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The Market Disciplining Effects of Trade Liberalisation and Regional Import Penetration on Manufacturing in South Africa

Lawrence Edwards and Tijl van de Winkel

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1 INTRODUCTION

Since the mid-1990s, South Africa (SA) has made considerable progress in opening up its trade regime. In 1994 SA committed itself to reduce and simplify its tariff levels and structure in accordance with its offer under the General Agreement on Tariffs and Trade (GATT) Uruguay Round. As a consequence, tariffs have fallen, although the number of tariff rates and types remains high. Some estimates suggest that average tariffs in manufacturing have fallen from close to 30% in 1990 to around 10% in 2002. However, the extent of the decline is highly dependent on the calculation of *ad valorem* equivalents for non-*ad valorem* tariffs (specific, mixed, compound and formula duties) and the choice of tariff measure (scheduled tariff or collection duties). The difficulty in measuring protection is reflected in the continuing debate on the extent to which the economy has liberalised its trade (Fedderke and Vase, 2001; Rangasamy and Harmse, 2003).

Less contentious is the rising importance of trade as a share of output. Export orientation within manufacturing rose from 12% in 1990 to 23% in 2000. Import penetration within manufacturing also rose from 17% to 28% during this period.[1] The structure of trade has also changed with relatively strong export growth in skill-intensive and capital-intensive sectors (Edwards, 2001). Important regional differences in trade patterns are also evident. Allenye and Subramanian (2001) find that SA is paradoxically 'revealed' to be relatively capital abundant *vis-à-vis* most regions in the world. However, when using skills, SA is 'revealed' to be skill-abundant relative to low-income economies and unskill-abundant relative to high-income economies. This is consistent with the middle-income status of SA where firms compete against both high-income and low-income economies on a range of products defined across a broad skill spectrum. These trade patterns suggest that the impact of increased trade flows on the economy will vary according to the region with which SA trades.

The increased openness of the SA economy, both in terms of tariff reductions and increased trade flows, is expected to have impacted upon industry behaviour. International trade restrictions affect both the pricing and output behaviour of domestic and foreign firms. How these firms respond depends very much 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.

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[1] Export orientation is calculated as a share of gross output, and import penetration is measured as the share of imports in gross domestic expenditure. Values are calculated using real-value data obtained from the SA Standardised Industry Database provided by TIPS. Export orientation and import penetration values have risen to 29% and 36% in 2002, respectively, if current price data are used.

The objective of this paper is to estimate the impact of increased openness on the internal competitiveness of SA manufacturing industries between 1988 and 2002. As is common in the international empirical literature, we use the mark-up of product price over marginal cost as an indicator of the degree of market power. While several international studies have analysed the impact of trade flows, particularly import penetration, on mark-ups (Levinsohn, 1993; Harrison, 1994; Kee and Hoekman, 2003) few have analysed the impact of trade liberalisation using tariff data. Within SA, only Fedderke *et al.* (2003) have analysed the impact of trade and other variables on mark-ups within SA manufacturing industries. Their study, however, also uses import penetration rather than tariffs as an indicator of international competition.

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 sector between 1988 and 2002. We consider five regional groupings: developed economies, Africa, China & India, Rest of Asia, South America and Eastern Europe.[2] As we show in this paper, the sectoral structure and growth of SA trade differ across these regions. We therefore test whether these regional variations in trade impact differently on mark-ups in the SA 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 primary goods, manufacturing and services sectors over the period 1970-2002. In the process we update the analysis of Fedderke *et al.* (2003) from 1997 to 2002.

The structure of the paper is as follows: Section 2 develops the theoretical relationship between trade liberalisation and mark-ups and reviews the methodologies used in the empirical literature. 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. We first analyse the level of mark-ups within SA industries over the period 1971-2002 and compare these results with those of previous studies. We then estimate and present the marginal impact of liberalisation and regional import penetration on these mark-ups. We conclude the paper in section 5.

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[2] Developed economies consist of EU, US, Canada, Japan, Australia and New Zealand. Rest of Asia consists of all Asian economies excluding Japan, China and India.

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, we analyse the sensitivity of the relationship between mark-ups and trade liberalisation to Bertrand and Cournot competition. In general, the literature suggests that the policy recommendations can be sensitive to the underlying assumptions and the nature of competition assumed in the models of strategic interaction.

This section also reviews the empirical methodologies used to calculate and estimate the mark-ups. We 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

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 homogeneous, markets clear and perfect competition ensures zero profits within firms, that is, mark-ups are zero. Under these circumstances trade liberalisation alters relative prices causing a restructuring of production away from import-competing sectors towards export-oriented sectors. Overall welfare increases, although the impact on factors is not uniform, with some gaining and some losing.

Besides these static gains, the elimination or reduction of trade barriers may also create dynamic gains. These arise from productivity improvements induced by greater competition, better access to higher quality and varied imported intermediate inputs and technology flows, both direct and embedded in imported inputs. In addition, expanded market size may enable firms to take advantage of economies of scale and scope. Classical trade theory therefore advocates free trade as the optimal trade policy.

However, much of the gains in classical trade theory arise from the assumption of perfect competition which enables firms to respond to the changing incentives induced by trade liberalisation. New trade theory, which introduces increasing returns, product differentiation and market power, suggests a more ambiguous outcome. Increasing returns are inconsistent with perfect competition as marginal cost pricing leads to universal losses. Therefore, one important aspect of imperfect competition is that the price of the goods exceeds the marginal cost of production. With imperfect competition, each firm is also 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 of trade policy, namely the Theory of Strategic Trade Policy (STP) (Dixit, 1984).

Our analysis forms part of the STP literature. Brander (1995: 397) 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). This strategic interaction provides an opportunity for government action to modify the terms of the interaction and thus benefit the home economy and producer (Brander, 1995: 1402). In this paper we are particularly interested in how tariff liberalisation alters the interaction between domestic and foreign firms and subsequently affects mark-up pricing behaviour.

Our model falls within the 'reciprocal-markets' framework in which two firms compete in the home market.[3] In this model there are two typical cases of non-repeated interaction, Bertrand competition and Cournot competition, that need to be considered. In the Bertrand model firms optimise by setting their price, while in the Cournot model firms choose the optimum production output. In the analysis that follows we deal with both forms of strategic interaction as the conclusions derived from these models can be sensitive to underlying assumptions (Dixit and Norman, 1998).

2.1.1 The Cournot duopoly 'reciprocal-markets' model[4]

The basic model consists of a domestic firm and foreign firm producing a homogenous good (Q_H and Q_F, respectively) for the home market (H).[5] To simplify the analysis, we assume that the foreign firm exports all its products to the home market. Demand for the product is given by the inverse demand function $P(Q)$ where industry output $Q = Q_H + Q_F$. Both firms have identical cost functions, that is, $C_H(Q_H) = C_F(Q_F)$. We also assume that both firms have increasing marginal cost at an increasing rate, which means that $C' > 0$ and $C'' > 0$.

Each firm maximises 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

$$\Pi^H = P(Q_H + Q_F)Q_H - C_H(Q_H) \qquad (1)$$

and

$$\Pi^F = \frac{P(Q_H + Q_F)Q_F}{(1+t)} - C_F(Q_F)\,. \quad (2)$$

---

[3] An alternative model is the 'third-market' model where rival oligopolistic exporters from two countries compete only in a third market.

[4] See Appendix for the extensive calculations.

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

Because foreign firms face a trade barrier (*t*), they receive the domestic price deflated by the tariff rate, that is $P_F = \frac{P(Q)}{(1+t)}$.

Under the Cournot assumption, each firm maximises its profits by choosing the optimum level of output to sell. The first-order conditions for the home and foreign firms are given, respectively by

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

and

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

Equations (3) and (4) form a system from which the equilibrium values for Q_H and Q_F and price, P(Q), are determined.[6] The second-order conditions for the critical points to be an optimum will be satisfied under most normal demand curves (see appendix).

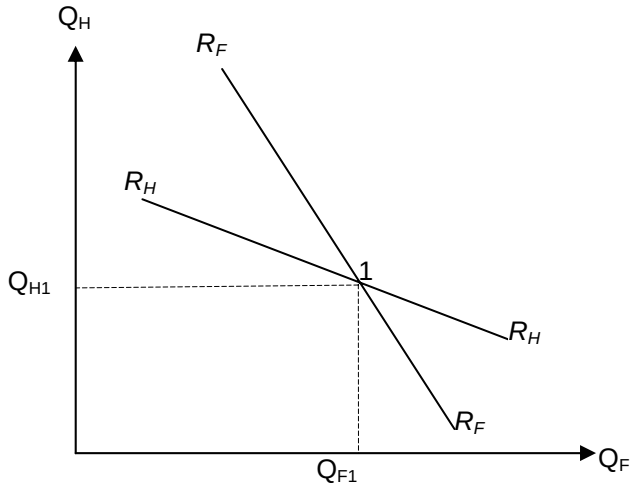
The solution to the system of equations (3) and (4) is represented diagrammatically in Figure 1. Equation (3) determines the optimal choice of output for the home firm (Q_H) as function of its beliefs about the foreign firm's output choice and this is represented as the reaction curve R_HR_H. Similarly, 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. We also assume that the products are strategic substitutes which ensure that the reaction functions are downward-sloping.[7] The intersection of these curves at point 1 gives the Cournot free-trade equilibrium point, where the home firm delivers Q_{H1} and the foreign firm delivers Q_{F1}.

---

[6] Note that under the Cournot model each firm treats its rival's output as fixed and hence does not take into account the marginal response of the rival firm to changes in their own output (i.e. $\frac{\partial Q_F}{\partial Q_H} = \frac{\partial Q_H}{\partial Q_F} = 0$).

[7] The strategic substitutes assumption ensures that the marginal impact of an increase in the competing firm's output reduces profit in the first firm, i.e. $\Pi^{\mathrm{H}}_{\mathrm{HF}}$ and $\Pi^{\mathrm{H}}_{\mathrm{HF}} < 0$.

Figure 1: Reaction curves of the Cournot duopoly



The reaction curves also provide useful frameworks for the analysis of the impact of tariff liberalisation on industry output. The import tariff raises the marginal cost of the foreign firm, and as a result the foreign firm supplies less for each level of output it expects the home firm to produce. This is represented in Figure 2 as a shift of the foreign reaction curve inwards to $R_F^{'}R_F^{'}$. A new equilibrium is then established at point 2 where 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. Overall output, however, declines as $\frac{dQ_H}{dt} + \frac{dQ_F}{dt} < 0$.[8] As output supplied to the home market falls, the market price P(Q) increases.[9] The implication of this finding is that an increase in tariffs reduces total output and hence raises prices.

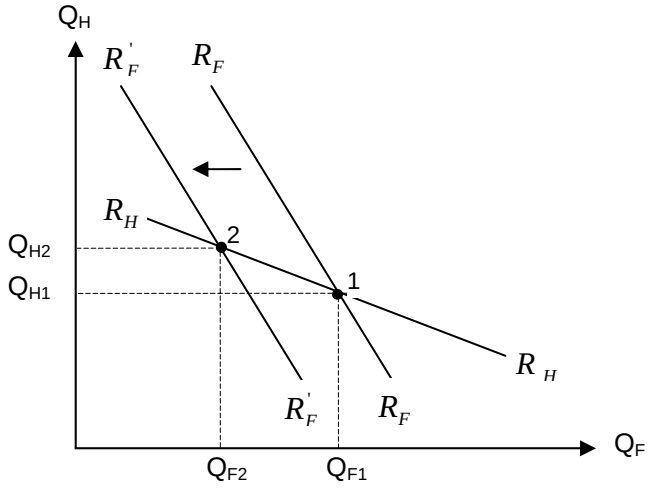
---

8 $\frac{dQ_H}{dt} + \frac{dQ_F}{dt} = \frac{(P'Q_F + P)}{(1+t)^2}(-P''Q_H - P' + 2P' + P'Q_H - C_H'')$

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

9 $\frac{dP}{dt} = P'(\frac{dQ_H}{dt} + \frac{dQ_F}{dt})$, which is positive.

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



The impact of the tariff on the mark-up depends on the relationship between output and marginal cost. The mark-up for the home firm is commonly expressed as the price over marginal cost, that is $u = \frac{P}{C_H'}$. Differentiating *u* with respect to *t* we obtain:

$$\frac{du}{dt} = \frac{1}{C_H'}\frac{dP}{dt} - \frac{PC_H''}{C_H'^{\,2}}\frac{dQ_H}{dt}. \quad (5)$$

The first term on the right-hand side reflects the impact of tariffs on prices and is positive. The second term on the right-hand side reflects the impact of tariffs on marginal cost. This term is also positive as a rise in tariffs raises domestic output (Q_H), which in turn raises marginal costs. If the increase in marginal costs exceeds the increase in price, mark-ups may decline. The impact of tariff increases on mark-ups is therefore ambiguous. However, in most applications constant marginal costs are assumed and the second term falls away, leading to a positive impact on mark-ups from tariff increases.

2.1.2 The Bertrand duopoly 'reciprocal-markets' model[10]

In Bertrand competition firms choose prices rather than output as their strategic variables. The basic model structure is similar to that of the Cournot model, except that we assume Bertrand behaviour and assume product differentiation. Product differentiation allows each firm to charge different prices at the margin without losing market share. With homogeneous goods, the demand would shift entirely in favour of the firm offering to sell at an infinitesimally lower price and we would eventually end up with a perfectly competitive price with neither firm earning profits under free

[10] See Appendix for the extensive calculations.

trade (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. Given these demand relationships, the profits for each firm are given, respectively, by

$$\prod^H = P_H X(P_H,P_F) - C_H X(P_H,P_F) \quad (6)$$

and

$$\prod^F = \frac{P_F Y(P_H,P_F)}{(1+t)} - C_F Y(P_H,P_F) \quad (7)$$

Bertrand firms select prices in order to maximise profits, but treat foreign prices as constant in the process (i.e. $\frac{\partial P_F}{\partial P_H} = 0$). The First Order Optimum Conditions for the home and foreign firm are then given by

$$\Pi^{\mathrm{H}}_{\mathrm{P_H}} = \frac{\partial \Pi^{\mathrm{H}}}{\partial \mathrm{P_H}} = X + X_{P_H} P_H - C_{P_H} = 0 \qquad (8)$$

and

$$\Pi^{\mathrm{F}}_{\mathrm{P_H}} = \frac{\partial \Pi^{\mathrm{F}}}{\partial \mathrm{P_F}} = \frac{Y}{(1+t)} + \frac{Y_{P_F} P_F}{(1+t)} - C_{P_F} = 0 \qquad (9)$$

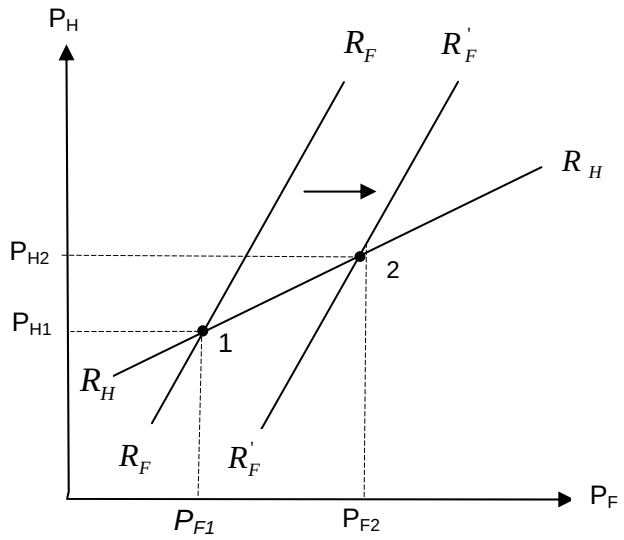
where $X_{P_H} = \frac{\partial X}{\partial P_H}$, $Y_{P_F} = \frac{\partial Y}{\partial P_F}$, $C_{P_H} = \frac{\partial C_H}{\partial P_H}$ and $C_{P_F} = \frac{\partial C_F}{\partial P_F}$. The system (equations 8 and 9) can be solved for P_H and P_F. Under standard assumptions, the second order conditions are satisfied, implying that the critical points are optimal.

The solution and the impact of tariffs on domestic prices can also be shown diagrammatically using the firms' reaction curves. Equation (8) 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 $R_H R_H$ in Figure 3:. Equation (9) similarly determines the foreign firm's reaction curve $R_F R_F$.[11] The Bertrand equilibrium is at the intersection of the two curves at point 1, where the home firm charges P_{H1} and the foreign firm charges P_{F1}. The imposition of a tariff shifts the foreign reaction

[11] The assumption that $\Pi^{\mathrm{H}}_{\mathrm{P_H P_F}}$ and $\Pi^{\mathrm{F}}_{\mathrm{P_F P_H}}$ are positive is imposed. This ensures that the reaction curves are upward-sloping. This is discussed in more detail in the Appendix.

curve rightward to $R_F^{'} R_F^{'}$. The foreign reaction curve shifts right as the foreign selling price in the home market now includes the tariff. This rightward shift induces an increase in the domestic price (P_{H2}) and an increase in the import price (P_{F2}), with a new equilibrium at point 2. If the percentage increase in P_F is less than the amount of the tariff (that is $P_F/(1+t)$ falls), the home country will experience improvement in terms of trade, and national welfare is more likely to increase (Feenstra, 2004).

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



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*

$$\frac{du}{dt} = \frac{C_{P_H}\frac{\partial P_H}{\partial t} - P_H C_{P_H P_H}\frac{\partial P_H}{\partial t}}{C_{P_H}^{'\ 2}}.$$

As found in the Cournot model, the sign of the impact is ambiguous and depends on the increase in the home good price relative to the increase in marginal cost. Under constant marginal costs, mark-ups increase as is found in the Cournot model.

2.1.3 Sensitivity analysis

The Cournot and Bertrand models are consistent with each other with regards to the impact of tariffs on mark-ups. In both cases, tariff barriers increase mark-ups under constant marginal costs. The effect of tariffs on mark-ups also appears robust to changes in some of the other assumptions such as product differentiation, integrated or separated markets and tariff barrier types (quotas and tariffs). The impact on national welfare, however, is not always positive.

For example, an import quota in the case of Cournot competition restricts the foreign firm's deliveries, which shifts the foreign reaction curve down the home reaction curve. The effect is

rising output prices, reduced sales in the domestic market and higher mark-ups. However, the foreign firm may capture the quota rents which show up as worsening terms of trade (Helman and Krugman, 1989). Thus from a national point of view, the welfare effects of the quota are worse than the tariff, but in both cases the mark-up rises.

In the case of Bertrand competition, Krishna (1989) shows that quota restrictions such as Voluntary Export Restraints (VERs) can facilitate collusive practices between firms to the detriment of national welfare. Home firms realise that by raising prices they can shift export sales towards the foreign firm, forcing foreign firms to raise their own prices in order to retain exports within the quota limit. Krishna (1989) points out that both firms can benefit from this collusive behaviour, but do so at the expense of consumers and national welfare. This collusive behaviour, however, enhances mark-up pricing.

The introduction of product differentiation into the Cournot model also does not affect the direction of the impact of tariffs on mark-ups. Although product differentiation reduces the degree of substitution, and hence the possible national welfare gains, home prices still rise (Bhagwati *et al.*, 1998). Under constant marginal costs, this leads to an increase in mark-ups.

The mark-up results, however, are more sensitive to the assumption regarding entry and exit. For example, Venables (1985) develops a model in which tariffs raise domestic profitability and hence cause domestic firms to enter the market. Output of each firm rises, which, under the assumptions of increasing returns, lowers prices and mark-ups.

2.1.4 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 marginal cost assumption. Although the results are sensitive to the underlying assumptions, it is important to note that in most cases, trade barriers raise the mark-ups. While the size of the impact varies, the direction of impact appears quite robust. In contrast, the outcome on national welfare is 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 estimation of mark-ups

The major problem with estimating the mark-up of prices over marginal costs arises from the fact that, while prices can be measured, marginal costs are not directly observable. Therefore, indirect

measures have been developed.[12] A widely used method is that of Hall (1988) who expressed the Solow Residual as a function of the mark-up and the labour/capital ratio. Hall (1988) 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:

$$SR = \Delta q - \alpha\Delta l - (1-\alpha)\Delta k = (u-1)\alpha(\Delta l - \Delta k) + \theta \quad (10)$$[13]

where $u = P/MC$, Δ denotes the first difference, lower case denotes natural logs, *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 does not correlate with the growth rate of the labour/capital ratio and is thus identical to the rate of technical progress. But under imperfect competition, equation (10) cannot be estimated directly because the labour/capital ratio correlates with the productivity term and the Ordinary Least Square (OLS) estimates of *u* will be inconsistent and biased (Martins & Scarpetta, 1999). The usual way to correct for this endogenous problem is to replace the labour/capital ratio by a set of instrumental variables[14]. For the case of the US, Hall (1988) used overall real gross domestic product (GDP), defence expenditures, oil prices and the political party of the president as instrument and found strong evidence of mark-ups in numerous industries. But some of these instruments have been criticised as being rather implausible.

To avoid the endogenous 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 (1995) first computed the Dual of the Solow Residual (DSR):

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

$$= (u-1)\alpha(\Delta w - \Delta r) + \theta \quad (11)$$

---

[12] Price-cost margins have also been calculated as revenue-variable costs/revenues. This is essentially a measure of price over average cost, which under constant returns to scale should equal the mark-up of price over marginal costs. See Hakura (1998) for a more detailed discussion of this approach.

[13] The production function for an industry is given as $Q = \delta F(L,K,)$ where Q is value-added output, K is capital, L is labour and δ is measure of technical innovation. Through manipulation of the first-order Taylor series approximation of the production function we can solve the Solow Residual, $SR = \Delta q - \alpha\Delta l - (1-\alpha)\Delta k$. Under perfect competition, where producers price their output at marginal cost, this is equivalent to the rate of technical innovation ($\theta = d\delta/\delta$). However, under imperfect competition, the rate of technical innovation is given by $\theta = \Delta q - \mu(\alpha\Delta l + (1-\alpha)\Delta k)$, where μ is the mark-up. Using these two equations, we can derive equation (10).

[14] These variables correlate with the growth rate of the labour/capital ratio and at the same time do not correlate with the productivity shocks (Martins & Scarpetta, 1996).

where *w* and *r* represent the natural logs of the wage rate and rental price of capital, respectively. Equation (11) is also subject to the same endogenous problems as the primal measure of the Solow Residual. Roeger's insight was that by subtracting equation (11) from (10) we obtain the nominal Solow Residual (NSR):

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

$$= (u-1)\alpha[\Delta(w+l) - \Delta(r+k)] \qquad (12)$$

in which the productivity terms (θ) are cancelled out. Mark-ups can therefore be estimated directly using equation (12) without suffering from the endogeny problem.[15]

A shortcoming of this specification is that it fails to account for intermediate inputs in the production function. 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). Norbinn (1993), for example, finds that once intermediate inputs are included, Hall's (1988) findings of imperfect competition in the US are reversed. Including intermediate inputs modifies equation (12) to:

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

$$= (u-1)[\alpha^{GO}\Delta(w+l) + \beta^{GO}\Delta(p_m + m) - (\alpha^{GO} + \beta^{GO})\Delta(r+k)] \qquad (13)$$

where lower case denotes natural log, q^{GO} and p^{GO} denote gross output and its price, *m* and p_m denote intermediate inputs and their prices, and α^{GO} and β^{GO} denote the share of labour and intermediate inputs in gross output value, respectively.

2.2.2 Estimating 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 to obtain a function of the form

$$NSR_{it} = \beta_0 + \beta_1 mup_{it} + \beta_2 Z_{it} * mup_{it} + \varepsilon_{it} \qquad (14)$$

where *mup* is $\alpha.[\Delta(w+l) - \Delta(r+k)]$, *Z* is the trade variable and ε is the error term. The level of mark-up is given by $\beta_1 + \beta_2\overline{Z}$ where $\overline{Z}$ is the average level of the trade variable, and the marginal

[15] Oliveira Martins and Scarpetta (1999) adjusted Roeger's equation, so that no specific assumption has to be made on the level of returns to scale. They show that $NSR = (\frac{u}{\lambda} - 1).\alpha[\Delta(w+l) - \Delta(r+k)]$ where *λ* is an index of the degree of returns to scale. Increasing returns to scale (*λ* > 1) produce a downward bias in the estimated mark-up.

impact of trade on mark-ups is given by β_2.[16] Using this approach, Fedderke *et al.* (2003) find that increased import penetration reduced mark-ups in SA manufacturing industries. 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 interact import penetration with the explanatory variable in a generalised specification of Hall's (1998) model and find no significant impact of import penetration on mark-ups in Belgium and a positive relationship in Netherlands. Foreign importers appear to join the "cartel paradise" in the Netherlands (Konings *et al.*, 2001: 852).

Kee and Hoekman (2003) follow a different approach and substitute the mark-up relationship (μ in their case) with a second order semi-translog function. Following a similar approach, the mark-up (μ - 1) can be approximated with a semi-log function

$$(\mu - 1) = \delta_0 + \delta_1 \ln T + \delta_2 \ln M + \delta_3 \ln Z \qquad (15)$$

where *T* represents tariff protection, *M* represents import penetration and *Z* represents other variables of interest. Substituting equation (15) into equation (12) yields the following function

$$NSR_{it} = (\delta_0 + \delta_1 \ln T_{it} + \delta_2 \ln M_{it} + \delta_3 \ln Z_{it}) mup_{it} + \varepsilon_{it} \qquad (16)$$

Equation (16) shows that the interaction between *mup* and arguments of the semi-log function (15) can be interpreted as the marginal impact of those factors on mark-ups. For example, the impact of a 1% increase in tariffs on mark-ups is given by[17]

$$\frac{\partial(\mu - 1)_{it}}{\partial \ln T_{it}} = \frac{\partial(\partial NSR_{it} / \partial mup_{it})}{\partial \ln T_{it}} = \delta_1 .$$

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 (14) and (16) represent the main specifications used to estimate the average level of mark-ups in SA industries and the marginal impact of trade

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[16] The average level of mark-ups equals the partial derivative of *NSR* with respect to *mup*, $\left(\frac{\partial nsr}{\partial mup} = \beta_1 + \beta_2 \bar{Z}\right)$. The impact of a 1%-point increase in the trade variable on mark-ups is given by $\partial\left(\frac{\partial nsr}{\partial mup}\right) \Big/ \partial Z = \beta_2$.

[17] Then average impact of a 1%-point increase is given by $\partial\left(\frac{\partial nsr}{\partial mup}\right) \Big/ \partial Z = \left(\frac{\delta_1}{\bar{T}}\right)$ where $\bar{T}$ is the average tariff.

(import penetration and tariffs) on mark-ups. In addition, we adjust these specifications to allow for intermediate inputs, as shown in equation (13).

3 DATA AND DATA ANALYSIS

This section discusses the construction and source of the data used in the econometric analysis. Using various data sources, we also reassess the progress SA has made in liberalising its trade, with particular emphasis on the period subsequent to 1988. Finally, we analyse the regional and sectoral composition of SA imports during the period 1988 to 2002.

3.1 Data

The data set used to estimate the level of mark-ups consists of a balanced panel of 45 Standard Industrial Classification (SIC) three-digit manufacturing, primary and services sectors for SA over the period 1970-2002. The main data source for this estimation is the SA Standardised Industry Database (SASID) (Quantec Research, 2004) obtained from Trade and Industrial Policy Strategies (TIPS). The Quantec dataset furnished us with data on Gross Operating Surplus, labour remuneration, intermediate inputs, fixed capital stock, consumption of capital 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 as consistent Harmonised System (HS) classified tariff and regional trade data are only available from 1988. To estimate the impact of tariff protection on mark-ups we use three different measures of tariff protection. Firstly, protection is measured using scheduled tariff rates at the HS8-digit level. Secondly, protection is measured using collection duties, calculated by dividing customs revenue by the import value, at the HS8-digit level. Thirdly, the scheduled tariff and collection duty rates are adjusted for surcharges using data obtained from GATT (1993) and the SA Reserve Bank (SARB). The scheduled tariff rates are obtained from the Trade Analysis and Information System database (TRAINS), the Economic Research Division of the Industrial Development Corporation (IDC) and the Department of Trade and Industry (**the dti**) (made available by TIPS). Missing years are updated using the SA Government Gazettes. Customs revenue data at the HS8-digit level are obtained from TIPS. The data appendix deals with the construction of the tariff data in more detail.

In estimating the impact of regional trade on mark-ups, we consider five regional groupings: Developed economies, Africa, China & India, Rest of Asia, South America and Eastern Europe.[18] Regional trade data at the HS8-digit level are sourced from Customs & Excise. Once again, data

[18] Developed economies consist of EU, US, Canada, Japan, Australia and New Zealand. Rest of Asia consists of all Asian economies excluding Japan, China and India.

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 biases in the level and trend of real imports.

The calculation of the *mup* term in equation (14) and (16) 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 and price deflator for investment, respectively. For the long-run interest rate we use the rate on 10-year government bonds obtained from SARB. The expected inflation rate is calculated as the smoothed GDP deflator for manufacturing, and the price deflator for investments is obtained by dividing the Gross Domestic Fixed Investment (GDFI) for manufacturing at current prices by the GDFI at nominal (1995) prices, both obtained from SARB.[19] Finally, we calculate the depreciation rate for each sector as the consumption of capital as a ratio of capital stock. We differ in this regard from Fedderke *et al.* (2003) who impose a common depreciation of 5% and 10% across all sectors.

3.2 Trade liberalisation in SA

The impact of trade liberalisation on mark-up pricing behaviour of domestic firms will depend on the extent to which the economy has liberalised its trade. This issue is particularly relevant in SA as there is substantial disagreement as to the extent to which protection has fallen since the 1980s (Holden, 1992; Bell, 1992 and 1997; Belli *et al.*, 1993; Fedderke and Vase, 2001; Van Seventer, 2001).[20]

Prior to the 1970s, SA's trade and industrial policies were aimed primarily at encouraging import substitution industrialisation (Belli *et al.*, 1993; Jenkins *et al.*, 1997). However, these policies began to change in the 1970s in response to a decline in the contribution of import substitution policies towards growth (Fallon and Pereira de Silva, 1994), a continued dependence on gold as a source of foreign exchange and diminished export pessimism brought about by rapid growth through exports in some of the newly industrialised countries of Southeast Asia (Jenkins *et al.*, 1997).

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[19] We use a Hodrick-Prescott filter (lambda value of 7) to smooth the GDP deflator series.

[20] For a detailed discussion on trade liberalisation see Holden (1992), Levy (1992), Bell (1997) and Jenkins *et al.* (1997).

These reforms in the 1970s began with the relaxation of quantitative restrictions (QRs) and the introduction of an Export Development Assistance scheme (Bell, 1992; 1997). Although tariff increases compensated for the relaxation of QRs, these were not fully compensatory resulting in a net decline in protection (Bell, 1992; 1997). Nevertheless, the trade regime remained protectionist as the incentives introduced were an attempt to redress some of the anti-export bias rather than shift the economy towards export-orientated growth (Jenkins *et al.*, 1997: 7).

During the 1980s, the picture became more confusing. While the relaxation of QRs continued into the 1990s, import surcharges implemented in response to balance of payment pressures, arising from the debt crisis in the mid-1980s, raised protection. Furthermore, there was an increase in the number of applications for protection in the form of *ad valorem* and formula duties as businesses experienced the effects of the economic downturn (Bell, 1992). Evidence suggests that by 1988 the economy had become more protected than in 1984. Holden (1992: 187) estimates that the weighted average effective protection rate rose from 30% to 70% between 1984 and 1988.[21] Belli *et al.* (1993) also note that by the end of the 1980s SA had the most tariff rates, the widest range of tariffs and the second highest level of tariff dispersion compared to a range of developing countries.

By 1994 the process of reducing QRs was largely complete and the focus of trade reform shifted to import liberalisation through tariff reductions.[22] This process was spurred by SA's commitment in the GATT Uruguay Round to bind 98% of all tariff lines, reduce the number of tariff rates to six, to rationalise the over 12,000 tariff lines and to replace quantitative restrictions on agricultural products with tariffs. Some progress has been made. The total number of HS8-digit tariff lines fell from over 12,000 in 1990 to 7,909 in 2002. The tariff structure has been simplified with the number of HS8-digit lines bearing formula duties declining from 1,900 in 1993 to 5 in 2002 (WTO, 1998; 2002). The number of lines with specific tariffs also fell from 500 to 195 lines over the same period. However, the number of tariff lines with mixed duties containing a minimum and maximum value remains high and declined from 1,938 to 1,701 only over the same period. The number of *ad valorem* tariff rates also remains high (38 in 2002) and exceeds the 6 tariff rates proposed in SA's GATT/World Trade Organisation (WTO) Uruguay Round offer. If non-*ad valorem* tariff rates are included, the number of different rates equals 217 in 2002.[23] Thus the tariff structure remains complex.

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[21] These estimates do not include the protectionist impact of quantitative restrictions. It is not clear for example whether the changes in effective protection rates reflect the replacement of quantitative restrictions with tariff equivalents or increases in protection.

[22] QRs on agricultural products were still prevalent.

[23] There were 857 different tariff rates in 1993.

Average tariff rates have also fallen, although there is substantial dispute over the extent of the decline (Fedderke and Vase, 2001; Rangasamy and Harmse, 2004). Average nominal protection (including non-*ad valorem* equivalents) for manufacturing in 1990 was estimated at 22% (IDC, 1990).[24] The average nominal tariff for 2003 is estimated at approximately 7% (own calculations). Such comparisons, however, need to be made with care as estimated values of the *ad valorem* equivalents of formula, specific, compound and mixed duties, which were frequently used prior to the late 1990s, vary enormously depending on the data and method followed. For example, collection rates, calculated by dividing collected customs duties by import values, show a much lower decline between 1990 and 2002 (5.6% to 3.2%). Import surcharges imposed between 1985 and 1995 also raise protection, particularly in the early 1990s. Surcharge revenue during the peak years of 1989 and 1990 was equivalent to approximately 6% of the value of merchandise imports, and represents a doubling of protection as measured by collection rates. The decline in protection during the 1990s is therefore more severe once surcharges are included.

Figure 4 and Table 1 present three different measures of average protection for the entire economy (agriculture, mining and manufacturing) and the manufacturing sector between 1988 and 2002. Protection is first measured using scheduled tariff rates at the HS8-digit level (see appendix for a more detailed discussion of the tariff data). These rates include *ad valorem* equivalents of formula, specific and mixed duties, which are set equal to the collection rates if the last-mentioned exceeded the *ad valorem* component of the scheduled rates. Lack of consistent import price data and quantity units prohibited the calculation of *ad valorem* equivalents according to the standard approach (tariff value/ free-on-board, or f.o.b., import value). The use of collection rates leads to an underestimate of protection levels as highly protected products may not be imported and exemptions on duty are frequently granted (e.g. imported intermediate inputs are often duty-free when the final product is to be exported).[25] We also estimate the level of protection using collection duties, calculated by dividing customs revenue by the import value at the HS8-digit level. As a final measure of protection, the scheduled tariff and collection duty rates are adjusted for surcharges using data obtained from GATT (1993) and the SA Reserve Bank. As is evident in Figure 4, the level and the decline in protection are very sensitive to the measure of protection used.

Simple collection rates excluding surcharges show a very gradual decline in protection on merchandise goods from 7.9% to 5.8% between 1988 and 2001. For manufacturing alone the

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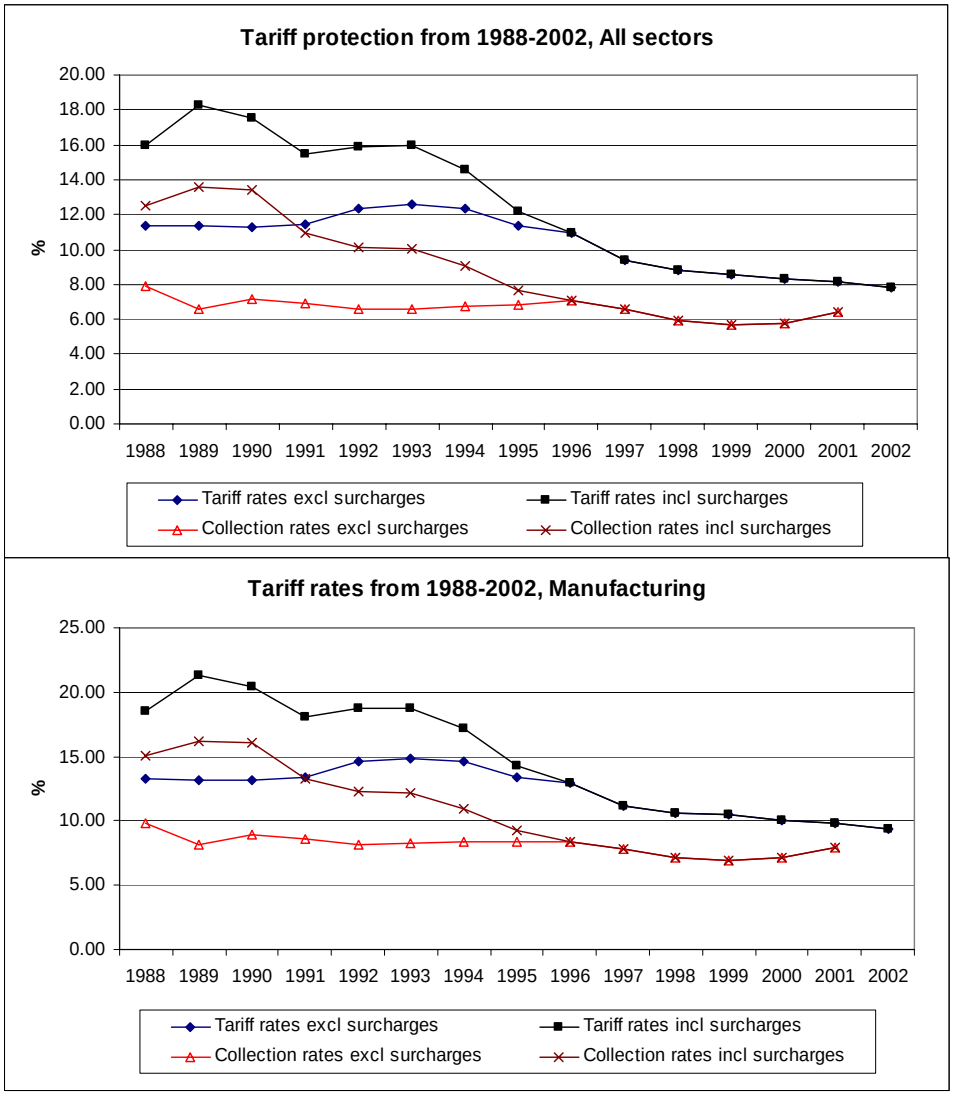
[24] Accounting average with zero rates included. Once zero rates are excluded, the average increases to 29% (IDC, 1990).

[25] Altman (1994) also notes that the duty-free credit system implemented as part of the Structural Adjustment Programme for clothing and textiles in 1989 encouraged the importation of final goods covered by very high tariffs. Very low duties were thus paid on some of the most highly protected clothing products.

decline is from 9.8% to 7.1%. The inclusion of surcharges raises protection during the early 1990s (13.4% for merchandise goods and 16.1% for manufacturing in 1990) and thus the degree to which the economy has liberalised its trade. When using scheduled tariff rates excluding surcharges, two distinct trends are shown. Average protection on merchandise goods rose from 11.4% in 1988 to 12.4% in 1993 before declining to 7.8% in 2002. Within manufacturing alone, protection rose from 13% to 15% and then fell reaching 9.4% by 2002.

Figure 4: Tariff protection from 1988 to 2002



Note: To calculate the economy-wide average tariff, we weight the simple average tariff at the SIC 3-digit level by average output between 1990 and 2002.

The upward trend in protection during the early 1990s arises from higher average nominal tariffs in the footwear, clothing, textiles, meat, fish, dairy and motor vehicle sectors. The increase in protection in the food sector arises from the tariffication of non-tariff barriers. The unavailability of tariff equivalents for the non-tariff barriers prevents an assessment of the extent to which the rise in average nominal protection is exaggerated. Rising protection within the clothing and textile industry reflects new tariffs imposed under the revised Structural Adjustment Programme (SAP) in 1992

and 1993.[26] More problematic is the increase in protection within the motor vehicle industry where protection primarily took the form of local content requirements rather than import tariffs. The rise in protection for this sector between 1988 and 1992 may thus be exaggerated.

Table 1: Average tariff rates, 1988-2002

	1988	1990	1992	1994	1996	1998	2000	2002
Agriculture, mining & manufacturing								
Tariff rates excl. surcharges	11.37	11.30	12.38	12.37	10.93	8.80	8.27	7.79
Tariff rates incl. surcharges	15.98	17.55	15.91	14.61	10.93	8.80	8.27	7.79
Collection rates excl surcharges	7.87	7.15	6.58	6.78	7.12	5.96	5.78	
Collection rates incl. surcharges	12.49	13.40	10.11	9.02	7.12	5.96	5.78	
Manufacturing								
Tariff rates excl. surcharges	13.23	13.16	14.62	14.57	12.97	10.58	10.04	9.42
Tariff rates incl. surcharges	18.57	20.39	18.71	17.15	12.97	10.58	10.04	9.42
Collection rates excl. surcharges	9.78	8.89	8.16	8.36	8.35	7.17	7.12	
Collection rates incl surcharges	15.12	16.12	12.25	10.94	8.35	7.17	7.12	

Note: These average rates are obtained by weighting the sector level tariffs by average industry output between 1990 and 2002.

Table 2 presents sector level information of protection and the change in protection between 1988 and 2002. In addition to nominal protection rates, effective protection rates, calculated according to the Balassa (1965) approach, are provided. Effective rates of protection measure the protection on value added and thus take into account protection on output as well as the import tax on intermediate inputs. The effective rates of protection presented in Table 2 are constructed using the 2000 Supply-Use table provided by Statistics SA (2003).

Looking at the nominal tariff rates, very high protection rates (more than 30%, inclusive of surcharges) are found in tobacco, textiles, footwear and clothing. Low rates (less than 10%) are found in some mining sectors, coke & refined petroleum, basic chemicals, basic metals and other transport equipment. Weighted average tariffs are marginally lower in skill-intensive sectors (13.97%) than in less skill-intensive sectors (15.98%). Tariff levels are also lower in capital-intensive sectors (8.6%) than labour-intensive sectors (15.55%).[27]

[26] It is difficult to gauge protection within the clothing and textile industry as formula duties were the most common type of tariff applied. Under the SAP in 1989 the *ad valorem* component of the formula duties on clothing and textiles were reduced, but the reference price was raised. However, this minimum price was quickly eroded by inflation (GATT, 1993) resulting in a decline in protection between 1989 and early 1992. The revision of these duties in May 1992 therefore raised protection within the clothing and textile industries. As argued by GATT (1933:170), "*The sector represents a clear-cut case of rent-seeking by entrenched special interests, with no final arbiter to guide the industry towards international competitiveness on the basis of free trade*".

[27] Weighted-average values are constructed using average factor shares between 1988 and 2002 as weights. Sectors are treated equivalently, irrespective of size in terms of output or employment. Similar sector biases, not levels, are obtained when using factor values (employment according to skill and capital stock) as weights. The averages exclude the gold mining sector, which accounts for a large share of total employment, but no imports. In calculating the skill bias of tariff rates, skilled labour includes managerial, professional and some skilled technical occupations.

The structure of effective protection rates is similar to nominal protection rates, as is reflected in very high correlation coefficients (more than 0.8 in all cases). Effective protection rates are, however, substantially higher than nominal protection rates in most cases. Very high effective protection rates (more than 100%, inclusive of surcharges) are found in the tobacco, textiles and clothing sectors. Negative protection rates are found in the services sector as a result of tariffs imposed on intermediate inputs. As with nominal protection, effective protection is slightly lower in skill-intensive sectors (weighted average of 31%) than in less skill-intensive sectors (37%).

Table 2 also presents the average annual change in tariffs between 1988 and 2002 for each sector. Large declines in scheduled tariff rates inclusive of surcharges (more than 15% per annum) are found in professional & scientific equipment, gold & uranium mining and other transport equipment. Sectors experiencing low declines in protection (less than 5% per annum) include footwear, food, textiles, clothing, furniture, wood products, paper products and coke & refined petroleum. On average tariffs inclusive of surcharges have fallen relatively strongly in skill-intensive sectors (6.69% per annum between 1988 and 2002), compared to less skill-intensive sectors (7.01% per annum). Using the capital-labour division, tariff declines are concentrated in labour-intensive sectors (7.37%) compared to capital-intensive sectors (6.31%).

Table 2: Measures of protection and change in protection for various industrial sectors

	Average tariff levels, 1988-2002				Average annual change in tariffs, 1988-2002				Average ERP, 1988-2002			
	Scheduled	Scheduled + surcharges	Collection	Collection + surcharge	Scheduled	Scheduled + surcharges	Collection	Collection + surcharge	Scheduled	Scheduled + surcharges	Collection	Collection + surcharge
	%	%	%	%	%	%	%	%	%	%	%	%
Agriculture, forestry & fishing	5.0	7.6	3.0	5.8	1.2	-4.5	2.1	-6.5	3.0	6.7	1.3	5.3
Coal mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.6	-4.3	-2.2	-2.9
Gold & uranium mining	6.0	6.0	0.8	0.9	-21.4	-21.5	0.0	-3.0	6.7	6.1	-0.9	-1.5
Other mining	2.4	2.4	1.1	1.1	-9.9	-10.1	-10.9	-12.1	2.1	1.7	0.5	0.1
Food	11.5	14.5	8.9	12.1	1.1	-2.4	1.7	-2.8	34.5	40.3	28.4	34.4
Beverages	8.4	16.3	12.0	20.5	4.8	-3.8	-1.4	-5.5	11.3	25.9	23.3	39.0
Tobacco	28.6	41.0	21.1	34.3	4.1	-1.9	5.4	-2.1	238.3	342.1	125.1	201.6
Textiles	29.5	31.6	15.3	17.5	0.2	-1.1	-0.2	-2.1	108.5	113.8	42.5	47.2
Wearing apparel	47.3	52.5	26.0	31.5	1.6	-0.9	1.7	-1.0	132.1	147.4	66.1	81.1
Leather products	14.9	17.9	11.9	15.2	-2.1	-4.6	-0.5	-3.6	31.9	37.0	27.8	33.3
Footwear	28.5	32.6	25.9	30.3	-1.5	-3.4	-0.4	-2.6	61.9	69.7	61.5	69.9
Wood products	10.7	12.2	8.6	10.2	-1.7	-3.4	-2.1	-4.2	17.6	18.4	15.2	16.1
Paper products	7.8	8.2	7.0	7.4	-1.8	-2.6	-0.8	-1.8	11.4	10.7	12.0	11.3
Printing & publishing	7.9	9.8	5.7	7.7	-6.0	-8.3	-3.9	-7.4	8.9	11.9	6.1	9.2
Coke & petroleum	5.0	5.0	3.8	3.8	-4.2	-4.2	-3.1	-3.4	11.3	11.0	9.5	9.2
Basic chemicals	5.6	5.8	3.6	3.8	-11.8	-12.2	-9.8	-11.2	9.6	9.7	5.8	5.9
Other chemicals	9.2	11.6	5.3	7.9	-7.3	-9.8	-4.7	-9.5	16.6	21.8	8.0	13.6
Rubber products	15.2	16.8	13.5	15.1	-3.3	-4.5	-2.7	-4.4	41.7	45.0	39.4	42.8
Plastic products	15.0	17.6	15.3	18.1	-4.6	-6.5	-3.6	-5.8	28.5	33.8	32.6	38.4
Glass products	9.6	12.8	7.8	11.3	-3.3	-6.5	-2.9	-7.2	17.0	23.2	14.0	20.7
Non-metallic minerals	8.6	10.1	6.9	8.6	-5.1	-6.9	-4.4	-7.2	16.4	19.3	14.0	17.2
Basic iron & steel	6.6	6.9	4.3	4.5	-4.7	-5.1	-2.0	-3.0	16.1	15.9	10.4	10.2
Non-ferrous metals	6.0	6.3	3.0	3.3	-9.8	-10.4	-6.4	-8.1	9.4	9.8	4.4	4.9
Metal products	11.2	13.6	8.5	11.0	-3.8	-6.0	-3.4	-6.8	21.1	26.8	17.1	23.1
Machinery & equipment	6.0	7.8	2.6	4.5	-5.1	-8.1	-5.3	-11.6	5.4	8.5	0.1	3.3
Electrical machinery	11.4	14.6	7.5	11.0	-4.5	-7.3	-3.1	-7.8	20.1	27.3	13.1	20.7
Communication equipment	9.4	12.6	4.1	7.6	-11.1	-13.9	-10.2	-15.8	11.0	15.3	3.2	7.8
Professional & scientific	3.4	6.6	2.2	5.7	-20.3	-26.1	-20.3	-29.9	-3.1	1.7	-2.8	2.4
Motor vehicles	22.0	24.7	8.2	11.0	-3.3	-4.8	-1.6	-5.2	45.0	49.6	8.8	13.3
Other transport	4.8	6.7	3.1	5.1	-16.4	-19.1	-12.1	-17.2	2.6	5.2	1.7	4.4
Furniture	20.4	24.8	16.0	20.7	-1.5	-4.1	-1.4	-4.6	49.9	62.5	39.7	52.7
Other manufacturing	11.3	14.8	8.9	12.7	-6.8	-9.7	-6.0	-10.2	33.5	47.6	28.8	43.6

Note: Protection rates using collection duties are based on the period 1988 to 2001.

3.3 International trade flows

SA is a middle-income country and faces competition from both high-income and low-income countries. In accordance with the Heckscher-Ohlin theorem, trade patterns are expected to differ as SA's relative factor endowments differ *vis-à-vis* each region. For example, SA has been shown to have a comparative advantage in skill-intensive products *vis-à-vis* developing countries, but less skill-intensive products *vis-à-vis* developed economies (Allenye and Subramanian, 2001). Hence the impact of import competition on mark-ups is expected to differ according to the region.

Table 3 presents data on manufacturing imports according to region. The average real value of manufacturing imports and the share of regional imports in total SA imports are analysed over the 1988-1994 and 1995-2002 periods. The average annual growth in imports between 1988 and 2002 is also presented.

Table 3: Manufacturing imports by region

	Average value (R mill, 1995 prices)		Share of total SA imports		Average annual growth
	1988-94	1995-02	1988-94	1995-02	1988-02
Africa	1,061	1,671	2%	2%	6%
China & India	769	4,701	1%	5%	20%
Rest of Asia	6,757	12,008	12%	12%	5%
South America	1,218	2,384	2%	2%	8%
Developed economies	46,417	73,338	79%	75%	4%
Eastern Europe	225	650	0%	1%	13%
European Union[1]	29,486	46,863	50%	48%	4%
Total	**56,448**	**94,753**	**96%**	**97%**	**5%**

Notes: Data sourced from Customs & Excise in current values. Data are deflated to 1995 prices using an import price deflator obtained from SASID (2004).

[1] The EU is included in Developed economies. Developed economies include EU, US, Canada, Japan, Australia and New Zealand.

Table 3 reveals large differences in the level and growth of imports across regions. Together these regions account for approximately 97% of total SA manufacturing imports. However, over 75% of SA manufacturing imports are obtained from developed economies, of which the EU is the primary source. Rest of Asia and Africa supply approximately 12% and 2% of SA imports, respectively. China & India supplied only 1% of SA manufacturing imports between 1988 and 1994, but this rose to an average of 5% between 1995 and 2002. This represents a 20% average annual growth in imports from these two countries between 1988 and 2002.

The sectoral composition of imports also differs across regions. Table 4 presents the average share structure of manufacturing imports from each region over the period 1990 to 2002.

Table 5 presents the top 5 sectors by average import value between 1990 and 2002 (see the Table Appendix for the data of all sectors).

Table 4: Average share structure of manufacturing imports according to region, 1990-2002

	Total	Africa	China & India	Rest of Asia	South America	Developed countries	Eastern Europe	EU
Food	4%	12%	5%	8%	39%	2%	7%	2%
Beverages	1%	1%	0%	0%	0%	1%	0%	1%
Tobacco	0%	0%	0%	0%	0%	0%	0%	0%
Textiles	2%	6%	8%	9%	1%	1%	1%	1%
Wearing apparel	1%	8%	9%	2%	0%	0%	1%	0%
Leather products	1%	2%	4%	1%	2%	0%	0%	0%
Footwear	1%	2%	8%	2%	0%	0%	1%	0%
Wood products	1%	6%	0%	2%	2%	0%	0%	0%
Paper products	2%	1%	0%	1%	3%	2%	3%	3%
Printing & publishing	2%	0%	0%	1%	0%	2%	0%	2%
Coke & petroleum	2%	2%	2%	1%	0%	1%	0%	1%
Basic chemicals	8%	4%	6%	7%	10%	7%	18%	8%
Other chemicals	6%	2%	3%	3%	4%	7%	2%	8%
Rubber products	1%	1%	1%	1%	0%	1%	1%	1%
Plastic products	1%	0%	2%	2%	0%	1%	1%	1%
Glass products	1%	0%	1%	1%	1%	0%	3%	1%
Non-metallic minerals	1%	2%	2%	1%	2%	1%	1%	2%
Basic iron & steel	1%	3%	1%	1%	4%	2%	7%	2%
Non-ferrous metals	2%	8%	1%	1%	1%	2%	6%	1%
Metal products	3%	5%	5%	3%	1%	2%	2%	2%
Machinery & equipment	21%	9%	16%	22%	8%	23%	17%	25%
Electrical machinery	4%	3%	4%	4%	2%	4%	6%	5%
Communication equipment	8%	2%	8%	13%	0%	8%	5%	9%
Professional & scientific	4%	2%	2%	3%	0%	4%	2%	4%
Motor vehicles	15%	3%	1%	4%	14%	20%	9%	17%
Other transport	4%	8%	1%	2%	3%	5%	2%	2%
Furniture	0%	2%	1%	1%	0%	0%	1%	0%
Other manufacturing	4%	6%	7%	3%	0%	1%	1%	1%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 5: Top five sectors by average import value, 1990-2002

Total	Africa	China & India	Rest of Asia	South America	Developed countries	Eastern Europe	EU
Machinery & equipment	Food	Machinery & equipment	Machinery & equipment	Food	Machinery & equipment	Basic chemicals	Machinery & equipment
Motor vehicles	Machinery & equipment	Wearing apparel	Communication equipment	Motor vehicles	Motor vehicles	Machinery & equipment	Motor vehicles
Basic chemicals	Wearing apparel	Communication equipment	Textiles	Basic chemicals	Communication equipment	Motor vehicles	Communication equipment
Communication equipment	Other transport	Footwear	Food	Machinery & equipment	Basic chemicals	Food	Basic chemicals
Other chemicals	Non-ferrous metals	Textiles	Basic chemicals	Basic iron & steel	Other chemicals	Basic iron & steel	Other chemicals

Note: Sectors are presented in order of rank with the largest import sector placed first.

As shown in Table 4, imports for the economy as a whole are concentrated within the machinery and equipment (21%), motor vehicles (15%), communication equipment (8%) and basic chemicals sectors (8%). These are also the dominant sectors for imports from developed economies from which SA sources the bulk of its imports. Significant differences, however, emerge in relation to imports from the other regions. Imports from Africa are largely concentrated in natural resource and labour-intensive products such as food (12%), non-ferrous metals (8%) and clothing (8%). Imports from China and India are concentrated in labour-intensive industries such as wearing apparel (9%), textiles (8%) and footwear (8%), as well as relatively skill-intensive sectors such as machinery & equipment (16%) and communication equipment (8%). Imports from Eastern Europe and South America are from similar sectors and include motor vehicles, machinery & equipment, basic chemicals, food and basic iron & steel.

Additional insight into the impact of regional trade on domestic consumption is provided in Table 6, which presents average import penetration by region during the period 1990-2002. Import penetration values are calculated as the share of regional imports in gross domestic expenditure for each sector.

Table 6: Average import penetration by region, 1990-2002

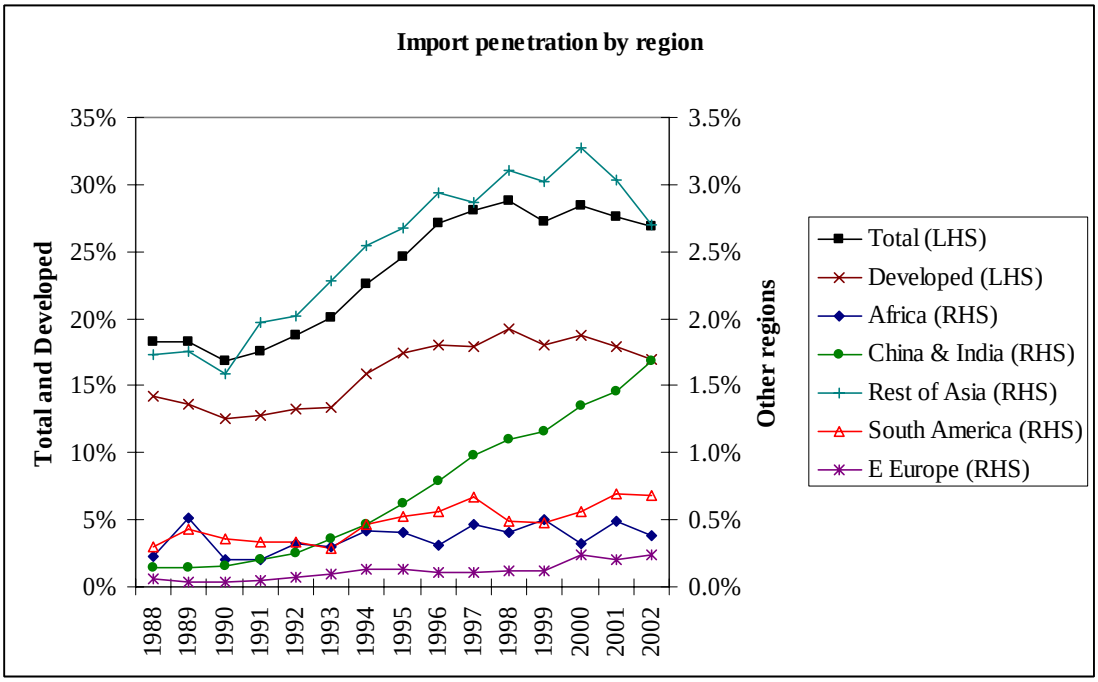
	Total	Africa	China & India	Rest of Asia	South America	Developed countries	Eastern Europe	EU
Food	8%	0%	0%	2%	2%	3%	0%	1%
Beverages	5%	0%	0%	0%	0%	4%	0%	3%
Tobacco	2%	0%	0%	0%	0%	1%	0%	0%
Textiles	26%	1%	3%	10%	0%	7%	0%	5%
Wearing apparel	12%	1%	3%	3%	0%	2%	0%	1%
Leather products	33%	2%	9%	7%	2%	11%	0%	8%
Footwear	25%	1%	9%	8%	0%	4%	0%	3%
Wood products	11%	1%	0%	3%	1%	4%	0%	2%
Paper products	13%	0%	0%	1%	0%	10%	0%	7%
Printing & publishing	19%	0%	0%	1%	0%	10%	0%	6%
Coke & petroleum	17%	0%	0%	1%	0%	3%	0%	1%
Basic chemicals	45%	0%	1%	4%	1%	27%	1%	20%
Other chemicals	24%	0%	0%	1%	0%	17%	0%	13%
Rubber products	27%	0%	1%	3%	0%	17%	0%	10%
Plastic products	12%	0%	1%	2%	0%	10%	0%	7%
Glass products	22%	0%	1%	4%	1%	11%	1%	9%
Non-metallic minerals	14%	0%	1%	1%	0%	9%	0%	7%
Basic iron & steel	12%	0%	0%	1%	1%	7%	0%	5%
Non-ferrous metals	20%	1%	0%	1%	0%	16%	0%	5%
Metal products	13%	0%	1%	2%	0%	6%	0%	5%
Machinery & equipment	62%	0%	1%	7%	0%	43%	0%	29%
Electrical machinery	30%	0%	1%	3%	0%	21%	0%	15%
Communication equipment	66%	0%	2%	13%	0%	45%	0%	33%
Professional & scientific	79%	1%	1%	6%	0%	63%	0%	37%
Motor vehicles	34%	0%	0%	1%	1%	28%	0%	15%
Other transport	61%	2%	1%	3%	1%	44%	0%	12%
Furniture	11%	1%	0%	1%	0%	5%	0%	4%
Other manufacturing	26%	0%	1%	2%	0%	4%	0%	3%
Total manufacturing	25%	0%	1%	3%	1%	16%	0%	11%

Note: Import penetration is calculated as imports divided by gross domestic expenditure.

Looking at the total column in Table 6, an average of 25% of gross domestic expenditure on manufacturing goods was made up of imports during 1990-2002. Import penetration, however, is strongest in the professional & scientific equipment (79%), communication equipment (66%), machinery & equipment (62%) and motor vehicles (61%) sectors. Much of the import penetration within these sectors arises from trade with developed economies. Looking at the other regions, we note high levels of import penetration by the Rest of Asia in communication equipment (13%), textiles (10%) and footwear (8%). China & India shows strong import penetration in footwear and leather products (9% each). Very low levels of import penetration are shown by the other regions, reflecting relatively small import volumes from these regions.

Of particular interest to this study is the rise in import penetration from 1988 and the potential impact that this has had on mark-ups in the domestic economy. Figure 5 presents the trend in import penetration in total manufacturing for each region between 1988 and 2002. Total import penetration and import penetration by developed economies correspond to the left axis (LHS) and all other regions to the right axis (RHS).

Figure 5: Import penetration by region



Note: Import penetration is calculated as the share imports in gross domestic expenditure (output plus imports minus exports) measured in 1995 prices.

As shown in Figure 5, import penetration in manufacturing (see Total) rose strongly during the 1990s before levelling off from 1999. During the 1990s import penetration rose from 17% to almost 30%. The rise in import penetration was driven by strong increases in imports from China and India (0.1% to 1.7%) and the Rest of Asia (1.7% to 2.7%). Import penetration by developed economies also increased, but at a slower rate. Although import penetration by the remaining countries rose, they still account for a very low share of overall trade.

Table 7 presents the five sectors experiencing the strongest growth in import penetration between 1990 and 2002 for each region. A table presenting the growth in import penetration for all sectors across the various regions can be found in the Table Appendix.

Table 7: Sectors experiencing strongest increase in import penetration by regions, 1990-2002

Total	Africa	China & India	Rest of Asia	South America	Developed countries	Eastern Europe	EU
Professional & scientific	Other transport	Footwear	Communication equipment	Leather products	Professional & scientific	Glass products	Professional & scientific
Communication equipment	Leather products	Leather products	Textiles	Food	Communication equipment	Basic chemicals	Communication equipment
Machinery & equipment	Wearing apparel	Wearing apparel	Footwear	Basic chemicals	Other transport	Non-ferrous metals	Machinery & equipment
Other transport	Wood products	Textiles	Leather products	Other transport	Machinery & equipment	Professional & scientific	Basic chemicals
Basic chemicals	Non-ferrous metals	Communication equipment	Machinery & equipment	Glass products	Motor vehicles	Basic iron & steel	Motor vehicles

There is substantial sectoral variation in the change in import penetration by region. For the manufacturing sector as a whole the strongest growth in import penetration occurred in the professional and scientific equipment, communication equipment, machinery and equipment, other transport and basic chemical sectors. Much of this was driven by increased imports from developed economies. These sectors are all relatively skill-intensive sectors and the shift reflects the comparative advantage of developed economies to skill-intensive sectors. Looking at China and India, Rest of Asia and Africa, the strongest increases in import penetration occurred in labour-intensive sectors such as clothing, leather products and footwear. These trends are also consistent with relative factor endowments which give these economies a comparative advantage in labour intensive products. Import penetration by South America and Eastern Europe is mixed with increases occurring in natural resource intensive sectors such as iron & steel and non-ferrous metals, as well as other sectors such as glass products and basic chemicals.

3.4 Summary

This section serves to highlight the progress SA has made in liberalising its trade. Average tariffs have fallen from the early 1990s, although the extent of the decline is sensitive to the use of collection duties or scheduled rates and the inclusion of surcharge duties. This section also shows that SA import patterns differ across regions. We find strong differences in the sectoral composition of imports and the degree of import penetration across regions. This suggests that the impact of import penetration on mark-ups is likely to differ across regions. Given the structure of trade presented in this section, we expect import penetration from developed economies to have a greater impact on mark-ups in relatively skill-intensive sectors. Import penetration from China & India is expected to have the largest impact on mark-ups in the clothing and textiles sectors. Africa competes mainly in natural resource-intensive products.

4 RESULTS

This section presents estimates of the average mark-ups in SA industries from 1970 to 2002. These average mark-ups are then compared with those of other domestic and international studies. This section also investigates the market disciplining effects of tariff liberalisation and import penetration during the period 1988 to 2002.

4.1 Average mark-ups

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

$$NSR_{it} = \mu_i + \beta_1 mup_{it} + \varepsilon_{it}$$

where *mup* is $\alpha.[\Delta(w+l) - \Delta(r+k)]$ and β_1 is the estimated mark-up and μ_i is a sector-specific fixed effect. We also estimate mark-ups allowing for intermediate inputs (see equation 13).

Figure 6 presents the estimated average mark-up between 1970 and 2002 for the broadly defined economic sectors. In estimating the average mark-ups, industry-level fixed effects are imposed and a common mark-up is assumed across all sectors.[28] The averages exclude the agriculture sector, the government sector, other producer services and social services.[29] Table 8 presents a further breakdown of the average mark-ups according to decade.

[28] We also estimate the average mark-up using a mean group estimator. The average mark-up, excluding intermediates, for mining, manufacturing and services between 1970 and 2002 are 101%, 67% and 86%, respectively. Average mark-ups once intermediate inputs are accounted for are 47%, 13% and 40%, respectively. The trends in mark-ups using the mean group estimator are similar to those found when using the fixed effects estimator.

[29] These sectors are excluded as they either show highly volatile estimated mark-ups due to poor data or do not represent groupings of relatively homogeneous industries.

Figure 6: Average mark-up, 1970-2002

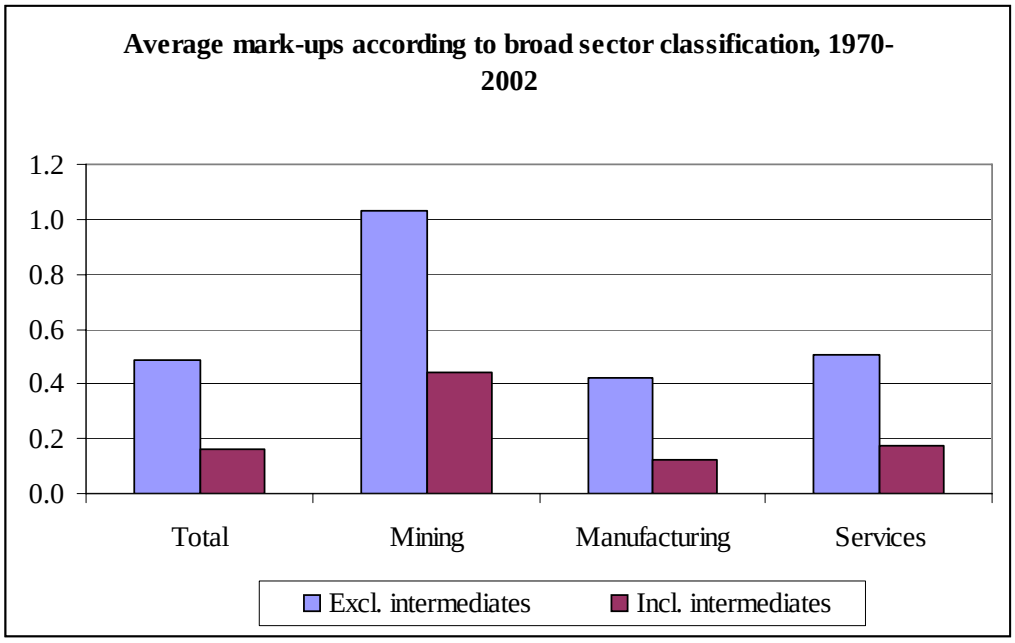


Table 8: Average mark-up by broad economic sector and decade

	1970-2002 Mark-up		1970s Mark-up		1980s Mark-up		1990-94 Mark-up		1995-2002 Mark-up	
Excluding intermediate inputs										
Mining	1.032	**	2.501	**	0.519		0.840	**	0.488	
Manufacturing	0.424	**	0.611	**	0.421	**	0.547	**	0.183	*
Services	0.504	**	0.424	**	0.360	**	0.784	**	0.923	**
Including intermediate inputs										
Mining	0.441	**	0.466	**	0.270		0.381	**	0.376	**
Manufacturing	0.125	**	0.097	**	0.076	**	0.183	**	0.185	**
Services	0.173	**	-0.048		0.148	**	0.311	**	0.281	**

*Note: Mark-ups are estimated separately for each sector and sub-sector. Fixed effects are included for each sector. * and ** represent significance at the 10% and 5% level, respectively.*

As shown in Figure 6 and Table 8 , the estimated mark-up is strongly influenced by the inclusion or exclusion of intermediate inputs. As found in most empirical research, the inclusion of intermediate inputs reduces the estimated mark-up. The average mark-up between 1970 and 2002 for the entire economy equals 0.49 when intermediates are excluded and 0.17 when intermediates are included. Looking at the results including intermediates, the mining sector has the highest average mark-up (0.44) and is followed by the services sector (0.17) and manufacturing sector (0.13).

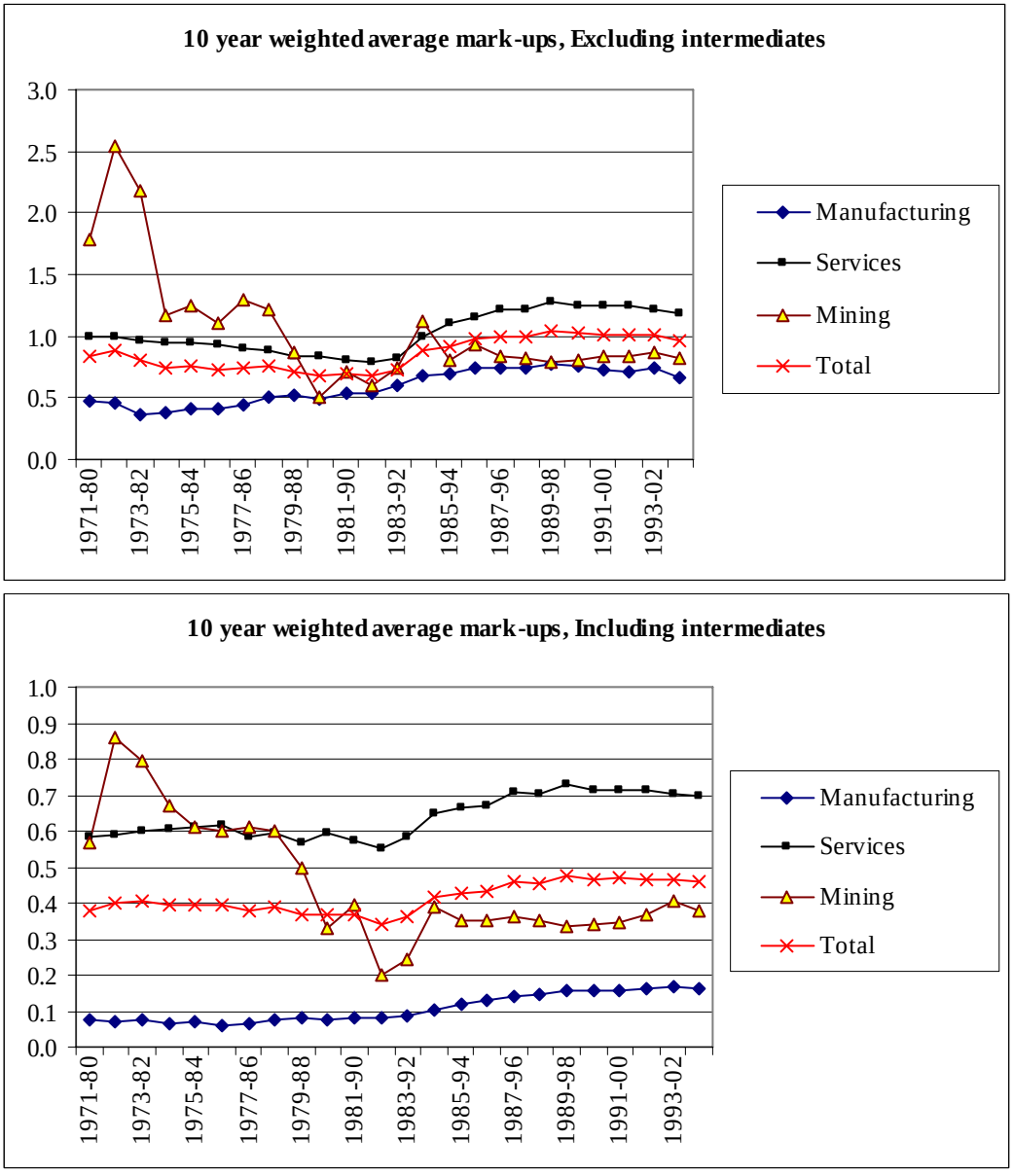
Looking at the trends, average mark-ups are lower in the 1980s than in the 1970s in almost all cases. Average mark-ups, however, are significantly higher in the early 1990s. The increase in mark-ups corresponds with high surcharges imposed during this period and is therefore consistent with the view that mark-ups rise under protection. Mark-ups then appear to decline or remain constant during the period of liberalisation from 1994-2002. Average mark-ups in mining and

manufacturing fall if intermediate inputs are excluded in the estimation, but are constant if intermediate inputs are included. Mark-ups in the services sector rise if intermediate inputs are excluded, but are constant if intermediate inputs are included.

Similar trends are also shown in Figure 7 which presents the weighted average mark-up for a sequence of 10 yearly observations between 1970 and 2003. The sector level mark-ups used to construct this diagram are presented in Figure 11 and Figure 12 in the Figure Appendix.

As shown in Figure 7, average mark-ups rise during the late 1980s and early 1990s and then stabilise from the mid-1990s.

Figure 7: 10-year average weighted mark-ups



Note: Excludes agriculture, other producers, government services, tobacco and other manufacturing. Total real output by sector between 1990 and 2002 is used as weights.

Turning to a sector level analysis of mark-ups, Figure 8 presents the average mark-up for each sector over the period 1970-2002. As is clear from Figure 8 there is considerable variation in the average level of mark-ups across sectors. Relatively high mark-ups in excess of 50% are found in agriculture, gold & uranium mining, other mining, electricity & water, wholesale & retail trade, transport & storage and business services. Some caution in interpreting these values is required as the accuracy of the estimations is dependent on the quality of the capital stock data. The highest mark-ups in manufacturing (in excess of 18%) are found in glass products, non-metallic minerals, coke & petroleum products, beverages and professional & scientific equipment.

Considerable variation in mark-ups during the different decades is also found at sector level (Table 9 and Table 10. See also Figure 11 and Figure 12 in the Figure Appendix). Estimated average mark-ups rose for most sectors (30-31 out of 42 sectors) during the early 1990s relative to the 1980s, irrespective of whether intermediate inputs are included or not. The increase in mark-ups, however, moderated during the late 1990s. Average mark-ups fell for 23 of the 42 sectors when intermediates are excluded and 18 sectors when intermediates are included. The slow-down in the increase in mark-ups appears to coincide with the accelerated programme of tariff liberalisation from 1994.

Figure 8: Average mark-ups by sector, 1970-2002

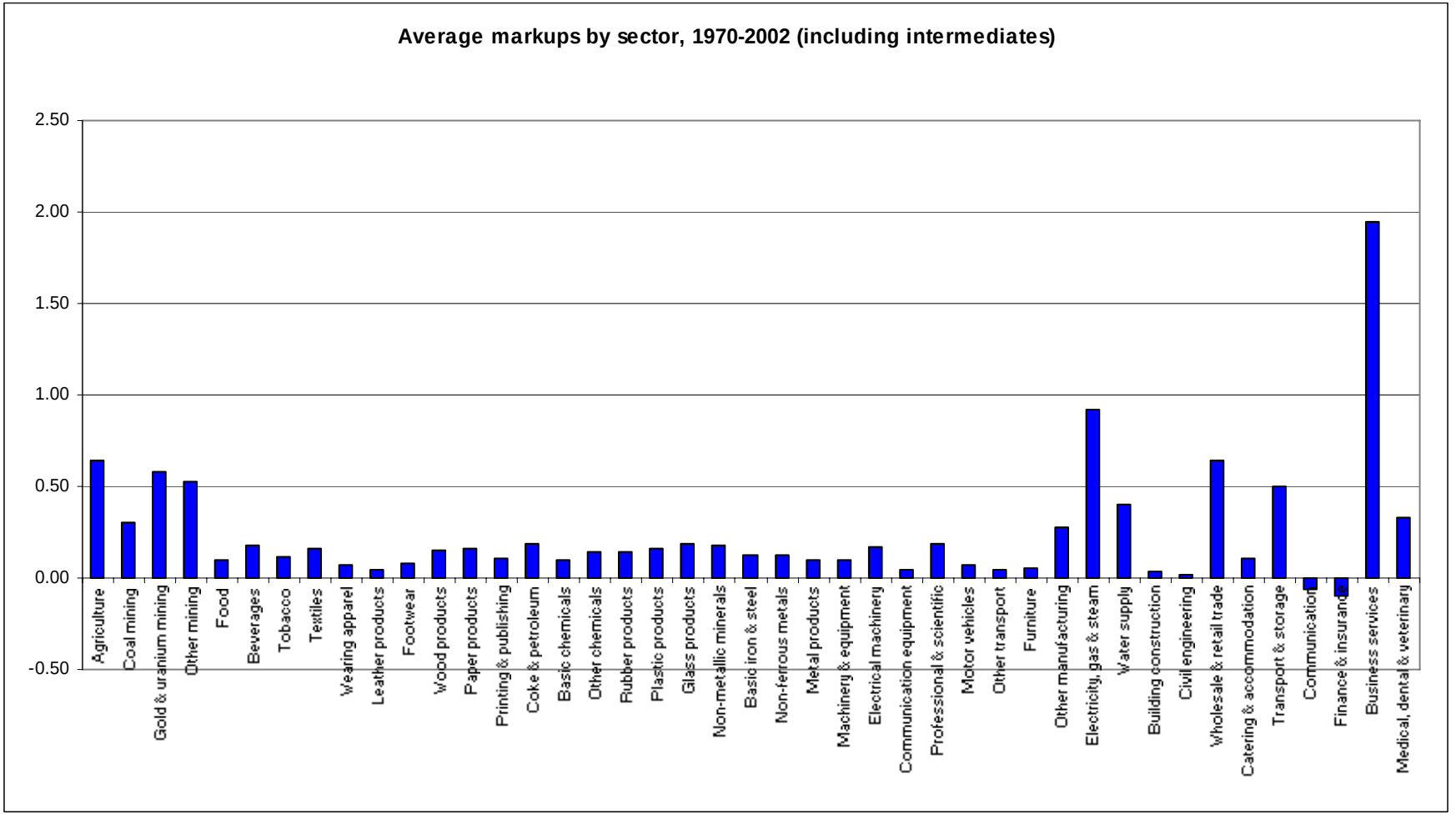


Table 9: Average mark-up by sector and decade, excluding intermediates

	1970-2002		1970s		1980s		1990-2002		1990-94		1994-2002	
	Coef.		Coef.		Coef.		Coef.		Coef.		Coef.	
Agriculture	1.67	**	2.14		1.48	*	1.84	**	1.91		1.60	
Coal mining	0.95	**	0.28		0.54		1.03	**	0.78	**	1.31	*
Gold and uranium mining	0.69	*	2.79		0.20		0.38		0.86	**	-0.28	
Other mining	1.56	**	5.09	**	0.74		1.25	**	0.87	*	2.12	**
Food	0.64	**	1.17	**	0.39	**	0.70	**	0.56	**	1.12	*
Beverages	1.06	**	0.89		1.02	*	1.53	**	1.17	**	2.26	**
Tobacco	3.33	**	7.11	**	4.59		2.32		3.18	**	0.25	
Textiles	0.55	**	0.85	**	0.24		1.25	**	1.40	**	1.15	
Wearing apparel	0.10		0.42	**	0.19	*	0.02		0.19	**	-0.30	
Leather products	0.08		0.07		0.13	**	0.10		-0.43		0.30	
Footwear	0.13		0.14	**	0.08	*	0.21		0.10	**	0.40	
Wood products	0.33		0.51		0.39		0.38		0.94	**	0.06	
Paper products	0.81	**	0.51	*	0.91	**	0.88	**	0.60	**	1.57	*
Printing & publishing	0.23	**	0.44	**	0.40	*	0.24	*	0.56	**	0.00	
Coke & petroleum	2.30	**	1.81	**	2.38	**	2.72	**	3.35	**	0.84	
Basic chemicals	0.84	**	1.06	**	0.71	**	0.86	**	0.78	**	1.11	
Other chemicals	0.63	**	1.11		0.52	**	0.76	*	1.22	**	-0.05	
Rubber products	0.29	**	0.48	**	0.46	**	0.10		0.55	**	-0.23	
Plastic products	0.36	**	0.49	*	0.61	**	0.18		0.56	**	-0.32	
Glass products	0.47	**	0.40	**	0.41	**	0.59		0.52	**	0.68	
Non-metallic minerals	0.53	**	0.94	**	0.48	**	0.49	*	0.35	**	0.97	
Basic iron & steel	0.48	**	0.56	**	0.30	**	0.64		0.41	**	0.85	
Non-ferrous metals	0.68	**	0.61	**	0.48	**	1.02	**	1.00	**	-0.01	
Metal products	0.37	**	0.73	**	0.28	*	0.46	**	0.21	**	1.57	**
Machinery and equipment	0.28	**	0.06		0.21	**	0.53	*	0.87	**	0.19	
Electrical machinery	0.56	**	0.59		0.37	**	0.70	**	1.29	**	-0.03	
Communication equipment	0.13		0.17		0.24	*	0.07		0.22	**	-0.24	
Professional and scientific	0.86	**	0.25		0.40		1.74	**	1.80	**	1.69	
Motor vehicles	0.45	**	0.37	**	0.38		0.79	*	0.65	**	1.16	
Other transport equipment	0.11		0.74	**	0.33	*	-0.13		0.47	**	-0.31	
Furniture	0.19	**	0.49	**	0.13		0.22		0.19	**	0.22	
Other manufacturing	2.02	**	1.91	**	1.68	**	3.83	**	3.57	*	4.18	**
Electricity, gas and steam	1.94	**	1.12		2.64	**	1.59	**	2.36	**	0.59	
Water supply	1.18	**	2.87		1.26		0.99	**	2.15	**	0.50	
Building construction	0.11	*	0.08		-0.01		0.19	**	0.11		0.47	**
Civil engineering	0.06		0.04		-0.04		0.19	**	0.11		0.47	**
Wholesale and retail trade	0.72	**	0.67	*	0.64	**	0.86	**	0.82	**	0.97	**
Catering and accommodation	0.53	**	0.37		0.53	**	0.87	**	0.91	**	0.80	**
Transport and storage	0.56	**	0.54	**	0.38	**	1.06	**	1.11	**	1.01	**
Communication	0.19	**	0.15	**	0.11	**	0.40	**	0.33	**	1.16	**
Finance and insurance	0.70	**	0.50	**	0.48	**	1.23	**	1.24	**	1.19	**
Business services	2.62	**	3.22	**	2.17	**	2.76	**	3.16	**	2.82	**
Medical, dental and veterinary	0.76	**	1.08	**	0.51	**	1.01	**	1.07	**	0.94	**
Excluding medical, dental and veterinary services	0.98	**	0.90	**	0.66	**	1.36	**	1.75	**	1.03	**
Other producers	0.01	**	0.00		0.01	**	0.01	**	0.01		0.02	**

*Note: * and ** represent significance at the 10% and 5% level, respectively.*

Table 10: Average mark-up by sector and decade, including intermediates

	1970-2002		1970s		1980s		1990-2002		1990-94		1994-2002	
	Coef.		Coef.		Coef.		Coef.		Coef.		Coef.	
Agriculture	0.65	**	0.94	*	0.75	**	0.61	**	0.58	*	0.63	*
Coal mining	0.30	**	0.29	**	0.07		0.37	**	0.28	**	0.50	**
Gold & uranium mining	0.58	**	0.89	**	0.32		0.33	**	0.48	**	0.09	
Other mining	0.53	**	0.59		0.48	**	0.49	**	0.41	**	0.65	**
Food	0.10	**	0.09	**	0.06	**	0.13	**	0.10	**	0.17	**
Beverages	0.18	**	0.22	**	0.10		0.28	**	0.22	**	0.36	**
Tobacco	0.11		0.06		-0.33		0.57	**	0.46	**	0.62	**
Textiles	0.16	**	0.18	**	0.13	**	0.19	**	0.18	**	0.20	**
Wearing apparel	0.08	**	0.13	**	0.07	**	0.08		0.09	**	0.07	
Leather products	0.05		0.03	**	0.02	**	0.12		-0.06		0.17	
Footwear	0.08	**	0.05	**	0.05	**	0.14	**	0.04	**	0.21	**
Wood products	0.15	**	0.12	**	0.08	*	0.25	**	0.22	**	0.31	**
Paper products	0.16	**	0.06		0.14	**	0.24	**	0.14	**	0.31	**
Printing & publishing	0.11	**	0.15	**	0.13	**	0.10	*	0.19	**	0.02	
Coke & petroleum	0.19	**	0.16		0.11		0.29	**	0.38	**	0.15	**
Basic chemicals	0.10	**	0.11	**	0.09	**	0.18	**	0.13	**	0.34	**
Other chemicals	0.14	**	0.10		0.09	**	0.22	**	0.22	**	0.21	**
Rubber products	0.14	**	0.16	**	0.17	**	0.11	*	0.16	**	0.08	
Plastic products	0.16	**	0.14	**	0.12	*	0.20	**	0.15	**	0.26	*
Glass products	0.19	**	0.10	**	0.10	**	0.33	**	0.17		0.39	**
Non-metallic minerals	0.18	**	0.22	**	0.12	**	0.22	**	0.12	**	0.37	**
Basic iron & steel	0.12	**	0.10	**	0.07	**	0.17	**	0.08	**	0.24	**
Non-ferrous metals	0.12	**	0.05	**	0.06	**	0.23	**	0.25	**	0.16	
Metal products	0.09	**	0.12	**	0.07		0.12	**	0.05		0.27	**
Machinery & equipment	0.10	**	0.10		0.04	*	0.18	**	0.17	**	0.19	*
Electrical machinery	0.17	**	0.11	**	0.09	**	0.21	**	0.25	**	0.14	*
Communication equipment	0.04	*	0.04	**	0.04	**	0.05		0.06	**	0.03	
Professional & scientific	0.18	**	0.14	**	0.12	**	0.22	*	0.23	**	0.22	
Motor vehicles	0.08	**	0.04	*	0.06	*	0.14	**	0.10	**	0.15	**
Other transport	0.05		0.18		0.06		-0.02		0.20	**	-0.25	
Furniture	0.06	**	0.02		0.08	**	0.06		0.09	**	0.04	
Other manufacturing	0.28	**	-0.06		0.29	**	0.51	**	0.50	**	0.56	**
Electricity, gas & steam	0.92	**	1.29	**	1.07	**	0.68	**	0.85	**	0.51	
Water supply	0.40	**	1.07	**	0.74	**	0.17	**	0.38	**	0.08	
Building construction	0.04	**	0.00		0.02		0.05	*	0.04		0.11	
Civil engineering	0.02	*	-0.03		-0.01		0.05	**	0.04		0.06	**
Wholesale & retail trade	0.64	**	0.58	*	0.59	**	0.74	**	0.70	**	0.85	**
Catering & accommodation	0.11		0.04		-0.13		0.09		0.04		0.16	
Transport & storage	0.50	**	0.56	**	0.37	**	0.69	**	0.88	**	0.47	**
Communication	-0.07		0.07		-0.30		0.07		0.04		0.33	
Finance & insurance	-0.10		-0.51	**	0.22		0.40	**	0.44	*	0.39	**
Business services	1.95	**	2.67	**	1.89	**	1.77	**	2.05	**	1.77	**
Medical, dental & veterinary	0.33	**	0.42	**	0.21	**	0.40	**	0.42	**	0.37	**
Excluding medical, dental & veterinary services	0.10		-0.28	*	0.30		0.28	**	0.25	**	0.34	**
Other producers	-0.06		-0.10	*	-0.14		0.04		0.03		-0.07	

*Note: * and ** represent significance at the 10%- and 5%-level, respectively.*

4.2 Comparison of estimated mark-ups with other studies

In this section we briefly compare our results with those of Fedderke *et al.* (2003) who use a similar approach to estimate average mark-ups in SA manufacturing over the period 1970-1997. We also compare the level of mark-ups in SA with a range of other countries. The data used in the cross-country comparison are drawn largely from Martins *et al.* (1996) and Martins and Scarpetta (1999).

These results for manufacturing differ slightly from those estimated by Fedderke *et al.* (2003). Their estimates of the magnitude of average mark-ups in SA manufacturing lie in the range of 72-79% (compared to 42% for this study) when intermediate inputs are excluded and 6-9% (compared to 13%) when intermediate inputs are included. Our study therefore produces lower estimated mark-ups when intermediate inputs are excluded and higher mark-ups when intermediates are included. There are various explanations for the differences in results that suggest that the results are relatively consistent across the two studies.

Firstly, Fedderke *et al.* (2003) impose constant depreciation rates (5% and 10%) across sectors in their estimations. The results of their study suggest that higher depreciation rates reduce the estimated mark-up when excluding intermediate inputs and raise the mark-up when including intermediate inputs. The depreciation rates used in this study vary across sectors and are on average higher (14.6%) than those used in Fedderke *et al.* (2003). Given the apparent relationship between estimated mark-ups and the level of depreciation in the Fedderke *et al.* (2003) study, the higher average depreciation rates used in this study will have contributed towards the lower estimated mark-up when excluding intermediate inputs and the higher estimated mark-up when including intermediate inputs.

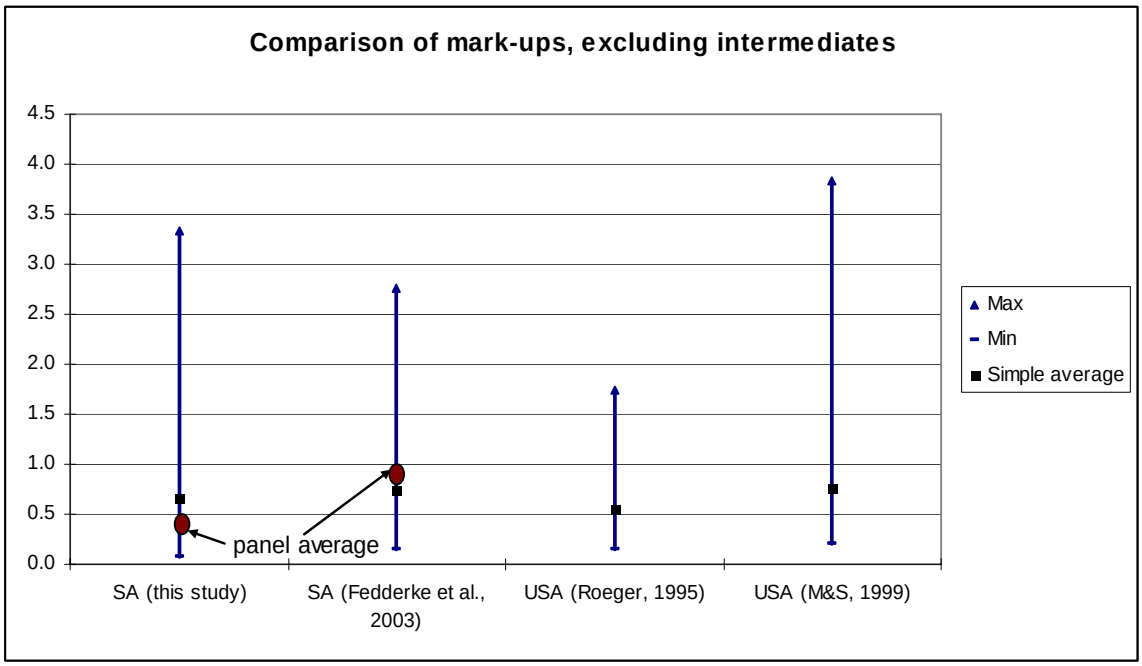
Secondly, this study covers a longer period than that of Fedderke *et al.* (2003) (1970-2002 compared to 1970-97). This study finds that average mark-ups fell during the late 1990s when excluding intermediate inputs, but stabilised, after strong increases during the 1980s, when including intermediate inputs. The extension of the data period from 1970-97 to 1970-2002 will, therefore, have reduced average mark-ups when excluding intermediates and increased mark-ups when including intermediate inputs.

Finally, Fedderke *et al.* (2003) use dynamic panel estimation techniques that enforce parameter homogeneity (across sectors) in estimating the long-run mark-up, but allow for short-run heterogeneity in mark-ups across sectors. Because our primary focus is on the relatively short period 1988-2002, we use a static fixed effects model in which we impose a common mark-up across sectors. When we use a mean group estimator that allows for heterogeneity across sectors, our average mark-up rises to 57%. The use of different estimators has therefore also contributed to differences in the estimated level of mark-ups.

For an international comparison of the level of mark-ups in SA, we draw on Martins *et al.* (1996) and Martins and Scarpetta (1999) who use a similar approach to this study. Nevertheless, these comparisons are made with caution, as the estimated mark-ups are sensitive to different empirical methodologies, time periods, data aggregation, and data measurement. The omission of important variables in the regression estimations can also lead to omitted variable bias (see Fedderke *et al.*, 2003).

Figure 9 presents various estimates of the mark-ups for manufacturing in the USA and SA. These mark-ups are estimated excluding intermediate inputs. Figure 10 presents a cross- country comparison of mark-ups taking into account intermediate inputs. To capture the variation in estimated mark-ups at the sector level, the maximum, the minimum and the simple average mark-up are presented in each figure. Particular care must be taken in interpreting the average, as the international studies use more disaggregated sector level data. The sector level estimates are presented in Table 17 and Table 18 in the Table Appendix.[30]

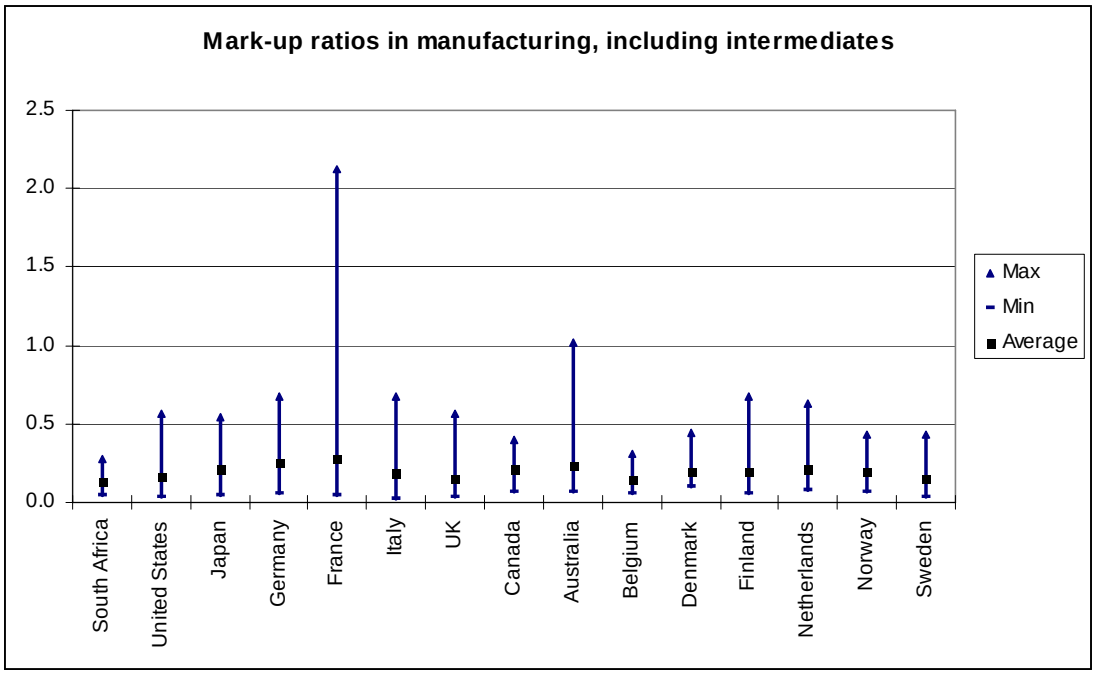
Figure 9: Comparison of mark-ups between USA and SA, excluding intermediates



Source: Own calculations and Martins and Scarpetta (1999) and Fedderke et al. (2003).
Note: The Roeger (1995) estimated mark-ups for the USA are based on the periods 1953-84 while those of Martins and Scarpetta (1999) are based on the period 1970-92.

[30] Some care must be taken when drawing comparisons across countries. Although a similar methodology (the Roeger (1995) approach) is used to derive the mark-up, differences in time period, sector aggregation and estimation techniques affect the results. The international studies, for example, use a more disaggregated sector classification than the SA studies. In many cases, these sub-sectors have relatively high mark-ups, leading to a wider range and a higher simple average. A further problem with these comparisons is that the estimates of the mark-ups may suffer from omitted variable bias as other factors such as industry concentration, import penetration, etc. are not included in the estimation. Although the direction of the bias should be consistent across studies, the size of the bias is not known.

Figure 10: Cross-county comparison of mark-ups, including intermediates



Source: Own calculations and Martins et al. (1996).

Note: Mark-ups for foreign countries and SA are based on the periods 1970-92 and 1970-2002, respectively. Estimated mark-ups not statistically different from zero are excluded.

Looking first at the mark-ups estimated excluding intermediate inputs (Figure 9), the simple unweighted average mark-up across sectors ranges from 55% to 76%. The average mark-up in SA manufacturing falls in the middle to upper end of this range. The average mark-up in SA manufacturing is also very close to the median mark-up of 41 countries studied by Hoekman *et al*. (2001), although the methodology used in the studies differ. Taking intermediate inputs into account (Figure 9) leads to lower mark-ups across all countries. Estimated mark-ups taking intermediate inputs into account range from 13% to 25% with SA at the lower end of this range.

There is, however, substantial variation in estimated mark-ups across sectors, as is reflected in the maximum and minimum values in both figures. When excluding intermediates, mark-ups in SA range from 8% (leather) to 333% (tobacco). A wide variation in estimated mark-ups is also found by Martins and Scarpetta (1999) for the USA (21% to 384%), with the tobacco sector also revealed to have the highest mark-ups. The sectoral structure of mark-ups (excluding intermediates) also appears to be similar to that of the USA. The Pearson's correlation coefficients between mark-ups in this study and those of the two US studies exceed 0.78.

A much lower range of mark-ups is found when intermediate inputs are incorporated (Figure 9). SA tends to have a narrower range of mark-ups across industries than many of the comparator countries, although this may arise from the more aggregated sector classification in the SA data. The sectoral structure of mark-ups in SA also differs from countries once intermediate inputs are accounted for. The Pearson's correlation coefficient between mark-ups in SA and the comparator

countries is lower than 0.45 in all cases. The Spearman rank correlation coefficients are also poor (-0.07 to 0.53).

In conclusion, mark-ups in SA industries appear to fall within the range of mark-ups estimated in international studies. The range of mark-ups, however, is sensitive to the inclusion of intermediate inputs. When intermediate inputs are not taken into account, the sectoral structure of mark-ups in SA is similar to that of the USA. However, once intermediate inputs are accounted for, we find little correlation in mark-ups in manufacturing between SA and a range of international countries. The sectoral differences in mark-ups may reflect domestic factors such as competition policy, openness, the number of domestic firms, etc., which have been shown to affect mark-ups (Fedderke *et al*., 2003; Kee and Hoekman, 2003). More cross-country comparisons using similar methodologies are thus required to firmly establish the relative mark-up in SA industries.

4.3 Trade liberalisation and mark-ups

In this section we present estimates of the impact of trade liberalisation on mark-ups. To examine the marginal impact of trade liberalisation on mark-ups we estimate a simplified form of equation (16) which is reproduced below.

$$NSR_{it} = (\delta_0 + \delta_1 \ln T_{it}) * mup_{it} + \mu_i + \varepsilon_{it}$$

T represents the tariff rates and μ_i is a sector-specific fixed effect. To test the robustness of the relationship to the choice of tariff data, we measure protection using nominal and effective protection rates calculated from collection duties and scheduled tariff rates, both including and excluding surcharges. We also interact the tariff variable with a dummy for 1995-2002 to isolate variations in the impact across time periods. The analysis is confined to the period 1988-2002 for which tariff data are available.

The impact of nominal tariff protection and effective tariff protection on mark-ups is presented in Table 11 and Table 12, respectively. The tariff coefficients measure the impact of a 1%-decline in tariff protection on the level of the mark-up. The variable “Tariff 95-02” captures the additional impact of tariffs on mark-ups during the period 1995-2002.

Table 11: Impact of tariff liberalisation on mark-ups in manufacturing, 1988-2002

	Collection duties		Collection duties incl. surcharges		Tariffs		Tariff incl. surcharges	
	Coef.		Coef.		Coef.		Coef.	
Excluding intermediate inputs								
Mark-up	0.180		0.150		0.220		0.198	
Tariff	0.141	**	0.136	**	0.104		0.105	*
Tariff 95-02	-0.046		-0.026		-0.089	*	-0.080	
N	392		392		420		420	
F	20.6	**	20.9	**	16.5	**	16.7	**
Including intermediate inputs								
Mark-up	0.175	**	0.176	**	0.150	**	0.147	**
Tariff	-0.005		-0.005		0.008		0.009	
Tariff 95-02	0.026	**	0.025	**	0.018	*	0.019	*
N	392		392		420		420	
F	110.7	**	110.8	**	87.3	**	87.4	**

*Note: * and ** represent significance at the 10%- and 5%-level, respectively. The coefficient on "Tariff 95-02" measures the additional impact of tariffs on mark-ups during the second period. Sector-specific effects (fixed effects) are imposed. The estimations using collection data are for the period 1988-2001.*

The results in Table 11 provide evidence for the market disciplining effects of trade liberalisation. In the regressions in which intermediate inputs are excluded, the tariff variable is positive and significantly different from zero (at the 10%-level) for most of the regressions. The results suggest that a 1%-decline in tariff rates reduces mark-ups by 10 to 14 percentage points on average. The impact during the period 1995-2002 is not significantly different from the earlier period 1988-1994.

Consistent results are obtained when intermediate inputs are included. However, the impact appears to be concentrated in the second period 1995-2002 with no significant relationship between tariffs and mark-ups during 1988-1994. A 1%-reduction in tariffs during the second period is estimated to reduce average mark-ups in manufacturing by approximately two percentage points.

Consistent results are also found when using effective rates of protection (Table 12). One advantage of using effective rates of protection is that changes in protection on intermediate inputs are also taken into account. We are therefore able to estimate the change in effective protection on services under the assumption that nominal output tariffs for these sectors are constant and equal to zero. Table 12 therefore presents results separately for all sectors (excluding agriculture, other services and government) and manufacturing.

Table 12: Impact of effective rates of protection on mark-ups

	Collection duties		Collection duties incl. surcharges		Tariffs		Tariff incl. surcharges	
	Coef.		Coef.		Coef.		Coef.	
Excluding intermediate inputs								
Manufacturing								
Mark-up	0.403	**	0.379	**	0.383	**	0.368	**
ERP	0.001		0.002		0.001		0.001	
ERP 95-02	-0.003		-0.003		-0.002		-0.002	
N	392		392		420		420	
F	18.88	**	19.06	**	14.85	**	14.98	**
All sectors								
Mark-up	0.601	**	0.594	**	0.574	**	0.570	**
ERP	-0.004		-0.002		-0.001		-0.001	
ERP 95-02	-0.001		-0.003		-0.002		-0.003	
N	602		602		645		645	
F	63.09	**	62.56	**	52.46	**	52.22	**
Including intermediate inputs								
Manufacturing								
Mark-up	0.168	**	0.165	**	0.171	**	0.169	**
ERP	0.000		0.000		0.000		0.000	
ERP 95-02	0.002	**	0.002	**	0.001	**	0.001	**
N	392		392		420		420	
F	115.94	**	116.7	**	89.72	**	90.08	**
All sectors								
Mark-up	0.246	**	0.242	**	0.244	**	0.243	**
ERP	-0.002	**	-0.001		-0.001		-0.001	
ERP 95-02	0.003	**	0.002	*	0.001		0.001	
N	602		602		645		645	
F	103.69	**	102.92	**	100.82	**	100.54	**

*Note: The interaction term here is ERP*mup, not ln(ERP)*mup as there are negative ERP values. * and ** represent significance at the 10%- and 5%-level, respectively.*

No significant relationship between effective protection and mark-ups is found for the whole sample or manufacturing alone when intermediate inputs are excluded. When intermediate inputs are included, a weakly significant (at the 10%-level) positive relationship between effective protection and mark-ups is found for the full sample, but only when using collection duties and only for the period 1995-2002. For manufacturing, the relationship is robust to the choice of tariff data, but is also only significant in the second period (1995-2002). A one percentage point reduction in ERP is estimated to reduce average mark-ups in manufacturing by 0.2 percentage points.

These results are broadly supportive of the view that tariff liberalisation during the 1990s, and from 1995 in particular, lowered average mark-ups in SA industries. Lower tariffs reduced import prices forcing firms to reduce their own prices and hence mark-ups. Consumers benefited in the form of lower product prices.

4.4 Import penetration and mark-ups

An alternative approach to estimating the impact of import competition on mark-ups is to use import penetration values instead of tariffs. This is the approach followed in Hakura (1998), Kee

and Hoekman (2003) and Fedderke *et al.* (2003). Higher import penetration reflects increased international competition and is hence expected to reduce domestic market power and mark-ups. In this section we present 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. As discussed earlier, the composition and growth of SA imports differ according to the regional source. The impact on mark-ups may thus differ across regions, as is found by Hakura (1998) for the European Union. Table 13 and Table 14 present the impact of total import penetration and regional import penetration on mark-ups during the period 1988-2002.

Table 13: Impact of import penetration on mark-ups in manufacturing, 1988-2002

	Excluding intermediate inputs		**Including intermediate inputs**	
Mark-up	0.220	*	0.102	**
Imports	-0.151	**	-0.038	**
Imports 95-02	0.108		-0.035	**
N	420		420	
F	16.82	**	96.81	**

*Note: * and ** represent significance at the 10%- and 5%-level, respectively.*

We find that import penetration has a strong disciplining effect on the mark-up pricing behaviour of domestic firms in SA. Similar results are found by Fedderke *et al.* (2003). The estimated impact is sensitive to the inclusion of intermediate inputs, with a larger impact found when intermediate inputs are excluded. There is also some evidence that impact penetration exerted a stronger influence on mark-ups during the latter half of the 1990s. Looking at the results including intermediate inputs, a 1%-rise in import penetration is estimated to have reduced average mark-ups in manufacturing by 7.3 percentage points during the period 1995-2002, compared to 3.8 percentage points during 1988-1994.

Table 14: Impact of regional imports on mark-ups in manufacturing, 1988-2002

	Africa		**China & India**		**Rest of Asia**		**South America**		**Developed countries**		**Eastern Europe**		**European Union**	
Excluding intermediate inputs														
Mark-up	-0.442		-0.170		-0.261		0.639	**	0.308	**	0.034		0.387	**
Imports	-0.149	**	-0.104	**	-0.171	**	0.038		-0.039		-0.049		-0.001	
N	420		417		420		413		420		412		420	
F(2,390)	26.65	**	27.76	**	29.29	**	23.03	**	22.26	**	23.48	**	21.97	**
Including intermediate inputs														
Mark-up	0.016		0.099	**	0.048		0.166	**	0.086	**	0.081	**	0.073	**
Imports	-0.029	**	-0.015	**	-0.033	**	-0.002		-0.045	**	-0.013	**	-0.042	**
N	420		417		420		413		420		412		420	
F(2,390)	134.21	**	132.37	**	145.07	**	128.28	**	143.66	**	132.94	**	142.29	**

*Note: * and ** represent significance at the 10%- and 5%-level, respectively.*

We also find that the market disciplining effects of import penetration differ according to the origin of these imports (Table 14). When excluding intermediate inputs, significant negative coefficients are obtained for Africa, China & India and the Rest of Asia, with imports from the latter region having the strongest impact on mark-ups. Better results, in terms of the number of significant

relationships and the relative size of the relationships, are obtained when intermediate inputs are included. In this case the coefficient on the import variable is negative and significant for all regions, except South America. Imports from developed economies appear to have the strongest market disciplining effects (-0.045), followed by Rest of Asia (-0.033) and then Africa (-0.029). The coefficient on imports from China & India (-0.015) is significant, but is relatively low. This partly reflects the large share of imports from this region accounted for by textiles and clothing, for which mark-ups are relatively low (Figure 8).

5 CONCLUSION

Since the mid-1990s, SA has made considerable progress in reintegrating itself into the international economy. Protective barriers such as quotas, tariffs and surcharges have been reduced or eliminated. Trade flows have increased, as is reflected in rising import penetration and export orientation. The increased openness of the SA economy has forced domestic producers and retailers to respond to new international competitors and lower international prices. This paper estimates the impact of increased openness on the pricing behaviour of SA industries.

This study advances existing empirical work in a number of ways. Firstly, we estimate the impact of openness on mark-ups using detailed sector level tariff data. Secondly, we analyse the impact of regional imports (Developed economies, Africa, China & India, Rest of Asia, South America and Eastern Europe) on mark-ups in the manufacturing sector between 1988 and 2002. Thirdly, we develop the theoretical relationship between trade liberalisation and mark-up pricing. In addition to these contributions, the paper presents estimates of mark-ups for the primary, manufacturing and services sectors over the period 1970-2002.

In our preliminary data analysis we find that SA has made considerable progress in liberalising its tariff barriers from 1994. The extent of the reduction in protection, however, is sensitive to the selection of tariff protection measure. Scheduled tariff rates reveal a decline in average protection in manufacturing from 14.5% to 9.4% between 1994 and 2002. If surcharges are included, average protection in manufacturing falls from 17.2% to 9.4% over this period. Collection duties yield significantly lower levels of protection. Using collection rates inclusive of surcharges, protection fell from 11% in 1994 to 7.1% in 2000.

The integration of SA into the international arena is also reflected in strong increases in import penetration. However, the composition and growth of imports differ according to the region from which the products are sourced. Most of SA's manufacturing imports are sourced from developed economies and tend to be relatively skill-intensive (machinery and equipment, motor vehicles, communication equipment). However, the strongest growth in imports is from China & India. These products are relatively labour-intensive and include footwear, leather, wearing apparel and textiles. The composition and growth of imports from Africa, South America and the Rest of Asia also vary

considerably and provide justification for our focus on the impact of regional imports on mark-ups in SA manufacturing.

We estimate mark-ups for mining, manufacturing and services sectors according to the approach outlined in Roeger (1995). We find that that estimates of the mark-up are sensitive to the inclusion of intermediate inputs. Average mark-ups in manufacturing are equal to 42% when excluding intermediate inputs, but fall to 12.5% when intermediate inputs are accounted for. Very high mark-ups are found in mining (44% including intermediate inputs) and services (17.3%). The trend in average mark-ups is also influenced by the inclusion or exclusion of intermediate inputs. In both cases mark-ups rise for all broadly defined sectors during the late 1980s and early 1990s, which appear to coincide with the implementation of surcharges during this period. Average mark-ups in mining and manufacturing then fall if intermediate inputs are excluded, but remain constant if intermediate inputs are accounted for. Mark-ups in the services sector rise if intermediate inputs are excluded, but remain constant if intermediate inputs are included.

We also compare mark-ups in SA manufacturing with a range of foreign economies. These comparisons are made with caution as the estimated mark-ups are sensitive to different empirical methodologies, time periods, data aggregation, and data measurement. In addition, the omission of important variable in the regression estimations can lead to omitted variable bias. We find that the level of mark-ups in SA manufacturing generally fall within the range of mark-ups estimated in international studies, but are again sensitive to the inclusion of intermediate inputs. When intermediate inputs are not taken into account, mark-ups in SA appear relatively high compared to the US, although the sectoral structure of mark-ups is similar to that of the USA. When intermediate inputs are accounted for, mark-ups in SA manufacturing appear low, but there is little correlation in the sectoral structure of mark-ups between SA 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 from our analysis.

We find strong evidence for the market disciplining effects of trade liberalisation. This effect is particularly strong during the period 1995-2002 where a 1%-reduction in tariffs is estimated to reduce average mark-ups in manufacturing by approximately two percentage points. This relationship is robust to the choice of protection measure (scheduled tariffs, collection rates, effective rates of protection). We also find that import penetration reduces mark-ups and the effect is stronger during the latter half of the 1990s. According to the results including intermediate inputs, a 1%-rise in import penetration reduces mark-ups by between 3.8 to 7.3 percentage points. The impact, however, differs according to the source of imports. Imports from developed economies have the strongest market disciplining effects, followed by the Rest of Asia and then Africa.

Some useful policy conclusions emerge from the results. Firstly, there is still substantial scope to lower prices and raise the welfare of consumers through stronger antitrust policies and tariff liberalisation. Secondly, an accelerated programme of liberalisation (from its current trend) and more competition-enhancing policies will enable the Reserve Bank to pursue a less restrictive monetary policy, at least in the short run.

The lower mark-ups may have additional benefits to the economy. A reduction in mark-ups through competition will enhance export profitability through lower input costs and will thus stimulate the growth of exports. As shown by Alves and Kaplan (2004), SA export performance has been mediocre compared to other developing economies and has not generated an export-led growth boom similar to those of East Asia and a few other dynamic emerging economies. Competition-enhancing policies will also facilitate the entry of new industries, particularly SMMEs into the economy.

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7 APPENDICES

7.1 Model Appendix

7.1.1 The Cournot Model

Starting from the profit functions of the Home and Foreign firm (equation 1 and 2), the first order optimum condition for the Home firm is represented as

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

Because the model deals with homogeneous products, the change in one firm's output will increase total output by the same amount (i.e. $\frac{\partial Q}{\partial Q_H} = \frac{\partial Q}{\partial Q_F} = 1$) and this can be simplified to

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

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 (that is, $\frac{\partial Q_F}{\partial Q_H} = \frac{\partial Q_H}{\partial Q_F} = 0$).

Hence the optimum Q_H is determined by:

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

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

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

which under the Cournot assumption can be simplified to

$$\Pi_F^F = \frac{\frac{\partial P}{\partial Q}Q_F}{(1+t)} + \frac{P(Q)}{(1+t)} - C_F^{'} = 0 . \quad \text{(c)}$$

Together the first order conditions (b and c) solve for the equilibrium outputs and price.

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

$$\Pi^{H}_{HH} = \frac{\partial \Pi^{H}_{H}}{\partial Q_H} = 2P^{'} + P^{''}Q_H - C^{''}_{H} < 0 \qquad \text{(d)}$$

and

$$\Pi^{F}_{FF} = \frac{\partial \Pi^{F}_{F}}{\partial Q_F} = \frac{2P^{'}}{(1+t)} + \frac{P^{''}Q_F}{(1+t)} - C^{''}_{F} < 0 \qquad \text{(e)}$$

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 second order conditions (SOC) positive. We therefore assume away a very convex demand function which ensures that the above second order conditions hold. The solutions to the first order conditions are thus optimal.

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

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

and

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

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

To determine the impact of changes in tariffs on output and mark-ups, we differentiate the first order condition equations (b and c) to obtain

$$P^{'}dQ_H + P^{''}(dQ_H + dQ_F)Q_H + P^{'}(dQ_H + dQ_F) - C^{''}_{H}dQ_H = 0$$

and

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

This can be rewritten in matrix notation to obtain

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

or in simpler representation

$$[J]\begin{bmatrix} dQ_H \\ dQ_F \end{bmatrix} = \begin{bmatrix} 0 \\ \dfrac{P'Q_F + P}{(1+t)^2} \end{bmatrix} dt \qquad \text{(h)}$$

where [J] is the Jacobian matrix $\begin{bmatrix} \Pi^H_{HH} & \Pi^H_{HF} \\ \Pi^F_{FF} & \Pi^F_{FH} \end{bmatrix}$. To solve the system we require the determinant of the coefficient matrix ($|J|$) in equation (h) to be non-zero. This is the sufficiency condition of the implicit function theorem, required for equations (b) and (c) 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 for Q_H and Q_F in terms of the exogenous variables *c*, *t* and *P*.

Dividing both sides by *dt*, the system can now be solved for $\dfrac{dQ_H}{dt}$ and $\dfrac{dQ_F}{dt}$ using Cramer's rule. Looking first at the impact on home output:

$$\frac{dQ_H}{dt} = \frac{\begin{bmatrix} 0 & P''Q_H + P \\ \dfrac{P'Q_F + P}{(1+t)^2} & \dfrac{2P'}{(1+t)} + \dfrac{P''Q_F}{(1+t)} - C''_F \end{bmatrix}}{|J|}$$

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

which is positive, because $\dfrac{(P'Q_F + P)}{(1+t)^2}$ is positive and Π^H_{HF} is negative (strategic substitutes assumption). Similarly, the impact on foreign output is given by

$$\frac{dQ_F}{dt} = \frac{\begin{bmatrix} 2P' + P''Q_H - C''_C & 0 \\ \dfrac{P''Q_F}{(1+t)} + \dfrac{P'}{(1+t)} & \dfrac{P'Q_F + P}{(1+t)^2} \end{bmatrix}}{|J|}$$

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

which is negative, because Π^H_{HH} is negative (SOC for profit maximisation) 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.

7.1.2 The Bertrand model

Starting from the first order conditions, for the critical point that solves the system of equations to be an optimum, the second order conditions need to be satisfied. For the home and foreign firm, respectively, this requires

$$\Pi^H_{P_H P_H} = \frac{\partial \Pi^H_{P_H}}{\partial P_H} = 2X_{P_H} + X_{P_H P_H} P_H - C_{P_H P_H} < 0 \qquad \text{(k)}$$

and

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

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 $C_{P_H P_H} = \frac{\partial^2 C}{\partial P_H \partial P_H}$. These conditions are satisfied under standard demand functions.

We will also assume that the cross partials $\Pi^H_{P_H P_F}$ and $\Pi^F_{P_F P_H}$ are positive. The cross partials can be written as:

$$\Pi^H_{P_H P_F} = \frac{\partial \Pi^H_{P_H}}{\partial P_F} = X_{P_F} + X_{P_H P_F} P_H > 0 \quad \text{(m)}$$

and

$$\Pi^F_{P_F P_H} = \frac{\partial \Pi^F_{P_F}}{\partial P_H} = \frac{Y_{P_H}}{(1+t)} + \frac{Y_{P_F P_H} P_F}{(1+t)} > 0 \ . \qquad \text{(n)}$$

The first term on the right-hand side, the cross price effect on demand, is positive. Therefore, a sufficient condition for $\Pi^H_{P_H P_F}$ and $\Pi^F_{P_F P_H}$ to be positive is that $X_{P_H P_F}$ and $Y_{P_F P_H}$ are positive. The restriction on $X_{P_H P_F}$ and $Y_{P_F P_H}$ implies that as the foreign firm raises its price (P_F), the marginal (negative) impact of an increase in P_H on demand for X (home output), diminishes, i.e. the demand

curve for home products becomes more inelastic. The overall implication of the assumption that $\Pi^H_{P_H P_F}$ and $\Pi^F_{P_F P_H}$ are positive is that if one firm raises its price, the other firm will follow suit.[31]

The two first order conditions (FOC) equations can also be used to determine the effect of a tariff on prices and the mark-up. Totally differentiating the FOC, we obtain

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

or, after simplification,

$$\begin{bmatrix} \Pi^H_{P_H P_H} & \Pi^H_{P_H P_F} \\ \Pi^F_{P_F P_H} & \Pi^F_{P_F P_F} \end{bmatrix} \begin{bmatrix} dP_H \\ dP_F \end{bmatrix} = \begin{bmatrix} 0 \\ \dfrac{Y_{P_F} P_F + Y}{(1+t)^2} \end{bmatrix} dt \,. \qquad \text{(o)}$$

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 $\Pi^F_{P_F P_H}$. The term $\dfrac{Y_{P_F} P_F + Y}{(1+t)^2}$ on the right-hand side is positive.[32]

Dividing both sides by *dt*, the system can be solved for $\dfrac{dP_H}{dt}$ and $\dfrac{dP_F}{dt}$ using Cramer's rule.

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[31] At low prices the marginal impact on profits of an own price increase is positive. Therefore, if the cross partials $\Pi^H_{P_H P_F}$ and $\Pi^F_{P_F P_H}$ are positive, a price increase by one firm (say P_F) causes the other firm to raise prices in order to re-establish the equilibrium condition as set out in the first order conditions (i.e. $\Pi^H_{P_H}$ > 0 subsequent to the increase in P_F and P_H rises to re-establish the equilibrium condition $\Pi^H_{P_H}$ = 0).

[32] From the first order conditions $\Pi^F_{P_H} = \dfrac{\partial \Pi^F}{\partial P_F} = \dfrac{Y + Y_{P_F} P_F}{(1+t)} - C_{P_F} = 0$. Because C_{P_F} is negative, $Y_{P_F} P_F + Y$ must be negative for $\Pi^F_{P_H}$ to equal 0 ((1+*t*) is positive). Hence the term on the right-hand side of equation (o) is negative.

The impact of tariff on the home price is

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

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

This is positive, because $\dfrac{Y_{P_F} P_F + Y}{(1+t)^2} < 0$ and $\Pi^H_{P_H P_F} > 0$.

The impact on foreign prices is given by

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

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

This is also positive, because $\Pi^H_{P_H P_H} < 0$ (SOC for profit maximisation) and $\dfrac{Y_{P_F} P_F + Y}{(1+t)^2} < 0$.

7.2 Data Appendix

For the purpose of this study it was necessary to construct a coherent set of industry-level tariff rates for the period 1988 to 2002. In constructing this data set, numerous problems needed to be dealt with.

Firstly, the estimation of protection levels at an industry level is made complex by the various types of customs duties used by the SA authorities. The types of customs duties include *ad valorem*, specific, mixed, compound and formula duties as well as their combinations.[33] Up to the late 1990s formula duties and mixed duties were often used to set a lower bound f.o.b. price for imported products and were particularly prevalent within the clothing and textile sectors. If the import price fell below this minimum f.o.b. additional duties were levied on the product. As a result the *ad valorem* equivalent of these tariffs could be extremely high. For example, the highest *ad valorem* equivalent tariff in 1990 was estimated to be over 1,000% (IDC, 1990). In many sectors, particularly clothing and textile sectors, the lower bound reference price was binding, leading to significantly higher levels of protection than is reflected in the *ad valorem* component of the mixed or formula duties. For example, the inclusion of *ad valorem* equivalents for the various duties raises protection in 1990 from 13.76% (own calculations) to 22% (IDC, 1990).[34]

A second problem associated with calculating protection rates is that protection during the import substitution industrialisation phase of SA's development was largely achieved through a wide-ranging system of quantitative restrictions rather than tariff-based protection (Belli *et al.*, 1993). Although quantitative restrictions were increasingly replaced by tariffs during the 1980s, they were still prevalent within the agriculture, food, beverages, tobacco, clothing and rubber sectors during the early 1990s (WTO, 1994: 77). For example, the importation, sale and pricing of numerous agricultural products were restricted until the mid-1990s by control boards, established under the Marketing Act of 1937 and 1968. Although tariffs rates, usually specific tariffs, were applied to these products, these were primarily to generate revenue once an import quota had been

[33] Three types of mixed duties are applied, for example: (a) 25% or 70c/kg, (b) 325c/kg with a maximum of 39% and (c) 22% or 27% with a maximum of 2880c/kg. In applying the mixed tariff, the higher of the two rates are applied. Formula duties were designed to combat "disruptive competition", but have been phased out as SA has adopted an anti-dumping framework (WTO, 1998: 39). An example of a formula duty is: 10% or 255c/kg less 90%. In this example, if the f.o.b. import price falls below 255c/kg, additional duties are levied to raise the effective import price to this value. The *ad valorem* equivalent of the formula duty converges to infinity as the f.o.b. price converges to zero.

[34] Altman (1994) argues that tariff rates inclusive of *ad valorem* equivalents were 167% for clothing in 1991. The simple average of the *ad valorem* component of the formula duties during this period was approximately 25%.

granted.[35] Failure to account for protection through non-tariff barriers will lead to an under-estimate of protection, particularly prior to the mid 1990s.

Finally, estimated protection levels vary enormously depending on whether scheduled tariff rates, collection duties and surcharges are used.

Given the complexity of measuring protection within SA from the late 1980s, various estimates of protection are used in this study. Firstly, protection is measured using scheduled tariff rates at the HS 8-digit level. Secondly, protection is measured using collection duties, calculated by dividing customs revenue by the import value. Thirdly, the scheduled tariff and collection duty rates are adjusted for surcharges using data obtained from GATT (1993) and the Reserve Bank. The scheduled tariff rates are obtained from the Trade Analysis and Information System database (TRAINS), the Economic Research Division of the Industrial Development Corporation (IDC) and TIPS. Missing years are updated using the SA Government Gazettes. Customs revenue at the HS8-digit level is obtained from Customs & Excise (made available from TIPS).

Because of the prevalence of non-*ad valorem* tariffs, it was important to include some estimate of the protection afforded by these tariff rates. To calculate *ad valorem* equivalents for the non-*ad valorem* rates, it is necessary to obtain f.o.b. prices for the products, often at the HS8-digit level. Although it is possible to use cost-insurance-freight (c.i.f.) prices, which can be calculated by dividing import values by import volumes, these are highly variable, even at the HS8-digit level (Jansen and Joubert, 1998). As an alternative, formula and mixed duties were replaced by collection rates if the latter exceeded the *ad valorem* component of the scheduled rates. This process will under-estimate protection levels as highly protected products may not be imported and exemptions on duty are frequently granted (e.g. imported intermediate inputs are often duty free when the final product is to be exported).[36] It was not possible to estimate the *ad valorem* equivalent of non-tariff barriers, which were prevalent in some sectors prior to 1994. However, coverage of import controls tended to apply to products already liable to high tariffs, with the exception of agriculture (GATT, 1993: 77). Moreover the sectors in which import licensing was eliminated were also those experiencing large reductions in tariffs (Jonsson and Subramanian, 2001). The reduction in tariffs may therefore serve as a reasonable proxy for the decline in protection within these sectors.

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[35] It is also argued that import duties in the motor vehicle industry acted as fiscal, rather than protective, measures during the early 1990s since the local content programme prevented foreign competition for assembled vehicles (WTO, 1994: 162).

[36] Altman (1994) also notes that the duty-free credit system, implemented as part of the Structural Adjustment Programme for clothing and textiles in 1989, encouraged the importation of final goods covered by very high tariffs. Very low duties were thus paid on some of the most highly protected clothing products.

Finally, a concordance file obtained from TIPS is used to calculate the simple average tariff rates according to the SIC system used in this analysis.[37]

7.3 Table Appendix

Table 15: Average imports by region, 1990-2002 (R-million in 1995 prices)

	Total	Africa	China & India	Rest of Asia	South America	Developed countries	Eastern Europe	EU
Food	3618	168	148	787	759	1406	36	705
Beverages	601	8	0	2	8	515	1	471
Tobacco	62	4	0	0	0	40	0	10
Textiles	2265	90	258	950	10	704	7	514
Wearing apparel	880	119	296	245	3	154	3	122
Leather products	541	27	146	116	40	181	1	135
Footwear	669	22	265	230	10	103	3	79
Wood products	643	81	13	185	34	279	1	161
Paper products	1777	11	6	74	56	1455	16	1037
Printing & publishing	2079	6	14	97	0	1176	2	740
Coke & petroleum	2177	25	75	137	5	405	0	229
Basic chemicals	7195	53	207	733	199	4638	91	3340
Other chemicals	5365	23	98	311	68	4392	12	3287
Rubber products	1091	15	29	144	8	737	6	420
Plastic products	918	6	64	182	5	810	4	575
Glass products	471	5	26	97	15	257	14	213
Non-metallic minerals	1054	24	66	56	35	783	7	603
Basic iron & steel	1394	42	44	86	76	991	35	746
Non-ferrous metals	1550	107	35	83	28	1400	32	425
Metal products	2525	68	155	355	20	1371	10	1002
Machinery & equipment	20013	127	537	2270	155	14784	85	9948
Electrical machinery	3713	40	126	395	47	2600	31	1874
Communication equipment	7034	32	266	1325	8	4785	25	3610
Professional & scientific	3487	29	58	281	6	2801	12	1632
Motor vehicles	14504	45	49	452	279	12345	46	6882
Other transport	3640	115	44	169	51	2874	12	744
Furniture	366	33	19	56	1	197	6	168
Other manufacturing	4066	80	228	317	7	798	4	485
Total	93697	1408	3273	10134	1937	62982	501	40157

[37] The simple average tariffs tend to bias estimated protection upwards as most information is available for highly protected products. Import weighted averages could be used, but these are biased downwards as consumers substitute highly protected products for less-protected products.

Table 16: Growth in import penetration by region, 1990-2002

	Total	Africa	China & India	Rest of Asia	South America	Developed countries	Eastern Europe	EU
Food	6%	0%	24%	3%	2%	1%	14%	1%
Beverages	3%	3%	26%	-1%	20%	-1%	-24%	-3%
Tobacco	-6%	13%	4%	-13%	-	-18%	-16%	-6%
Textiles	4%	4%	13%	-1%	-4%	-2%	3%	-2%
Wearing apparel	10%	9%	13%	-4%	2%	-3%	32%	-3%
Leather products	2%	-3%	11%	-6%	3%	-12%	13%	-12%
Footwear	20%	-2%	21%	4%	8%	2%	24%	2%
Wood products	5%	4%	12%	-2%	-2%	5%	18%	6%
Paper products	-1%	-7%	16%	3%	-4%	-8%	1%	-7%
Printing & publishing	4%	5%	18%	0%	13%	3%	19%	4%
Coke & petroleum	3%	32%	-1%	9%	-16%	2%	30%	-1%
Basic chemicals	4%	9%	20%	8%	1%	-2%	9%	-2%
Other chemicals	5%	-3%	20%	1%	2%	1%	9%	1%
Rubber products	7%	0%	31%	8%	6%	5%	32%	4%
Plastic products	8%	3%	23%	5%	5%	3%	54%	3%
Glass products	6%	7%	17%	4%	6%	-1%	8%	-1%
Non-metallic minerals	8%	2%	16%	6%	5%	3%	16%	2%
Basic iron & steel	4%	-2%	33%	8%	4%	-3%	25%	-2%
Non-ferrous metals	1%	-2%	25%	3%	11%	-2%	5%	-8%
Metal products	6%	1%	16%	3%	0%	1%	17%	0%
Machinery & equipment	5%	14%	25%	5%	6%	1%	18%	1%
Electrical machinery	6%	2%	22%	3%	8%	-1%	16%	-1%
Communication equipment	10%	11%	21%	4%	6%	6%	9%	8%
Professional & scientific	3%	10%	21%	0%	5%	0%	12%	-1%
Motor vehicles	6%	0%	39%	14%	13%	3%	33%	4%
Other transport	13%	14%	7%	-1%	31%	9%	15%	6%
Furniture	17%	10%	35%	9%	24%	14%	43%	13%
Other manufacturing	4%	7%	16%	1%	5%	1%	16%	1%

Table 17: Comparison of USA and SA mark-ups, excluding intermediates

	SA (this study) 1970-2002	SA (Fedderke *et al.*, 2003) 1979-97	USA (Roeger, 1995) 1953-84	USA (M&S, 1999) 1970-92
Food products and beverages			0.5	
Food	0.64	0.81		0.55
Beverages	1.06	1.27		
Tobacco	3.33	1.22	1.75	3.84
Textiles	0.55	0.67	0.34	0.32
Wearing apparel	0.10	0.23	0.15	0.31
Leather products and footwear			0.19	0.38
Leather products	0.08	0.55		
Footwear	0.13	0.34		
Wood products	0.33	0.34	0.75	0.86
Paper products	0.81	1.06		0.52
Printing & publishing	0.23	0.35	0.4	0.53
Coke & petroleum	2.30	2.76		
Petroleum refineries				
Chemical products			1.11	
Basic chemicals	0.84	1.12		1.22
Other chemicals	0.63	0.77		1.36
Drugs & medicines				1.65
Rubber and plastic products			0.36	
Rubber products	0.29	0.80		
Plastic products	0.36	0.63		0.27
Non-metallic minerals			0.59	
Glass products	0.47	0.94		0.46
Pottery & China				0.21
Non-metallic min. prod.	0.53	0.88		0.63
Basic metal products			0.58	
Basic iron & steel	0.48	0.72		0.46
Non-ferrous metals	0.68	1.92		1
Metal products	0.37	0.37	0.33	0.3
Machinery and equipment	0.28	0.32	0.41	
Machinery and equipment nec.				0.25
Office computing machinery				1.97
Electrical machinery	0.56	0.37	0.34	
Communication equipment	0.13	0.52		0.86
Professional and scientific	0.86	0.44	0.47	0.29
Motor vehicles	0.45	0.40	1.06	0.59
Other transport equipment	0.11	0.14	0.22	
Motorcycles & bicycles				0.74
Shipbuilding & repair				
Railroad equipment				
Aircraft				0.37
Furniture	0.19	0.23	0.28	0.22
Other manufacturing	2.02	0.59	0.62	0.46
Max	3.335	2.760	1.750	3.840
Min	0.082	0.140	0.150	0.210
Simple average	**0.673**	**0.741**	**0.553**	**0.764**
correlation with SA	1	0.60	0.80	0.78

Source: Own calculations for SA. Foreign mark-ups are sourced from Martins et al. (1996).
Notes: A dot or missing observation for the USA mark-ups indicates that no data are available or that the result is statistically insignificant. All results are presented for SA. The mark-ups are presented as μ - 1.

Table 18: Cross-country comparison of mark-ups, including intermediates

	SA	USA	Japan	Germany	France	Italy	UK	Canada	Australia	Belgium	Denmark	Finland	Netherlands	Norway	Sweden
Food	0.10	0.05	0.32	0.12	0.11		0.2	0.09	0.13	0.15	0.1	0.09	0.12		0.03
Beverages	0.18		0.26	0.33	0.68		0.54	0.3	0.27	0.19	0.21	0.25	0.63		0.19
Tobacco		0.56		0.52	2.12		0.56	0.19	0.57	0.07		0.3	0.53		
Textiles	0.16	0.08	0.19	0.15	0.1	0.16	0.03	0.2	0.13	0.08	0.12	0.13	0.08	0.13	0.14
Wearing apparel	0.08	0.1		0.11	0.15	0.14	0.03	0.1	0.11		0.14	0.13	0.09	0.13	
Leather products		0.08		0.18	0.11	0.14	0.06	0.11	0.16	0.28	0.15	0.1	0.08	0.16	0.1
Footwear	0.08	0.08			0.13	0.13	0.04	0.07	0.11	0.1		0.09	0.09	0.13	0.04
Wood products	0.15	0.22		0.2	0.15	0.17	0.18	0.28	0.21		0.12		0.21	0.17	0.24
Paper products	0.16	0.13	0.2	0.29	0.13	0.15	0.05	0.39	0.18	0.11	0.13	0.08	0.16	0.14	0.29
Printing & publishing	0.11	0.19	0.1	0.09	0.24	0.18	0.09	0.21	0.22	0.13	0.11	0.1	0.2	0.11	0.13
Coke & petroleum	0.19	0.11	0.1	0.09			0.06	0.31	0.23		0.33	0.34		0.15	
Petroleum refineries	.	0.03	0.04		0.19		0.07		0.35			0.11			
Basic chemicals	0.10	0.18	0.23		0.21	0.16	0.06	0.4	0.23	0.1	0.24	0.2	0.41	0.42	0.22
Other chemicals	0.14	0.26	0.26	0.24	0.19		0.08	0.2	0.27	0.12	0.15	0.18	0.33	0.08	
Drugs & medicines	0.14	0.44	0.54	0.45	0.04		0.16	0.25	0.42		0.41	0.68	0.1	0.22	0.43
Rubber products	0.14		0.15		0.2	0.1		0.12	0.17	0.06	0.12	0.13	0.13	0.15	0.08
Plastic products	0.16	0.07	0.15			0.08		0.17	0.21		0.18	0.23	0.24	0.11	0.17
Glass products	0.19	0.17	0.41	0.23	0.22	0.3	0.06	0.31	0.26	0.15	0.22	0.12	0.19	0.07	
Pottery & China	.	0.09	0.22		0.29	0.3		0.4	0.15		0.41	0.32	0.16	0.11	
Non-metallic minerals	0.18	0.18	0.26	0.26	0.24	0.3	0.15	0.32	0.25		0.28	0.21		0.24	
Basic iron & steel	0.12	0.1	0.19	0.14	0.16	0.17		0.25	0.14	0.25		0.18	0.4	0.33	0.1
Non-ferrous metals	0.12	0.14	0.26		0.26	0.15	0.05	0.14	0.18	0.17	0.14	0.05	0.3	0.35	0.11
Metal products	0.09	0.09	0.11	0.2	0.18	0.39	0.03	0.16	0.17	0.08	0.15	0.19	0.13	0.15	0.13
Machinery and equipment	0.10	0.06	0.09	0.06	0.12	0.19		0.15	0.17		0.12	0.14	0.16	0.1	0.07
Electrical machinery	0.17		0.05		0.25	0.08		0.16	0.07		0.17	0.26		0.19	
Office computing machinery	.	0.54	0.24	0.58	0.17	0.67	0.47				0.44		0.15	0.37	0.15
Communication equipment	0.04	0.4	0.13	0.34	0.11	0.19	0.25	0.31	1.02		0.1	0.2	0.19	0.2	0.32
Professional and scientific	0.18	0.09	0.22	0.67		0.21	0.16		0.22	0.31		0.16	0.25	0.33	0.13
Motor vehicles	0.08	0.09	0.17	0.15	0.13	0.02		0.14	0.08			0.14	0.12	0.21	0.15
Other transport equipment						0.05						0.33		0.39	
Motorcycles & bicycles	.	0.13									0.13	0.31	0.16		
Shipbuilding & repair	.		0.27					0.16	0.07			0.14		0.11	
Railroad equipment	.				0.69			0.13	0.44			0.22			
Aircraft	.				0.21	0.1		0.25					0.19	0.43	
Furniture	0.06	0.06	0.25	0.15	0.21	0.21	0.19	0.16	0.14	0.18	0.16	0.17	0.12	0.16	0.08
Other manufacturing	0.28	0.08	0.38	0.3		0.09		0.11	0.18		0.25	0.17	0.13	0.16	
Max	0.28	0.56	0.54	0.67	2.12	0.67	0.56	0.40	1.02	0.31	0.44	0.68	0.63	0.43	0.43
Min	0.04	0.03	0.04	0.06	0.04	0.02	0.03	0.07	0.07	0.06	0.10	0.05	0.08	0.07	0.03
Average	**0.13**	**0.17**	**0.21**	**0.25**	**0.28**	**0.19**	**0.16**	**0.21**	**0.23**	**0.15**	**0.20**	**0.20**	**0.21**	**0.20**	**0.16**
correlation with SA	1.00	-0.10	0.30	0.35	0.38	-0.05	0.10	0.21	-0.20	0.26	0.45	0.16	0.20	-0.06	0.18

Source: Own calculations for SA. Foreign mark-ups are sourced from Martins et al. (1996).
Notes: A dot or missing observation indicates that no data are available or that the result is statistically insignificant.

7.4 Figure Appendix

Figure 11: 10-year average mark-up by sector, excluding intermediates

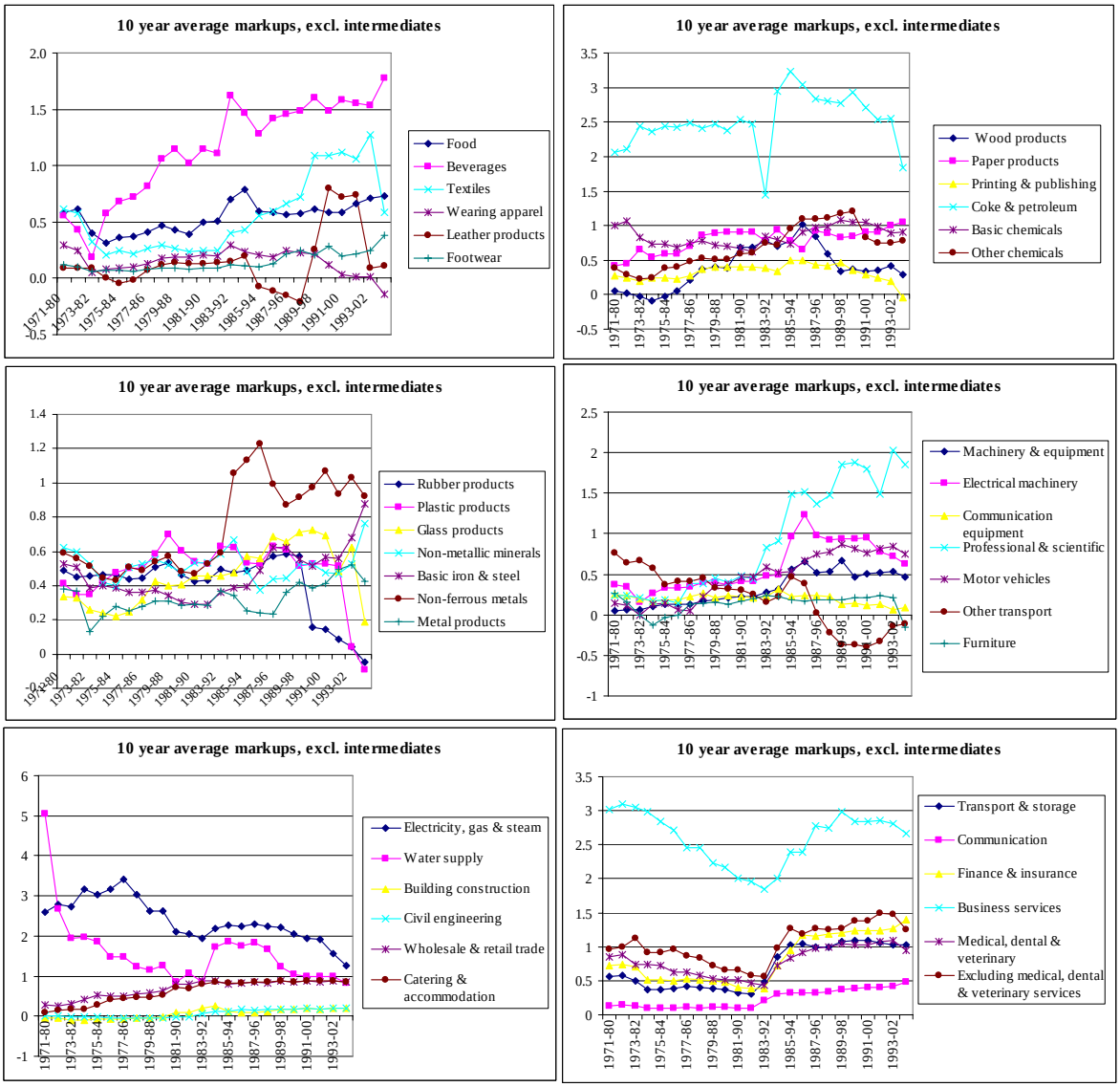

Figure 12: 10-year average mark-up by sector, including intermediates