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Industry Structure and Labour Market Flexibility in the South African Manufacturing Sector: A Time Series and Panel Data Approach

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Abstract

This paper presents a joint analysis of labour market flexibility and product market structure. Our investigation of industry structure in South African manufacturing reveals evidence of imperfect competition. We find an average mark-up of 50% for the period 1970 to 2004, without consistent trend in the mark-up over time. This paper links output market structure to labour market flexibility. We infer the proportion of labour cost that is fixed rather than flexible from the mark-up, and find that two thirds of total labour employed in South African manufacturing is devoted to fixed costs. We find that this proportion falls during the 1980s and rises during the 1990s, suggesting an increase in labour flexibility followed by a decrease.

Keywords: mark-up, industry structure, labour market flexibility

JEL Codes: D43, J29, J69, L60.

1. Introduction

This paper examines a new approach of empirically identifying the extent of labour market flexibility. The contribution of the paper lies in numerically estimating labour market flexibility, linking labour market characteristics to the structure of output markets. The empirical application of the approach adopted is to the manufacturing sector of South Africa, and provides a series of time-varying measures of the extent of inflexibility in sectoral labour markets.

There is a strong labour market debate in South Africa, centred on its high rate of unemployment. A number of potential causes have been identified in the literature. Examples of these include the level of real wages (Fedderke et al (2000)), information asymmetries (Wittenberg (2002)), the impact of technology (Fedderke et al (2000)) and trade liberalization (Edwards (2001)). An important subtext of the debate is the degree of labour market flexibility. While an early study dismissed this as a potential cause of poor labour market performance,[1] labour market flexibility has consistently been indicated as a source of concern in South Africa.[2]

We investigate industry structure in South African manufacturing by analyzing mark-ups of prices over marginal cost. This is performed for the manufacturing sector as a whole and individually for its twenty-eight sub-sectors in an analysis that extends from 1970 to 2004. We establish average mark-ups as well as investigating the trends and changes in mark-ups for this period, using both a computational approach and an econometric approach. Both approaches follow from a methodology developed by Roeger (1995).

Oliviera Martins and Scarpetta (1999) proposed an extension of Roeger's methodology that allows for the investigation of short-run dynamics in mark-ups. They considered the possible impact of downward rigidities in the labour market through the inclusion of an

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[1] Fallon and Lucas (1998).

[2] An overview of the debate can be found in Burger and Woolard (2005).

additional labour adjustment parameter. This parameter can be interpreted as a measure of labour flexibility. We use our mark-up results to extract estimates of this parameter. As in the analysis of mark-ups, this is done for the manufacturing sector as a whole and individually for its twenty-eight sub-sectors. We also investigate both long-run means and trends and changes of this parameter over time.

This paper extends the work of Aghion et al (2006) and Fedderke et al (2006) by obtaining more recent estimates of mark-ups for South African manufacturing, as well as establishing the extent of labour market flexibility that derives from product market structure. The primary contribution of this paper, however, is the provision of a labour flexibility analysis in which we obtain numerical estimates of the magnitude of the flexibility and its changes.

Our paper is organized as follows: Section 2 provides details on the relationship between productivity residuals and the mark-up. It also establishes the link between labour market flexibility and the level of the mark-up in output markets, concluding with an overview of relevant previous empirical results. Econometric methodology and data are presented in Section 3. Section 4 reports the results for the estimation and computation of the mark-up and labour market flexibility respectively. Our concluding comments form Section 5.

2. Productivity Residuals and the Mark-up

Hall (1990) first showed that the magnitude of an industry mark-up can be estimated from the Solow residual (SR). Estimation of Hall's specification suffers from endogeneity bias, and reliable instrumentration has proved difficult. The consequence was that empirical results for the US led to the estimation of mark-ups that generally were argued to be implausibly high.[3] Roeger (1995) solved the estimation problem by pointing out that a specification based on the nominal Solow residual (NSR) avoids the endogeneity trap.[4] This gives us the following expression for estimation purposes:

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

where $\mu = \frac{P}{MC}$, defines the mark-up of prices over marginal cost, $\alpha = \frac{wL}{PQ}$, denotes the factor share earned by labour, P and Q denotes the price and quantity of value-added respectively, W and L the wage and labour time respectively, and R and K the supply price of capital and capital stock respectively. Lower case notation denotes log transforms.[5] The mark-up is now accessible to either estimation or computation.

[3] See Oliviera Martins and Scarpetta (1999) for a more detailed discussion of the potential for bias associated with instrumentation and Basu (1995) for bias associated with the omission of intermediate inputs.

[4] For a fuller overview and exposition of the theory and associated estimation issues of this approach to the estimation of mark-ups, see Fedderke et al (2006).

[5] While the derivation is for constant retruns to scale, Oliviera Martins and Scarpetta (1999) provide an extension that demonstrates that estimates of the mark-up obtained under estimation of equation (1), represents a lower-bound estimate.

There have been several further extensions within this methodological framework. Oliviera Martins and Scarpetta (1999) consider the impact of intermediate inputs and cyclical fluctuations in their analysis of mark-ups in the US manufacturing sector. Hakura (1998) looks at the impact of openness on the mark-up. Fedderke et al (2006) consider the impact of market structure on the magnitude of mark-ups. These extensions introduce a variety of additional parameters and terms into the mark-up equation.

2.1. The Mark-up and Labour Adjustment

The above theory relating productivity residuals and the mark-up is based on a first-order approximation of the primal and dual Solow residuals. This is appropriate when estimating the steady-state mark-up. However it does not allow for the investigation of cyclical effects as these are second-order. An adaptation of a result derived by Oliviera Martins and Scarpetta (1999) shows us that under the condition of a two-input production function (where we ignore intermediate inputs) and with Hicks neutrality in technical progress, the equation for the variable mark-up is given by:

$$\begin{aligned} \Delta \log \mu &= (\Delta q + \Delta p) - \Delta w + \left(\frac{1}{\sigma} - 1\right)\overline{\mu}(1-\alpha)\Delta k \\ &\quad -\frac{1}{\sigma}\frac{L}{L-\overline{L}}\overline{\mu}(1-\alpha)\Delta l - \overline{\mu}\alpha\Delta l \end{aligned} \tag{2}$$

where σ denotes the elasticity of substitution between capital and labour, $\overline{\mu}$ the steady-state mark-up and $\overline{L}$ the amount of labour devoted to fixed costs.

A generalization of the Oliviera Martins and Scarpetta (1999) result proceeds from the production function given by:

$$Q(K, L-\overline{L}) = \Theta G(K, L-\overline{L}) \tag{3}$$

where we assume the possibility of downward rigidities in the adjustment of labour inputs by introducing $\overline{L}$, the amount of labour devoted to fixed costs. (Also recall that $\Delta \log \Theta = \theta$.)

For a profit-maximizing firm under imperfect competition, the mark-up of prices over marginal cost is given by:

$$\mu = \frac{\Theta G_L(K, L-\overline{L})}{W/P} \tag{4}$$

where $\Theta G_L(K, L-\overline{L})$ denotes the marginal product of labour (the partial derivative of $Q(K, L-\overline{L})$ with respect to labour).

We take logs and first differences to obtain the following expression for the growth rate of the mark-up:

$$\Delta \log \mu = \theta - (\Delta w - \Delta p) + \frac{1}{G_L}(G_{LL}\Delta L + G_{LK}\Delta K) \tag{5}$$

We can now use the established results that $G_{LL} = -G_{LK}\frac{K}{L-\overline{L}}$, $\sigma = \frac{G_L G_K}{G_{LK} G}$ (Uzawa, 1962) and $\frac{G_K K}{G} = \overline{\mu}(1-\alpha)$ to simplify this expression, obtaining:

$$\begin{aligned}\Delta \log \mu &= \theta - (\Delta w - \Delta p) + \frac{\overline{\mu}(1-\alpha)}{\sigma}\Delta k \\ &\quad - \frac{\overline{\mu}(1-\alpha)}{\sigma}\frac{L}{L-\overline{L}}\Delta l\end{aligned} \tag{6}$$

It remains for the unobservable productivity term θ to be replaced by observable measures. We do this by obtaining an expression for the growth rate of real value-added from the original expression of the production function. Note that:

$$\begin{aligned}\frac{\Delta Q}{Q} &= \frac{(\Delta\Theta)G}{Q} + \frac{\Theta(\Delta G)}{Q} \\ &= \frac{\Delta\Theta}{\Theta} + \frac{\Theta G_K \Delta K}{Q} + \frac{\Theta G_L \Delta L}{Q}\end{aligned} \tag{7}$$

We now use the first-order conditions $\frac{G_K K}{Q} = \frac{\overline{\mu}(1-\alpha)}{\theta}$ and $\frac{G_L L}{Q} = \frac{\overline{\mu}\alpha}{\theta}$ to obtain:

$$\Delta q = \theta + \overline{\mu}(1-\alpha)\Delta k + \overline{\mu}\alpha\Delta l \tag{8}$$

from which an expression for θ can be obtained and substituted into equation (6). This gives us equation (2).

The term $\frac{L}{L-\overline{L}}$, is the ratio of total labour employed (L) to the employed labour that is devoted to variable costs ($L-\overline{L}$), and can be interpreted as an indicator of the degree of downward rigidities in labour adjustment. Its plausible range is from unity (indicating no rigidity) to infinity (complete rigidity). For example, a value of two means that of the total labour employed, half is devoted to fixed cost and half to variable cost.

Finally, we can re-arrange (2) to obtain the following expression:

$$\begin{aligned}&\frac{1}{1-\alpha}\left(\frac{\Delta \log \mu - ((\Delta q + \Delta p) - \Delta w)}{\overline{\mu}} - \alpha \Delta l\right) \\ &= \left(\frac{1}{\sigma} - 1\right)\Delta k - \frac{1}{\sigma}\frac{L}{L-\overline{L}}\Delta l\end{aligned} \tag{9}$$

which leads to the empirical specification that is employed in this study.

2.2. Previous Empirical Results

The literature on imperfect competition and the practical application of mark-up pricing has a long tradition.[6] The modern literature begins with Hall (1990), who based on an instrumentation strategy designed to decompose the Solow residual into a pure technology component and a mark-up component, found large positive mark-ups for many US

[6] See Hall and Hitch (1939), Nield (1963), Rushdy and Lund (1967), McCallum (1970), and Coutts et al (1978).

industries. Subsequent studies argued that the instrumentation strategy biased the mark-up estimates upward. The Roeger (1995) estimation methodology removes the dependence on instrumental variables, and while finding positive mark-ups substantially reduced their magnitude.

For South Africa, two previous papers have examined the magnitude of price mark-ups over the marginal cost of production. Fedderke et al (2006) find a significant mark-up in the South African manufacturing sector over the period 1970 to 1997, which in comparative terms is approximately twice that found for the US manufacturing sector. They also provide several alternative estimates of the mark-up that take into account a number of characteristics of the manufacturing sector's component industries, looking at both within-industry and between-industry effects. They find that the mark-up increases with both industry concentration and an industry's competitiveness relative to other industries. Furthermore, the mark-up is found to be lowered by import and export penetration and to be countercyclical in relation to the business cycle.

Edwards and Van De Winkel (2005) look at the mark-up over time and find that average mark-ups are in most cases lower in the 1980s than in the 1970s, but are significantly higher in the early 1990s. They suggest that this increase is due to high import surcharges imposed during this period; evidence consistent with the belief that mark-ups rise under protection. During the period of liberalization from 1994-2002, however, they find that mark-ups tend to decline or remain constant. Sensitivity of the mark-up to intermediate inputs is confirmed in their finding that average mark-ups in manufacturing fall from 42% to 12.5% with the inclusion of intermediate inputs. They also compare mark-ups in South African manufacturing to marks-ups obtained in studies on a range of foreign economies. Although they find that mark-ups in South Africa are generally comparable with mark-ups estimated in international studies, they find that the comparison is largely dependent on the inclusion or exclusion of intermediate inputs; when intermediate inputs are excluded, mark-ups in South Africa are high relative to the US while when intermediate inputs are included, mark-ups in South Africa appear relatively low.

Labour market flexibility and adjustment has also received attention in the South African literature.[7] Much of the debate has centred on wage formation, wage flexibility and the wage elasticity of employment. Fedderke and Mariotti (2002) find that real wages are likely to be important in determining employment trends in the labour markets of the South African manufacturing sector. Fields et al (2000) find that wage elasticities in the private formal sector in South Africa are substantial and growing, as well as varying strongly across sectors. Fedderke et al (2000) provide the highest and estimate of wage elasticity.[8] They use a more fully-specified labour equation than earlier papers and test the sensitivity of their finding by utilizing a range of different specifications. Kingdon and Knight (2005) look at the flexibility of wages in response to local unemployment in South Africa, and find that the elasticity of wages to local unemployment rates in South Africa is similar to that found in other countries

[7] See for instance Bhorat and Oosthuizen (2005).

[8] Their estimate is approximately 1.97 when they compute the wage elasticity using the ratio of user cost of capital to real wages.

like the UK and US, with low responsiveness.

The evidence on labour market flexibility in South Africa is noted to be contradictory by Burger and Woolard (2005). The evidence includes a survey by the Economist Intelligence Unit that ranked South Africa last out of 60 countries in the labour flexibility afforded by its labour laws, as well as a contrasting World Bank study that ranked the South African labour market as the 16th most flexible out of the 133 countries included in the survey.

3. The Econometric Methodology and Data

The paper presents both sectorally disaggregated results for the South African manufacturing sector, as well as panel evidence across the 28 three digit sectors that constitute the manufacturing sector.

For the sectoral results we proceed with an estimation of equation (1) and equation (9). Since data employed for this study is stationary, estimation of industry specific results can proceed either by OLS or by Autoregressive Distributed Lag (ARDL) estimation.[9]

The panel estimator is provided by the Pooled Mean Group Estimator (PMGE) of Pesaran et al (1999).[10] The PMGE 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 estimator (MGE) proposed by Pesaran and Smith (1995), which allows for heterogeneity of all parameters.[11] Although it admits dynamic heterogeneity, PMGE exploits the statistical power offered by the panel through long-run homogeneity. The advantage of the PMG estimator is that it recognizes the presence of a long-run equilibrium relationship and explicitly models the dynamics of adjustment towards this equilibrium at the same time. It is appropriate in an analysis of the mark-up of prices over marginal cost as it is consistent with the theory of homogeneity in the mark-up in the long run and the possible heterogeneity of mark-up dynamics in the short-run.

3.1. Data

The data employed for this study focus on the three digit manufacturing industries, over the 1970-2004 period. Variables for the manufacturing sector include the output, capital stock, and labour force variables and their associated growth rates. Data are obtained from the Trade and Industrial Strategies (TIPS) database. We employ both panel data and individual industry data for the purposes of estimation, with observations from 1970 through 2004. The panel employs data for the 28 three-digit SIC version 5 manufacturing industries in the South African economy for which data is available. Due to problems with data availability some sectors are omitted for parts of the analysis. These omissions are noted where relevant.

[9] See Pesaran, Shin and Smith (1996, 2001).

[10] See also the discussion in Fedderke et al (2000) and Fedderke (2004).

[11] Pesaran and Smith (1995) draw attention to the threat of inefficiency and inconsistency associated with an unjustified assumption of long-run homogeneity.

There are questions over the reliability of industry data post-1996. Since the last manufacturing survey was undertaken by Statistics South Africa in 1996, data post-1996 have been disaggregated from the 2-digit sector level on the basis of input-output tables.[12] The large sample manufacturing survey of 2001 does not appear to have been incorporated into the data, and moreover the 2001 survey has not released the labour component of the survey. The reliability of the data has suffered as a result of this data collection strategy in South Africa.

This is evident from the evidence presented in Table 1C, which reports standard deviations of the computed mark-ups for this study. Standard deviations increase substantially post-1996 for all sectors, and increase even more markedly after 2000. Several sectors show strong spikes in the standard deviations either for both of the last two sub-periods or for the last sub-period (1991-2000 and 1995-2004). In the instance of some sectors (e.g.. Rubber products), the increase is of very substantial magnitude. This reflects increased underlying volatility in the component data from which the mark-ups are computed, although it is worth emphasizing that this volatility is less visible in the component data.

In interpreting the results that follow, the caveat that the reliability of all results based on industry data are likely to decline substantially after 1996 must be borne in mind. There is no adequate means of compensating for the absence of data collection for the manufacturing sector, and after having collected manufacturing censuses on a biennial basis since 1917, South Africa simply ceased doing do since 1996.

4. Results

We build the evidence cumulatively. In section 4.1. we develop a series of estimates of the magnitude of the mark-up in South African manufacturing, both on average across all sectors, as well as on a disaggregated sectoral level. Section 4.2. extends the analysis to the derivation of labour market flexibility.

4.1. Roeger Results

We have taken two approaches to investigate the mark-up: a computational approach and an estimation approach.

The computational approach follows immediately from equation (1). The mark-up is computed for each year using annual values of the constituent variables. As we are interested in the trend of the mark-up over time, we split the full sample period into several overlapping ten-year sub-periods and calculate the average computed mark-up for each sub-period to allow for investigation of the trend over time. The results are reported in Table 1A.

Since cyclical variability and measurement error generate volatility in the results, we also present the results of the computation after having filtered by means of the Hodrick-Prescott technique, as reported in Table 1B. In order to show the volatility of the computed mark-up

[12] The TIPS database cites a 1998 Statistics South Africa input-output table as the most recent input-output table used as a primary data source in the compilation of the database.

over time, the standard deviation of the mark-up for each sub-period is also reported - see Table 1C.

INSERT TABLE 1A, 1B, and 1C ABOUT HERE.

The resultant trend structure in the mark-up implied from the direct computations is generally symmetrical to the estimated values reported below, although the absolute values of the implied mark-ups continue to reflect the underlying volatility of the series. This is evident even for the smoothed series despite the application of the Hodrick-Prescott filter. This trend is an initial fall in the mark-up (from a moderate base) which is followed by a rise in the mark-up from the mid-1990s. A good example is provided by the Food sector. We see an initial mark-up of 70% in the 1971-80 sub-period, lower mark-ups in the next two sub-periods, and substantial increases in the mark-up over the next three sub-periods (with a mark-up approaching 200% in the 1995-2004 sub-period).

Estimation is preferred to computation due to its more reliable results. The estimation approach involves using the specification:

$$\begin{aligned} NSR_{it} &= \gamma_{0i} + \gamma_1 ROEGER_{it} + \varepsilon_{it} \\ where\ ROEGER_{it} &= \alpha_{it}[\Delta(w+l)_{it} - \Delta(r+k)_{it}] \end{aligned} \tag{10}$$

In Table 2 we report the average manufacturing sector mark-up, both over the full sample period, as well as rolling decade-long sub-periods, estimated from the panel data set. Results indicate the presence of an aggregate mark-up for the manufacturing sector over the full sample period of 54%. The error-correction term, the ϕ-parameter, indicates that adjustment to the long-run equilibrium is rapid as it is close to unity. The Hausman test accepts the inference of an homogenous mark-up across sectors for the long run.

INSERT TABLE 2 ABOUT HERE.

The declining trend in the aggregate manufacturing sector mark-up noted by Edwards and Van De Winkel (2005) is again evident in the estimates. However, the decline in the mark-up is evident prior to the period of liberalization of the economy (proving lowest during the period of maximal closure of the economy (1975-90)), while post-liberalization the trend in the mark-up reverses and it increases. (The estimated mark-up is 50% in the 1991-2000 sub-period and rises to 62% in the 1995-2004 sub-period.) This is supportive of a procyclical mark-up as the fall in the mark-up and its subsequent rise post-1994 mirrors the performance of the South African economy over the same period.

Fedderke et al (2006) and Edwards and Van De Winkel (2005) suggest that trade liberalization should lower the mark-up. It is argued that South Africa liberalized in the 1990s. However, our results associate this period with an increase in the mark-up rather than a decrease. There are three possible reasons for this. First, in an analysis of effective rates of protection, Fedderke and Vaze (2001) conclude that liberalization was incomplete.[13] Second, the substantial depreciation of the rand/dollar exchange rate over this period may have neutralized the effects of liberalization. And, third, liberalization may have had effects on

[13] Though see the dissent in Rangasamy and Harmse (2003), the response by Fedderke and Vaze (2004), and Edwards (2006).

the composition of industry as inefficient firms shut down, leaving only efficient firms with high price-cost margins.

We note here that at the sectoral level the regressors are almost without exception stationary. (The only exception being Basic Iron and Steel.) This is shown by the ADF test statistics of Table 3. ARDL is thus an appropriate estimation strategy (with efficiency gains over OLS in the presence of dynamics). Also note that due to the small sample size of the data at the individual sector level, our sectoral results have low statistical power. These sectoral results are therefore less reliable than the results for the manufacturing sector as a whole. As a result, the behaviour of the estimated mark-up for some individual sectors may be inconsistent with the behaviour of the mark-up for the manufacturing sector as a whole.

INSERT TABLE 3 ABOUT HERE.

In Table 4 we report the three digit manufacturing sector mark-up estimates obtained from the ARDL cointegration estimations. Again, estimated mark-ups are both for the full sample period, as well as for rolling decade-long sub-periods. The mark-up estimates for the full sample period estimation generally fall in a plausible range; the majority of them lying between 10% and 100%. We also find general consistency with the computation results. (Note, for example, that the sub-period estimates for the Food sector are similar to the computation results discussed above; we have an initial mark-up of 79% that falls to 61% in the 1980s but rises to over 100% in the 1995-2004 sub-period.)

INSERT TABLE 4 ABOUT HERE.

The mark-up is consistently statistically significant across all 3-digit manufacturing sectors.[14] There is also variation across sectors in the size of the mark-up. This is despite the finding reported in Table 2 of cross-sector homogeneity in the panel estimations. Sub-period estimations indicate a range of differential responses in the size of mark-up across sectors. For several sectors, there seems to be an increase in the mark-up in the last sub-period or in the last few sub-periods. However, there are also some sectors in which the estimated mark-up decreases. In Table 5 we summarize by placing sectors into six main categories: high mark-ups that either decline, rise or stay the same into the last within-sample decade (1995-2004); or low mark-ups that either decline, rise or stay the same into the last within-sample decade (1995-2004).[15]

INSERT TABLE 5 ABOUT HERE

[14] Standard diagnostics are sound for all sectors but for Glass and Glass Products. For space considerations diagnostics are not reported, but are available on request.

[15] Note that when looking at the estimations for individual sectors over the full sample period,for Tobacco, Coke & Refined Petroleum and Other Manufacturing the estimated mark-up is so high as to raise questions concerning their reliability (all have mark-ups in excess of 200%), suggesting that there may be problems with the estimation or data.

4.2. Labour Adjustment Results

In order to econometrically investigate the relationship between the mark-up and labour adjustment, equation (9) suggests a specification of the form:

$$\begin{aligned} y_{it} &= \beta_{0i} + \beta_1 \Delta k_{it} + \beta_2 \Delta l_{it} + \varepsilon_{it} \\ where\ y_{it} &= \frac{1}{1-\alpha_{it}} \left(\frac{\Delta \log \mu_{it} - ((\Delta q + \Delta p)_{it} - \Delta w_{it})}{\overline{\mu_i}} - \alpha_{it} \Delta l_{it} \right) \end{aligned} \tag{11}$$

with the expressions represented by β_1 and β_2 following directly from (9).

Two of the required variables are not available directly from the original panel data set: the steady-state mark-up ($\overline{\mu}$) and the growth rate of the mark-up ($\Delta \log \mu$). We use the mark-up that was estimated over the full sample period from the previous section as the steady-state mark-up for each sector and use the smoothed computed mark-up series to calculate the growth rate of the mark-up for each sector.[16]

A simple manipulation of the estimated coefficients β_1 and β_2 allows us to obtain an estimate of the labour adjustment coefficient, $\frac{L}{L-\overline{L}}$. From β_1 we obtain an estimate of the elasticity of substitution between capital and labour, σ_{est}, and combined with the β_2 estimate we are able to identify the implied labour adjustment coefficient. Equations (12) and (13) demonstrate:

$$\beta_1 = \left(\frac{1}{\sigma} - 1 \right) \Rightarrow \sigma_{est} = \frac{1}{\beta_1 + 1} \tag{12}$$

$$\beta_2 = \frac{1}{\sigma} \frac{L}{L - \overline{L}} \Rightarrow \frac{L}{L - \overline{L}} = \sigma \beta_2 = \frac{\beta_2}{\beta_1 + 1} \tag{13}$$

Note that where $\widehat{\beta}_1$ is not significantly different from zero, $\sigma_{est} = 1$ follows directly, in which case trivially $\frac{L}{L-\overline{L}} = \widehat{\beta}_2$.

We report the PMGE results for the manufacturing sector in Table 6. Results indicate the presence of an aggregate labour adjustment coefficient for the manufacturing sector over the full sample period of between 2.84 and 3.43, depending on which lag structure is adopted.[17] This would suggest that of the total labour employed in manufacturing in South Africa, approximately two-thirds is devoted to fixed costs and one-third is devoted to variable costs. It would be useful to contextualize this through comparisons with other countries, but we are not aware of literature on this. Oliviera Martins and Scarpetta (1999) considered cases where the fixed amount of labour represented either 20% or 40% of total labour inputs. The inference is that in south Africa the proportion of labour cost that belongs to fixed cost is considerably higher than the corresponding OECD values.

[16] One concern with this approach might be the underlying volatility of the computed mark-up series. For this reason we tested the sensitivity of results to variation in the computed mark-up series. results are robust to such variation. For example, imposing a growth rate of zero on the mark-up rather than calculating the growth rate from the computed mark-up series did not alter estimation results substantively.

[17] Note that from the underlying estimations, the error-correction term in the PMG estimator indicates that adjustment to the long-run equilibrium is rapid. The Hausman test accepts the inference of an homogenous labour adjustment coefficient across sectors for the long run, justifying the use of the PMG estimator.

INSERT TABLE 6 ABOUT HERE

In order to investigate the trend of the labour adjustment coefficient over time, we use a similar approach to the sub-period approach used in the previous section. We run the estimation on fifteen-year sub-periods and roll these through the full sample period year-by-year. The results are reported in Table 7, and illustrated in Figure 1. We include a plot in which third degree polynomial trendlines have been added. The general pattern that emerges is a U-shape: a decreasing labour adjustment coefficient through the first half of the sample followed by an increasing labour adjustment coefficient in the second half of the sample. Recall that a decreasing coefficient is associated with an increase in labour flexibility. Specifically, the labour adjustment coefficient falls by about one third (from an initial level of four to around two and a half in the 1978-92 sub-period) before rising towards the original level in the latter sub-periods.

A number of possible interpretations of this evidence are plausible. First, we note that labour flexibility over the 1980s may be different because this is the period in which the closure of the South African economy was greatest. Second, the response to the upward real wage pressure associated with the unionization of the 1980s may have been an enforced increased flexibility in labour hours. Third, the reversal in the labour flexibility coefficient during the course of the 1990s may be due to the additional introduction of labour market legislation that raised non-wage costs of employment,[18] and reduced reliance of the labour factor of production. The third interpretation in particular is supported by an IMF country report (2005) that identifies the labour laws associated with hiring and dismissal as being particularly responsible for inflexibilities in the South African labour market rather than other factors.

Figure 1 also summarizes the evidence on the trend structure in the "true" estimated σ_{est} from the β_1 coefficient. Two features of the σ_{est} are striking. The first is that throughout the sample period, $0 < \sigma < 1$, with the inference that capital and labour are substitutes rather than complements ($0 < \sigma$), but less than proportionately ($\sigma < 1$). The second is that the degree of substitutability of capital and labour fell in concert with declining labour market flexibility, and then rose as labour market flexibility declined. The inference is that under periods of increasing labour market inflexibility, capital is increasingly relied on to substitute for labour, an interpretation that accords immediately with intuition.

INSERT TABLE 7 AND FIGURE 1 ABOUT HERE

In Table 8 we compare the labour adjustment coefficient across sectors. These are estimates over the full sample period obtained from the ARDL cointegration estimations. Although both the labour adjustment coefficient with $\sigma = \sigma_{est}$ and the labour adjustment coefficient with $\sigma = 1$ are reported, it is the column associated with the "correct" σ_{est} in which we are interested. It is the labour adjustment coefficient in this column that is used to provide the summary table, Table 9. This is a table that characterizes each sector as either one that has high rigidity in labour adjustment (large degree of labour is devoted to fixed costs), medium rigidity in labour adjustment or low rigidity in labour adjustment. Not

[18] These include the Labour Relations Act of 1996, the Basic Conditions of Employment Act of 1997 and the Employment Equity Act of 1998.

surprisingly, some of the highly unionized sectors (such as Textiles and Motor Vehicles, Parts and Accessories) are in the most rigid category, while some of the sectors in which labour is not a significant cost are in the least rigid category (such as Basic Iron and Steel).

INSERT TABLES 8 AND 9 ABOUT HERE

We also look at the trend of the sector-specific labour adjustment coefficient over time. Results are reported in Table 10.[19] Sectors fall into three distinct categories. A number of sectors report a declining $\frac{L}{L-\overline{L}}$ coefficient, thus implying *increasing* labour market flexibility, though in a number of instance there is a reversion to much greater inflexibility in the very last observation. This pattern applies to Leather and Leather Products, Footwear, Wood and Wood Products, Paper and Paper Products, Plastic Products and Basic Iron & Steel. By contrast there are sectors in which the $\frac{L}{L-\overline{L}}$ coefficient has been rising, thus implying *decreasing* labour market flexibility. This applies to Food, Textiles, Wearing Apparel, Printing, Publishing & Recorded Media, Basic Chemicals, and Other Chemicals & Man-Made Fibers. Finally, there are a range of sectors that have consistently reported a high $\frac{L}{L-\overline{L}}$ coefficient, with the associated *low* degree of labour market flexibility. This applies particularly to Metal Products, Machinery, Electrical Machinery, Professional & Scientific Equipment, and Furniture.

INSERT TABLE 10

5. Conclusion

We find evidence of imperfect competition and pricing power in South African manufacturing through the presence of an aggregate mark-up of around 50% for the sector over the period from 1970 to 2004. When looking at the trend of the mark-up over time, our results suggest that the mark-up fell from a moderate base during the 1970s and 1980s before rising again after the liberalization of the South African economy in the early 1990s. The analysis of individual sectors reveals strong variation in the magnitudes and trends of mark-ups at the sectoral level.

Labour market flexibility (particularly the ease of labour adjustment) is investigated through an extension of the mark-up analysis. It is found that of the total labour employed in manufacturing in South Africa, approximately two-thirds is devoted to fixed costs and one-third is devoted to variable costs. We also look at the trend of this proportion over time. Results indicate that there is an increase in labour flexibility in the 1970s and early 1980s (a higher proportion of labour is devoted to variable costs) followed by a decrease in labour

[19] Note that there are several omitted values and sectors. These indicate circumstances in which statistically reliable results were not obtained. Note that in order to obtain sensible results, it was necessary to either choose a constant elasticity of unity throughout all the sub-periods or use the variable elasticity of substitution throughout all the sub-periods when obtaining the labour adjustment coefficient. This is because if we change from using an elasticity of unity in one sub-period to the variable elasticity of substitution in the following sub-period, changes in the labour adjustment coefficient are potentially due to the change in the elasticity of substitution rather than the behaviour of the labour market. We chose unitary or variable elasticities for each sector based on the general trend in the significance of the β_1 in the sub-period estimations, and for only two sectors chose to use variable elasticities: Basic Chemicals and Basic Iron and Steel.

flexibility in the 1990s. Labour legislation that was introduced in the 1990s is identified as a possible reason for this. Evidence from the elasticity of substitution between capital and labour suggests that the declining degree of labour market flexibility was associated with an increasing propensity to substitute capital for labour.

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Table 1A: Computed Mark-up - Moving Average

Manufacturing 3-digit Sectors	**1971-1980**	**1975-1984**	**1981-1990**	**1985-1994**	**1991-2000**	**1995-2004**
Food	0.77	0.66	0.70	0.73	1.28	1.85
Beverages	0.74	-0.18	1.73	2.11	2.09	3.56
Tobacco	-1.48	0.85	1.73	-2.06	-0.45	-76.29
Textiles	-0.34	0.29	0.54	0.66	1.23	1.31
Wearing apparel	0.17	0.18	0.31	0.36	-1.06	-0.50
Leather & leather products	0.08	0.11	0.24	0.30	0.60	-0.54
Footwear	0.07	0.08	0.15	0.17	-0.04	0.13
Wood & wood products	0.49	0.56	0.88	1.07	0.64	0.39
Paper & paper products	0.59	0.72	4.41	4.45	2.30	2.14
Printing, publishing & recorded media	0.22	0.25	0.54	0.60	-0.30	-0.48
Coke & refined petroleum	-1.47	1.92	0.58	1.99	-14.32	-17.75
Basic chemicals	1.11	0.70	0.81	0.89	2.27	1.38
Other chemicals & man-made fibers	0.28	0.56	0.83	0.91	1.60	1.47
Rubber products	0.39	0.41	0.38	0.40	0.44	-2073.24
Plastic products	0.75	0.69	2.27	2.30	0.59	-0.60
Glass & glass products	0.29	0.35	0.59	0.66	0.69	-2.51
Non-metallic minerals	0.45	0.48	-0.70	-0.73	1.98	3.56
Basic iron & steel	0.09	0.37	0.35	0.36	-0.26	2.18
Basic non-ferrous metals	-0.06	0.51	1.28	1.47	-5.19	-7.48
Metal products excluding machinery	0.29	0.27	0.59	0.33	0.41	1.54
Machinery & equipment	0.50	0.28	0.41	0.53	0.01	0.23
Electrical machinery & apparatus	0.91	0.79	0.49	0.29	0.29	0.36
Television, radio & communication equipment	0.41	0.48	-1.93	-0.94	-2.37	-4.36
Professional & scientific equipment	0.45	0.51	0.46	0.85	1.60	2.33
Motor vehicles, parts & accessories	0.23	0.20	0.06	0.30	-1.95	-0.80
Other transport equipment	0.91	0.12	0.74	0.46	-2.43	-3.00
Furniture	-0.09	-0.07	0.15	0.20	0.03	0.12
Other manufacturing	1.36	1.31	2.54	3.30	5.07	4.44

Table 1B: Computed Mark-up - Moving Average of Smoothed Series

Manufacturing 3-digit Sectors	1971-1980	1975-1984	1981-1990	1985-1994	1991-2000	1995-2004
Food	0.77	0.72	0.69	0.88	1.38	1.69
Beverages	0.71	0.65	1.75	2.15	2.61	3.52
Tobacco	-1.52	1.57	1.09	-1.83	12.58	-77.07
Textiles	-0.36	0.08	0.53	0.60	1.32	1.38
Wearing apparel	0.17	0.19	0.29	0.51	0.09	-0.67
Leather & leather products	0.08	0.12	0.23	0.41	0.23	-0.65
Footwear	0.07	0.09	0.13	0.29	0.11	0.01
Wood & wood products	0.48	0.58	0.88	1.15	0.61	0.31
Paper & paper products	0.57	0.55	2.99	5.18	3.85	1.53
Printing, publishing & recorded media	0.21	0.29	0.57	0.33	-0.35	-0.22
Coke & refined petroleum	-1.43	2.97	1.10	1.87	-12.05	-17.81
Basic chemicals	1.11	0.92	0.79	1.14	1.94	1.14
Other chemicals & man-made fibers	0.26	0.56	0.84	0.86	2.51	1.51
Rubber products	0.50	-0.07	2.16	59.26	-837.79	-2131.59
Plastic products	0.74	0.62	1.92	2.44	0.71	-0.69
Glass & glass products	0.28	0.38	0.61	0.77	-0.05	-2.64
Non-metallic minerals	0.48	0.57	-0.64	-0.72	1.99	3.54
Basic iron & steel	0.08	0.27	0.36	0.34	0.18	2.20
Basic non-ferrous metals	-0.09	0.50	1.38	-0.27	-4.24	-5.72
Metal products excluding machinery	0.28	0.29	0.48	0.41	0.44	1.46
Machinery & equipment	0.51	0.35	0.41	0.54	0.30	0.21
Electrical machinery & apparatus	0.92	0.72	0.49	0.48	0.22	0.17
Television, radio & communication equipment	0.46	0.43	-1.35	-1.23	-2.71	-4.03
Professional & scientific equipment	0.46	0.44	0.45	0.83	1.86	2.38
Motor vehicles, parts & accessories	0.22	0.19	0.13	0.22	-2.27	-0.70
Other transport equipment	0.88	0.24	0.72	-0.24	-2.21	-2.32
Furniture	-0.10	-0.02	0.18	0.16	-0.01	0.16
Other manufacturing	1.32	1.54	2.66	3.27	4.94	4.43

Table 1C: Computed Mark-up - Standard Deviation

Manufacturing 3-digit Sectors	1971-1980	1975-1984	1981-1990	1985-1994	1991-2000	1995-2004
Food	0.54	0.23	0.14	0.13	1.26	1.30
Beverages	5.00	3.70	1.68	1.63	1.00	3.52
Tobacco	10.64	8.31	8.22	14.16	19.92	259.31
Textiles	1.91	0.21	0.52	0.50	1.37	2.39
Wearing apparel	0.18	0.10	0.29	0.27	9.49	9.67
Leather & leather products	0.08	0.09	0.10	0.11	1.47	3.42
Footwear	0.06	0.04	0.12	0.15	3.40	3.85
Wood & wood products	0.67	0.41	0.64	0.62	1.99	1.95
Paper & paper products	0.51	0.39	11.34	11.33	4.04	4.30
Printing, publishing & recorded media	0.20	0.09	0.63	0.60	2.20	2.15
Coke & refined petroleum	11.47	2.74	7.31	8.39	44.10	42.85
Basic chemicals	1.38	0.45	0.41	0.36	2.04	3.57
Other chemicals & man-made fibers	0.63	0.28	0.61	0.59	1.78	8.69
Rubber products	0.29	0.13	0.23	0.24	2.41	6555.49
Plastic products	0.83	0.71	5.01	5.00	1.28	4.00
Glass & glass products	0.16	0.11	0.49	0.49	0.76	7.70
Non-metallic minerals	0.54	0.29	4.25	4.23	3.71	4.39
Basic iron & steel	1.01	0.22	0.14	0.12	1.44	6.33
Basic non-ferrous metals	1.10	0.63	0.97	0.94	13.78	18.53
Metal products excluding machinery	0.21	0.14	0.65	1.22	1.19	2.33
Machinery & equipment	0.69	0.26	0.43	0.41	1.96	2.10
Electrical machinery & apparatus	1.24	1.19	0.19	1.16	2.65	2.40
Television, radio & communication equipment	0.53	0.47	7.79	8.70	9.44	8.53
Professional & scientific equipment	0.96	0.93	0.39	0.91	2.05	4.76
Motor vehicles, parts & accessories	0.20	0.17	2.21	2.24	19.30	20.27
Other transport equipment	2.39	1.12	1.05	1.35	5.56	5.76
Furniture	0.55	0.54	0.31	0.32	1.61	1.67
Other manufacturing	1.97	1.94	1.74	1.92	1.89	2.95

Table 2: PMGE Results for Manufacturing Sector Mark-up

	μ-1	**Φ (ECM)**	**h-test**	**RLL**	**LR**
1971-2004	0.54*	-0.87*	0.98	951.06	364.39
	(0.02)	(0.07)	[0.32]		[0.00]
1971-1980	0.79*	-1.02*	0.40	327.57	332.29
	(0.02)	(0.06)	[0.53]		[0.00]
1975-1984	0.50*	-1.01*	1.91	245.47	425.16
	(0.01)	(0.02)	[0.17]		[0.00]
1981-1990	0.57*	-0.94*	0.74	281.41	333.49
	(0.01)	(0.04)	[0.39]		[0.00]
1985-1994	0.70*	-0.98*	0.96	393.46	368.42
	(0.01)	(0.09)	[0.33]		[0.00]
1991-2000	0.50*	-1.12*	1.93	258.80	122.53
	(0.03)	(0.08)	[0.16]		[0.00]
1995-2004	0.62*	-1.05*	0.98	228.63	91.16
	(0.06)	(0.06)	[0.32]		[0.00]

Note: * denotes significance at the 5% level, (s.e.), [p-value]

Table 3: ADF Test Statistic (using AIC(5) to select lag order) Manufacturing 3-digit Sectors	**Variable: NSR I(0)**	**I(1)**	**ROEGER I(0)**	**I(1)**
Food	-4.66		-5.45	
Beverages	-4.67		-5.35	
Tobacco	-5.07		-6.61	
Textiles	-3.95		-5.84	
Wearing apparel	-4.03		-5.78	
Leather & leather products	-4.55		-5.82	
Footwear	-3.00		-5.61	
Wood & wood products	-4.67		-5.16	
Paper & paper products	-4.10		-4.71	
Printing, publishing & recorded media	-4.55		-4.54	
Coke & refined petroleum	-5.62		-5.55	
Basic chemicals	-4.73		-5.98	
Other chemicals & man-made fibers	-4.76		-5.84	
Rubber products	-4.67		-4.80	
Plastic products	-3.91		-4.86	
Glass & glass products	-3.57		-5.59	
Non-metallic minerals	-3.81		-5.44	
Basic iron & steel	-2.77*	-6.48	-5.64	
Basic non-ferrous metals	-5.02		-5.20	
Metal products excluding machinery	-4.41		-5.52	
Machinery & equipment	-4.92		-5.46	
Electrical machinery & apparatus				
Television, radio & communication equipment	-4.47		-4.94	
Professional & scientific equipment	-4.77		-7.31	
Motor vehicles, parts & accessories	-3.26		-5.31	
Other transport equipment	-5.07		-4.21	
Furniture	-3.93		-5.32	
Other manufacturing	-5.62		-5.73	

Note: * denotes test statistic that is greater than the critical value

Table 4: Estimated Mark-up

Manufacturing 3-digit Sectors	**1971-2004**	**(s.e.)**	**1971-1980**	**1975-1984**	**1981-1990**	**1985-1994**	**1991-2000**	**1995-2004**
Food	0.86*	(0.10)	0.79	0.87	0.61	0.70	0.68	1.08
Beverages	1.07*	(0.12)	1.45	1.47	0.97	1.30	1.17	2.29
Tobacco	4.05*	(0.58)	4.27	0.73	5.03	3.79	2.16	-7.79
Textiles	0.51*	(0.06)	0.49	0.56	0.30	0.39	0.82	1.26
Wearing apparel	0.29*	(0.07)	0.35	0.29	0.19	0.26	0.24	0.63
Leather & leather products	0.16*	(0.03)	0.17	0.13	0.21	0.26	0.07	-0.25
Footwear	0.14*	(0.04)	0.10	0.14	0.10	0.15	-0.69	0.47
Wood & wood products	0.55*	(0.06)	0.93	0.79	0.59	0.77	-0.24	0.22
Paper & paper products	0.84*	(0.09)	0.17	0.81	0.73	0.81	1.02	1.19
Printing, publishing & recorded media	0.28*	(0.06)	0.35	0.39	0.31	0.45	1.19	0.07
Coke & refined petroleum	3.31*	(0.60)	1.55	2.90	2.93	2.98	4.74	2.12
Basic chemicals	0.83*	(0.11)	0.89	0.79	0.34	0.84	5.05	0.59
Other chemicals & man-made fibers	0.70*	(0.06)	0.40	0.93	0.61	0.76	0.29	0.29
Rubber products	0.52*	(0.06)	0.58	0.60	0.42	0.48	0.03	0.07
Plastic products	0.69*	(0.09)	0.45	0.75	0.50	0.56	1.82	0.85
Glass & glass products	**		0.28	0.40	0.58	0.65	0.84	1.36
Non-metallic minerals	0.96*	(0.25)	0.70	0.79	0.58	0.62	0.29	1.03
Basic iron & steel	0.60*	(0.11)	0.54	0.54	0.24	0.24	0.24	1.52
Basic non-ferrous metals	0.77*	(0.12)	2.75	1.35	0.76	1.16	0.62	1.55
Metal products excluding machinery	0.41*	(0.05)	0.44	0.46	0.32	0.40	0.30	0.79
Machinery & equipment	0.29*	(0.05)	0.14	0.23	0.25	0.39	0.36	0.27
Electrical machinery & apparatus	0.49*	(0.05)	0.93	0.72	0.45	0.62	0.38	-0.01
Television, radio & communication equipment	0.46*	(0.05)	0.28	0.39	0.44	0.42	0.53	0.52
Professional & scientific equipment	0.52*	(0.06)	0.74	0.61	0.53	0.82	0.98	1.12
Motor vehicles, parts & accessories	0.39*	(0.10)	0.46	0.42	0.19	0.51	0.74	1.41
Other transport equipment	0.36*	(0.08)	0.70	0.49	0.46	0.50	-0.04	0.11
Furniture	0.20*	(0.03)	0.42	0.28	0.18	0.26	0.30	0.42
Other manufacturing	2.16*	(0.19)	3.12	2.00	2.09	3.28	5.73	4.50

Note: * denotes significance at the 5% level, ** denotes case in which statistically reliable results were not available

Table 5: Summary of Recent Mark-up Behaviour

Level of mark-up in 1991-2000	**Change in mark-up from 1991-2000 to 1995-2004** **Increase**	**Decrease**	**Less than 10% change**
High	Beverages	Tobacco	
(above 80%)	Textiles	Printing, publishing & recorded media**	
	Paper & paper products	Coke & refined petroleum*	
	Glass & glass products	Basic chemicals**	
	Professional & scientific equipment	Plastic products*	
	Furniture	Other manufacturing**	
Medium	Food		Television, radio & communication equipment
	Basic non-ferrous metals**		
	Motor vehicles, parts & accessories		
Low	Wearing apparel	Leather & leather products	Other chemicals & man-made fibers**
(below 40%)	Footwear		Rubber products**
	Wood & wood products*		Machinery & equipment
	Non-metallic minerals		
	Basic iron and steel		
	Metal products excluding machinery		
	Other transport equipment		
Note:	*** change is off singular low or high**		
	**** change does not reflect trend - entire series should be looked at**		

Table 6: PMGE Results for Manufacturing Sector Labour Adjustment

1972-2004	$\beta 1$	$\beta 2$	**σ-hat**	**Lab adj (σ-hat)**	**Lab adj (σ=1)**
AIC(1)	0.42*	-4.88*	0.70	3.43	4.88
	(0.15)	(0.15)			
AIC(2)	0.67*	-4.74*	0.60	2.84	4.74
	(0.14)	(0.15)			
AIC(3)	0.59*	-4.76*	0.63	2.99	4.76
	(0.14)	(0.15)			

Note: * denotes significance at the 5% level

Table 7: PMGE Results for Manufacturing Sector Labour Adjustment

	Lab adj ("correct" σ)*		**Lab adj (σ=1)**	
Sub-period	**AIC(1)**	**AIC(2)**	**AIC(1)**	**AIC(2)**
1972-1986	3.54	2.76	4.63	4.25
1973-1987	3.51	3.36	4.56	4.27
1974-1988	3.71	4.06	4.40	4.06
1975-1989	3.35	2.75	4.34	4.33
1976-1990	3.28	2.17	4.32	3.35
1977-1991	2.35	1.75	3.61	2.59
1978-1992	2.50	2.02	4.13	2.77
1979-1993	2.42	1.68	4.29	5.46
1980-1994	2.43	1.13	4.84	1.87
1981-1995	2.58	2.80	4.94	4.79
1982-1996	2.62	2.78	4.63	4.77
1983-1997	3.29	2.27	5.00	2.27
1984-1998	2.72	2.43	4.84	4.19
1985-1999	5.69	1.96	5.69	1.50
1986-2000	6.79	3.66	3.69	1.56
1987-2001	3.50	3.40	3.50	2.62
1988-2002	2.45	1.83	4.58	3.76
1989-2003	4.23	**	4.23	**
1990-2004	**	**	**	**

*** See text for interpretation of "correct"**
**** Statistically reliable results not available**

Table 8: PSS ARDL Results for Manufacturing Sector Labour Adjustment

1972-2004	β1	β2	σ-hat	Lab adj (σ-hat)	Lab adj (σ=1)	Lab adj ("correct" σ)
Food	0.13	-2.86*	0.88	2.52	2.86	2.86
	(0.25)	(0.31)				
Beve**	0.29	-1.24*	0.78	0.96	1.24	1.24
	(0.26)	(0.16)				
Toba	n/a					
Text***	5.82	-8.99*	0.15	1.32	8.99	8.99
	(3.23)	(2.00)				
Wear	0.31	-5.13*	0.76	3.91	5.13	5.13
	(1.76)	(1.95)				
Leat**	-2.32	-5.37*	-0.76	-4.07	5.37	5.37
	(1.46)	(0.91)				
Foot	7.93*	-9.95*	0.11	1.11	9.95	1.11
	(3.40)	(1.86)				
Wood	0.99	-2.97*	0.50	1.50	2.97	2.97
	(0.68)	(0.88)				
Pape	n/a					
Prin	-0.27	-2.11*	1.37	2.88	2.11	2.11
	(0.35)	(1.00)				
Coke	-0.22	-1.27*	1.29	1.64	1.27	1.27
	(0.22)	(0.44)				
Chem	0.23	-1.55*	0.81	1.26	1.55	1.55
	(0.23)	(0.26)				
Otch	n/a					
Rubb***	8.27	-7.18*	0.11	0.77	7.18	7.18
	(5.39)	(2.63)				
Plas***	1.45*	-3.79*	0.41	1.54	3.79	1.54
	(0.57)	(0.77)				
Glas***	0.01	-6.93*	0.99	6.85	6.93	6.93
	(0.81)	(1.40)				
Nmet	n/a					
Iron**	1.25*	-4.32*	0.45	1.92	4.32	1.92
	(0.28)	(0.34)				
Nfer	n/a					
Meta	-0.59	-5.36*	2.45	13.10	5.36	5.36
	(0.47)	(0.34)				
Mach**	-0.56	-4.90*	2.28	11.19	4.90	4.90
	(0.42)	(0.56)				
Elec**	-0.81	-2.84*	5.37	15.25	2.84	2.84
	(0.57)	(0.45)				
Tele	n/a					
Prof	-0.97	-3.41*	33.50	114.36	3.41	3.41
	(0.58)	(0.31)				
Moto***	3.24	-8.61*	0.24	2.03	8.61	8.61
	(2.32)	(3.69)				
Ottr	n/a					
Furn***	-0.80	-7.36*	4.93	36.28	7.36	7.36
	(0.63)	(0.59)				
Otma	n/a					

Note: * denotes significance at the 5% level, ** denotes sector in which time dummies were used, * denotes sector in which some diagnostics were problematic, although still workable**

Table 9: Summary of Manufacturing Sector Labour Adjustment

Top third (most rigid)		**Middle third**		**Bottom third (least rigid)**	
Text	8.99	Food	2.86	Beve	1.24
Leat	5.37	Wear	5.13	Foot	1.11
Rubb	7.18	Wood	2.97	Coke	1.27
Glas	6.93	Prin	2.11	Chem	1.55
Meta	5.36	Mach	4.90	Plas	1.54
Moto	8.61	Elec	2.84	Iron	1.92
Furn	7.36	Prof	8.61		

Table 10: MGE Results for Manufacturing Sector Labour Adjustment

	Food	Text	Wear	Leat	Foot	Wood	Pape	Prin	Chem	Otch	Plas	Glas	Iron	Meta	Mach	Elec	Prof	Furn
Sub-period	**σ=1**	**σ=1**	**σ=1**	**σ=1**	**σ=1**	**σ=1**	**σ=1**	**σ=1**	**var σ**	**σ=1**	**σ=1**	**σ=1**	**var σ**	**σ=1**	**σ=1**	**σ=1**	**σ=1**	**σ=1**
1972-1986	3.34	2.79	9.42	13.99	17.87		7.04	4.31	1.85		4.33	5.19	4.09	5.65	6.88	3.77	4.82	11.98
1973-1987	3.15	2.78	9.61	11.90	17.84		5.49	4.43	1.92		4.34	5.22	2.77	5.54	7.09	3.95	4.75	11.73
1974-1988	3.41	3.47	6.99	16.50	17.93		4.88	4.59	1.68		4.68	4.93	2.87	5.48	7.19	4.03	4.66	11.76
1975-1989	3.04	4.23		15.83	18.01		5.42	4.30	1.70		4.80	4.82	1.89	4.94	7.32	3.76	4.63	11.68
1976-1990	2.56	2.18		15.28	16.55	4.19	5.18		1.77		4.74	4.57	1.49	4.82	6.99	3.10	4.10	11.58
1977-1991	3.07	5.69	4.32		15.14	3.21	3.35	5.14	1.92	1.67		3.58	1.43	4.79	5.79	3.23	4.79	9.99
1978-1992	3.59	5.61	6.47	6.51	9.39	3.07	2.33	4.45	1.86	1.84	4.05	3.30	1.15	4.92	5.74	3.21	5.32	8.36
1979-1993	3.75	5.28	7.32	7.91	13.96	2.48	1.80	4.49	1.88	2.04	3.91	2.56	1.12	5.27	5.69	3.32	2.85	8.48
1980-1994	2.14	5.15	7.03	9.48	13.80	2.09	1.48	4.15	1.67	3.58	3.28	2.93		5.40	5.92	5.01	2.24	8.48
1981-1995	1.54	5.00	6.96	9.41	12.84	2.16		1.44	1.89	2.72	3.53			5.07	5.25	5.25	2.20	7.63
1982-1996	1.65	5.00	12.41	2.78	12.37	1.60		2.11	3.40	2.80	3.18	1.91		4.65	6.15	3.26	3.31	8.75
1983-1997	2.22	5.58	11.64	5.28	12.20	1.77	1.48	3.76		2.86	1.02	4.03	1.18	4.60	5.48	2.93	3.46	8.61
1984-1998	4.13	8.34	10.53	5.42	12.24	1.21	1.76	4.27	5.52	2.76				4.59	5.36	2.86		10.13
1985-1999	4.01	8.38	4.66	6.06	10.78	1.31	1.95	2.76	2.74	2.03	1.20		2.33	6.46	9.98	2.66	6.29	9.09
1986-2000	3.63	8.75		6.18	6.43	1.40	1.91	3.80	3.75	1.77	4.16		1.70	6.56	6.77	2.08	6.06	9.04
1987-2001	2.63	10.70		5.15	8.88				2.24	4.38			1.68	6.39	5.35	2.24	6.07	9.20

Figure 1: Trend Structure in Labour Flexibility and the Elasticity of Substitution between Capital and Labour over Time