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Industry structure and labor 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 labor market flexibility and product market structure. Our investigation confirms earlier results of imperfect competition in South African manufacturing where we find an average mark-up of 50% for the period 1970 to 2004 that is without consistent trend over time. The contribution of the paper is to provide a theoretically grounded means of linking output market conduct to labor market flexibility. We infer the proportion of labor associated with rigidities in the labor market from the mark-up, and find that two thirds of total labor employed in South African manufacturing is associated with rigidities. We find that this proportion falls during the 1980s and rises during the 1990s, suggesting an increase in labor flexibility followed by a decrease.

1. Introduction

This paper examines a new approach of empirically identifying the extent of labor market flexibility. The contribution of the paper lies in numerically estimating labor market flexibility, linking labor market characteristics to the structure of output markets.[2] 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 labor markets.

There is a strong labor market debate in South Africa, centered 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 labor market flexibility. While an early study dismissed this as a potential cause of poor labor market performance,[3] labor market flexibility has consistently been indicated as a source of concern in South Africa.[4] To date there has been no theoretically consistent quantification of the degree of labor market flexibility in South Africa. This paper fills that gap by proposing a theoretically derived measure of flexibility.

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).

Oliveira 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 labor market through the inclusion of an additional labor adjustment parameter. This parameter can be interpreted as a measure of labor 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

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2 We would expect that in sectors that exhibit pricing power, costs can be passed on to consumers, increasing the bargaining power of labor and therefore decreasing the variability of employed labor. See also Blanchard and Giavazzi (2003), Dobbelaere (2005), Bughin (1996), Crépon et al. (2002), Neven et al. (2002) and Schroeter (1988).

3 Fallon and Lucas (1998).

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

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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. (2008) and Fedderke et al. (2007) by obtaining more recent estimates of mark-ups for South African manufacturing, as well as establishing the extent of labor market flexibility that derives from product market structure. The primary contribution of this paper, however, is the provision of a labor 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 labor 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 labor 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 instrumentation 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.[5] Roeger (1995) solved the estimation problem by pointing out that a specification based on the nominal Solow residual (*NSR*) avoids the endogeneity trap.[6] This gives us the following expression for estimation purposes:

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

where $\mu = \frac{P}{MC}$, defines the mark-up of prices over marginal cost, $\alpha = \frac{wL}{PQ}$, denotes the factor share earned by labor, P and Q denote the price and quantity of value-added respectively, W and L denote the wage and labor time respectively, and R and K denote the supply price of capital and capital stock respectively. Lower case notation denotes log transforms.[7] The mark-up is now accessible to either estimation or computation.

There have been several further extensions within this methodological framework. Oliveira 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. (2007) 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 labor 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 Oliveira 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:

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

where σ denotes the elasticity of substitution between capital and labor, $\bar{\mu}$ the steady-state mark-up and $\bar{L}$ the labor associated with rigidities in the labor market.

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

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

where we assume the possibility of downward rigidities in the adjustment of labor inputs by introducing $\bar{L}$, the labor associated with rigidities in the labor market. (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:

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

where $\Theta G_L(K,L-\bar{L})$ denotes the marginal product of labor (the partial derivative of $Q(K,L-\bar{L})$ with respect to labor).[8]

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 $G_{LL} = -G_{LK}\frac{K}{L-\bar{L}}$, $\sigma = \frac{G_L G_K}{G_{LK} G}$ (Uzawa, 1962) and $\frac{G_K K}{G} = \bar{\mu}(1-\alpha)$ to simplify this expression, obtaining:

$$\Delta log\mu = \theta-(\Delta w-\Delta p)+\frac{\bar{\mu}(1-\alpha)}{\sigma}\Delta k-\frac{\bar{\mu}(1-\alpha)}{\sigma}\frac{L}{L-\bar{L}}\Delta l \tag{6}$$

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 $\frac{G_K K}{Q} = \frac{\bar{\mu}(1-\alpha)}{\Theta}$ and $\frac{G_L L}{Q} = \frac{\bar{\mu}\alpha}{\theta}$ to obtain:

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

[5] See Oliveira 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. While variable, in practice the bias appears to be substantial, with Hall reporting mark-ups for the USA up to ten-fold the magnitude obtained under the Roeger approach.

[6] 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. (2007).

[7] While the derivation is for constant returns to scale, Oliveira Martins and Scarpetta (1999) provide an extension that demonstrates that estimates of the mark-up obtained under this assumption represent a lower-bound estimate.

[8] We are not allowing for fixed costs in labor with this formulation. This is for two reasons. First, we do not have the data to distinguish between the wage share of overhead (fixed) and non-overhead (variable) labor. And, second, although we ultimately find that due to institutional factors there are costs associated with rigidities in the labor market, this does not mean that the rigid part of the cost of labor becomes recorded as part of fixed costs as conventionally defined.