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Investigating the Behaviour of the Mark-Up of Price over Marginal Cost under Different Business Cycle Situation: Empirical Study in Malaysia Manufacturing Industry

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Abstract: This paper investigates the behaviour of the mark-up of price over marginal cost under different business cycle situations. It analyses how the interaction between firms' entry and exit, and the business cycle affects the variations in the degree and cyclicality of the mark-up. In this paper, mark-ups are estimated for Malaysian manufacturing industry using a Nominal Solow Residual (NSR) Roeger (1995) type model. It is interesting to examine the extent to which the mark-up varies across the industries within a sector. However, it is also helpful to pool the data across all manufacturing industries to gain further insights into the reason for variations in the mark-up in the whole sample.

Key words: Business Cycles, Entry, Exit, Mark-up, Manufacturing industry, Malaysia

INTRODUCTION

A longstanding issue among macroeconomists is the question of why the measured productivity residual is pro-cyclical, i.e. higher in years of economic booms than in years of economic recessions (Abdol Samad and Norzaidi, 2011). A representative neoclassical explanation is given by Real Business Cycle (RBC) theory, according to which, economic booms are the result of productivity increases generated by technological shocks. In this context, productivity and output move in tandem and increases in total factor productivity (TFP) are attributable to technological shocks.

The debate regarding the cyclicality of the Solow residual and imperfect competition in the business cycle and the empirical findings of various studies (e.g. Hall (1990), Caballero and Lyons (1992), Basu and Fernald (1995), Burnside (1996), Burnside, Eichenbaum and Rebelo (1996)**)** are also of considerable relevance to Malaysia, especially since Malaysia has achieved a relatively impressive growth rate of approximately 7 percent per annum since its independence in 1957 (Economic Report). In addition, in the middle of 1997, Malaysia was affected by the financial crisis that was triggered initially by the speculative attack on the Thai currency (Baht).

These empirical observations have motivated this research to investigate the behaviour and variations in the mark-up, as measured by the sensitivity of the mark-up toward the business cycle, and entry and exit, for sub-sectors of the Malaysian manufacturing industries from 1978 to 1999. This period is particularly interesting because it captures at least two significant downturns in the Malaysian economy, namely the periods of downturn in 1984-1987 (due to lower demand in the developed countries) and in 1997-1998 (due to the Asian financial crisis). The next section reviews pertinent literatures that have garnered theoretical and practical support.

Literature Review and Theoretical Background

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Market Power:

The estimation of the degree of market power in various U.S. industries has received increased attention Domowitz, Hubbard, and Petersen (1988), and Roeger (1995). Other studies have carried out estimations of the mark-up ratio in gross output, see Oliviera-Martins, *et al.* (1996), Basu and Fernald (1997), and Basu and Fernald (1999). Whilst these different studies use different methodological approaches and analyse different data sets, the empirical evidence emerging from these studies suggests consistently that the presence of mark-ups of prices over marginal costs is evident in many U.S. industries.

Market Power and the Business Cycle:

Klemperer (1995), and Chevalier and Scharfstein (1996) have studied and emphasized the role of capital-market imperfections in price fluctuations over the business cycle. When capital-market imperfections exist, the incentives for firms to make investments may be reduced because firms may not reap the profits associated with the investments. Another strand of the literature has emphasized the role of collusion. Rotemberg and Woodford (1991, 1992) and Bagwell and Staiger (1997) show that a firm participating in a collusive group may have more incentive to defect during a boom period, because the short-term gains from defection are relatively large. Thus, an optimal collusive mechanism may involve lower prices (or mark-ups over marginal cost) during booms than during recessions, in order to eliminate the incentive to defect. Bagwell and Staiger (1997) show that this pattern of countercyclical pricing (or mark-ups) becomes less likely as demand shocks become more positively correlated. To avoid the problems of using accounting data for estimating the price-cost margin, Domowitz (1992) takes an approach that examines total factor productivity. He adjusts the Solow residual to allow firms to price above marginal cost and then permits the price-cost margin to vary with the level of aggregate demand as measured by capacity utilization in manufacturing.

Entry, Exit and the Business Cycle:

Figure 1 reproduces the figures in Chatterjee *et al*. (1993) and Devereux, Head, and Lapham (1996). It shows cyclical fluctuations in real GDP, in the net business formation index, and in new business incorporations at the quarterly frequency between 1958 and 1995 in the U.S. As is evident from Figure 1, net business formation and the incorporation measures are all strongly procyclical.

As suggested earlier, one of the empirical concerns with respect to these results is that whilst this evidence suggests that in the U.S. data the number of firms varies procyclically, the fluctuations are driven mainly by changes in the number of small firms. However, it is important to emphasise that variations in the number of firms are only one of the channels that generate actual changes in the number of competitors. Some evidence that addresses this claim can be found by analysing variations in the number of establishments and franchises as an additional channel affecting the number of competitors.

Variations in the Mark-up:

Behaviour of the Mark-up:

Given the unobserved nature of marginal cost, different studies use different methodological approaches to estimate the marginal cost and, in turn the cyclicality of the mark-up. Most of these studies conclude that in the U.S. economy mark-ups are countercyclical. For example, Bils (1987) uses two-digit industry level data to estimate countercyclical mark-ups. His results are consistent with Rotemberg and Woodford (1991); they use mostly aggregate data and a modified Solow residual to identify technology shocks. Rotemberg and Woodford (1991) estimate the correlation between the mark-up and output time series and conclude that "….the constructed series displays strongly countercyclical mark-up variations." In a later paper, Rotemberg and Woodford (1999) use three different methods, which are wage variations, cyclical variations in the use of intermediate inputs and in inventory accumulations, and the response of mark-ups to particular non-technological shocks to estimate the cyclicality of the mark-up.

Regarding the interaction between the number of operating firms and the price-marginal cost ratio, Bresnahan and Reiss (1991) find that competitive conduct changes quickly as the number of incumbents increase. They report that increases in the number of producers will increase the competitiveness in the market they analyse. Finally, Campbell and Hopenhayn (2005) provide empirical evidence to support the argument that "Face-to-Face" strategic interactions are an important component of competition. They emphasise that one implication of this evidence is that the number of competitors they face affects firms' pricing decisions. Campbell and Hopenhayn (2005) provide estimates for the "toughness of price competition" and show that mark-ups react negatively to an increase in the number of firms.

Why Mark-up Varies?:

The variations in the mark-up in manufacturing industries must be in part due to differences in entry conditions into each industry. Traditionally, entry conditions and the resulting market structures have been related to technological conditions, such as economies of scale and scope. The entry of new firms can be expected to bring prices down to average costs over the long run (Oliviera-Martins *et al*., 1996). Another explanation of the variations in the mark-up is the existence of product differentiation. Research such as Falvey (1981), Shaked and Sutton (1983) and Falvey and Kierzkowski (1987) has focused on so-called "vertical" product differentiation where firms are able to influence the perceived quality of their products.

Along these lines, the rationale for consistent variations in the mark-up in the manufacturing industry also rests on the type of industry and form of competition. Following Sutton (1991) and a subsequent discussion by Schmalensee (1992), two major types of industries (or type of competition) can be identified. Industries with a small average establishment size were termed "fragmented" industries. In "segmented" industries concentration remains relatively stable or converges towards a finite lower bound. Furthermore, the variations in the mark-up in manufacturing industries must be also in part due to the way that each firm in the manufacturing industry takes into account the effect of the pricing and production decisions of other firms on the demand for its goods. Thus the more firms in a sector, the more elastic is the demand that each producer faces; this leads in turn to a lower mark-up that the producer can charge.

The Productivity Residuals and the Mark-up:

Under the assumption of constant returns to scale and constant mark-up, Hall (1990) derived the primal Solow residual (SR), which is often termed growth in TFP). But the estimation of the SR equation caused the explanatory variables to be correlated with the productivity shocks. This has results in a bias and inconsistent estimate of the mark-up of price over marginal cost. One solution is to use an instrument, which in turn raises the requirement that the instruments are correlated with the factor inputs, but not with technological change and hence the error term.

Roeger (1995) has suggested an alternative approach to avoid the endogeneity bias and instrumentation problems by computing the dual of the nominal Solow residual (NSR). The NSR is a function of the mark-up, the labour share and the growth rate of the ratio of labour to capital costs. The NSR was then extended to incorporate intermediate inputs and express the mark-up ratio over gross output (GO) instead of value added (VA).

Oliveira-Martins *et al*., (1999) demonstrate that where the assumption of constant returns to scale is dropped, NSR is actually:

$$NSR_{it} = \left(\frac{\mu}{\lambda} - 1\right)\alpha\left\{\Delta(n_{it} + w_{it}) - \Delta(k_{it} + r_{it})\right\} \tag{1.1}$$

where $\mu = \frac{P}{MC}$ is the mark-up of price over marginal cost, with Δ denoting the first difference or growth rate, lower case denotes the natural logarithms transform, *n,* and *k* denote real value added, labour, and capital inputs respectively, α is the labour share in value added. While w, r and p denote the natural logarithms of the wage rate of labour, rental price of capital and price of output respectively. If $\lambda > 1$, it would indicate increasing returns to scale. From the equation it can be seen that with increasing returns to scale, Roeger's method produces a downward bias in the estimation mark-up. Conversely, the presence of decreasing returns to scale induces an upward bias in the estimation of the mark-up. Thus any estimates of the mark-up that follow from Solow residuals should be interpreted as lower bound values of the true mark-ups if increasing returns to scale are present.

Sectoral Business Cycles and Dynamic Mark-up:

Empirical studies have indicated the possibility that the mark-up may be sensitive to the business cycle (See Haskel *et al*., 1995; and Beccarello, 1996), although their reliance on the Hall methodology is likely to compromise their reliability (See the discussion in Ramey, 1991). The mark-up is likely to depend on the specific product market conditions in which each firm operates. Oligopolistic markets in which conjectural response behaviour is present would generate mark-ups that depend on market conditions. Where capacity utilisation constraints are present, mark-ups would be pro-cyclical (Chatterjee *et al*., 1993).

The debate over the variability of the mark-up has been primarily empirical in nature. On the one hand, proponents of cyclically fluctuating mark-up consider both cost and demand determinants of the mark-up and focus on the income elasticity of demand to explain mark-ups that decline during the expansion phase of the business cycle and rise during the contraction. Where entry into markets is feasible, the expansion phase of the business cycle would be characterised by entry, increased competition, and downward pressure on the mark-up (Chatterjee *et al*., 1993). On the other hand, there are the cost dominated theories of the mark-up, which predominantly argue that the mark-up is constant over the business cycle (e.g. see Blair (1972) and Eichner (1976)).

Thus, this paper will attempt to concentrate on the variability of the mark-up. A simple way to measure the variability of the mark-up over the business cycle is to postulate a linear relationship between price cost mark-ups and a variable which captures the cyclical fluctuations of demand (e.g. see Domowitz *et al*., (1988), Haskel (1995) and Beccarello (1996)).

Assume the following relation between the *Lerner Index (B)* and the business cycle:

$$B_{it} = \overline{B} + \lambda \ln CYCL_{it} \tag{1.2}$$

where (CYCL) is an indicator of cyclical variation, which is represented by the change in product demand. Various proxies for product demand have been used in previous studies such as aggregate unemployment and capacity utilisation (both in Haskel *et al*., 1995), sectoral employment (Bils, 1987), and deviations of output from long term trend as given by the Hodrick-Prescott (HP) filter (Oliviera-Martins *et al*., 1999).

Thus the deviation of industry output from its long-term trend will be used in this paper as a proxy for the measure of (CYCL). The output trend of the Malaysian manufacturing industry from 1978-1999 is obtained using a smoothing approach based on the Hedrick-Prescott filter. The weighting factor is set to 100.

Using the Solow Residual and maintaining the simplifying assumption of constant returns to scale, it can be shown that the new estimating equation with a cyclical mark-up is as follows:

$$NSR_{it} = \overline{B}(OLIVIERA_{it}) + \lambda\left[OLIVIERA_{it}(\ln CYCL_{it}) - \Delta \ln CYCL_{it}\right] \tag{1.3}$$

where $OLIVIERA_{it} = \Delta\left(p_{it} + q_{it}\right) - \Delta\left(k_{it} + r_{it}\right)$ (1.4)

with $\Delta\left(p_{it} + q_{it}\right)$ denotes the change in nominal value added, $\Delta(k_{it} + r_{it})$ denotes the change in total capital stock and $B = \frac{P - MC}{P} = 1 - \frac{1}{\mu}$ is the *Lerner Index*, such that $\overline{\mu} = \frac{1}{1-\overline{B}}$ gives the constant component of the mark-up, whilst λ provides an estimate of the cyclical component of the mark-up. The λ parameter can be negative or positive, implying a counter-cyclical or pro-cyclical variation of mark-ups.

Further augmenting Equation (1.3) to allow for cyclical variation of the mark-up for an individual *i*'th industry, equation (1.3) can be rewritten as follows:

$$NSR_{it} = \overline{B}(OLIVIERA_{it} - \overline{OLIVIERA_i}) + \lambda\left[(MARKUPCHARACTER_{it} - \overline{MARKUPCHARACTER_i})\right] \tag{1.5}$$

where $OLIVIERA_{it} = \Delta\left(p_{it} + q_{it}\right) - \Delta\left(k_{it} + r_{it}\right)$ and

$MARKUPCHARACTER_{it} = OLIVIERA_{it}(\ln CYCL_{it}) - \Delta \ln CYCL_{it}$., $MARKUPCHARACTER_{it}$ denotes the natural logarithm of cyclical variation of mark-up for an individual *i*'th industry, and $\overline{MARKUPCHARACTER_i}$ denotes the natural logarithm of the mean cyclical variation of mark-up for an individual *i*'th industry. NSR_{it} is the Nominal Solow Residuals for an individual *i*'th industry. Thus λ captures the counter-cyclical (negative signs) or pro-cyclical (positive signs) for an individual *i*'th industry variation of the mark-up.

The industry-level mean value of *MARKUPCHARACTER* ($\overline{MARKUPCHARACTER}$) is defined as the total value of *MARKUPCHARACTER* divided by the number of industry in the list in natural logarithms.

The industry-level mean value of *OLIVIERA* ($\overline{OLIVIERA}$) is defined as the total value of *OLIVIERA* divided by the number of industry in the list in natural logarithms. The impact of the business cycle on the strength of the mark-up of price over marginal cost can be tested as follows:

$$\mu_{it} - 1 = \Lambda_0 + \Lambda_1 \ln(CYCL_{it} - \overline{CYCL_i}) + \Lambda_2 \ln(CYCL_{-it} - \overline{CYCL_{-i}}) \quad (1.6)$$

Equation (1.6) splits the sources of the variations of the mark-up in the manufacturing industry into two components: that due to the impact of deviations of demand fluctuations from the mean value of demand fluctuations on variations of the mark-up for an individual *i*'th manufacturing industry; and that due to the impact of deviations of demand fluctuations from the mean value of demand fluctuations on variations of the mark-up for the whole sample except for manufacturing industry *i*. Thus Λ_1 captures the sensitivity for an individual *i*'th manufacturing industry demand fluctuation of the variations on the mark-up, and Λ_2 captures the sensitivity for the whole sample except for manufacturing industry *i* demand fluctuations of the variations on the mark-up. $\mu_{it} - 1$ denotes the mark-up which have already taken into account intermediate inputs.

The industry-level mean value of *CYCL* ($\overline{CYCL}$) is defined as the total value of *CYCL* divided by the number of industry in the list in natural logarithms. The impact of entry and exit on the mark-up can be investigated as given by:

$$\mu_{it} - 1 = \tau_0 + \tau_1 \ln(EntryExit_{it} - \overline{EntryExit_i}) + \tau_2 \ln(EntryExit_{-it} - \overline{EntryExit_{-i}}) \quad (1.7)$$

where ln $EntryExit_{it}$ denotes the natural logarithm of entry and exit for an individual *i*'th industry, ln $EntryExit_{it}$ denotes the natural logarithm of entry and exit for the whole sample except for industry *i*, ln $\overline{EntryExit_i}$ denotes the natural logarithm of the mean entry and exit for an individual *i*'th industry, and ln $\overline{EntryExit_{-i}}$ denotes the natural logarithm of the mean entry and exit for whole sample except for industry *i*. In addition Equation (1.6) also splits sources of the sensitivity of variations of the mark-up in manufacturing industry into two components: that due to the impact of deviations of entry and exit from the mean value of entry and exit on variations of the mark-up for an individual *i*'th manufacturing industry; and that due to the impact of deviations of entry and exit from the mean value of entry and exit on variations of the mark-up for the whole sample except for manufacturing industry *i*.

Hence τ_1 captures the sensitivity of the mark-up to entry and exit for an individual *i*'th manufacturing industry, and τ_2 captures the sensitivity of the mark-up to entry and exit for the whole sample except for manufacturing industry *i*. To measure the entry and exit from the Malaysian manufacturing industry, the turnover rate will be employed. The turnover rate will be defined as entering firms plus exiting firms divided by total firms.

The industry-level mean value of *EntryExit* ($\overline{EntryExit}$) is defined as the total value of *EntryExit* divided by the number of industry in the list in natural logarithms.

The Econometric Methodology:

To proceed, Equations (1.5), (1.6), and (1.7) will be estimated. The Pooled Mean Group (PMG) estimator has been employed as a panel estimator for estimation of Equations (1.5), (1.6), and (1.7) provided by Pesaran, Shin and Smith (1999). See also the discussion in Fedderke, Shin and Vaze (2000) and Fedderke (2003a).

Panel Estimator:

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

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i' X_{i,t-1} + \sum_{j=1}^{p-1} \omega_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}' \Delta X_{i,t-j} + \Omega_i + \varepsilon_{it} \qquad (1.8)$$

where $= 1,2,....,N, t = 1,2,...,T$, p, q denote the cross section units, time period, lags dependent and lags independent variable respectively. Here y_{it} is a scalar dependent variable, $X_{it}(kx1)$ a vector of (weakly exogenous) regressors for group *i*, and Ω_i represents fixed effects. Allow the disturbances ε_{it}'s to be independently distributed across *i* and *t*, with zero means and variances σ_i^2 >0, and assume that ϕ_i < 0 for all *i*. Then there exists a long-run relationship between y_{it} and X_{it} :

$$y_{it} = \theta_i' X_{it} + \eta_{it} \quad , i = 1, 2, …., N, t = 1, 2, ….., T, \qquad (1.9)$$

where $\theta_i = \frac{-\beta_i'}{\phi_i}$ is the *k* x 1 vector of the long-run coefficients, and η_{it}'s are stationary with possibly non-zero means (including fixed effects). This allows Equation (1.9) to be written as:

$$\Delta y_{it} = \phi_i \eta_{i,t-1} + \sum_{j=1}^{p-1} \omega_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}' \Delta X_{i,t-j} + \Omega_i + \varepsilon_{it} \qquad (1.10)$$

where $\eta_{i,t-1}$ is the error correction term given by Equation (1.10), and thus ϕ_i is the error correction coefficient measurement (ECM) 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 homogeneous; i.e. $\theta_i = \theta \forall i$. Group specific short-run coefficients and the common long-run coefficients are computed by the pooled maximum likelihood estimation. Denoting these estimators by $\tilde{\phi}_i, \tilde{\beta}_i, \tilde{\omega}_{ij}, \tilde{\delta}_{ij}$ and $\tilde{\theta}_i$. The PMG estimation will be obtained by:

$$\hat{\phi}_{PMG} = \frac{\sum_{i=1}^{N} \tilde{\phi}_i}{N}, \hat{\beta}_{PMG} = \frac{\sum_{i=1}^{N} \tilde{\beta}_i}{N}, \hat{\omega}_{jPMG} = \frac{\sum_{i=1}^{N} \tilde{\omega}_i}{N}, \quad j = 1,...p-1, \quad \text{and}$$

$$\hat{\delta}_{PMG} = \frac{\sum_{i=1}^{N} \tilde{\delta}_{ij}}{N}, j = 0,....,q-1, \hat{\theta}_{PMG} = \tilde{\theta}.$$

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.

The Data, Method of Estimation and Results:
The Data:

This research was focused on the Malaysian five digit manufacturing sectors as listed in the Standard Industry Classification (SIC), over the period of 1978 through 1999. The data employed for estimation is a panel data set and the list of sectors included in the panel is specified in Table 1.

Table 1: Five digit Malaysian Manufacturing Industries

Sectors	Period (T)	Five digit SIC (N)	Total of Panel Observations (NT)
Food, beverages and Tobacco	22	33	726
Textiles, Apparel and Leather	22	22	484
Wood Products	22	70	1540
Paper Products, Printing and Publishing	22	45	990
Chemical, and Petroleum, Coal, Rubber and Plastics Products	22	31	682
Non-Metallic Mineral Products	22	24	528
Metallic Mineral Products	22	26	572
Metal Products, Machinery and Equipment	22	74	1628
Other Manufacturing	22	46	1012

CYCL:

The deviation of industry output from its long-term trend will be used for the measure of cyclical variation. The trend of output of Malaysian manufacturing industry from 1978-1999 is obtained on a smoothing approach based on the Hedrick-Prescott filter. The weighting factor is set to 100.

Entry and Exit:

To measure entry and exit in the Malaysian manufacturing industry, the turnover rate will be employed. The turnover rate will be defined as entering firms plus exiting firms divided by total firms.

Panel Estimation Results for Malaysian Manufacturing Industry:

Oliveira-Martins approach for estimating the constant components and behaviour of the mark-up over business cycle for each individual *i*'th industry.

Table 2 reports the PMGE estimations for the constant components of the mark-up and behaviour of the mark-up over Business Cycles for each individual *i*'th industry as in the specification given by:

$$NSRGO_{it} = \lambda_0 (OLIVIERA_{it} - \overline{OLIVIERA_i}) + \lambda_1 \left[(MARKUPCHARACTER_{it} - \overline{MARKUPCHARACTER_i}) \right] + \varepsilon_{it} \quad (1.11)$$

Where: $OLIVIERA_{it} = \Delta\left(p_{it} + q_{it}\right) - \Delta\left(k_{it} + r_{it}\right)$

$$MARKUPCHARACTER_{it} = OLIVIERA_{it}(\ln CYCL_{it}) - \Delta \ln CYCL_{it}$$

ln *CYCL* is an indicator of cyclical variation in natural logarithms. In this paper, the deviation of industry output from its long-term trend will be used as the measure of cyclical variation (*CYCL*). The trend of output of Malaysian manufacturing industry from 1978-1999 is obtained on a smoothing approach based on the Hedrick-Prescott filter. The weighting factor was set to 100.

$MARKUPCHARACTER_{it}$ denotes the natural logarithm of the behaviour of the mark-up over the business cycle for an individual *i*'th industry, $\overline{MARKUPCHARACTER_i}$ denotes the natural logarithm of the mean behaviour of the mark-up over the business cycle for an individual *i*'th industry. $NSRGO_{it}$ is the Nominal Solow Residual in Gross Output for an individual *i*'th industry. Thus allow the disturbances ε_{it}'s to be independently distributed across *i* and *t*, with zero means and variances σ_i^2 >0. Furthermore

λ_1 captures the counter-cyclical (negative signs) or pro-cyclical (positive signs) for an individual *i*'th industry variation of the mark-up.

Taking the deviation in the regression λ_1 between *MARKUPCHARACTER* from the mean *MARKUPCHARACTER* ensures that $\hat{\lambda}_1$ does not capture unobserved differences by industry that is correlated with *MARKUPCHARACTER* variables.

Taking the deviation in the regression between *OLIVIERA* from the mean *OLIVIERA* ensures also that $\hat{\lambda}_0$ does not capture unobserved differences by industry that is correlated with *OLIVIERA* variables.

The *Lerner index* is given directly by $\lambda_0 = \frac{P - MC}{P} = 1 - \frac{1}{\mu}$, containing the constant component of the mark-up. The signs of λ_1 indicates the cyclical character of the mark-up directly. If the λ_1 parameter is negative (< 0), then a counter-cyclical variation of the mark-ups is implied, however if λ_1 parameter is positive (> 0), this implies pro-cyclical variations of the mark-ups.

In Table 2, Column 3 indicates that on the cyclical methodology, the constant component of the mark-up varies between 43 per cent and 49 per cent for an individual *i*'th manufacturing industry. Column 5 shows the cyclical character of the mark-ups. The cyclical character of the mark-up suggests a statistically significant counter-cyclical variation of the price – marginal cost ratio over the business cycle for an individual *i*'th manufacturing industry (since $\lambda_1 < 0$). This is consistent with a growing body of empirical literature such as Bils (1987) and Rotemberg and Woodford (1999) showing that during economic booms there tend to be increased competition due to an increase in the number of firms entering to the market, thereby creating downward pressure on price cost margins.

Column 7 in Table 2 shows that the Hausman test accepts the inference of a long run homogeneity mark-up for an individual *i*'th manufacturing industry. Furthermore, the $\phi - parameters$ in Columns 6 confirm the presence of rapid adjustment towards long-run equilibrium relationship between NSRGO, business cycles and cycle variations for an individual *i*'th manufacturing industry. The optimal lag length was determined by Akaike Information Criterion, (AIC (1)).

Table 2: PMG estimator results for the constant components and behaviour of the mark-up over business cycle for an individual *i*'th manufacturing industry

Industry	Roeger Approach μ -1 (2)	Oliveira-martins Approach (3)	λ_0 (4)	λ_1 (5)	φ (*ECM*) (6)	h-test (7)
Food, Beverages and Tobacco	0.45	0.43	0.30** -0.03	-0.69** -0.04	-0.76* -0.08	5.52 -0.23
Textiles, Apparel and Leather	0.46	0.45	0.31** -0.04	-0.70** -0.04	-0.79* -0.09	5.03 -0.08
Wood Products	0.47	0.47	0.32** -0.02	-0.71** -0.02	-0.82* -0.06	11.36 -1.04
Paper Product, Printing and Publishing	0.49	0.47	0.32** -0.02	-0.75** -0.03	-0.81* -0.08	8.67 -0.09
Chemical, and Petroleum, Coal, Rubber and Plastics Products	0.47	0.45	0.31** -0.04	-0.70** -0.04	-0.79* -0.09	4.03 -0.3
Non-Metallic Mineral Products	0.49	0.47	0.32** -0.04	-0.72** -0.04	-0.81* -0.09	2.22 -0.6
Metallic Mineral Product	0.5	0.49	0.33** -0.02	-0.75** -0.04	-0.86* -0.09	2.35 -0.56
Metal Product, Machinery and Equipment	0.44	0.43	0.30** -0.04	-0.72** (0.04)	-0.80* -0.06	13.4 -1.03
Other Manufacturing	0.49	0.49	0.33** -0.02	-0.78** -0.03	-0.84* -0.08	8.96 -0.07

(*** denotes Significance at 1% level, ** denotes Significance at 5% level, * denotes Significance at 10% level, ECM= Error Correction Measurement, p-values in parentheses)

The Impact of Demand Fluctuations on the Mark-up for an Individual I'th Industry and for the Whole Sample Except for Industry i:

Table 3 reports the PMGE estimation of the impact of demand fluctuations on the mark-up for an individual *i*'th industry and the whole sample except industry *i* using the specification given by:

$$\mu_{it} - 1 = \Lambda_0 + \Lambda_1 \ln(CYCL_{it} - \overline{CYCL_i}) + \Lambda_2 \ln(CYCL_{-it} - \overline{CYCL_{-i}}) + \varepsilon_{it} \qquad (1.12)$$

where Λ_1 captures the sensitivity for an individual *i*'th manufacturing industry demand fluctuation of the variations on the mark-up, and Λ_2 captures the sensitivity for the whole sample except for manufacturing industry *i* demand fluctuations of the variations on the mark-up. Thus allow the disturbances ε_{it}'s to be independently distributed across *i* and *t*, with zero means and variances σ_i^2 >0.

Taking the deviation in the regression between *CYCL* from the mean *CYCL* ensures that $\hat{\Lambda}_1$ and $\hat{\Lambda}_1$ do not capture unobserved differences by industry that are correlated with *CYCL* variables.

Column 5 in Table 3 shows that the Hausman test accepts the inference of a long run homogeneity mark-up for an individual *i*'th manufacturing industry and the whole sample except for manufacturing industry *i*. Furthermore, the $\phi - parameters$ in columns 4 confirm the presence of rapid adjustment towards long-run equilibrium for dependent and independent variable. The optimal lag length was determined by Akaike Information Criterion, (AIC (1)).

Columns 2 and 3 shows that demand fluctuations for an individual *i*'th industry and the whole sample except industry *i* seems to have a significant negative impact on the mark-ups (since Λ_1 and Λ_2< 0). This is also consistent with a growing body of empirical literature such as Bils (1987), and Rotemberg and Woodford (1999) showing that during economic booms there tends to be increased competition due to an increase in the number of firms entering to the industry, thereby creating downward pressure on price cost margins and lower the mark-up. In addition, this finding is consistent with Chatterjee *et al*. (1993), which argues that where entry into markets is feasible, expansion of demand would lead to entry, increased competition, and downward pressure on the mark-up.

Table 3: PMG estimator results for the impact of demand fluctuations on the mark-up for an individual *i*'th industry and for the whole sample except for industry I

Industry	Λ_1	Λ_2	φ(*ECM*)	h-test
Food, Beverages and Tobacco	-0.71**	-0.29**	-0.76*	5.52
	-0.04	-0.03	-0.09	-0.23
Textiles, Apparel and Leather	-0.72**	-0.30**	-0.74**	9.8
	-0.04	-0.04	-0.09	-0.09
Wood Products	-0.75**	-0.33**	-0.75*	9.41
	-0.04	-0.04	-0.09	-0.07
Paper Product, Printing and Publishing	-0.75**	-0.32**	-0.75*	9.53
	-0.04	-0.04	-0.08	-0.17
Chemical, and Petroleum, Coal, Rubber and Plastics Products	-0.68**	-0.30**	-0.98*	8.89
	-0.04	-0.03	-0.09	-0.09
Non-Metallic Mineral Products	-0.67**	-0.29**	-0.99*	8.47
	-0.04	-0.03	-0.09	-0.09
Metallic Mineral Product	-0.76**	-0.40**	-0.78*	7.27
	-0.03	-0.03	-0.09	-0.13
Metal Product, Machinery and Equipment	-0.71**	-0.41**	-0.75*	7.29
	-0.04	-0.03	-0.08	-0.14
Other Manufacturing	-0.67**	-0.32**	-0.75*	10.73
	-0.04	-0.03	-0.09	-0.1

(*** denotes Significance at 1% level, ** denotes Significance at 5% level, * denotes Significance at 10% level, ECM= Error Correction Measurement, p-values in parentheses)

The impact of turnover rate (entering firms plus exiting firms divided by total firms) on the mark-up for an individual *i*'th industry and for the whole sample except for industry *i*

Table 4 reports the PMGE estimation the impact of turnover rate on the mark-up for an individual *i*'th industry and the whole sample except for industry *i* as from the specification given by:

$$\mu_{it} - 1 = \tau_0 + \tau_1 \ln(EntryExit_{it} - \overline{EntryExit_i}) + \tau_2 \ln(EntryExit_{-it} - \overline{EntryExit_{-i}}) + \varepsilon_{it} \qquad (1.13)$$

τ_1 captures the sensitivity of the mark-up to entry and exit for an individual *i*'th manufacturing industry, and τ_2 captures the sensitivity of the mark-up to entry and exit for the whole sample except for industry *i* manufacturing industry. $\mu_{it} - 1$ denotes an individual *i*'th industry, where $\mu = \frac{P}{MC}$ is the mark-up. Thus allow the disturbances ε_{it}'s to be independently distributed across *i* and *t*, with zero means and variances σ_i^2 >0.

Taking the deviation in the regression between *EntryExit* from the mean *EntryExit* ensures that $\hat{\tau}_1$ and $\hat{\tau}_1$ do not capture unobserved differences by industry that are correlated with *EntryExit* variables.

Column 5 in Table 4 shows that the Hausman test accepts the inference of a long run homogeneity mark-up for an individual *i*'th manufacturing industry and the whole sample except for manufacturing industry *i*. Furthermore, the $\phi - parameters$ in columns 4 confirm the presence of rapid adjustment towards long-run equilibrium for dependent and independent variable. The optimal lag length was determined by Akaike Information Criterion, (AIC (1)).

Columns 2 and 3 shows that turnover rate for an individual *i*'th industry and the whole sample except industry *i* seems to have a significant negative impact on the mark-ups (since τ_1 and τ_2< 0). This is consistent with a growing body of empirical literature such as Bils (1987), and Rotemberg and Woodford (1999) showing that during economic booms there tends to be increased competition due to an increase in the number of firms entering to the industry, thereby creating downward pressure on price cost margins and lower the mark-up. Besides, this finding is also consistent with Chatterjee *et al*. (1993), which argues that where entry into markets is feasible, expansion of demand would lead to entry, increased competition, and downward pressure on the mark-up.

Table 4: PMG estimator results for the impact of turnover rate on the mark-up for an individual *i*'th industry and for the whole sample except for industry *I*

Industry	τ_1	τ_2	$\varphi(ECM)$	h-test
Food, Beverages and Tobacco	-0.75**	-0.33**	-0.75*	9.41
	-0.04	-0.04	-0.08	-0.07
Textiles, Apparel and Leather	-0.75**	-0.41**	-0.82*	4.6
	-0.03	-0.03	-0.09	-0.26
Wood Products	-0.71**	-0.32**	-1.82*	11.38
	-0.02	-0.02	-0.07	-0.1
Paper Product, Printing and Publishing	-0.78**	-0.34**	-0.79*	13.12
	-0.03	-0.02	-0.08	-0.12
Chemical, and Petroleum, Coal, Rubber and Plastics Products	-0.73**	-0.29**	-0.77*	7.78
	-0.04	-0.03	-0.09	-0.1
Non-Metallic Mineral Products	-0.69**	-0.32**	-0.81*	5.51
	-0.04	-0.04	-0.09	-0.2
Metallic Mineral Product	-0.76**	-0.34**	-0.85*	6.47
	-0.04	-0.03	-0.09	-0.15
Metal Product, Machinery and Equipment	-0.66**	-0.37**	-0.99**	13.81
	-0.02	-0.02	-0.05	-0.15
Other Manufacturing	-0.80**	-0.36**	-0.80*	13.51
	-0.03	-0.02	-0.08	-0.13

(*** denotes Significance at 1% level, ** denotes Significance at 5% level, * denotes Significance at 10% level, ECM= Error Correction Measurement, p-values in parentheses)

Conclusion:

This paper investigates the behaviour of the mark-up under different business cycle situations. The main conclusions are summarised below.

Firstly, by estimating the character of the mark-up over business cycles for each individual *i*'th manufacturing industry, this paper shows that the cyclical character of the mark-up suggests a counter-cyclical variation of the price-marginal cost ratio over the business cycle. This is also consistent with a growing body of empirical literature such as Bils (1987), and Rotemberg and Woodford (1999) showing that during economic booms there tend to be increased competition due to an increase in the number of firms entering to the industry, thereby creating downward pressure on price cost margins. Hence this leads to a lower mark-up.

Secondly, the introduction of the cyclical variable (i.e. *Lerner Index*) does not have much effect on the values and the statistical significance of the constant component of the mark-up ($\bar{\mu} = \frac{1}{1-\bar{B}}$) for an individual *i*'th industry in the Malaysian manufacturing industry. This finding is consistent with Oliviera-Martins *et al*. (1999).

Thirdly, testing the impact of demand fluctuations for an individual *i*'th industry and the whole sample except industry *i*, this paper reveals that demand fluctuations seems to have a significant negative impact on the mark-up. This finding is consistent with Chatterjee *et al*. (1993), which argues that where entry into markets is feasible, expansion of demand would lead to entry, increased competition, and downward pressure on the mark-up and vice versa.

Finally, investigating the impact of turnover rate for an individual *i*'th industry and the whole sample except industry *i,* this paper also uncovers that turnover rate seems to have a significant negative impact on the mark-up. This finding is also coherent with Chatterjee *et al*. (1993), which argues that where entry into markets is feasible, expansion of demand would lead to entry, increased competition, and downward pressure on the mark-up and vice versa.

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