Mark-up Pricing in South African Industry

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ABSTRACT: This paper investigates the extent of the mark-up of the three-digit manufacturing sectors in South Africa taking into account a number of characteristics of the sectors. We find significant mark-ups to be present in South African manufacturing industry. In comparative terms, the mark-up is approximately twice that found for US manufacturing. Industry concentration exerts a positive influence on the markup over marginal cost. An indicator of competitiveness suggests that an increase in an industry's competitiveness relative to other industries allows it to raise its mark-up. However, within industry increases in competitiveness lower the mark-up. We also analyze the impact of import and export penetration. Both import and export penetration serve to lower the mark-up. The impact of the business cycle on markup indicates that markup is countercyclical. Finally, accounting for intermediate inputs significantly lowers the absolute size of the mark-up. However, relative to findings on the US manufacturing sectors, SA manufacturing mark-ups remain approximately twice as large.

KEYWORDS: Mark-up pricing, industry concentration, industry competitiveness, import and export penetration, business cycles, dynamic heterogeneous panel estimation.
JEL Classification: L11, L12, L13, L60, D43.

1 Introduction

Prospects of economic growth depend crucially on the competitiveness of industry. One manifestation of the extent to which markets are competitive is pricing behaviour within industry. In the present paper we examine the price - marginal cost ratio in South African manufacturing industry.

There exists an extensive international literature regarding the markup and how to measure it. However, most empirical studies of the mark-up have focussed on the United States, though some analyze the mark ups in OECD countries. One departure point into the modern literature is Hall (1988).[1] Hall's study did not appear to successfully resolve the endogeneity problem inherent in estimating mark-ups over marginal cost employing measures of Total Factor Productivity, thus a number of studies that followed attempted to deal with the apparent upward bias in the estimated mark-up for the US. A solution to the endogeneity problem has been presented by Roeger (1995). Utilizing the broad Hall-approach, but employing nominal magnitudes serves to remove the source of the endogeneity bias (see the discussion below), while generating more plausible magnitudes for the mark-up of price over marginal cost.

This paper introduces a number of innovations to the debate. *First*, to our knowledge the study is the first application of the methodology to a middle income context. Consideration of a middle income country might plausibly alter the findings established for the US markets. Middle income countries typically lack market sizes which might allow them to exploit the economies of scale open to US producers. Conceivably therefore, access to international markets might prove to exercise a greater impact on pricing than for developed countries, with similar conclusions following for import penetration into the domestic economy. To our knowledge these questions have not yet been explored empirically, and our study allows for a comparison of the mark-up in South African (middle income) manufacturing industry with that found in comparable US manufacturing industry.

Second, an important qualification applies to any empirical application of the methodology estimating the mark-up over marginal cost. The first of these is that the methodology of estimating the mark-up from the relation between the Solow residual and measures of input costs is explicitly one

[1] For a review of the early literature, with an application to South African manufacturing industry, see Fedderke (1992). See also Eichner (1973, 1987), Gordon (1948), Hall and Hitch (1939), Coutts, Godley and Nordhaus (1978) as classic references.

presumed to hold in long run equilibrium states. Noting that real world processes seldom reflect pure equilibrium states is trivial - but the implication is that any empirical application of the mark-up methodology has to account not only for the nature of the equilibrium relationship predicted by theory, but also for the fact that dynamic adjustments to equilibrium may be an important feature of the modeling. Thus far estimation of mark-ups has proceeded mostly by means of OLS specifications, on an industry-by-industry basis.

In order to address this limitation to the empirical methodologies employed thus far, the present paper departs from the estimation methodology employed in previous studies, by employing a number of alternative estimation methods. First, we employ the dynamic heterogeneous panel estimation technique proposed by Pesaran, Shin and Smith (1999), in the form of the Pooled Mean Group estimator. The advantage of the technique is that it incorporates the recognition of an explicit long run relationship, as well as short run dynamics. The obvious objection to the use of a panel estimator is the reason motivating an industry-by-industry estimation approach: industries may prove to have heterogeneous mark-ups. There are certainly many reasons why sectors differ substantially - from the degree of trade liberalization, developments within labor market institutions, trade composition, market structure and contestability, amongst others. The advantage of the PMG estimator is that homogeneity across sectors need not be assumed, but tested for. Use of the PMG estimator allows for both dynamics across time periods and heterogeneity across cross-sectional units, since it allows us to simultaneously investigate both a homogenous long-run relationship and heterogenous short-run dynamic adjustment towards equilibrium. The net result is the achievement both of substantial statistical power from the panel, without denying the importance of sectoral heterogeneity. We also present results from the Mean Group estimator, as well as the standard OLS approach to sectoral estimation. The advantage of the MG estimation is that the results are obtained from an ARDL estimation which distinguishes between long run equilibrium and short run dynamics, thereby providing an efficiency gain over OLS. Finally, for the standard OLS results, we provide results both for the full time period under estimation, as well as for the three decades constituting the full sample period under estimation individually.

A further advantage of the present study is therefore that results from the alternative econometric approaches can be compared for consistency.

Third, the paper controls for a range of possible determinants of mark-ups. These include the possible impact of business cycles,[2] the extent of import and export penetration,[3] the impact of market structure,[4] as well as some new estimates of industry competitiveness.[5] Both the explicit control for market structure and for international competitiveness represent a further advance on the existing literature. In all cases except the tests for the impact of cyclical variation, we control for both within and between industry variation in the determinant of the mark-up. Finally, we also control for the possible impact of intermediate inputs on the magnitude of the mark-up, again comparing the resultant mark-up in South African manufacturing industry with that found for US manufacturing industry.

For South African manufacturing industry we find a mark-up that is consistently higher than that of US manufacturing industry, with counter cyclical variation. Both import and export penetration serves to decrease the mark-up in sectors, with the implication that competition on world markets serves to discipline domestic producers. Increased industry concentration increases industry mark-up. By contrast, increased between industry competitiveness as measured by falling relative unit labour costs increases industry mark-ups, though increased within industry competitiveness does serve to lower the mark-up. The implication is that South African industry does not pass on cost improvements. Finally, including intermediate input costs in the computation of marginal cost does serve to lower the estimated mark-up, but the South African mark-up continues to be substantially greater than that of US industry, provided only that industry concentration is controlled for in regression.

The paper begins with a literature review and theoretical outline in Section 2. Relevant extensions of the theory are also provided along with previous results. In section 3 the estimation methodology is outlined. We report results in Section 4 and conclude in Section 5.

2 Productivity Residuals and the Mark-up

Under the assumption of constant returns to scale, the primal computation of the Solow residual (SR, but often termed growth in Total Factor Productivity

[2] See the discussion in Oliveira Martins and Scarpetta (1999).

[3] See the discussion in Hakura (1998).

[4] See Fedderke (2003) on the estimates of industry concentration for South Africa.

[5] See the discussion in Edwards and Schör (2002), and Edwards and Golub (2003) on estimates of international competitiveness.

TFP), is related to the mark-up of prices over marginal cost. Hall (1990) demonstrates that:

$$\begin{aligned} TFP &= SR = \Delta q - \alpha \cdot \Delta l - (1-\alpha) \cdot \Delta k \\ &= (\mu - 1) \cdot \alpha \cdot (\Delta l - \Delta k) + \theta \end{aligned} \tag{1}$$

where $\mu = P/MC$, with P denoting price, and MC denoting marginal cost, Δ denotes the first difference, lower case denotes the natural log transform, q, l, and k denote real value added, labour, and capital inputs, α is the labour share in value added, and $\theta = \dot{A}/A$ denotes exogenous (Hicks-neutral) technological progress.

Under perfect competition $\mu = 1$, while imperfectly competitive markets allow $\mu > 1$.

Estimation of equation (1) faces the difficulty that the explanatory variables $(\Delta l - \Delta k)$ will themselves be correlated with the productivity shocks θ, and hence result in bias and inconsistency in the estimates of μ. One solution is to instrument, which in turn raises the requirement that the instruments are correlated with the factor inputs, but not technological change and hence the error term (θ). In the case of applications to the US, instruments employed have been pure aggregate demand shifters. In particular, variables employed have been aggregate real GDP, military expenditure, the world oil price, and the political party of the president.[6] Instrumentation for the US led to the estimation of mark-ups that often were argued to be implausibly high.[7]

An alternative approach to avoid the endogeneity bias and instrumentation problems has been suggested by Roeger (1995). By computing the dual of the Solow residual (DSR), we can again obtain a relation of the price-based productivity measure to the mark-up:

$$\begin{aligned} DSR &= \alpha \cdot \Delta w - (1-\alpha) \cdot \Delta r - \Delta p \\ &= (\mu - 1) \cdot \alpha \cdot (\Delta w - \Delta r) + \theta \end{aligned} \tag{2}$$

with w, r denoting the natural logs of the wage rate and rental price of capital respectively. While equation (2) is subject to the same endogeneity problems, and hence instrumentation problems as equation (1), Roeger's insight was

[6]See for instance the discussion in Oliveira Martins and Scarpetta (1999).

[7]Bias remains a problem for an application to South African data. For this reason we exclude the Hall methodology from the South African study.

that subtraction of equation (2) from equation (1) would give us the *nominal* Solow residual (NSR), given by:

$$\begin{aligned} NSR &= \Delta(p+q) - \alpha \cdot \Delta(w+l) - (1-\alpha)\cdot\Delta(r+k) \\ &= (\mu - 1)\cdot\alpha\cdot[\Delta(w+l) - \Delta(r+k)] \end{aligned} \qquad (3)$$

in which the productivity shocks (θ) have cancelled out, removing the endogeneity problem, and hence the need for instrumentation. The mark-up is now accessible to simple OLS estimation, or computation.[8]

While problems of endogeneity and instrumentation are addressed by equation (3), there is an additional difficulty arising from the assumption of constant returns to scale, and the use of value added measures of output. Oliveira Martins and Scarpetta (1999) demonstrate that where the assumption of constant returns to scale is dropped, equation (3) is actually:

$$NSR = \left(\frac{\mu}{\lambda} - 1\right)\cdot\alpha\cdot[\Delta(w+l) - \Delta(r+k)] \qquad (4)$$

where $\lambda > 1$ denotes increasing returns to scale.[9] Thus any estimate of mark-up that follows from Solow residuals should be interpreted as *lower-bound* values if increasing returns to scale are present.

2.1 Sectoral Business Cycles and Dynamic Mark-Ups

Empirical studies have indicated the possibility of mark-ups sensitive to the business cycle,[10] though their reliance on the Hall methodology is likely to compromise their reliability.[11] Theory is ambiguous concerning the expectations we might form on mark-up behaviour over the business cycle. Both counter- and pro-cyclical mark-ups are feasible.

Oligopolistic markets in which conjectural response behaviour is present, would generate mark-ups that depend on market conditions. Where capacity constraints are present, mark-ups would be pro-cyclical.

[8] Trivially:

$$\mu - 1 = \frac{\Delta(p+q) - \alpha\cdot\Delta(w+l) - (1-\alpha)\cdot\Delta(r+k)}{\alpha\cdot[\Delta(w+l) - \Delta(r+k)]}$$

[9] The point about equation (3) is that it assumes $\lambda = 1$.

[10] See Bils (1987), Domowitz et al (1988), Rotemberg and Woodford (1991), Morrison (1994), Haskel et al (1995), and Beccarello (1996).

[11] See the discussion in Ramey (1991).

Counter-cyclical mark-ups are also feasible. Where entry into markets is feasible, expansion of demand would lead to entry, increased competition, and downward pressure on the mark-up.[12] Where firms develop customer bases during expansions mark-ups may again prove counter-cyclical.[13] Should firms defecting from cartels increase market share during upturns, the gain from increased market share may outweigh the long term loss from cartel punishment.[14] Since profit maximization implies that the mark-up is an inverse function of demand elasticity, the mark-up will prove counter-cyclical as long as product variety is pro-cyclical.[15]

As long as one is able to postulate a linear relationship between price margins and a measure of cyclical demand fluctuation (C), then we may estimate:[16]

$$\begin{aligned} NSR &= \overline{B}\cdot\Delta x+\gamma\cdot[\Delta x\cdot C-\Delta C] \\ & \quad where \\ \Delta x &= \Delta\left(p+q\right)-\Delta\left(r+k\right) \end{aligned} \tag{5}$$

where $B=\frac{P-MC}{P}=1-\frac{1}{\mu}$ is the Lerner index, such that $\overline{\mu}=\frac{1}{1-\overline{B}}$ gives the fixed component of the mark-up, while γ provides an estimate of the cyclical component of the mark-up. For the measure of cyclical fluctuation, the literature has employed aggregate employment, capacity utilization,[17] sectoral employment,[18] and deviations of output from long term trend as given by the Hodrick-Prescott filter.[19]

[12]See Chatterjee (1993).
[13]See Bils (1987) and Phelps (1994).
[14]See Rotemberg and Saloner (1986) and Chevalier and Scharfstein (1996).
[15]See Weitzman (1982).
[16]See the discussion in Oliveira Martins and Scarpetta (1999).
[17]Both in Haskel et al (1995).
[18]See Bils (1987).
[19]See Oliveira Martins and Scarpetta (1999). One limitation of this approach is that equation (5) follows from a first-order Taylor approximation of the primal and dual Solow residuals. Strictly speaking this allows estimation only of the steady-state mark-up $(\overline{\mu})$, not of cyclical effects which are second-order. Under the assumption of technology that is Leontieff, with capital and labour nested in a value added function which combines with intermediate inputs (let the function be denoted G), and with Hicks neutrality in technological progress, a relation for variable mark-up is given by:

$$\begin{aligned} \Delta\log\mu &= (\Delta q+\Delta p)-\Delta w-[(\Delta p_G+\Delta g)-(\Delta p_M+\Delta m)]\cdot\overline{\mu}\cdot s_M \\ & \quad +\left(\frac{1}{\sigma_G}\cdot\frac{s_K}{s_L+s_K}-\overline{\mu}\cdot s_K\right)\cdot\Delta k \end{aligned} \tag{6}$$

2.2 The Open Economy Context

The discussion thus far has ignored the impact of the open economy context. Yet tariff and other restrictions clearly carry implications for the degree of international competition to which domestic industry is exposed, and hence the magnitude of the feasible mark-up that domestic industry can maintain. By implication, the suggestion is that trade liberalization is a means by which inefficiency in production can be remedied.[20]

Hakura (1998) offers one means of incorporating the open economy context into the estimation of mark-ups over marginal cost. The starting point of analysis is the suggestion that tariff and other trade restrictions shield domestic industry from international competition. Hence reduction in trade barriers should decrease the market power of domestic producers, through increased import penetration, decreasing mark-ups of price over marginal cost. The suggestion is thus that trade liberalization will reduce the pricing power of industry (see for instance Helpman and Krugman, 1989). The impact of exports on mark-ups is more ambiguous. Increasing export ratios might be argued to increase exposure to competitive pressure, leading to reduced mark-ups. However, where producers can price discriminate between domestic and international markets, or in the presence of a corresponding product differentiation, the relationship between export ratios and mark-ups may prove positive.

The relationship tested by Hakura (1998) is given by:[21]

$$\begin{aligned} dq_{it} &= \eta_0 + \eta_{1,it} dx^*_{it} + \eta_2 \left[IPR_{it} - \overline{IPR_i} \right] dx^*_{it} + \eta_{3,i} + u_{it} \qquad (7) \\ where\ dq &= dv + \frac{s_{ym}}{1 - s_{ym}} dm \\ &\quad + \left(\frac{1}{\sigma_G} \cdot \frac{s_K}{s_L + s_K} \cdot \frac{L}{L - \overline{L}} - \overline{\mu} \cdot s_L \right) \cdot \Delta l - \overline{\mu} \cdot s_M \cdot \Delta m \end{aligned}$$

where $\Delta p_G + \Delta g$ denotes the change in nominal value added, σ_G the elasticity of substitution between capital and labour in the value added function, s_i the share of factor i in gross output, $\overline{L}$ the amount of labour devoted to fixed cost. Thus $L/\left(L - \overline{L}\right)$ gives an indication of the degree of downward rigidity in labour adjustment, with $L/\left(L - \overline{L}\right) = 1$ providing the case for perfect flexibility, $L/\left(L - \overline{L}\right) = \infty$ the case for complete rigidity. In the application by Oliveira Martins and Scarpetta (1999), the cases given by $\sigma_G = 1,\ 0.5,\ 2,$ were considered, as well as $\overline{L} = 0,\ 0.4,\ 0.2.$

[20] See for instance the discussion in Helpman and Krugman (1989).

[21] The panel employed in the Hakura study employs both corss-country and corss-industry elements. The reported equation has adapted this to the cross-industry panel context employed in the present study.

$$dx^* = s_{vl}dl + s_{vk}dk + \frac{s_{ym}}{1 - s_{ym}}dm$$

where dv denotes the log change in value added, s_{va} the share of factor a in value added, s_{ym} the share of intermediate goods in gross output, IPR denotes the import penetration ratio, and i denotes the $i'th$ industry. While η_1 provides a measure of the mark-up, η_2 captures the impact of deviations of import penetration from the sectoral mean value of import penetration on the mark-up. Where $\eta_2 < 0$, rising import penetration lowers the mark-up, where $\eta_2 > 0$, rising import penetration raises the mark-up.

While in the Hakura study, η_2 is held to be homogenous across countries and sectors by assumption, in the present study our panel estimation methodology allows us to test whether the assumption is justified.

An additional difficulty is that the specification given by equation 7 is again subject to endogeneity problems, since production and input change decisions are likely to be simultaneous. We therefore again subject the specification of 7 to the transformations suggested by Roeger (1995).

A final extension proves necessary due to the use of panel data in the present study. Estimation of the mark-up on an industry-by-industry basis requires a control only for within-industry variation of import penetration in order to capture trade effects. In a panel data context this is not sufficient, since variation in import penetration between industries is not captured, omitting an important source of heterogeneity between industries. For this reason we estimate the following specification to test for the impact of import penetration on the mark-up:

$$\begin{aligned} NSR_{it} = {} & \theta_0 + \theta_1 \left(\alpha \cdot \left[\Delta\left(w+l\right) - \Delta\left(r+k\right)\right]\right)_{it} \\ & + \theta_2 \left[IPR_{it} - \overline{IPR_i}\right] \left(\alpha \cdot \left[\Delta\left(w+l\right) - \Delta\left(r+k\right)\right]\right)_{it} \\ & + \theta_3 \left[IPR_{it} - \overline{IPR}\right] \left(\alpha \cdot \left[\Delta\left(w+l\right) - \Delta\left(r+k\right)\right]\right)_{it} + u_{it} \end{aligned} \tag{8}$$

where $\overline{IPR_i}$ denotes the mean import penetration for the $i'th$ industry, and $\overline{IPR}$ denotes the mean import penetration across all industries. Thus θ_2 captures the impact of within-industry variation of import penetration, and θ_3 the between-industry variation in import penetration on the mark-up.

Interpretation of the results is symmetrical with equation 7, except that endogeneity problems are absent.

Finally, we can provide symmetrical specifications to equations 7 and 8, replacing the import penetration term, IPR, with export penetration, EPR.

2.3 The Impact of Market Structure and Industry Performance

Another important consideration concerns the impact of market structure on the magnitude of mark-ups. Market concentration may determine the pricing power of firms, and hence the mark up of price over marginal cost.[22] Of course, contestability of markets may limit the ability of domestic producers to exercise market power even in the presence of high degrees of industry concentration.[23] Absent an ability to control for the contestability of markets, the effect of industry concentration on mark-ups is therefore ambiguous, and must remain a matter for empirical determination.

Given the use of panel data for the present study, it is again appropriate to control for both within-industry and between-industry variation in market structure. In order to anticipate the now standard endogeneity problems, we therefore specify the relationship for purposes of estimation:

$$\begin{aligned} NSR_{it} &= \vartheta_0 + \vartheta_1 \left(\alpha \cdot [\Delta(w+l) - \Delta(r+k)]\right)_{it} \\ &+ \vartheta_2 \left(\Upsilon_{it} - \overline{\Upsilon}_i\right) \cdot \left(\alpha \cdot [\Delta(w+l) - \Delta(r+k)]\right)_{it} \\ &+ \vartheta_3 \left(\Upsilon_{it} - \overline{\Upsilon}\right) \cdot \left(\alpha \cdot [\Delta(w+l) - \Delta(r+k)]\right)_{it} + \varepsilon_{it} \end{aligned} \tag{9}$$

where Υ_{it} denotes the concentration ratio of sector i in period t, while $\overline{\Upsilon}_i$ denotes the mean concentration ratio of industry i and $\bar{\Upsilon}$ denotes the mean

[22] Following Cowling and Waterson (1976), one can show that $\frac{p-MC_i}{p} = -\frac{s_i(1+\lambda_i)}{\eta}$, where MC_i denotes $i'th$ firm-specific marginal cost, s_i the market share of firm i, λ_i the $i'th$ firm's expectation of anticipated competitive behaviour of rival firms ($\lambda > 0$ implies an expectation of an increased roduction by rivals, $\lambda < 0$ a decrease), and η the market price elasticity of demand. Thus there is a potential relationship between price-cost margins, and market power, the strength of which is determined by the price elasticity of demand. Under Cournot (1938), $\lambda_i = 0$, such that $\frac{p-MC_i}{p} = \frac{s_i}{\eta}$, providing a direct relation between price-cost margins and market power. See Friedman (1983) and Ruffin (1971). Stigler (1964)-collusion would provide $\frac{p-MC_i}{p} = \frac{1}{\eta}$, identical to the monopolistic case. In the presence of a dominant firm exercising price leadership, we have $\frac{p-MC_d}{p} = \frac{s_d}{\eta+(1-s_d)s_s}$, with MC_d and s_d denoting marginal cost and market share of the dominant firm, and s_s the market share of fringe firms. See Waterson (1984), and Gollop and Roberts (1979). See also Tirole (2000:221ff), where the profit - revenue ratio equals the Herfindahl index - price elasticity of demand ratio. For the more complex case of pricing in the presence of product differentiation, see Cubbin (1983).

[23] Though not completely. Bain (1956) limit prices to effectively impede entry do not require perfectly competitive prices to be realized. In South Africa, Modigliani's (1958) conditioning of limit pricing on economies of scale in production, market size and price elasticity of demand may be particularly important. See also Tirole (2000:308ff).

concentration ratio of the manufacturing sector as a whole. While ϑ_1 provides a measure of the mark-up, ϑ_2 captures the impact of deviations of concentration from the sectoral mean concentration ratio on the mark-up, and ϑ_3 measures the impact of deviations of concentration from the aggregate mean value of concentration on the mark-up.

An additional consideration is that industry performance may also influence pricing behaviour. While concentration may serve to enhance pricing power, an industry's cost competitiveness may also have two possible effects on firms' ability to price above marginal cost. Where there are strong competitive pressures present in the industry, price should be driven toward marginal cost of production even in the presence of cost reductions. Alternatively, where firms possess pricing power, reductions in production costs would translate into reduced price-cost margins. Variation in an industry's cost competitiveness could thus either serve to increase, or leave unaffected the mark-up of price over marginal cost. Industry cost competitiveness may or may not translate into price competition, and the net impact of cost competitiveness on price- marginal cost mark-ups remains a matter for empirical determination.

As is now standard, the panel data used in this study necessitates controlling for both within- and between-industry variation in cost competitiveness. Similarly, to control for the now standard endogeneity problems noted for the present context, we therefore specify:

$$\begin{aligned} NSR_{it} &= \xi_0 + \xi_1 \left(\alpha \cdot \left[\Delta\left(w+l\right) - \Delta\left(r+k\right)\right]\right)_{it} \\ &\quad + \xi_2 \left(\;_{it} - \overline{\;}_i \right) \cdot \left(\alpha \cdot \left[\Delta\left(w+l\right) - \Delta\left(r+k\right)\right]\right)_{it} \\ &\quad + \xi_3 \left(\;_{it} - \overline{\;} \right) \cdot \left(\alpha \cdot \left[\Delta\left(w+l\right) - \Delta\left(r+k\right)\right]\right)_{it} + \varepsilon_{it} \end{aligned} \tag{10}$$

where $\;_{it}$ denotes the cost competitiveness of sector i in period t, while $\overline{\;}_i$ denotes the mean cost competitiveness of industry i and $\overline{\;}$ denotes the mean cost competitiveness of all manufacturing sectors. While ξ_1 provides a direct measure of the mark-up, ξ_2 captures the impact of deviations from the industry mean value of cost competitiveness, and ξ_3 measures the impact of deviations of cost competitiveness from the aggregate mean value of cost competitiveness across all economic sectors on the mark-up.

2.4 Accounting for Intermediate Input Costs

A final consideration arises from the specification of marginal cost. A sequence of studies have pointed out that specifying marginal cost in terms of capital and labour inputs would serve to bias upward the estimate of marginal cost, due to the omission of intermediate inputs. Norrbin (1993) and Basu (1995) demonstrate.[24] Incorporating intermediate inputs modifies equation (3) to:

$$\begin{aligned} NSR^{GO} &= \Delta\left(p^{GO}+q^{GO}\right)-\alpha^{GO}\cdot\Delta\left(w+l\right)-\beta^{GO}\cdot\Delta\left(p_m+m\right) \\ &\quad -\left(1-\alpha^{GO}-\beta^{GO}\right)\cdot\Delta\left(r+k\right) \\ &= \left(\mu-1\right)\cdot\left[\begin{array}{c}\alpha^{GO}\cdot\Delta\left(w+l\right)+\beta^{GO}\cdot\Delta\left(p_m+m\right) \\ -\left(\alpha^{GO}+\beta^{GO}\right)\Delta\left(r+k\right)\end{array}\right] \end{aligned} \quad (11)$$

where the GO superscript denotes gross output values, and m, p_m, β denote intermediate inputs, prices and output share, $\Delta\left(w+l\right)$ denotes the log change in nominal labour cost, $\Delta\left(p_m+m\right)$ the log change in nominal intermediate goods costs, $\Delta\left(r+k\right)$ the log change in nominal capital cost, and α^{GO} and β^{GO} are the share of labour and intermediate goods in gross output respectively. Empirical application generates mark-ups that lie substantially below those obtained under the Roeger and Hall methodologies.

2.5 Previous Empirical Results

Studies investigating the mark up experienced in the US manufacturing industry do find that applying the Hall (1990) instrumental variables methodology does appear to contain an upward bias relative to the Roeger (1995) methodology. Also, the predicted upward bias of mark-ups obtained from value added output measures does appear to be present in the Oliveira Martins and Scarpetta (1999) study.

Further studies have shown the presence of counter-cyclical variation in the mark-up, regardless of whether the estimates are based on first or second order effects, and regardless of the assumption advanced concerning the degree of rigidity of the labour market, or the elasticity of substitution between capital and labour.

3 The Econometric Methodology

We proceed with an estimation of equations 3, 5, 8, 9, 10 and 11. The panel estimator is provided by the Pooled Mean Group estimator provided

[24] See also the discussion in Basu and Fernald (1995), and Oliveira Martins and Scarpetta (1999).

by Pesaran, Shin and Smith (1999). See also the discussion in Fedderke, Shin and Vaze (2000) and Fedderke (2003a). Since data employed for this study is stationary,[25] estimation can proceed either by OLS or by ARDL.

3.1 The Panel Estimator

Consider the unrestricted error correction ARDL(p, q) representation:

$$\Delta y_{it} = \phi_i y_{i,t-1} + \boldsymbol{\beta}_i' \mathbf{x}_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \boldsymbol{\delta}_{ij}' \Delta \mathbf{x}_{i,t-j} + \mu_i + \varepsilon_{it}, \quad (12)$$

where $i = 1, 2, ..., N$, $t = 1, 2, ..., T$, denote the cross section units and time periods respectively. Here y_{it} is a scalar dependent variable, $\mathbf{x}_{it}$ $(k \times 1)$ a vector of (weakly exogenous) regressors for group i, and μ_i represents fixed effects. Allow the disturbances ε_{it}'s to be independently distributed across i and t, with zero means and variances $\sigma_i^2 > 0$, and assume that $\phi_i < 0$ for all i. Then there exists a long-run relationship between y_{it} and $\mathbf{x}_{it}$:

$$y_{it} = \boldsymbol{\theta}_i' \mathbf{x}_{it} + \eta_{it}, \; i = 1, 2, ..., N, \; t = 1, 2, ..., T, \quad (13)$$

where $\boldsymbol{\theta}_i = -\boldsymbol{\beta}_i'/\phi_i$ is the $k \times 1$ vector of the long-run coefficients, and η_{it}'s are stationary with possibly non-zero means (including fixed effects). This allows (12) to be written as:

$$\Delta y_{it} = \phi_i \eta_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \boldsymbol{\delta}_{ij}' \Delta \mathbf{x}_{i,t-j} + \mu_i + \varepsilon_{it}, \quad (14)$$

where $\eta_{i,t-1}$ is the error correction term given by (13), and thus ϕ_i is the error correction coefficient measuring the speed of adjustment towards the long-run equilibrium.

This general framework allows the formulation of the PMG estimator, which allows the intercepts, short-run coefficients and error variances to differ freely across groups, but the long-run coefficients to be homogenous; i.e. $\boldsymbol{\theta}_i = \boldsymbol{\theta} \; \forall \; i$. Group-specific short-run coefficients and the common long-run coefficients are computed by the pooled maximum likelihood estimation. Denoting these estimators by $\tilde{\phi}_i$, $\tilde{\boldsymbol{\beta}}_i$, $\tilde{\lambda}_{ij}$, $\tilde{\boldsymbol{\delta}}_{ij}$ and $\tilde{\boldsymbol{\theta}}$, we obtain the PMG

[25] Space constraints prohibit a report of the comprehensive set of ADF statistics. They are available from the authors on request.

estimators by $\hat{\phi}_{PMG} = \frac{\sum_{i=1}^{N} \tilde{\phi}_i}{N}$, $\hat{\boldsymbol{\beta}}_{PMG} = \frac{\sum_{i=1}^{N} \tilde{\boldsymbol{\beta}}_i}{N}$, $\hat{\lambda}_{jPMG} = \frac{\sum_{i=1}^{N} \tilde{\lambda}_{ij}}{N}$, $j = 1, ..., p-1$, and $\hat{\boldsymbol{\delta}}_{jPMG} = \frac{\sum_{i=1}^{N} \tilde{\boldsymbol{\delta}}_{ij}}{N}$, $j = 0, ..., q-1$, $\hat{\boldsymbol{\theta}}_{PMG} = \tilde{\boldsymbol{\theta}}$.

PMG estimation provides an intermediate case between the dynamic fixed effects (DFE) estimator which imposes the homogeneity assumption for all parameters except for the fixed effects, and the mean group (MG) estimator proposed by Pesaran and Smith (1995), which allows for heterogeneity of all parameters. It exploits the statistical power offered by the panel through long-run homogeneity, while still admitting short-run heterogeneity.

The crucial question is whether the assumption of long-run homogeneity is justified, given the threat of inefficiency and inconsistency noted by Pesaran and Smith (1995). We employ a Hausman (1978) test (hereafter h test) on the difference between MG and PMG estimates of long-run coefficients to test for long run heterogeneity.[26] Note that as long as the homogeneity Hausman test is passed in our estimations, we report only PMG estimation results.[27]

Finally, it is worth pointing out that a crucial advantage of the estimation approach of the present paper, is that the dynamics of adjustment in the mark-up are explicitly modelled, while recognizing the presence of a long run equilibrium relationship underlying the dynamics. Thus the justification for the use of the PMG estimator is that it is consistent both with the underlying theory of a homogenous long-run mark-up of price over marginal cost relationship and the possibly heterogeneous dynamic time series nature of the data. As long as sector-homogeneity is assured, the PMG estimator offers efficiency gains over the MG estimator, while granting the possibility of dynamic heterogeneity across sectors unlike the DFE estimator. In the presence of long run homogeneity, therefore, our preference is for the use of the PMG estimator.

[26] An alternative is offered by Log-Likelihood Ratio tests. However, the finite sample performance of such tests are generally unknown and thus unreliable. We therfore employ the h-test instead.

[27] The authors thank Yongcheol Shin for the provision of the appropriate GAUSS code for estimation purposes.

4 Estimation Results

4.1 The Data

The data employed for this study focus on the three digit manufacturing sectors, over the 1970-97 period.

We employ a panel data set for purposes of estimation, with observations from 1970 through 1997. The panel employs data for the 28 three-digit SIC version 5 manufacturing sectors in the South African economy for which data is available. Due to problems with data availability a number of sectors have been omitted. These sectors are Tobacco, Coke and Refined Petroleum products, Television Equipment, Professional Equipment and Other Transport Equipment. In addition, due to missing concentration ratios we have also omitted the Other Chemicals sector. The list of sectors included in the panel is that specified in Table 1. This provides a 22×28 panel with a total of 616 observations. For data on TFP growth in South African manufacturing, we rely on Fedderke (2002). For data on competitiveness we rely on Edwards and Golub (2002). Data on concentration ratios is obtained from Fedderke (2003b). Further variables for the manufacturing sector include the output, capital stock, and labour force variables and their associated growth rates.

4.2 Panel Estimation Results for Manufacturing

4.2.1 The Roeger Results

In Table 2 we report the PMGE results for the manufacturing sectors given by the specification:

$$\begin{aligned} NSR_{it} &= \gamma_0 + \gamma_1 ROEGER_{it} + \varepsilon_{it} \qquad (15) \\ & \quad where \\ ROEGER_{it} &= \alpha_{it} \cdot [\Delta (w + l) - \Delta (r + k)] \end{aligned}$$

with α_{it} denoting the share of labour in value added of sector i, $\Delta (w + l)_{it}$ the log change in nominal labour cost for sector i, $\Delta (r + k)_{it}$ the log change in total capital stock for sector i, and NSR_{it} the nominal Solow residual. γ_1 now measures $(\mu - 1)$, where $\mu = P/MC$ is the mark-up.

An important estimation issue concerns the construction of the $\Delta (r + k)_{it}$ variable. $ROEGER\delta$ employs the rental price of capital, defined as $((i - \pi_e)+$

Sectors
Food
Beverages
Textiles
Wearing apparel
Leather & leather products
Footwear
Wood & wood products
Paper & paper products
Printing, publishing & recorded media
Basic chemicals
Plastic products
Rubber products
Glass & glass products
Non-metallic minerals
Basic iron & steel
Basic non-ferrous metals
Metal products exlcuding machinery
Machinery & equipment
Electrical machinery
Motor vehicles, parts & accessories
Furniture
Other industry

Table 1: Three Digit Manufacturing Sectors

$\delta) \cdot P_{K,i}$, where $(i - \pi_e)$ denotes the expected real interest rate,[28] δ denotes the depreciation rate on capital stock computed from the series on depreciation, and $P_{K,i}$ denotes the price index on total capital stock, to compute the nominal value of capital stock.[29] For $ROEGER5$ we set $\delta = 5\%$, for $ROEGER10$ $\delta = 10\%$.[30]

Results indicate the presence of an aggregate mark-up for the manufacturing sector over the sample period, and in both instances adjustment to equilibrium as indicated by the ϕ-parameter is rapid. The Hausman test accepts the inference of an homogenous mark-up across manufacturing sectors.

We note that a significant mark-up is present for the manufacturing sector regardless of whether we employ the $ROEGER5$ or $ROEGER10$ specifications. The distinction between the rental price of capital computed under the 5% and 10% depreciation assumptions appears to make relatively little difference to the implied mark-up in South African manufacturing.

On both estimations for the Roeger methodology, the manufacturing sector mark-up for South Africa lies above the average manufacturing sector mark-up obtained in the original Roeger (1995) estimations for the US (79% or 77% as opposed to a 45% average across US sectors).[31] Thus the mark-up in South African manufacturing industry appears to be higher than in comparable US industries, despite the fact that manufacturing sectors, in producing tradeables, might be expected to be subject to foreign competitive pressure.

4.2.2 The Cyclical Results

In Table 3 we report the PMGE estimations for the specification given by:

$$\begin{aligned} NSR_{it} &= \zeta_0 CYC_{1,it} + \zeta_1 CYC_{2,it} + \varepsilon_{it} \qquad (16) \\ & \quad where \\ CYC_1 &= \Delta(p+q) - \Delta(r+k) \end{aligned}$$

[28] We define i as the yield on 10 year government bonds, while π_e is computed on the basis of a Hodrick-Prescott filter on the inflation rate.

[29] Strictly speaking, the rental price of capital should include capital taxes and deductions. However, since concern here is with the growth rate in the rental price of capital, and capital taxes and deductions do not show strong variability over time, the computation of the rental price can legitimately abstract from the tax dimension.

[30] An alternative would employ the first difference in the nominal value of total capital stock. However, it is clear that this represents an incorrect computation of the $\Delta(r+k)$ term, since it would incorporate economic profit, thus overstating the cost of capital.

[31] Recall that $\gamma_1 = \mu - 1$.

	$\gamma_1 = \mu - 1$	$\phi\ (ECM)$	h-test	RLL	LR: $\chi^2_{\{d.f.\}}$	Lag Order
$nsr5$	0.79^* (0.01)	-0.93^* (0.04)	1.13 [0.25]	618	622^* {21}	AIC(3)
$nsr10$	0.77^* (0.02)	-0.91^* (0.05)	1.36 [0.24]	817	311^* {21}	AIC(3)

Table 2: PMG estimator results for manufacturing sector mark-up

$$CYC_2 = CYC_1 \cdot C - \Delta C$$

where $(p+q)$ denotes nominal value added, $(r+k)$ nominal capital stock, and C an indicator of cyclical variation. For the present estimations we employ an index of capacity utilization to proxy for the cyclical indicator.

The Lerner index is given directly by $\zeta_0 = \frac{P-MC}{P} = 1 - \frac{1}{\mu}$, containing the fixed component of the mark-up. In order to render the mark-up estimate consistent with the preceding results, we also report it in the form $(\mu - 1) = \frac{\zeta_0}{1-\zeta_0}$. The sign of ζ_1 indicates the cyclical character of the mark-up directly.

We again employ the two distinct estimates of the $\Delta(r+k)_{it}$ variable outlined under the Roeger results. Thus $Cyclical5$ employs the rental price of capital under the 5% depreciation assumption, and $Cyclical10$ employs the rental price of capital under the 10% depreciation assumption.

Hausman tests again allow for the inference of homogeneity across manufacturing sectors, and the ϕ-parameter confirms the presence of a long run equilibrium relationship.

On the cyclical methodology, the constant component of the mark-up varies over the $118 - 142\%$ range (for $Cyclical5$, $Cyclical10$ respectively), while the cyclical component suggests a statistically significant counter-cyclical variation of the price - marginal cost ratio over the business cycle for both the $Cyclical5$ and $Cyclical10$ estimations.

While there is thus some sensitivity of the estimated mark-up to the choice of rental price of capital, both estimates continue to confirm a substantial mark-up of price over marginal cost. Moreover, the sign on ζ_1 (<0) consistently confirms a counter-cyclical fluctuation in the mark-up for the manufacturing sector, regardless of the choice of the rental price of capital.

	$\mu - 1$	ζ_0	ζ_1	ϕ (ECM)	h-test	RLL	LR: $\chi^2_{\{d.f.\}}$	Lag Order
$nsr5$	1.18	0.54* (0.03)	−0.001* (0.000)	−0.62* (0.08)	$n.p.d.$	1126	184* {42}	ARDL(1,1,0)
$nsr10$	1.42	0.59* (0.03)	−0.001* (0.000)	−0.99* (0.11)	5.87 [0.05]	1164	278* {42}	AIC(3)

Table 3: PMG estimator results for the impact of the Business Cycle

4.2.3 The Open Economy Results

In Tables 4 and 5 we report the PMGE estimations for the specification given by:[32]

$$\begin{aligned} NSR_{it} &= \theta_0 + \theta_1 ROEGER_{it} \\ &+\theta_2 \left[jPR_{it} - \overline{jPR_i}\right] ROEGER_{it} \\ &+\theta_3 \left[jPR_{it} - \overline{jPR_i}\right] ROEGER_{it} + u_{it} \\ j &= I, E \end{aligned} \quad (17)$$

Variables are as defined above, and I, E denote imports and exports respectively. We again employ the two alternative specifications of the rental price of capital already discussed above.

Hausman tests consistently allow for the inference of homogeneity across manufacturing sectors. Further, we note that the ϕ-parameters confirm the presence of adjustment to equilibrium for all specifications.

The magnitude of the mark-up parameter, θ_1, is consistent with that already estimated under the preceding sections, regardless of whether estimation proceeds in the presence of import or export penetration ratios, with the estimate ranging from 76−82% for the specification controlling for import penetration, to 85% for the specifications controlling for export penetration.

Crucially, we find that increased import penetration ratios both within industries and across the manufacturing sector serve to decrease industry mark-ups (since $\theta_2 < 0$ and $\theta_3 < 0$). Similarly, export penetration ratios also serve to decrease industry mark-ups both within industries and across the manufacturing sector. The implication under the Roeger methodology is that domestic producers do not appear to be able to price discriminate between domestic and foreign consumers.

[32] We also estimated the specification suggested by Hakura - see 8. Results are consistent with those reported under the present section, though the estimated magnitude of the mark-up is considerably higher under the Hakura methodology.

The implication is thus that integrating South African manufacturing sectors into world markets, has the effect of increasing price competition, and hence lowering the size of the mark-up. Figures 1 and 2 provide an illustration of the impact of the in-sample changes in both the within- and between-industry variations in import and export penetration under the estimated parameter values assuming a 5% depreciation rate of capital.

For import penetration, variation of industry import penetration ratios varies from the industry specific mean import penetration ratio over the range of -1 to $+3$.[33] This is labelled Within Variation. Between Variation refers to variation of industry import penetration ratios from the all sector mean import penetration ratio. The implication of import penetration impacts is that an opening of the economy to competition from imports would serve to reduce the magnitude of mark-ups over marginal cost. For maximum within-industry import penetration, the mark-up would fall from 82% (the mark-up at the industry mean) to 76%. More significantly, increasing the between industry import penetration ratio from its mean value (of 0.38) to the in-sample maximum deviation, serves to drive down the mark-up to 0%.[34] Thus, while small variation about an industry mean value of import penetration does not serve to lower mark-ups, increasing import penetration relative to the manufacturing sector average, does serve to exercise price discipline on industries. The small effect of the within industry variation is further corroborated by the statistical insignificance of the coefficient.

For export penetration, for maximum within-industry export penetration, the mark-up would fall from 85% (the mark-up at the industry mean) to 84%. Again, the strong impact of international market competition is reserved for the between industry variation. Increasing the between industry export penetration ratio from its mean value (of 0.36) to the in sample maximum deviation, serves to drive down the mark-up to 30%. Thus, while small variation about an industry mean value of import penetration does not serve to lower mark-ups, increasing import penetration relative to the manufacturing sector average, does serve to exercise price discipline on industries. Again, therefore, within industry variation of export penetration appears to exercise little economically meaningful price discipline. By con-

[33] A variation approaching -1 is feasible for a mean import penetration approaching 1, and a time specific import penetration ratio of 0. A variation of $+3$ is feasible for a mean import penetration approaching 0, and a time specific import penetration ratio of 3.

[34] A between variation of greater than 3.5 only occurs in the Professional & Scientific Equipment sector.

	$\theta_1 = \mu - 1$	θ_2	θ_3	$\phi\ (ECM)$	h-test	RLL	LR: $\chi^2_{\{d.f.\}}$	Lag Order
$nsr5$	0.82^* (0.02)	-0.02 (0.05)	-0.23^* (0.06)	-0.71^* (0.09)	0.74 [0.86]	865	217^* {63}	AIC(1,2,0,0)
$nsr10$	0.76^* (0.04)	-0.11^* (0.05)	-0.32^* (0.06)	-0.63^* (0.14)	3.90 [0.27]	1107	222^* {63}	ARDL(3)

Table 4: PMG estimator results for Import Penetration Ratios

	$\theta_1 = \mu - 1$	θ_2	θ_3	$\phi\ (ECM)$	h-test	RLL	LR: $\chi^2_{\{d.f.\}}$	Lag Order
$nsr5$	0.85^* (0.03)	-0.002 (0.003)	-0.18^* (0.07)	-0.50^* (0.10)	3.39 [0.34]	931	204 {63}	ARDL(2,1,1,3)
$nsr10$	0.85^* (0.04)	-0.003^* (0.004)	-0.18^* (0.08)	-0.67^* (0.10)	1.43 [0.70]	1020	182^* {63}	ARDL(2)

Table 5: PMG estimator results for Export Penetration Ratios

trast, export intensive industries have to have considerably curtailed pricing power. Again, moreover, the small effect of the within industry variation is further corroborated by the statistical insignificance of the coefficient.

4.2.4 The Impact of Market Structure: concentration ratios

Before turning to the impact of intermediate inputs, we cosider the impact of industrial structure and performance on the mark-up. We begin by an examination of the impact of market structure on mark-up over marginal cost. We thus estimate:

$$\begin{aligned} NSR_{it} &= \vartheta_0 + \vartheta_1 ROEGER_{it} + \vartheta_2 \left(\Upsilon_{it} - \overline{\Upsilon}_i\right) \cdot ROEGER_{it} \\ &\quad + \vartheta_3 \left(\Upsilon_{it} - \overline{\Upsilon}\right) \cdot ROEGER_{it} + \varepsilon_{it} \end{aligned} \tag{18}$$

where all variables are as defined above. We employ a Gini coefficient concentration ratio as an indicator of industry concentration.[35] We again employ the now standard two alternative specifications of the rental price of capital.

Results are reported in Table 6.

Again, Hausman tests consistently allow for the inference of homogeneity across manufacturing sectors, and the ϕ-parameter confirms the presence of

[35] See Fedderke (2003b) for the full data set and its construction.

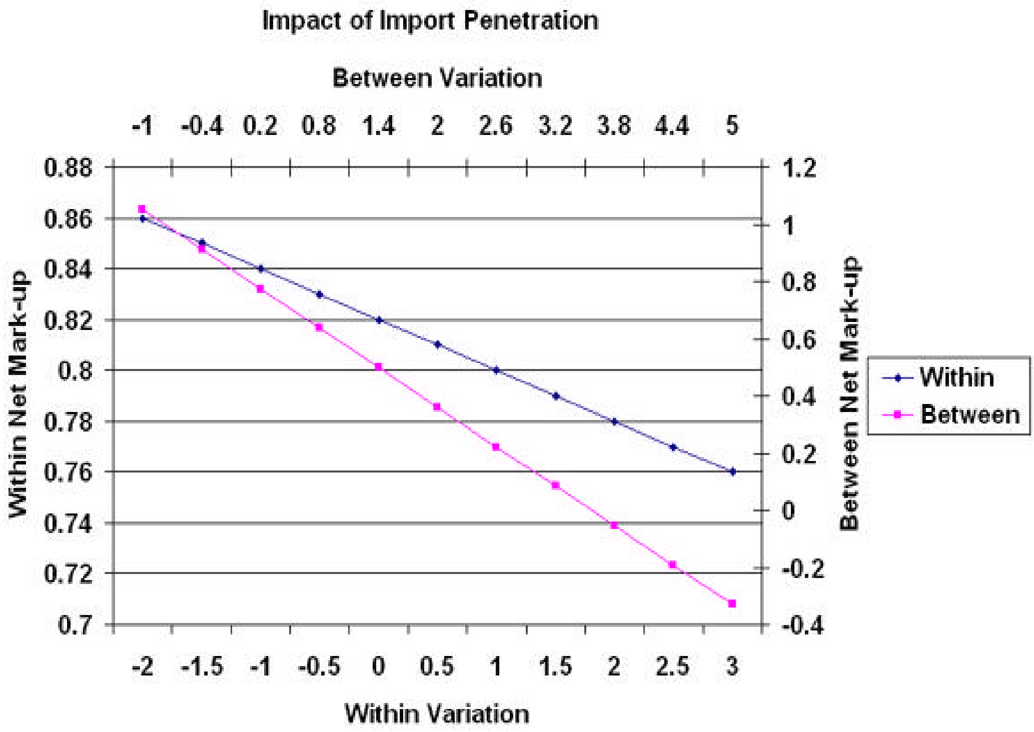

Figure 1: Impact of Within Industry and Between Industry Variation in Import Penetration

	$\vartheta_1 = \mu - 1$	ϑ_2	ϑ_3	ϕ (ECM)	h-test	RLL	LR: $\chi^2_{\{d.f.\}}$	Lag Order
$nsr5$	0.80* (0.01)	-0.42 (0.56)	0.86* (0.33)	-0.89* (0.07)	4.85 [0.18]	752	605* {63}	AIC(3)
$nsr10$	0.64* (0.04)	-2.12 (1.24)	1.40* (0.67)	-0.79* (0.06)	7.50 [0.06]	975	164* {63}	ARDL(3,2,2,1)

Table 6: PMG estimator results for Concentration Ratios

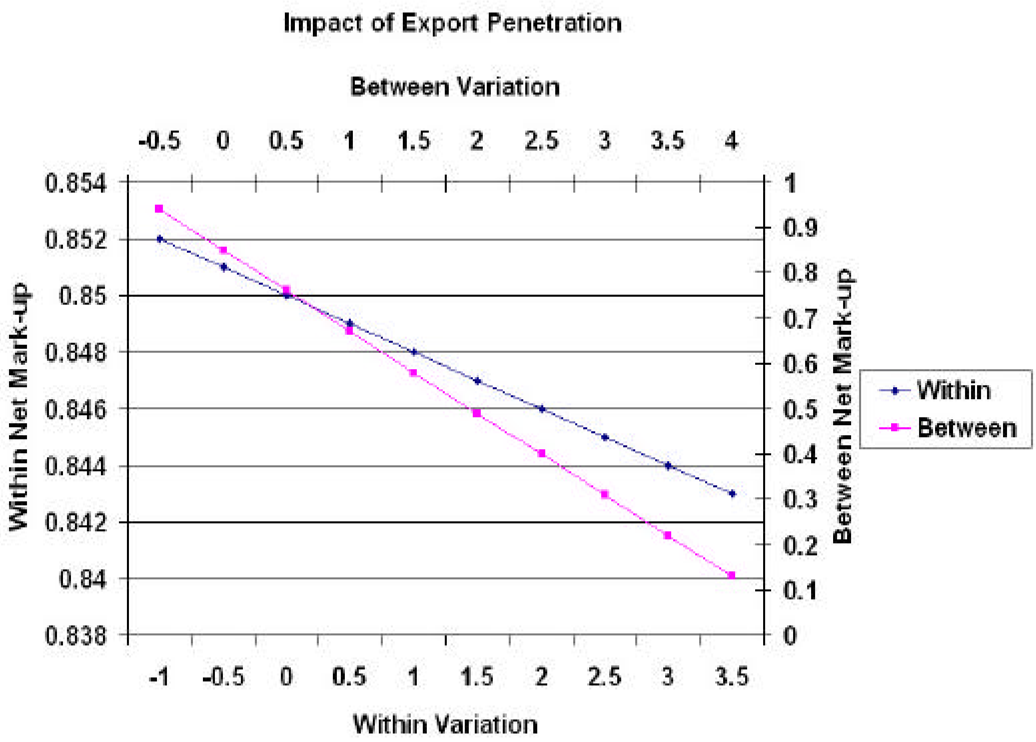

Figure 2: Impact of Within Industry and Between Industry Variation in Export Penetration

a long run equilibrium relationship in the data.

The magnitudes of mark-ups are consistent with those found under earlier sections.

Note that on both specifications within industry variation has no statistically significant impact on the industry mark-up. By contrast, the impact of between industry variation in concentration has not only a statistically significant impact, but the impact is positive. It does not appear to be the case that the contestability of markets prevents firms from exercising pricing power under conditions of increased concentration in South African industry.

Indeed, the impact of increased concentration appears to be relatively powerful. Figure 3 reports the impact of within and between industry variation in the concentration ratio. Since the within industry variation is not statistically significant, we focus on the between industry variation in industry concentration. Note that the maximum deviation of industry concentration from manufacturing mean value (of 0.82)[36] serves to increase the mark-up of price over marginal cost substantially (to a mark-up close to 100%). Conversely, a decrease in industry concentration ratio below the manufacturing sector mean is a means of lowering the magnitude of the mark-up substantially also - with the maximum deviation being associated with a mark-up of price over marginal cost of only 20%, rather than 80%.

The implication is clear. Market concentration does impact on the pricing behaviour of South African manufacturing sectors. Rising concentration serves to raise the market power of producers, and generating higher mark-ups of price over marginal cost. Conversely, the implication is that competition policy offers one means of actively improving the competitiveness of South African industry (as measured by the ratio of price to marginal cost).

4.2.5 The Impact of Industry Performance: relative unit labour cost

To explore the impact of industry cost competitiveness we estimate:

$$\begin{aligned} NSR_{it} &= \xi_0 + \xi_1 ROEGER_{it} + \xi_2 \left(\;_{it} - \overline{\;\;}_{i} \right) \cdot ROEGER_{it} \\ &\quad + \xi_3 \left(\;_{it} - \overline{\;\;} \right) \cdot ROEGER_{it} + \varepsilon_{it} \end{aligned} \tag{19}$$

with all variables defined as above. We continue to employ the two alternative specifications for the two alternative estimated capital rental prices.

[36]A higher Gini coefficient implies greater industry concentration.

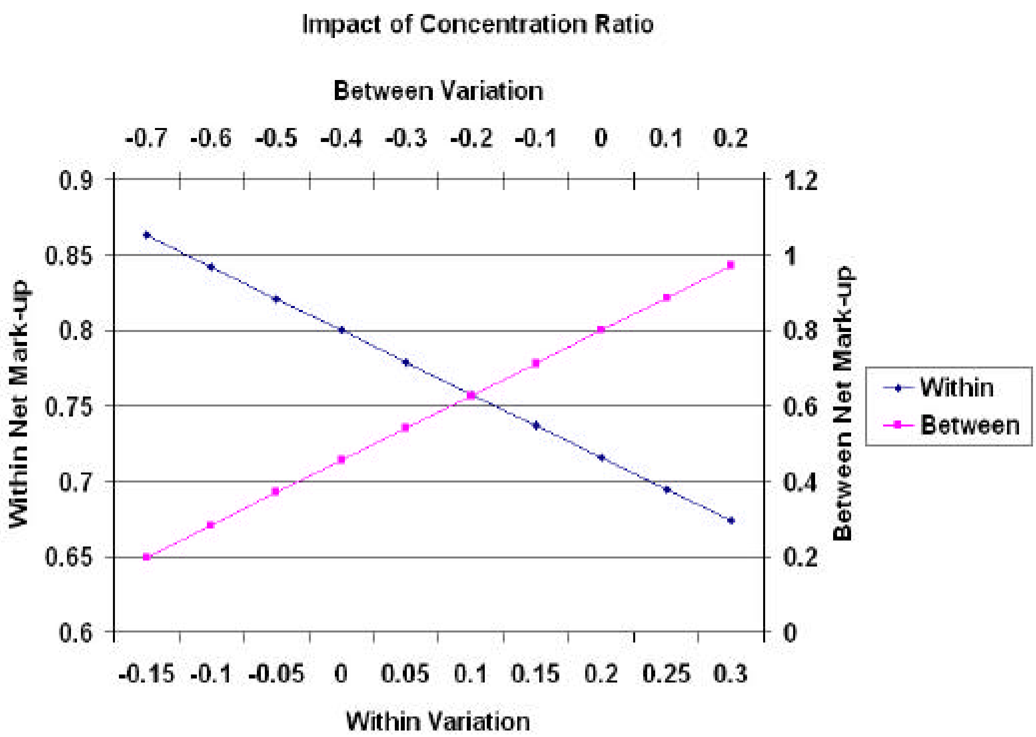

Figure 3: Impact of Within Industry and Between Industry Variation in Concentration Ratios

	$\xi_1 = \mu - 1$	ξ_2	ξ_3	ϕ (ECM)	h-test	RLL	LR: $\chi^2_{\{d.f.\}}$	Lag Order
$nsr5$	0.64* (0.01)	0.89* (0.05)	−0.95* (0.05)	−0.89* (0.08)	4.70 [0.19]	779	381* {57}	AIC(3)
$nsr10$	0.63* (0.02)	0.88* (0.09)	−1.09* (0.09)	−0.97* (0.06)	1.78 [0.62]	905	305* {57}	AIC(3)

Table 7: PMG estimator results for Competitiveness

The data used in the analysis of competitiveness was obtained from Edwards and Golub (2002). Competitiveness is calculated using a measure of relative unit labour cost which represents the labour cost of producing one unit of domestic output relative to other countries measured in a common currency. Relative unit labour cost is measured as the ratio of domestic real unit labour cost to foreign real unit labour cost expressed in the domestic currency. Edwards and Golub calculate unit labour cost in a number of different ways. The measure of productivity used to calculate both domestic and foreign unit labour costs can be either GDP or value added. The measure used in this paper is the ratio of real wages to GDP. In addition, they use three different exchange rates in their weighting of the relative unit labour cost, taking account of South Africa's varying trading partners. This paper employs the real effective exchange rate taking into account the whole world.[37] An increase in the value of relative unit labour costs indicates a decrease in competitiveness.

Given that cost competitiveness is measured by relative unit labour cost, an increase in competitiveness is given by $\frac{d\ _{it}}{dt} < 0$ - i.e. the -measure of competitiveness is inverted. For the interpretation of the results it is important to recognize that both $\frac{d(\ _{it} - \bar{\ }_i)}{dt} > 0$, and $\frac{d(\ _{it} - \bar{\ })}{dt} > 0$ therefore signify a fall in competitiveness of the industry relative to the relevant mean. Hence $\xi_2 \gtrless 0$, signifies a decline and increase in the industry mark-up due to an increase in the within industry variation in real unit labour cost, respectively. Symmetrically for $\xi_3 \gtrless 0$.

Results from estimations are reported in Table 7.

The magnitudes of mark-ups remain broadly consistent with those found under earlier sections. Similarly, adjustment to equilibrium continues to be present in the estimations, as is evident from the ϕ-parameter. Hausman

[37] Other possibilities are an exchange rate based only on developed countries' exchange rates and an exchange rate based only on less developed countries.

tests confirm the homogeneity of long run parameters across manufacturing sectors.

Results suggest that both between and within industry variation of cost competitiveness exercise a statistically significant impact on the mark-up. However the impact of the two variations is distinct.

Given $\xi_2 > 0$, a within industry increase in cost competitiveness serves to *decrease* the mark-up. By contrast, $\xi_3 < 0$ signifies that a between industry increase in cost competitiveness serves to increase the mark-up of price over marginal cost. The implication is thus that market competitiveness does appear to influence the pricing behaviour of South African manufacturing sectors. But only within industry increases in cost competitiveness serve to lower the mark-up. Improvement of an industry's cost competitiveness relative to the manufacturing sector average simply translates into a higher margin between price and marginal cost. Industries that become more competitive relative to the manufacturing sector average enjoy higher mark ups as a result. Only firms that become more competitive relative to their industry average face lower mark ups.

Figure 4 again serves to render the estimated impact concrete. For ease of interpretation, we have inverted the cost competitiveness scale - such that higher is more cost competitive. In this instance the within industry variation's impact on the mark-up is not only statistically significant, but also proves to be relatively strong. Thus under sufficiently strong increases in the within variation of cost competitiveness, under the estimated coefficient it is feasible that the mark-up be driven down close to zero. Conversely, however, industries that lie above the manufacturing sector mean in cost competitiveness, experience considerably greater mark-ups of price over marginal cost. The implication is that manufacturing industries that do experience improved cost conditions simply absorb the improved production conditions in the form of higher mark-ups.

4.2.6 Results Incorporating Intermediate Inputs

For the estimation of mark-ups over marginal cost in the presence of intermediate inputs we employ the specification given by:

$$\begin{aligned} NSRGO_{it} &= \delta_0 + \delta_1 SCARPETTA_{it} + \varepsilon_{it} \qquad (20) \\ & \quad where \end{aligned}$$

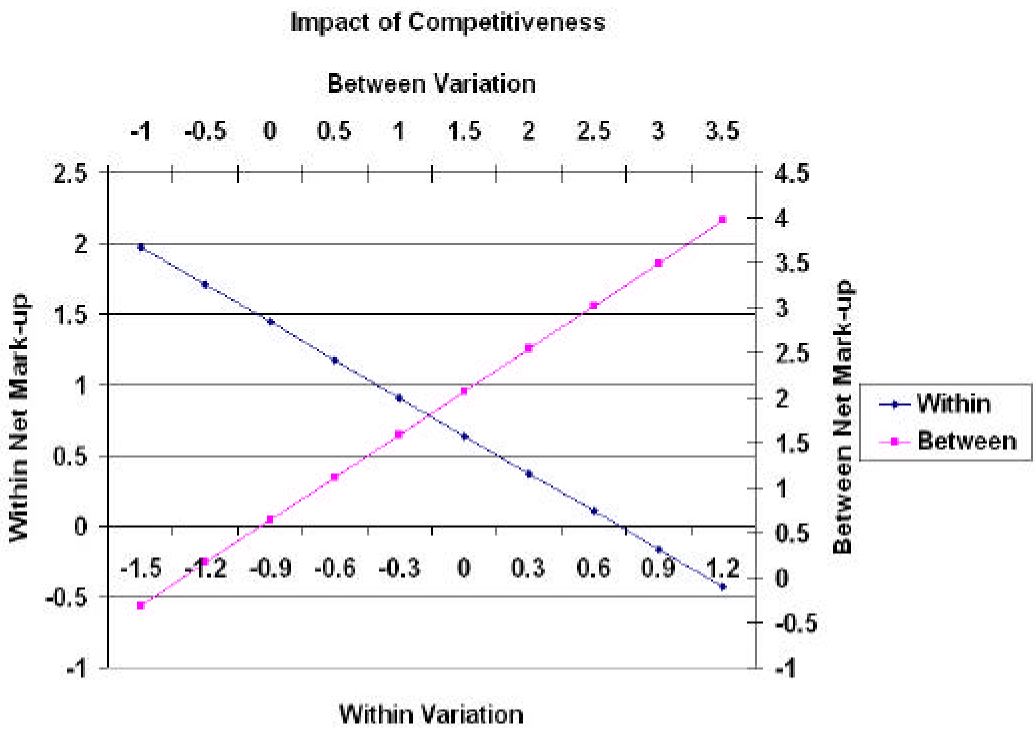

Figure 4: Impact of Within Industry and Between Industry Variation in Cost Competitiveness

$$SCARPETTA_{it} = \alpha^{GO} \cdot \Delta(w+l) + \beta^{GO} \cdot \Delta(p_m + m) - \left(\alpha^{GO} + \beta^{GO}\right) \Delta(r+k)$$

We continue to employ the two alternative specifications for the two alternative estimated capital rental prices. Thus $SCARPETTA5$ employs the rental price of capital under the 5% depreciation assumption and $SCARPETTA10$ employs the rental price of capital under the 10% depreciation assumption.

The first two rows of Table 8 report the PMGE estimations of equation 20.

Adjustment to equilibrium continues to be confirmed in the estimations by the ϕ-parameter. Hausman tests confirm the homogeneity of long run parameters across manufacturing sectors.

Results indicate the presence of an aggregate mark-up for the manufacturing sector over the sample period. Consistent with international results, the magnitude of the mark-up is considerably reduced with the introduction of intermediate inputs. Indeed, the magnitude of the mark-up over total marginal cost is of an order of magnitude lower than that found by Oliveira Martins and Scarpetta for the US. The magnitude of the mark-up for South African manufacturing would appear to lie in the range of $6-9\%$, lower than the average level of the mark-up across manufacturing sectors in the US obtained for the Oliveira Martins-Scarpetta study (13% for US industry).

Two possibilities may account for this divergence between the SA-US relative mark-up structure under the Roeger and Oliveira Martins & Scarpetta methodologies. The first is that the South African data on intermediate inputs is not fully reliable. The share of intermediate inputs in gross output in many of the manufacturing sectors averages between 0.8 and 0.9. The results under the inclusion of intermediate inputs may thus be subject to an errors in variables problem.

The second possibility may be that there is an omitted variables bias in the estimation. Given the strongly divergent levels of concentration between US and SA manufacturing industry, the most plausible source of the omitted variables bias is the omission of concentration ratios from the empirical specification. For this reason we also estimated the specification given by:

$$NSRGO_{it} = \xi_0 + \xi_1 SCARPETTA_{it} + \xi_2 \left(\Upsilon_{it} - \overline{\Upsilon}_i\right) \cdot SCARPETTA_{it} + \xi_3 \left(\Upsilon_{it} - \overline{\Upsilon}\right) \cdot SCARPETTA_{it} + \varepsilon_{it} \quad (21)$$

	$\xi_1 = \mu - 1$	ξ_2	ξ_3	ϕ (ECM)	h-test	RLL	LR: $\chi^2_{\{d.f.\}}$	Lag Order
$nsrgo5$	0.06^* (0.01)			-0.99^* (0.02)	0.02 [0.90]	815	314^* $\{21\}$	AIC(3)
$nsrgo10$	0.09^* (0.01)			-0.98^* (0.04)	0.11 [0.74]	938	161^* $\{21\}$	AIC(3)
$nsrgo5$	0.08^* (0.01)	-0.43 (0.43)	0.90^* (0.25)	-0.79^* (0.07)	3.22 [0.36]	953	202^* $\{63\}$	ARDL(2)
$nsrgo10$	0.07^* (0.01)	-0.17 (0.48)	1.11^* (0.39)	-0.95^* (0.10)	5.87 [0.12]	936	167^* $\{63\}$	ARDL(3,1,1,2)

Table 8: PMG estimator results for intermediate input costs

where all variables are as defined above.

Using equation 21 in estimation, the last two rows of Table 8 show that the inclusion of the deviation of concentration from the industry mean has no impact on mark-ups in the presence of intermediate inputs. However, deviation of concentration from the manufacturing sector mean does have a positive and significant impact on industry mark-up.

In Figure 5 we detail the impact of the between-industry variation in concentration. Correcting for the between-industry variation in concentration, it is clear that the industry mark-up rises potentially considerably above the US level. Results from the Roeger and Oliveira Martins & Scarpetta methodologies can thus be rendered consistent, in the sense that the relative divergence between US and SA mark-ups can be maintained, if concentration ratios in industry are controlled for.

While we maintain our scepticism about the intermediate input data for SA manufacturing, and believe that the results presented in this section should be treated with caution, one possible explanation for the difference between the mark-ups in the absence or in the presence of intermediate inputs may well relate to the role of concentration in South African manufacturing. While this paper cannot address the concern, it is possible that the high concentration of SA industry manifests itself in vertical integration of industries as well as horizontal integration. One possibility is therefore that SA industry actively transfers prices, making the isolation of precise mark-ups in the presence of intermediate inputs difficult.

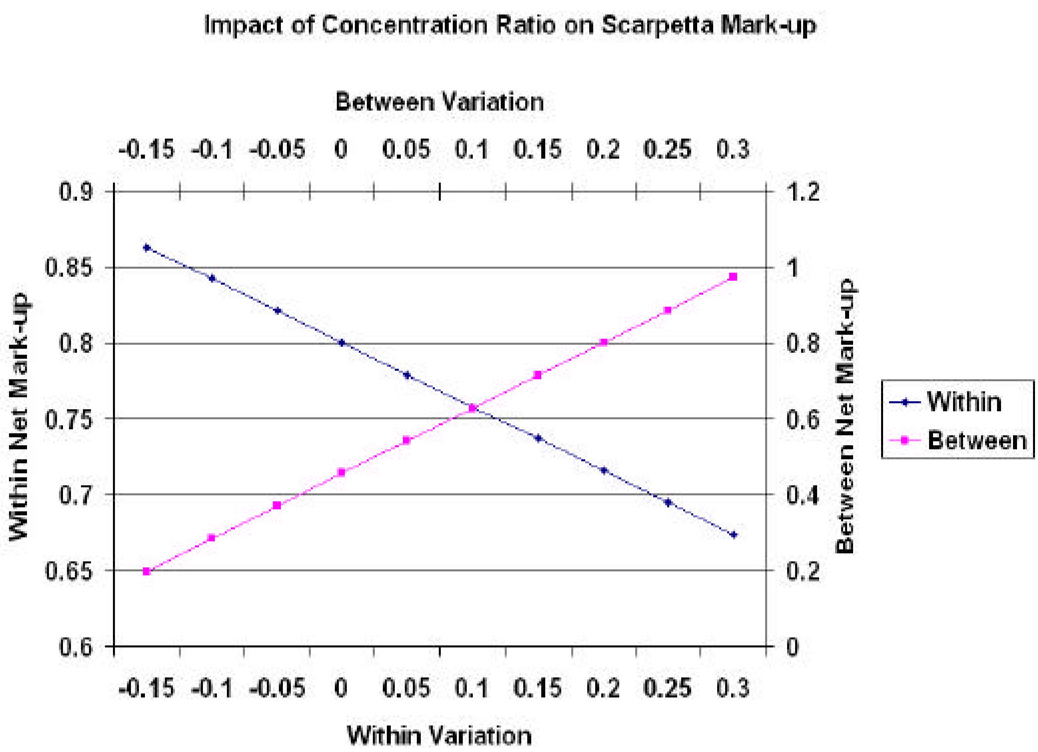

Figure 5: Impact of Within Industry and Between Industry Variation in Concentration Ratios on Mark-ups in the Presence of Intermediate Inputs

4.3 Conclusions and Implications of the Panel Data Estimations

The results found in this paper suggest that South African manufacturing industries show evidence of strong pricing power - up to twice that found in comparable studies for US manufacturing. This result is shown to be robust to tests including variables accounting for cyclical variation, openness to world trade, industry concentration and cost competitiveness, as well as the inclusion of intermediate inputs in marginal cost.

Results suggest further that the mark-up is counter cyclical in South African manufacturing. Increased industry concentration is associated with increased pricing power of industry, while reduced cost competitiveness of industry appears correlated with increased price-cost margins. Openness of industries to world trade is associated with reduced price-cost margins, regardless of whether openness assumes the form of increased import or export penetration of an industry.

Policy implications are that both trade liberalization, as well as more aggressive competition policy would serve to reduce price-cost margins, increasing the competitiveness of South African industry.

Finally, note that the implications of the present study carry significant and severe implications for South African growth prospects in at least two senses. First, the presence of anti-competitive pricing strategies on the part of South African industry does not augur well for the competitiveness of South African industry internationally. Second, maintenance of pricing power entails the curtailment of productive capacity. Low investment rates in South African industry may well be a reflection of monopolistic or oligopolistic practice. Such questions are left for future investigation.

4.4 Results from Alternative Estimation Methodologies

As a final step in our exposition, we report the results from alternative estimation methodologies.

Traditionally estimation of mark-ups of price over marginal cost has proceeded by means of sector-by-sector estimation, generally employing OLS estimation methodologies. Hausman test statistics throughout the study suggest that the PMG estimator used thus far in the present study is valid given the homogeneity of long run mark-up over marginal cost across manufacturing sectors in South Africa. We nevertheless also report sectorally specific estimations of mark-ups. We report both ARDL estimations underlying the MG estimator dynamics as well as OLS estimations without any explicit dynamics.[38] While we report the sectorally specific results, readers should bear in mind throughout that statistically the magnitude of the mark-up does not differ across the sectors.

Apart from nine sectors, the MG and OLS estimators provide a common classification of sectoral mark-ups. Table 9 reports the classification for these manufacturing sectors. Detailed sectoral estimation results can be found in Tables 12 and 13 in Appendix 1. Sectors on which the two estimators differ are Tobacco, where the MGE shows no mark-up but the OLS estimator suggests a mark-up of over 100%, Electrical Machinery, where the MGE shows no mark-up yet the OLS estimator suggests a mark-up between 0 and 50%, Glass and glass products, which has a mark-up over 100% in the MGE case and a mark-up falling in the 50-100% range in the OLS case and Professional and Scientific Equipment, which under the MGE is classified as falling under the 50-100% mark-up and under the OLS estimator as falling under the 0-50% mark-up classification. Note that the average mark-up of price over marginal cost implied is consistent with the result obtained under the PMG estimator.

An advantage of the OLS estimator is that minimal loss of degrees of freedom under this estimator allows for an examination of possible changes to the mark-up over the three decades covered by the sample period. Summary results are reported in Table 10, while detailed results are reported in Table 13 in Appendix 1. What is noticeable is that most sectors manifest a pattern under which the mark-up declines from the 1970's to the 1980's but then rises into the 1990's. However, a few sectors show a declining mark-up over time: Textiles, Other chemicals, Rubber and Plastics. In addition, several sectors show a consistently increasing mark-up over time: Tobacco, Leather and leather products, Paper and paper products, Basic non-ferrous metals, Other transport equipment and Other industries. Finally, two sectors show an increase in the mark-up in the 1970s and 1980s but a decline thereafter, namely, Coke and refined petroleum products and Glass and glass products.

[38] The OLS estimator is valid despite the use of time series data since the data for all but one sector prove to be stationary.

Magnitude of Sectoral Mark-ups:		
0-50%	50-100%	>100%
Wearing apparel	Food	Beverages
Leather	Textiles	Paper
Footwear	Rubber	Coke
Wood	Other chemicals	Basic Chemicals
Printing	Plastics	Basic non-ferrous metals
Machinery	Basic Iron & Steel	
Other transport equipment	Metal products	
Furniture	Non Met. Min Prods	
	Motor industry	
	TV, radio, etc.	
	Other industries	

Table 9: Classification of Manufacturing Sectors

Change in Sectoral Mark-ups from 1970's to 1990's:			
Declining	Rising	Peak in 1980's	Trough in 1980's
Textiles*	Leather*	Coke*	Food*
Wearing apparel	Paper*	Glass*	Beverages*
Other chemicals*	Basic non-ferrous metals*		Wood*
Rubber*	Other transport equip.*		Printing*
Plastics*	Other industry*		Basic chemicals*
Electrical machinery	Tobacco*		Non-metallic min. products
			Basic iron & steel*
			Metal products*
			Machinery*
			TV, radio, & etc.*
			Prof. & scientific equip.*
			Motor industry*
			Furniture*
			Footwear*

Table 10: Changes in Mark-Up over Marginal Cost, * denotes mark-up still significant in 1990's

5 Conclusions and Evaluation

The results found in this paper suggest that after applying the appropriate methodology measuring the Solow residual, South African manufacturing industries experience strong pricing power. This result is shown to be robust to tests including variables accounting for cyclical variation where we have shown that the markup is counter cyclical and import and export penetration suggesting that increased participation in trade reduces the markup in the domestic market. New variables analysing the impact of industry competitiveness and concentration suggest that industries that can increase their overall competitiveness also experience increased markup and thus that increased cost efficiency on the part of the manufacturer does not translate into lower prices. An analysis of concentration ratios within industries suggests that higher industry concentration induces higher markups.

Accounting for intermediate input costs does not alter these results.

A central implication of the present paper is therefore that the South African manufacturing markup appears to be consistently higher than in comparable US industries.

We conclude with a few more general observations concerning the interaction between mark-ups and employment growth rates, investment rates and output growth rates. Table 11 reports Pearson's correlation coefficients and the Spearman rank correlation coefficients between mark ups and the specified indicators, for the three digit manufacturing sectors in South Africa. There is scant evidence in favour of a positive impact of mark-ups on output growth rates and investment rates. The one exception is the correlation coefficient between mark-ups and the investment rate over the full 1970-97 sample period. To test the possibility further, we tested the impact of concentration ratios on investment rates in South African manufacturing industry. Given the positive impact of concentration ratios on mark ups, we employed concentration ratios as a proxy for the mark up. Since we do not have a time-varying measure of the size of the mark up over the sample period, we were not able to estimate the impact of the mark up on the investment rate directly. The estimation methodology employed is that of Fedderke (2003a). We found no compelling evidence to suggest that concentration ratios impact on investment rates in manufacturing industry.

Perhaps most dramatically of all, we find that the magnitude of the mark up over marginal cost in South African manufacturing industry is negatively related to the capacity of industry to increase employment. Moreover, this

	Pearson				Spearman			
	1970-97	1970's	1980's	1990's	1970-97	1970's	1980's	1990's
Employment Growth	-0.32	0.06	-0.18	-0.47	-0.29	0.00	-0.19	-0.36
Investment Rate	0.63	0.26	0.32	0.46	0.64	0.49	0.36	0.35
Output Growth Rate	0.36	0.21	0.23	0.35	0.30	0.31	0.27	0.10

Table 11: Three Digit Economic Sectors, Pearson and Spearman correlation coefficients

is an increasing trend over time.

An important question that is raised by the present paper is therefore whether the pricing power of South African industry may not be an indicator of an additional constraint on long run growth in South Africa. This is a question beyond the scope of the present paper - and is left for future attention by researchers.

References

Applebaum, E., 1979, Testing Price Taking Behaviour, *Journal of Econometrics,* 9: 283-294.

Bain, J.S., 1953, *Barriers to New Competition*, Harvard University Press.

Basu, S., 1995, Intermediate Goods and Business Cycles: Implications for Productivity and Welfare, *American Economic Review*, 85, 512-531.

Basu, S., and Fernald, J.G., 1995, Are Apparent Productive Spillovers a Figment of Specification Error? *Journal of Monetary Economics*, 36, 165-88.

Beccarello, M., 1996, Time-series analysis of market power: evidence from G7 manufacturing, *International Journal of Industrial Organisation*, 15, 123-36.

Bils, M., 1987, The cyclical behaviour of marginal cost and price, *American Economic Review*, 77, 838-55.

Bresnahan, T.F., 1990, Empirical Studies in Industries with Market Power, *In Handbook of Industrial Organisation,* Vol. 2 (Schmalense, R. and Willig, R. G., eds) Amsterdam: North-Holland.

Chatterjee, S., Cooper, R., and Ravikumar, B., 1993, Strategic Complementarity in Business Formation, Aggregate Fluctuations and Sunspot Equilibria, *Review of Economic Studies*, 60, 765-811.

Chevalier, J.A., and Scharfstein, D.S., 1996, Capital-market imperfections and countercyclical markups: Theory and evidence, *American Economic Review*, 86(4), 703-25.

Chirinko, R. S. and Fazzari, S. M., 1994, Economic Fluctuations, Market Power and Returns to Scale: Evidence from Firm-Level Data, *Journal of Applied Econometrics,* 9: 47-69.

Cournot, A.A., 1938, *Researches into the mathematical Principles of the Theory of Wealth*, Macmillan.

Coutts, K., Godley, W., and Nordhaus, W., 1978, *Industrial Pricing in the United Kingdom*, Cambridge: University Press.

Cowling, K.G., and Waterson, M., 1976, Price cost margins and market structure, *Economica*, 43, 267-74.

Cubbin, J., 1983, Apparent collusion and conjectural variations in differentiated oligopoly, *International Journal of Industrial Organization*, 1, 155-63.

Domowitz, I., Hubbard, R Glenn, Petersen, B., 1988, Market Structure and Cyclical Fluctuations in U.S. Manufacturing, *Review of Economics and Statistics*, 70, 703-25.

Edwards, L., and Schör, V., 2002, Measures of Competitiveness: A Dynamic Approach to South Africa's Trade Performance in the 1990's, *South African Journal of Economics*, 70(6), 1008-46.

Edwards, L., and Golub, S.S., 2002, South Africa's International cost Competitiveness and Productivity: A Sectoral Analysis, Report Prepared for South African national Treasury.

Eichner, A.S., 1973, A theory of the determination of mark-up under oligopoly, *Economic Journal*, 83, 1184-1200.

Eichner, A.S., 1987, Prices and Pricing, *Journal of Economic Issues*,

Fedderke, J.W., 1992, Pricing Behaviour in South African Manufacturing Industry: 1945-82, *The South African Journal of Economics*, 60(2), 173-90.

Fedderke, J.W., 2002, The Structure of Growth in the South African Economy: Factor Accumulation and Total Factor Productivity Growth 1970-97, *South African Journal of Economics*, 70(4), 611-646.

Fedderke, J.W., 2003a, Investment in Fixed Capital Stock: testing for the impact of sectoral and systemic uncertainty, *Oxford Bulletin of Economics and Statistics*, forthcoming.

Fedderke, J.W., 2003b, Industry Concentration in South African Manufacturing: Trends and Consequences, 1970-96, Econometric Research Southern Africa Policy Paper No. 23.

Fedderke, J.W., Shin, Y and Vaze P., 2000, Trade and Labour Usage: An Examination of the South African Manufacturing Industry, Econometric Research Southern Africa Working Paper No 15, University of the Witwatersrand.

Friedman, J.W., 1983, *Oligopoly Theory*, Cambridge: University Press.

Gerald, C.F., Wheatley, P.O., (1989), *Applied Numerical Analysis* (4th Edition), Addison-Wesley Publishing Co.

Gollop, F., and Roberts, M., 1979, Firm interdependence in oligopolistic markets, *Journal of Econometrics*, 10, 313-31.

Gordon, R.A., 1948, Short-period price determination in theory and practice, *American Economic Review*, 38, 265-88.

Hakura, D.S., 1998, The Effects of European Economic Integration on the Profitability of Industry, *International Monetary Fund Working Paper WP/98/85*.

Hall, R.E., 1988, The Relation between Price and Marginal Cost in US Industry, *Journal of Political Economy*, 96(5), 921-47.

Hall, R.E., 1990, The Invariance Properties of Solow's Productivity Residual, in P. Diamond (Ed..) *Growth, Productivity, Unemployment*, Cambridge MA: MIT Press.

Hall, R.L., and Hitch, C.J., 1939, Price theory and business behaviour, *Oxford Economic Papers*, 2, 12-45.

Harrison, A.E., 1994, Productivity, imperfect competition and trade reform, *Journal of International Economics*, 36, 53–73.

Haskel, J., Martin, C., and Small, I., 1995, Price, Marginal Cost and the Business Cycle, *Oxford Bulletin of Economics and Statistics*, 57(1): 25-42.

Hazilla, M., 1991, Econometric Analysis of Market Structure: Statistical Evaluation of Price Taking Behaviour and Market Power, *In Advances in Econometrics,* (Rhodes, G. F., editor), Greenwich: JAI Press.

Helpman, E., and Krugman, P.R., 1989, *Trade Policy and Market Structure,* Cambridge, MA: The MIT Press.

Leach, D.F., (1992), Absolute vs. Relative Concentration in Manufacturing Industry 1972-1985, *The South African Journal of Economics*, 60(4), 386-400.

Levinsohn, J., 1993, Testing the imports-as-market-discipline hypothesis, *Journal of International Economics*, 35, 1-22.

Modigliani, F., 1958, New developments on the oligopoly front, *Journal of Political Economy*, 66, 215-32.

Morrison, C.J., 1994, The Cyclical Nature of Markups in Canadian Manufacturing: A Production Theory Approach, *Journal of Applied Econometrics*, 9(3), 269-82.

Norrbin, S., 1993, The relation between price and marginal cost in the U.S. industry: A contradiction, *Journal of Political Economy*, 101, 1149-64.

Oliveira Martins, J., and Scarpetta, S., 1999, The Levels and Cyclical Behaviour of Mark-ups Across Countries and Market Structures, OECD Economics Department Working Papers No. 213.

Pesaran, M.H. and Smith, R., 1995, Estimating Long-Run Relationships from Dynamic Heterogeneous Panels, *Journal of Econometrics*, Vol. 68, pp. 79-113.

Pesaran, M.H., Shin, Y. and Smith, R., 1999, Pooled Mean Group Estimation of Dynamic Heterogeneous Panels, *Journal of the American Statistical Association*, Vol. 94, pp. 621-634.

Phelps, E., 1994, *Structural Slumps: A Modern Equilibrium Theory of Unemployment, Interest and Assets*, Cambridge MA: Harvard University Press.

Ramey, V.A., 1991, Comment on Markups and the Business Cycle by Michael Woodford and Julio Rotemberg, *NBER Macroeconomics Annual.*

Roeger, W., 1995, Can Imperfect Competition explain the Difference between Primal and Dual Productivity Measures? Estimates for US Manufacturing, *Journal of Political Economy*, 103, 316-30.

Rotemberg, J., and Saloner, J., 1986, A Super-game-Theoretic Model of Business Cycles and Price Wars During Booms, *American Economic Review*, 76, 390-407.

Rotemberg, J., and Woodford, M., 1991, Markups and the Business Cycle, in O.J. Blanchard and S. Fischer, eds., *NBER Macroeconomics Annual*, Cambridge: M.I.T. Press.

Ruffin, R.J., 1971, Cournot oligopoly and competitive behaviour, *Review of Economic Studies*, 38, 493-502.

Stigler, G.J., 1964, A theory of oligopoly, *Journal of Political Economy, 72, 44-61.*

Tirole, J., 2000, *The Theory of Industrial Organization*, Cambridge Mass: MIT Press.

Waterson, M., 1984, *Economic Theory of the Industry*, Cambridge: University Press.

Weitzman, M., 1982, Increasing Returns and the Foundations of Unemployment Theory, *Economic Journal*, 100, 787-804.

Appendix 1: Detailed Sectoral Estimation Results Employing OLS and MG Estimators

Sectoral Results (MGE)					
	γ_1	ϕ (ECM)		γ_1	ϕ (ECM)
Food	0.89* (0.05)	−1.50* (0.33)	Plastic	0.75* (0.08)	−1.32* (0.38)
Beverages	1.45* (0.20)	−0.81* (0.33)	Glass	1.29* (0.50)	−0.41 (0.32)
Tobacco	0.84 (0.60)	−0.55* (0.39)	Non-Metallic Mineral Prods	0.94* (0.06)	−1.17* (0.31)
Textiles	0.77* (0.07)	−1.28* (0.36)	Basic Iron & Steel	0.78* (0.06)	−1.62* (0.43)
Wearing Apparel	0.27* (0.06)	−1.37* (0.49)	Basic Non-Ferrous Metals	2.07* (0.20)	−0.99* (0.30)
Leather	0.54* (0.11)	−1.09* (0.35)	Metal Industries	0.47* (0.17)	−0.58 (0.47)
Footwear	0.38* (0.11)	−0.88* (0.47)	Machinery	0.31* (0.03)	−1.71* (0.37)
Wood	0.64* (0.08)	−1.12* (0.35)	Electrical Machinery	−0.72 (0.41)	−0.49 (0.65)
Paper	1.18* (0.13)	−1.05* (0.33)	TV, Radio & Comms.	0.55* (0.03)	−1.72* (0.36)
Printing	0.38* (0.04)	−1.33* (0.33)	Prof. & Scientific Equip.	0.51* (0.03)	−1.77* (0.35)
Coke	2.52* (0.52)	−0.63* (0.27)	Motor Industry	0.55* (0.15)	−0.93* (0.32)
Basic Chemicals	1.24* (0.15)	−1.05* (0.36)	Other Transport	0.15* (0.05)	−1.45* (0.33)
Other Chemicals	0.92* (0.13)	−0.92* (0.40)	Furniture	0.28* (0.05)	−1.18* (0.34)
Rubber	0.90* (0.06)	−1.34* (0.35)	Other Industry	0.73* (0.08)	−0.99* (0.23)

Table 12: Sectoral Mark-Ups, Roeger Results, Figures in round parentheses denote standard errors, in square parentheses probability values, and curly parentheses degrees of freedom, * denotes significance

	1970's	1980's	1990's	1970-97
Food	0.92*	0.77*	0.79*	0.81*
Beverages	1.55*	1.20*	1.52*	1.27*
Tobacco	1.18*	1.25*	1.26*	1.22*
Textiles	0.83*	0.61*	0.61*	0.67*
Wearing Apparel	0.32*	0.21*	0.24†	0.23*
Leather	0.46*	0.58*	1.02*	0.55*
Footwear	-0.37*	-0.32*	0.52*	0.34*
Wood	0.63*	0.54*	0.80*	0.34*
Paper	0.94*	1.07*	1.64*	1.06*
Printing	0.41*	0.33*	0.43*	0.35*
Coke	1.83*	3.21*	2.43*	2.76*
Basic Chemicals	1.25*	1.02*	1.20*	1.12*
Other Chemicals	0.85*	0.74*	0.71*	0.77*
Rubber	0.87*	0.76*	0.71*	0.80*
Plastic	0.71*	0.60*	0.56*	0.63*
Glass	0.77*	1.03*	1.00*	0.94*
Non-Met. Min Prod.	0.93*	0.87*	0.93*	0.88*
Bas. Iron & Steel	0.73*	0.68*	0.97*	0.72*
Bas. Non-Ferr. Met	1.63*	1.90*	2.64*	1.92*
Metal Prods.	0.45*	0.35*	0.51*	0.37*
Machinery	0.61*	0.18*	0.44*	0.32*
Elect. Machin.	0.85	0.33*	0.17	0.37*
TV, Radio, etc.	0.53*	0.51*	0.55*	0.52*
Prof & Scien. Equip.	0.44*	0.40*	0.61*	0.44*
Motor Ind.	0.46*	0.30	0.90*	0.40*
Oth. Trans. Equip	0.19†	0.10*	0.22*	0.14*
Furniture	0.28*	0.21*	0.33*	0.23*
Oth. Ind.	0.43*	0.64*	0.85*	0.59*

Table 13: The OLS Results, * denotes significance at the 5 percent, + at the 10 percent levels