2.19	2.19	1.33	1.66
Metal prods	1.21	1.21	1.36	1.73	1.59	1.63	1.22	1.83	1.87	1.85
Machinery	1.34	1.31	1.42	1.39	1.40	1.34	1.31	1.40	1.90	1.71
Electr mach	1.47	1.47	1.65	1.47	1.54	1.47	1.47	1.72	1.54	1.61
Tv & coms eq	0.96	1.44	1.35	0.67	0.93	0.54	1.24	1.09	0.53	0.75
Scientific eq	1.40	1.46	1.79	1.05	1.33	1.68	1.51	2.05	1.38	1.63
Motveh & parts	1.36	1.21	1.43	1.78	1.64	1.36	1.58	1.83	1.50	1.63
Oth trnsp eq	1.20	1.15	0.94	0.78	0.84	1.50	1.15	0.94	0.78	0.84
Furniture	1.33	1.07	1.17	1.45	1.34	1.52	1.09	1.16	1.41	1.31
Oth industry	-	-	-	-	-	2.26	2.89	3.39	4.03	3.79

Source: Own calculations.

	Narrow Including Intermediates					Broad Including Intermediates				
Industry	**1970s**	**1980s**	**1990-94**	**1995-2002**	**1990-2002**	**1970s**	**1980s**	**1990-94**	**1995-2002**	**1990-2002**
Food	1.09	1.10	1.10	1.13	1.12	1.09	1.10	1.10	1.13	1.12
Beverages	1.27	1.26	1.35	1.35	1.35	1.27	1.26	1.34	1.51	1.45
Tobacco	1.14	0.84	1.12	1.56	1.39	1.70	1.00	1.11	1.80	1.53
Textiles	1.08	1.15	1.17	1.18	1.18	1.08	1.15	1.17	1.18	1.18
Clothing	1.12	1.08	1.06	1.05	1.05	1.12	1.08	1.06	1.05	1.05
Leather prods	1.03	1.03	1.06	1.24	1.17	1.05	1.28	1.07	0.89	0.95
Footwear	1.10	1.19	1.29	1.09	1.17	1.10	1.19	1.29	1.09	1.17
Wood & prods	1.12	1.01	1.04	1.23	1.16	1.12	1.01	1.04	1.23	1.16
Paper & prods	1.03	1.16	1.10	1.35	1.25	1.03	1.16	1.10	1.35	1.25
Printing	0.95	1.09	1.28	1.15	1.20	1.60	1.07	1.28	1.15	1.20
Petrol ref	1.03	0.99	1.35	1.22	1.27	1.03	0.80	1.34	1.22	1.27
Basic chems	1.00	1.04	1.17	1.33	1.27	1.00	1.04	1.17	1.33	1.27
Other chems	1.11	1.13	1.19	1.14	1.15	1.11	1.13	1.19	1.14	1.15
Rubber prods	0.96	1.10	1.17	1.09	1.12	0.96	1.10	1.17	1.09	1.12
Plastic prods	1.21	1.14	1.15	0.99	1.05	1.21	1.14	1.15	0.99	1.05
Glass & prods	1.13	1.10	1.08	1.27	1.20	1.31	1.20	1.07	1.42	1.29
Non-met mins	1.12	1.13	1.17	1.45	1.35	1.12	1.13	1.17	1.45	1.35
Bas iron & st	1.16	1.07	1.09	1.18	1.14	1.16	1.07	1.09	1.18	1.14
Bas n-fer met	1.08	1.09	0.97	1.31	1.18	1.08	1.09	0.45	1.23	0.93
Metal prods	0.95	1.10	1.22	1.17	1.19	0.95	1.10	1.22	1.17	1.19
Machinery	1.09	1.00	1.12	1.10	1.11	1.09	1.00	1.12	1.10	1.11
Electr mach	1.07	1.14	1.08	1.11	1.10	1.07	1.14	1.08	1.11	1.10
Tv & coms eq	1.03	1.03	1.09	1.16	1.14	1.03	1.02	1.25	0.77	0.96
Scientific eq	1.18	1.13	1.08	1.12	1.10	1.18	1.13	1.09	0.87	0.96
Motveh & parts	1.02	0.83	0.99	1.24	1.14	1.26	0.82	0.99	1.24	1.14
Oth trnsp eq	1.06	1.29	1.08	0.71	0.85	1.20	1.30	1.07	1.00	1.02
Furniture	1.11	1.08	1.14	1.18	1.16	1.14	1.22	1.13	1.18	1.16
Oth industry	1.38	1.45	1.67	1.56	1.60	1.38	1.11	1.60	1.57	1.58

Source: Own calculations.

Table 12: Import data regional groups[22] (R000)

Total SA Imports

	Average Total SA imports		Sector Percentage Region		
Industry	*1988-1994*	*1995-2002*	*1988-1994*	*1995-2002*	**Change Industry**
Food	1.742.554,26	5.613.134,48	4%	4%	NO
Beverages	352.564,60	900.979,18	1%	1%	NO
Tobacco	40.832,75	54.848,28	0%	0%	NO
Textiles	1.436.830,00	3.029.154,78	3%	2%	Neg
Clothing	465.571,23	1.411.575,73	1%	1%	NO
Leather prods	271.393,17	657.656,38	1%	0%	Neg
Footwear	272.780,29	1.183.165,59	1%	1%	NO
Wood & prods	396.929,45	1.042.817,35	1%	1%	NO
Paper & prods	1.018.785,38	2.389.979,93	2%	2%	NO
Printing	780.573,69	2.132.374,44	2%	2%	NO
Petrol ref	239.168,28	1.888.623,76	0%	1%	Pos
Basic chems	4.030.764,62	10.052.829,65	8%	7%	Neg
Other chems	3.023.752,29	10.061.735,11	6%	7%	Pos
Rubber prods	496.586,83	1.580.303,37	1%	1%	NO
Plastic prods	597.688,12	1.967.390,41	1%	1%	NO
Glass & prods	264.283,85	648.187,30	1%	0%	Neg
Non-met mins	522.401,18	1.882.156,82	1%	1%	NO
Bas iron & st	882.575,39	2.211.753,88	2%	2%	NO
Bas n-fer met	4.738.580,39	3.547.785,01	10%	3%	Neg
Metal prods	1.220.024,06	3.188.507,07	2%	2%	NO
Machinery	11.084.997,70	29.900.205,46	22%	21%	Neg
Electr mach	2.044.485,12	5.404.425,24	4%	4%	NO
Tv & coms eq	2.073.410,43	11.986.780,68	4%	9%	Pos
Scientific eq	1.995.799,13	5.696.299,93	4%	4%	NO
Motveh & parts	6.427.383,53	21.727.551,08	13%	16%	Pos
Oth trnsp eq	1.530.056,36	5.602.961,07	3%	4%	Pos
Furniture	99.847,52	630.484,96	0%	0%	NO
Oth industry	827.308,51	2.461.544,29	2%	2%	NO
Undefined	682.807,78	287.964,30	1%	0%	-
	49.560.735,91	***139.143.175,56***	***1***	***1***	
Growth over Periods	**281%**				

Source: Customs & Excise

[22] Note that Japan is included in both ORCD_HI and Asia.

OECD High Income (EU, US, Norway, Japan, Iceland, Switzerland, Canada and Australia and New Zealand)

	Average OECD HI		Sector Percentage Region			Percentage of Total SA Imports		
Industry	*1988-1994*	*1995-2002*	*1988-1994*	*1995-2002*	**Change Industry**	*1988-1994*	*1995-2002*	**Change Industry**
Food	769.071,91	2.379.198,32	2%	2%	NO	44%	42%	Neg
Beverages	329.255,52	819.357,37	1%	1%	NO	93%	91%	Neg
Tobacco	37.265,25	36.793,29	0%	0%	NO	91%	67%	Neg
Textiles	561.711,43	1.031.613,91	2%	1%	Neg	39%	34%	Neg
Clothing	104.661,91	232.547,16	0%	0%	NO	22%	16%	Neg
Leather prods	122.404,74	215.451,61	0%	0%	NO	45%	33%	Neg
Footwear	52.095,95	177.912,38	0%	0%	NO	19%	15%	Neg
Wood & prods	158.779,14	527.527,70	0%	0%	NO	40%	51%	Pos
Paper & prods	929.009,07	2.090.949,66	3%	2%	NO	91%	87%	Neg
Printing	635.160,52	1.952.697,87	2%	2%	NO	81%	92%	Pos
Petrol ref	175.934,88	1.061.801,56	0%	1%	Pos	74%	56%	Neg
Basic chems	3.508.870,55	7.426.415,63	10%	7%	Neg	87%	74%	Neg
Other chems	2.742.505,52	8.963.660,06	7%	8%	Pos	91%	89%	Neg
Rubber prods	417.168,11	1.205.710,89	1%	1%	NO	84%	76%	Neg
Plastic prods	484.007,21	1.449.111,31	1%	1%	NO	81%	74%	Neg
Glass & prods	193.070,75	374.285,81	1%	0%	Neg	73%	58%	Neg
Non-met mins	426.953,18	1.504.652,40	1%	1%	NO	82%	80%	Neg
Bas iron & st	763.280,63	1.575.498,03	2%	1%	Neg	86%	71%	Neg
Bas n-fer met	522.209,35	2.783.810,41	1%	3%	Pos	11%	78%	Pos
Metal prods	929.272,60	2.139.976,14	3%	2%	Neg	76%	67%	Neg
Machinery	9.424.729,83	23.966.515,42	26%	22%	Neg	85%	80%	Neg
Electr mach	1.773.610,96	4.177.338,88	5%	4%	Neg	87%	77%	Neg
Tv & coms eq	1.493.322,09	8.870.262,45	4%	8%	Pos	72%	74%	Pos
Scientific eq	1.788.449,90	4.961.748,15	5%	5%	NO	90%	87%	Neg
Motveh & parts	6.240.857,10	19.915.879,09	17%	19%	Pos	97%	92%	Neg
Oth trnsp eq	1.337.672,92	4.927.619,23	4%	5%	Pos	87%	88%	Pos
Furniture	60.697,42	395.967,18	0%	0%	NO	61%	63%	Pos
Oth industr	499.355,61	1.315.874,10	1%	1%	NO	60%	53%	Neg
Undefined	227.292,28	206.469,90	1%	0%	-	33%	72%	-
	36.708.676,35	***106.686.645,92***	***1***	***1***	**Share Total SA Imports**	***74%***	***77%***	
Growth over Periods	**291%**							

Source: Customs & Excise

Africa

	Average Africa		Sector Percentage Region			Percentage of Total SA Imports		
Industry	***1988-1994***	***1995-2002***	***1988-1994***	***1995-2002***	**Change Industry**	***1988-1994***	***1995-2002***	**Change Industry**
Food	122.000,98	235.137,48	**15%**	**10%**	Neg	7%	4%	Neg
Beverages	6.021,91	10.335,17	1%	0%	Neg	2%	1%	Neg
Tobacco	2.400,36	8.805,86	0%	0%	NO	6%	16%	Pos
Textiles	57.161,11	137.556,66	**7%**	**6%**	Neg	4%	5%	Pos
Clothing	45.201,90	220.726,22	**6%**	**9%**	Pos	10%	16%	Pos
Leather prods	18.356,09	30.778,24	2%	1%	Neg	7%	5%	Neg
Footwear	20.583,90	23.598,05	3%	1%	Neg	8%	2%	Neg
Wood & prods	45.673,64	143.770,98	**6%**	**6%**	NO	12%	14%	Pos
Paper & prods	6.643,44	16.404,17	1%	1%	NO	1%	1%	NO
Printing	74.429,84	9.582,54	**9%**	0%	Neg	10%	0%	Neg
Petrol ref	7.248,98	69.444,19	1%	3%	Pos	3%	4%	Pos
Basic chems	21.926,68	100.778,19	3%	4%	Pos	1%	1%	NO
Other chems	16.662,52	37.695,62	2%	2%	NO	1%	0%	Neg
Rubber prods	10.549,79	20.387,45	1%	1%	NO	2%	1%	Neg
Plastic prods	4.296,93	9.259,97	1%	0%	Neg	1%	0%	Neg
Glass & prods	1.470,08	9.535,16	0%	0%	NO	1%	1%	NO
Non-met mins	20.879,56	34.905,53	3%	1%	Neg	4%	2%	Neg
Bas iron & st	28.796,32	70.070,99	4%	3%	Neg	3%	3%	NO
Bas n-fer met	32.766,22	224.881,73	4%	**9%**	Pos	1%	6%	Pos
Metal prods	45.296,60	98.766,61	**6%**	4%	Neg	4%	3%	Neg
Machinery	36.918,49	251.533,00	5%	**10%**	Pos	0%	1%	Pos
Electr mach	18.957,01	70.427,29	2%	3%	Pos	1%	1%	NO
Tv & coms eq	14.324,54	54.868,59	2%	2%	NO	1%	0%	Neg
Scientific eq	7.810,73	61.411,59	1%	2%	Pos	0%	1%	Pos
Motveh & parts	24.168,39	66.405,30	3%	3%	NO	0%	0%	NO
Oth trnsp eq	19.270,46	219.814,11	2%	**9%**	Pos	1%	4%	Pos
Furniture	15.268,59	55.541,63	2%	2%	NO	15%	9%	Neg
Oth industr	56.561,74	119.926,81	**7%**	5%	Neg	7%	5%	Neg
Undefined	23.747,53	50.883,19	3%	2%	-	3%	18%	-
	805.394,33	***2.463.232,33***	***1***	***1***	**Share Total SA Imports**	***2%***	***2%***	
Growth over Periods	**306%**							

Source: Customs & Excise

ASIA

	Average Asia		Sector Percentage Region			Percentage of Total SA Imports		
Industry	***1988-1994***	***1995-2002***	***1988-1994***	***1995-2002***	**Change Industry**	***1988-1994***	***1995-2002***	**Change Industry**
Food	450.270,26	1.636.135,57	4%	4%	NO	26%	29%	Pos
Beverages	1.036,69	4.591,82	0%	0%	NO	0%	1%	Pos
Tobacco	176,01	2.789,29	0%	0%	NO	0%	5%	Pos
Textiles	864.279,72	1.862.022,11	**7%**	5%	Neg	60%	61%	Pos
Clothing	321.501,55	945.483,56	3%	3%	NO	69%	67%	Neg
Leather prods	116.944,72	349.897,78	1%	1%	NO	43%	53%	Pos
Footwear	193.402,42	956.284,33	2%	3%	Pos	71%	81%	Pos
Wood & prods	167.770,02	303.789,58	1%	1%	NO	42%	29%	Neg
Paper & prods	59.579,21	203.200,62	1%	1%	NO	6%	9%	Pos
Printing	71.237,93	184.837,45	1%	1%	NO	9%	9%	NO
Petrol ref	62.373,64	722.735,22	1%	2%	Pos	26%	38%	Pos
Basic chems	447.453,23	2.275.503,84	4%	**6%**	Pos	11%	23%	Pos
Other chems	381.318,08	1.259.084,19	3%	3%	NO	13%	13%	NO
Rubber prods	171.116,84	675.714,41	1%	2%	Pos	34%	43%	Pos
Plastic prods	149.559,46	569.053,77	1%	2%	Pos	25%	29%	Pos
Glass & prods	60.766,22	225.963,53	1%	1%	NO	23%	35%	Pos
Non-met mins	85.975,71	410.664,16	1%	1%	NO	16%	22%	Pos
Bas iron & st	208.464,16	484.919,02	2%	1%	Neg	24%	22%	Neg
Bas n-fer met	47.092,84	281.027,01	0%	1%	Pos	1%	8%	Pos
Metal prods	315.366,12	1.038.457,16	3%	3%	NO	26%	33%	Pos
Machinery	2.440.591,39	7.288.986,00	**21%**	**20%**	Neg	22%	24%	Pos
Electr mach	433.952,62	1.312.444,80	4%	4%	NO	21%	24%	Pos
Tv & coms eq	895.176,21	3.497.416,86	**8%**	**9%**	Pos	43%	29%	Neg
Scientific eq	357.366,55	979.600,62	3%	3%	NO	18%	17%	Neg
Motveh & parts	2.980.657,59	7.636.553,37	**25%**	**21%**	Neg	46%	35%	Neg
Oth trnsp eq	185.798,24	427.579,08	2%	1%	Neg	12%	8%	Neg
Furniture	25.246,11	154.613,33	0%	0%	NO	25%	25%	NO
Oth industr	323.023,47	1.118.214,08	3%	3%	NO	39%	45%	Pos
Undefined	30.163,66	27.016,52	0%	0%	-	4%	9%	-
	11.847.660,66	***36.834.579,06***	***1***	***1***	**Share Total SA Imports**	***24%***	***26%***	

Growth over Periods **311%**

Source: Customs & Excise

China + India

	Average China India		Sector Percentage Region			Percentage of Total SA Imports		
Industry	***1988-1994***	***1995-2002***	***1988-1994***	***1995-2002***	**Change Industry**	***1988-1994***	***1995-2002***	**Change Industry**
Food	10.414,06	339.064,37	2%	5%	Pos	1%	6%	Pos
Beverages	3,51	1.080,39	0%	0%	NO	0%	0%	NO
Tobacco	19,34	1.182,20	0%	0%	NO	0%	2%	Pos
Textiles	84.104,20	516.622,30	12%	7%	Neg	6%	17%	Pos
Clothing	120.990,09	593.685,29	18%	8%	Neg	26%	42%	Pos
Leather prods	39.376,49	222.540,94	6%	3%	Neg	15%	34%	Pos
Footwear	69.121,84	572.758,24	10%	8%	Neg	25%	48%	Pos
Wood & prods	4.427,44	30.056,41	1%	0%	Neg	1%	3%	Pos
Paper & prods	676,58	14.852,09	0%	0%	NO	0%	1%	Pos
Printing	2.793,29	32.608,67	0%	0%	NO	0%	2%	Pos
Petrol ref	42.505,06	203.302,03	6%	3%	Neg	18%	11%	Neg
Basic chems	25.894,38	477.109,70	4%	7%	Pos	1%	5%	Pos
Other chems	16.238,97	263.061,15	2%	4%	Pos	1%	3%	Pos
Rubber prods	1.477,23	66.657,91	0%	1%	Pos	0%	4%	Pos
Plastic prods	8.160,57	153.300,05	1%	2%	Pos	1%	8%	Pos
Glass & prods	5.710,76	53.444,23	1%	1%	NO	2%	8%	Pos
Non-met mins	15.156,46	161.001,61	2%	2%	NO	3%	9%	Pos
Bas iron & st	6.451,47	116.261,77	1%	2%	Pos	1%	5%	Pos
Bas n-fer met	3.539,39	79.279,88	1%	1%	NO	0%	2%	Pos
Metal prods	34.182,99	327.457,75	5%	5%	NO	3%	10%	Pos
Machinery	59.256,51	1.204.393,61	9%	17%	Pos	1%	4%	Pos
Electr mach	16.962,15	305.771,45	2%	4%	Pos	1%	6%	Pos
Tv & coms eq	34.436,31	596.180,73	5%	8%	Pos	2%	5%	Pos
Scientific eq	8.385,78	152.871,14	1%	2%	Pos	0%	3%	Pos
Motveh & parts	2.377,99	107.028,82	0%	1%	Pos	0%	0%	NO
Oth trnsp eq	14.964,59	72.533,31	2%	1%	Neg	1%	1%	NO
Furniture	1.274,44	45.559,37	0%	1%	Pos	1%	7%	Pos
Oth industry	55.280,14	500.659,36	8%	7%	Neg	7%	20%	Pos
Undefined	701,11	4.949,35	0%	0%	-	0%	2%	-
	684.883,15	***7.215.274,11***	***1***	***1***	**Share Total SA Imports**	***1%***	***5%***	
Growth over Periods	**1054%**							

Source: Customs & Excise.

Eastern Europe

	Average Eastern Europe		Sector Percentage Region			Percentage of Total SA Imports		
Industry	***1988-1994***	***1995-2002***	***1988-1994***	***1995-2002***	**Change Industry**	***1988-1994***	***1995-2002***	**Change Industry**
Food	22.694,73	47.551,67	12%	5%	Neg	1%	1%	NO
Beverages	379,76	734,88	0%	0%	NO	0%	0%	NO
Tobacco	30,08	125,40	0%	0%	NO	0%	0%	NO
Textiles	5.963,28	8.971,55	3%	1%	Neg	0%	0%	NO
Clothing	384,59	6.388,29	0%	1%	Pos	0%	0%	NO
Leather prods	156,50	1.364,85	0%	0%	NO	0%	0%	NO
Footwear	349,69	6.631,75	0%	1%	Pos	0%	1%	Pos
Wood & prods	342,43	2.251,91	0%	0%	NO	0%	0%	NO
Paper & prods	7.521,92	28.720,40	4%	3%	Neg	1%	1%	NO
Printing	486,97	3.022,52	0%	0%	NO	0%	0%	NO
Petrol ref	97,04	815,69	0%	0%	NO	0%	0%	NO
Basic chems	52.155,53	177.852,62	28%	18%	Neg	1%	2%	Pos
Other chems	5.305,32	28.854,68	3%	3%	NO	0%	0%	NO
Rubber prods	1.328,40	12.363,00	1%	1%	NO	0%	1%	Pos
Plastic prods	506,85	10.525,55	0%	1%	Pos	0%	1%	Pos
Glass & prods	7.919,20	22.525,36	4%	2%	Neg	3%	3%	NO
Non-met mins	3.201,26	11.206,77	2%	1%	Neg	1%	1%	NO
Bas iron & st	3.962,83	85.668,98	2%	9%	Pos	0%	4%	Pos
Bas n-fer met	7.342,30	60.851,77	4%	6%	Pos	0%	2%	Pos
Metal prods	3.953,86	20.875,62	2%	2%	NO	0%	1%	Pos
Machinery	20.632,09	178.713,71	11%	18%	Pos	0%	1%	Pos
Electr mach	8.565,43	65.818,04	5%	7%	Pos	0%	1%	Pos
Tv & coms eq	8.291,72	47.536,42	4%	5%	Pos	0%	0%	NO
Scientific eq	6.474,32	20.075,39	3%	2%	Neg	0%	0%	NO
Motveh & parts	3.328,57	114.997,28	2%	11%	Pos	0%	1%	Pos
Oth trnsp eq	7.488,77	15.805,82	4%	2%	Neg	0%	0%	NO
Furniture	195,06	16.156,08	0%	2%	Pos	0%	3%	Pos
Oth industr	2.540,45	5.168,32	1%	1%	NO	0%	0%	NO
Undefined	3.938,44	1.055,46	2%	0%	-	1%	0%	-
	185.537,39	***1.002.629,77***	***1***	***1***	**Share Total SA Imports**	***0%***	***1%***	
Growth over Periods	**540%**							

Source: Customs & Excise.

Table 13: List of Stata commands

```
(1) Average markup
xtreg nsr mup
by period: xtreg nsr mup if period !=.
xtreg nsr_interm mup_interm
by period: xtreg nsr_interm mup_interm if period !=.

(2) Tariff impact Dummy Analysis (Substitution + Interaction approach)
xi: xtreg nsr i.D9502|mup i.D9502|LItar
xi: xtreg nsr i.D9502|mup i.D9502|LItar_surch
xi: xtreg nsr i.D9502|mup i.D9502|LItar_adj
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LItar_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LItar_surch_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LItar_adj_int

xi: xtreg nsr i.D9502|mup i.D9502|Itar
xi: xtreg nsr i.D9502|mup i.D9502|Itar_surch
xi: xtreg nsr i.D9502|mup i.D9502|Itar_adj
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Itar_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Itar_surch_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Itar_adj_int

(3) Average tariff
sum tar tar_adj tar_surch
by period: sum tar tar_adj tar_surch
sum Ltar Ltar_adj Ltar_surch
by period: sum Ltar Ltar_adj Ltar_surch

(4) Impact Imports by region Dummy Analysis (Substitution + Interaction approach)
xi: xtreg nsr i.D9502|mup i.D9502|LImpenet
xi: xtreg nsr i.D9502|mup i.D9502|LImpenet_africa
xi: xtreg nsr i.D9502|mup i.D9502|LImpenet_asia
xi: xtreg nsr i.D9502|mup i.D9502|LImpenet_eastern_europe
xi: xtreg nsr i.D9502|mup i.D9502|LImpenet_china_india
xi: xtreg nsr i.D9502|mup i.D9502|LImpenet_oecd_high_income
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LImpenet_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LImpenet_africa_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LImpenet_asia_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LImpenet_eastern_europe_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LImpenet_china_india_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|LImpenet_oecd_high_income_int

xi: xtreg nsr i.D9502|mup i.D9502|Impenet
xi: xtreg nsr i.D9502|mup i.D9502|Impenet_africa
xi: xtreg nsr i.D9502|mup i.D9502|Impenet_asia
xi: xtreg nsr i.D9502|mup i.D9502|Impenet_eastern_europe
xi: xtreg nsr i.D9502|mup i.D9502|Impenet_china_india
xi: xtreg nsr i.D9502|mup i.D9502|Impenet_oecd_high_income
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Impenet_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Impenet_africa_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Impenet_asia_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Impenet_eastern_europe_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Impenet_china_india_int
xi: xtreg nsr_interm  i.D9502|mup_interm  i.D9502|Impenet_oecd_high_income_int
```

Table 14: The impact of tariffs on SA mark-ups (excluding intermediate inputs)

	Substitution			Interaction		
	Tariff	**Tariff_Surch**	**Tariff_Adj**	**Tariff**	**Tariff_Surch**	**Tariff_Adj**
Mark-up	1.067**	1.098**	1.066**	0.691**	0.697**	0.696**
	(0.245)	(0.271)	(0.239)	(0.083)	(0.089)	(0.083)
Tariff 1988-2002	- 0.187**	- 0.18*	- 0.185**	- 0.006	- 0.005	- 0.006
	(0.095)	(0.095)	(0.092)	(0.004)	(0.004)	(0.004)
Tariff 1995-2002	0.35	0.345**	0.351**	0.014*	0.014*	0.015*
	(0.119)	(0.119)	(0.117)	(0.008)	(0.008)	(0.008)
N	420	420	420	420	420	420
R – squared	0,284	0,284	0,284	0,274	0,275	0,275
Hausman Test	NO	NO	NO	NO	NO	NO

Note: ** indicate significance at 5 percent, * at the 10 percent levels.
Source: Own calculations.

Table 15: Impact of regional imports on SA mark-ups (including intermediate inputs)

Interaction	**Total SA**	**OECD_HI**	**Eastern Europe**	**Africa**	**Asia**	**China_India**
Mark-up	0.176**	0.171**	0.163**	0.174**	0.193**	0.18**
	(0.015)	(0.016)	(0.013)	(0.015)	(0.016)	(0.012)
Import 1988-2002	- 0.039	- 0.028	1.032	- 1.83	- 0.493**	- 2.434**
	(0.037)	(0.064)	(4.144)	(2.019)	(0.198)	(0.95)
Import 1995-2002	- 0.232**	- 0.267**	- 4.498	- 2.724	- 0.153	2.068*
	(0.072)	(0.095)	(6.685)	(2.539)	(0.3)	(1.097)
N	420	420	420	420	420	420
R – squared	0,517	0,514	0,494	0,505	0,51	0,502
Hausman Test	Ok	NO	Ok	Ok	NO	NO

Note: ** indicate significance at 5 percent, * at the 10 percent levels.
Source: Own calculations.

Table 16: The impact of regional imports on mark-ups (excluding intermediates)

Interaction	**Total SA**	**OECD_HI**	**Eastern Europe**	**Africa**	**Asia**	**China_India**
Mark-up	0.614**	0.746**	0.723**	- 0.225	0.2	0.092
	(0.125)	(0.125)	(0.239)	(0.341)	(0.152)	(0.18)
Import 1988-2002	0.011	0.069	0.017	- 0.146**	- 0.12**	- 0.086**
	(0.065)	(0.052)	(0.032)	(0.06)	(0.044)	(0.029)
Import 1995-2002	- 0.334**	- 0.221**	- 0.148**	- 0.005	- 0.091	- 0.063
	(0.115)	(0.09)	(0.065)	(0.083)	(0.083)	(0.064)
N	420	420	412	420	420	419
R – squared	0,288	0,279	0,286	0,29	0,296	0,294
Hausman Test	NO	NO	NO	NO	ok	NO

Note: ** indicate significance at 5 percent, * at the 10 percent levels.

Interaction	Total SA	OECD_HI	Eastern Europe	Africa	Asia	China_India
Mark-up	0.546**	0.513**	0.534**	0.693**	0.72**	0.695**
	(0.081)	(0.08)	(0.065)	(0.073)	(0.078)	(0.06)
Import 1988-2002	0.206	0.467	35.317	- 18.587*	- 2.003**	- 11.286**
	(0.258)	(0.34)	(21.751)	(9.703)	(0.913)	(3.274)
Import 1995-2002	- 1.046**	- 1.287**	- 77.465**	4.148	0.613	10.331**
	(0.385)	(0.463)	(37.389)	(10.505)	(1.513)	(4.052)
N	420	420	420	420	420	420
R – squared	0,284	0,283	0,276	0,296	0,279	0,289
Hausman Test	NO	NO	ok	NO	NO	NO

Note: ** indicate significance at 5 percent, * at the 10 percent levels.
Source: Own calculations.