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PRICE SETTING IN INDIAN INDUSTRY

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Price setting models with variable mark-up rates are specified and estimated for four sectors of Indian industry. It is found that capacity utilisation has a significant effect on mark-up rates implying a Phillips curve type trade-off between output and prices. International prices do not appear to be as important in the price-setting behaviour of firms.

1. Introduction

Price setting behaviour by firms in Indian industry is generally studied in the framework of a constant mark-up over unit cost of production. Empirical evidence, however, suggests that mark-up rates have varied substantially both across industries and over time (see fig. 1).[1]

Analytically, in the absence of a Phillips curve type relation between demand pressure and the money wage rate (and hence prices) in a developing economy, the constant mark-up assumption implies a dichotomy between output and price determination: output being demand determined and prices cost determined. An unacceptable policy implication of this is that by increasing the demand for industrial output (say, through fiscal or monetary policy), the government can continuously 'buy' higher output without the threat of a rise in industrial prices.

This paper specifies and estimates variants of a variable mark-up price-setting function for four sectors of Indian industry paying special attention to the effect of demand pressure on the mark-up rate.[2] The other important

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[1]Weintraub (1965) and NCAER (1980, 1981), for instance, assume constant mark-up rates while Sawhney and Sawhney (1974) and Katrak (1980) provide evidence of variable mark-up rates.

[2]The four sectors are: consumer goods, capital goods, intermediate goods and basic goods. The industries in each of these four sectors are listed in appendix A. This four-way classification is commonly used in India, which is the rationale behind our use of it.

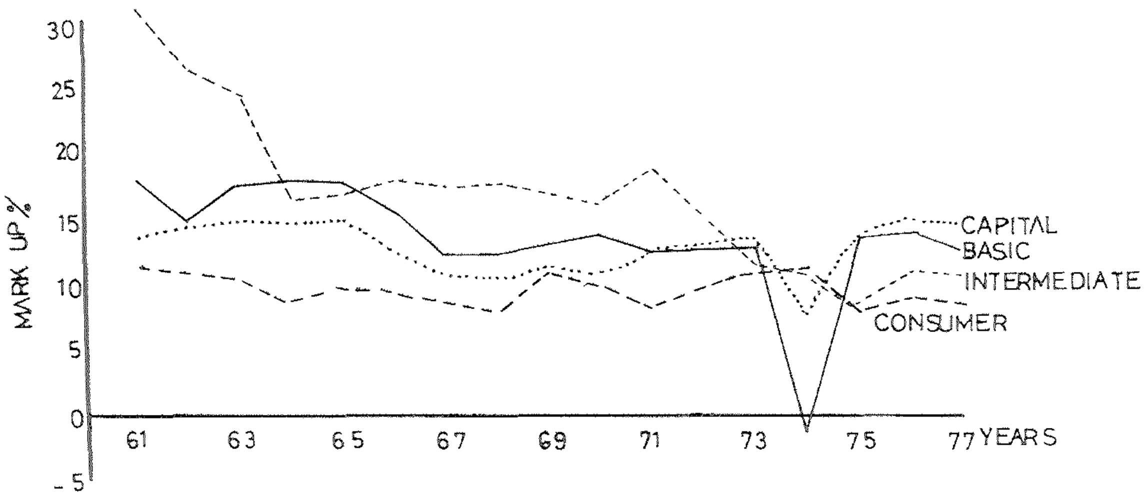

Fig. 1. Sectoral mark-up rates in Indian industry.

aspect investigated is the role of international prices in the price-setting behaviour of Indian industry. This study forms part of a larger model of the Indian economy.

In the next section we discuss alternative specifications of variable mark-up rates in firms' price-setting behaviour. Section 3 presents the empirical results and a selection is made between the alternative models for each sector. The chosen equations are then subjected to stability tests in section 4 and the predictive record of each equation is analysed. Section 5 discusses the implications of the results.

2. Model specification

The analytical basis of our price-setting model is the Hicksian concept of a fix-price market. Prices are not determined by the free play of demand and supply and, therefore, do not adjust instantaneously to clear the market. Prices are, instead, 'set' by producers once their costs of production are given. This, however, does not mean that the price–cost margins are completely insulated from market forces; it only stresses that the 'automaticity' attributable to perfectly competitive flex-price markets is absent.

Consequently, prices are postulated to be sticky; they adjust only gradually to variations in demand pressure and costs of production. Theoretical rationale for such a characterisation of price formation in the case of industrial goods is provided in the works of Hicks (1965, 1974, 1977) and Okun (1981). In the conventional literature on market forms this price-setting behaviour is typical of an oligopolistic market structure [Silbertson (1973)].

Within this overall framework two alternative specifications of variable mark-up, sticky-price models are considered: Hypothesis 1 in which demand pressure and international prices affect the price–cost margin in the short run as well as in the long run, and Hypothesis 2 in which demand pressure and international prices are postulated to have only a temporary effect on price–cost margins, the long-run price–cost margin being invariant to these factors.

Hypothesis 1. Consider a more general version of the standard cost plus mark-up specification,[3]

$$P_t^* = \beta_t^* C_t, \tag{1}$$

where

P is price (ex-factory) per unit of output,
C is cost per unit of output,
β is (1+mark-up rate); henceforth, we refer to this as the mark-up rate for convenience,
$*$ superscript indicates desired value,
t subscript indicates time.

In its simplest and widely used version, the constant mark-up hypothesis assumes that:

(i) prices adjust instantaneously to cost changes, i.e., $P_t^* = P_t$ (consequently $\beta_t^* = \beta_t$), and
(ii) the mark-up rate is constant over time, i.e., $\beta_t = \bar{\beta}$.

These restricting assumptions give the familiar version

$$P_t = \bar{\beta} C_t.$$

There are, however, a number of reasons why prices adjust only gradually to changes in costs. Okun (1981) suggests that prices may lag behind costs of production because of a lag between the purchasing of raw materials and labour and their embodiment in output.[4] Nordhaus (1971, p. 33), on the other hand, points out that firms, in an attempt to oblige their customers who generally like to have prices stable as a service, may bear some of the burden of adjustment in short-run cost fluctuations.

Moreover, the presence of adjustment costs is often cited as a cause of lagged price variations [Eckstein (1968, p. 1160)]: 'the cost of price changes

[3]Although mark-up pricing has been widely used in the literature both for developed and developing economies [Nordhaus (1971), Hagger (1977), and Taylor (1979)], its microeconomic foundations have not been rigorously formulated.

[4]See Okun (1981, p. 168). The length of this lag would depend on the time required for the production of the commodity under consideration and the method of accounting (e.g., FIFO or LIFO) practised by the firm.

may be too great, and where a product line is complicated, frequent price changes may exceed managerial capabilities'. These adjustment costs may be accentuated in the Indian context where government administered prices are not an insignificant feature in industrial price setting. The existence of bureaucratic delays and the political costs associated with price increases may result in the government 'administering' lags in the response of prices to costs.

These lags in price setting functions would, therefore, appear to be important and a convenient method of incorporating them is to use the familiar partial adjustment framework,

$$(P_t - P_{t-1}) = \lambda(P_t^* - P_{t-1}), \qquad 0 < \lambda \leqq 1. \tag{2}$$

Substitution of eq. (1) in (2) gives

$$(P_t - P_{t-1}) = \lambda\beta_t^* C_t - \lambda P_{t-1}. \tag{3}$$

In eq. (3) producers adjust their prices to changes in costs only gradually: the short-run and long-run price response to a unit change in cost are $\lambda\beta_t^*$ and β_t^*, respectively.[5]

In preference to restricting the mark-up rate, β_t^*, to be constant over time, we specify it to be variable and a function of some measure of demand pressure for industrial goods.[6] The specific measure of demand pressure used in this study is the level of capacity utilisation in the industrial sector.[7] This removes the artificial dichotomy between output and price found in constant mark-up models. Instead, it incorporates a Phillips curve type trade-off, which is more consistent with the structure of a developing economy where labour is abundant relative to capital and hence demand pressure in the

[5]Note that under the constant mark-up assumption eq. (3) can also be derived from one version of the 'normal' cost pricing hypothesis in which normal cost is simply a weighted average of the current and past unit costs of production. Let

$$P_t = \bar{\beta} C_t^n \quad \text{and} \quad C_t^n = \lambda C_t + (1-\lambda) C_{t-1}^n, \tag{i), (ii}$$

where C_t^n = normal cost, λ = weight of current costs in normal cost, and $\bar{\beta}$ = (1 + a constant mark-up).

Applying the familiar Koyck transformation to (i) and (ii) we have

$$(P_t - P_{t-1}) = \lambda\bar{\beta} C_t - \lambda P_{t-1}. \tag{iii}$$

In empirical work the two equations [eqs. (3) and (iii)], however, imply very different error structures.

[6]See Nordhaus (1971) and Hagger (1977) for a summary of empirical results using similar specifications for developed economies.

[7]Capacity utilisation reflects demand pressure under conditions where output is demand determined. If supply bottlenecks cause output fluctuations one would expect an inverse relation between capacity utilisation and mark-up rate. However, between 1960 and 1977 mark-up rates have generally moved in the same direction as capacity utilisation, indicating that output fluctuations were largely demand determined [see Lahiri et al. (1984)].

commodity market can be expected to affect the mark-up rate more than the wage rate.

Another source of variation in the mark-up rate could be changes in international prices. There are a number of channels by which world prices can influence domestic price-setting behaviour. For instance, commodity price arbitrage may occur and to that extent domestic price–cost margins are likely to react positively to a rise in international prices [Nambiar (1983)]. Similarly, Indian subsidiaries of multinational firms may respond to price signals from their parent companies. Moreover, in an effort to maintain their market share in the face of international competition, domestic firms may not raise their mark-up rates and prices until international price levels increase. However, since the importance of international factors is to some extent dependent on the degree of protection, in the Indian case it is difficult, a priori, to assess the impact of price signals from the world market on domestic prices. The level of protection varies considerably between industries [Bhagwati and Desai (1970), Bhagwati and Srinivasan (1976)] which suggests that the importance of international price movements may be sector specific.

In order to incorporate the role of demand pressure and international prices, we specify mark-up to be a function of capacity utilisation and import prices (a proxy for the international price relevant for Indian industry).[8] Both these arguments are lagged by one period on the grounds that firms set their mark-up rates on the basis of static expectations about capacity utilisation, U, and international prices, I.[9]

$$\beta_t^* = \beta_0 + \beta_1 U_{t-1} + \beta_2 I_{t-1}, \qquad \beta_1, \beta_2 \geqq 0. \tag{4}$$

Substituting eq. (4) in (3) we have the final estimating form for Hypothesis 1,

$$(P_t - P_{t-1}) = \lambda\beta_0 C_t + \lambda\beta_1 C_t U_{t-1} + \lambda\beta_2 C_t I_{t-1} - \lambda P_{t-1}. \tag{5a}$$

The actual estimation is carried out – see section 3 for the results – by testing alternative forms of eq. (5a) and using various restrictions:

(a) International prices are excluded ($\beta_2 = 0$) – eq. (5b).
(b) In addition to (a) eq. (5a) is estimated with the constraint $\beta_0 = 0$ – eq. (5c).
(c) International prices are introduced as in eq. (5a) but $\beta_0 = 0$ – eq. (5d).

[8]Variations in the degree of monopoly, measured by, say, the 'concentration ratio' [Katrak (1980)], may cause shifts in the mark-up function. Owing to an absence of time series data on sectoral concentration ratios this could not be incorporated in the mark-up function.

[9]Alternative expectation formation hypotheses, such as adaptive expectations, were not introduced as they would complicate the final estimating equation considerably – it already contains a number of interactive terms.

Hypothesis 2. An alternative to Hypothesis 1 is one which postulates that capacity utilisation and international prices have only a transitory effect on the mark-up rate and hence on industrial prices. A convenient way of formulating such a hypothesis is to assume that the long-run mark-up rate, β^*, is constant and vary the short-run mark-up rate by allowing the speed of adjustment (of actual prices to their desired values) to depend on capacity utilisation and international prices,

$$P_t^* = \beta^* C_t, \tag{6}$$

$$(P_t - P_{t-1}) = \lambda_t (P_t^* - P_{t-1}), \tag{7}$$

$$\lambda_t = \lambda_1 U_{t-1} + \lambda_2 I_{t-1}, \qquad \lambda_1, \lambda_2 \geqq 0. \tag{8}$$

Hypothesis 2 is distinguished from Hypothesis 1 in that the long run, or the equilibrium value of the price level, is independent of capacity utilisation and international prices. This can be quite easily seen from eqs. (6) through (8) since in equilibrium $P_t = P_t^* = \beta^* C_t$; capacity utilisation and international prices affect only the speed with which actual prices move towards their equilibrium values.

Under Hypothesis 2, therefore, in the long run firms would be earning no more than their 'normal' profits though there would be short-run deviations of actual profits from the 'normal' level [Silbertson (1973)]. Here, β^* corresponds to the 'normal' mark-up rate.

Substituting eqs. (6) and (8) in (7) we get the estimating form for Hypothesis 2,

$$(P_t - P_{t-1}) = \lambda_1 \beta^* C_t U_{t-1} + \lambda_2 \beta^* C_t I_{t-1} - \lambda_1 P_{t-1} U_{t-1} - \lambda_2 P_{t-1} I_{t-1}. \tag{9a}$$

The estimation of eq. (9a) is also carried out with the restriction $\lambda_2 = 0$ – eq. (9b) – in order to test for the significance of international price movements.

3. Estimation and model selection

The six alternative versions of the price setting function were estimated using annual data for the period 1961–1977 for the four subsectors of Indian industry: Consumer goods, Capital goods, Intermediate goods and Basic goods.[10,11] All equations except eq. (9a) were estimated by Ordinary Least

[10] See appendix B for sources of data.

[11] We also estimated two other versions – one in which both β and λ were constant and the other in which both β and λ were variable and dependent on capacity utilisation and international prices. Both these versions were rejected on the basis of the test criteria given in table 2.

Table 1.a
Parameters of alternative models of price setting (dependent variable $= P_t - P_{t-1}$)

Hypothesis	Eq. no.	Independent variables C_t	$C_t U_{t-1}$	$C_t I_{t-1}$	$P_{t-1} U_{t-1}$	$P_{t-1} I_{t-1}$	P_{t-1}	Estimation procedure
1	5a	$\lambda\beta_0$	$\lambda\beta_1$	$\lambda\beta_2$			λ	OLS
1	5b		$\lambda\beta_1$	$\lambda\beta_2$			λ	OLS
1	5c	$\lambda\beta_0$	$\lambda\beta_1$				λ	OLS
1	5d		$\lambda\beta_1$				λ	OLS
2	9a		$\lambda_1\beta^*$	$\lambda_2\beta^*$	λ_1	λ_2		NLSQ
2	9b		$\lambda_1\beta^*$		λ_1			OLS

Table 1.b
Nested and non-nested sets in table 1.a.[a]

Nested sets (number of restrictions in parentheses)					
Set I	5d	$\subset$ (one)	5c	$\subset$ (one)	5a
Set II	5d	$\subset$ (one)	5b	$\subset$ (one)	5a
Set III	9b	$\subset$ (one)	9a		

[a] $\subset$ = nested in.

Table 2
Model selection: Test criteria applied.

Model description	Estimation procedure: Linear (OLS)	Non-linear (NLSQ)
Nested	Amemiya's prediction criterion	Likelihood ratio test
Non-nested	Davidson and Mackinnon '*J*' test	Davidson and Mackinnon '*P*' test

Squares; eq. (9a) was estimated by Non-linear Least Squares (since the parameters are non-linearly related) which conforms with maximum likelihood estimation under the standard classical assumptions. Appendix C reports the detailed results of these estimated equations.

The immediate issue following estimation was the adoption of appropriate criteria to choose among the various models. The obvious initial requirement was to segregate the estimating equations into nested and non-nested sets as very different tests are applicable in the two cases [see Pesaran (1974), Pesaran and Deaton (1978) and Davidson and Mackinnon (1980)]. Table 1.b presents this classificatory scheme. Note that the six alternative versions of the price-setting function considered here lead to three sets of nested regressions.

Our next task was to decide on appropriate econometric tests to be applied for model selection both within the nested sets and between the non-nested sets. Special emphasis had to be given here to the estimation method since linear and non-linear estimation procedures imply different selection criteria; consequently, these needed to be categorised appropriately. We arrived at a four-way classification of the estimated equations and each category necessitated a different selection procedure (see table 2).

As the first step we selected the appropriate models from the nested sets. Using the umbrella criterion of minimising the residual error sum of squares we decided to use Amemiya's (1980) 'prediction criterion' (PC) in preference to the commonly used $\bar{R}^2$. The reason for this is that $\bar{R}^2$ does not include a consideration of the losses associated with choosing an incorrect model. Since Amemiya (1980) incorporates this consideration in his PC which is based on the mean square prediction error, it was felt to be more appropriate in the selection of regressors in this case as the number of independent variables differs substantially in each nested set.[12]

In the comparison of non-linear nested equations, however, neither of the above tests is applicable and we therefore used the likelihood ratio test. Finally, to select between the non-nested models we applied the tests proposed by Davidson and Mackinnon (1980).

We are aware that many of the procedures used in this paper are valid only asymptotically. For example, the 't' statistics in the non-linear least squares estimates are asymptotic. The small sample properties of the Davidson–Mackinnon tests for non-nested equations are unknown. With a sample size of only 17 observations the validity of these tests can be questioned. However, we could not think of any alternative procedures to replace these tests, and until the small sample properties are available, the results of these tests must be considered at best as only indicative.

Table 3 reports the equations selected from each of the nested sets.

The final selection between the two non-nested models, one from each hypothesis, involved the use of the Davidson–Mackinnon 'J' and 'P' test for linear and non-linear cases, respectively. In brief, the Davidson–Mackinnon

[12]Essentially Amemiya's PC incorporates a higher penalty for additional variables than Theil's $\bar{R}^2$. This is clear from the relationship between the two,

$$PC=\frac{T+K}{T-1}(1-\bar{R}^2)\left(\frac{SST}{T}\right),$$

where T=number of observations, K=number of variables included, SST=total sum of squares.

Table 3

Selected equations for each hypothesis: Results from nested selection procedure.

		Hypothesis 1		
Sector	Eq. no.	Estimated parameters of structural equations	Average desired mark-up	λ
Consumer	5c (OLS)	$\beta_t^* = 1.0013 + 0.1205U_{t-1}$ $(P_t - P_{t-1}) = 1.0413(P_t^* - P_{t-1})$	9.2%	1.04
Capital	5a (OLS)	$\beta_t^* = 1.0332 + 0.1095U_{t-1} + 0.0003I_{t-1}$ $(P_t - P_{t-1}) = 0.8276(P_t^* - P_{t-1})$	11.8%	0.83
Intermediate	5c (OLS)	$\beta_t^* = 0.4994 + 0.7523U_{t-1}$ $(P_t - P_{t-1}) = 0.9361(P_t^* - P_{t-1})$	16.4%	0.94
Basic	5c (OLS)	$\beta_t^* = 1.0824 + 0.1545U_{t-1}$ $(P_t - P_{t-1}) = 0.5822(P_t^* - P_{t-1})$	22.2%	0.58

		Hypothesis 2		
Sector	Eq. no.	Estimated parameters of structural equations	Desired mark-up	Mean λ_t
Consumer	9b (OLS)	$\lambda_t = 1.4696U_{t-1}, \quad P_t^* = 1.0869C_t$	8.7%	1.12
Capital	9a (NLSQ)[a]	$\lambda_t = 0.5035U_{t-1} + 0.0036I_{t-1}$ (4.20) (5.68) $P_t^* = 1.1483C$ (263.08)	14.8%	0.81
Intermediate	9a (NLSQ)[a]	$\lambda_t = 1.2608U_{t-1} - 0.0013I_{t-1}$ (17.27) (3.94) $P_t^* = 1.1738C_t$ (82.92)	17.4%	0.98
Basic	9b (OLS)	$\lambda_t = 0.7000U_{t-1}, \quad P_t^* = 1.1670C_t$	16.7%	0.63

[a]Figures in parentheses are asymptotic 't' statistics; 't' statistics for OLS results are provided in appendix C.

test is as follows:

If H_0: $\quad y_i = f_i(X_i, \phi) + e_{0i}$,

and H_1: $\quad y_i = g_i(Z_i, \gamma) + e_{1i}$,

where y_i is the ith observation of the dependent variable, X_i and Z_i are vectors of observations on independent variables, ϕ and γ are vectors of parameters to be estimated and the error terms e_{0i} and e_{1i} are assumed NID $(0, \sigma^2)$. H_0 is non-nested in H_1, where the truth of H_0 implies the falsity of H_1 and vice versa.

The 'J' test is simply

$$y_i = (1-\alpha) f_i(X_i, \phi) + \alpha \hat{g}_i + e_i,$$

where

$$\hat{g}_i = g_i(Z_i, \hat{\gamma}) \quad \text{and } \hat{\gamma} \text{ is the MLE of } \gamma.$$

Using the conventional asymptotic 't' test or the likelihood ratio test, $\alpha = 0$ implies the falsity of H_1. The test is repeated for H_0 and H_1 reversed.

For non-linear equations, where f_i is non-linear, the 'P' test applies:

$$y_i - \hat{f}_i = \alpha(\hat{g}_i - \hat{f}_i) + \hat{F}_i b + e_i,$$

where $\hat{F}_i$ is the row vector containing the derivatives of f_i with respect to ϕ for the ith observation, evaluated at $\hat{\phi}$. Once again, $\alpha = 0$ implies the falsity of H_1.

The results of the non-nested tests are given in table 4. On the basis of the 't' values for α, eq. (5c) is selected as the most preferred version of the price-setting model for three of the four sectors: consumer, intermediate and basic. For the capital goods sector equation (9a) is selected.[13] The implications of these results are discussed in section 5 after the selected equations are subjected to further tests in the next section.

Table 4
Pairwise non-nested tests – results for each sector.

Sector	Consumer		Capital		Intermediate		Basic	
Tested hypothesis: eq. no.	5c	9b	5a	9a	5c	9a	5c	9b
Alternative hypothesis: eq. no.	9b	5c	9a	5a	9a	5c	9b	5c
Test used	J	J	J	P	J	P	J	J
Asymptotic 't' values for α	0.81	59.05	3.91	0.30	0.15	2.77	0.40	20.88

4. Sample period prediction and stability

Results of tests for stability and the predictive ability of each of the finally chosen equations for the four sub-sectors are reported in graphical form in this section. Sample period predictions are given in fig. 2 for the consumer,

[13]See table 3 and appendix C for the details of these equations.

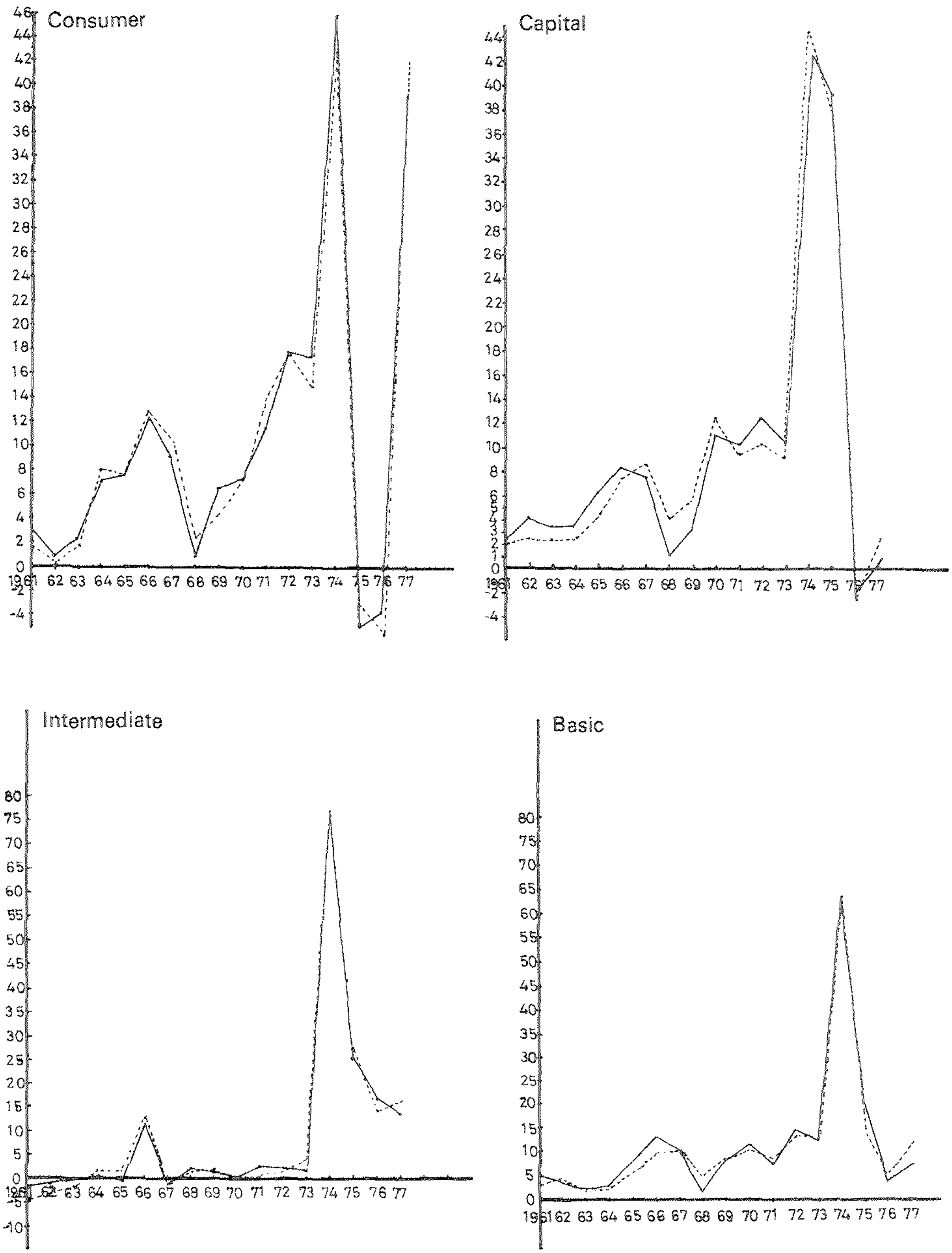

Fig. 2. Change in prices (sample period predictions).

capital, intermediate and basic goods sectors. By and large the chosen specifications perform well in predicting annual changes in industrial prices.

The equations were also subjected to Cusum and Cusum of Squares stability tests [Brown, Durbin and Evans (1975)] and the latter tests' results are reported in fig. 3 for the consumer, intermediate and basic sectors.[14,15] For the consumer goods sector, the null hypothesis of stability of the parameters is not rejected during the sample period at a 10% level of significance. However, in the case of the intermediate goods sector there are signs of instability in 1972 at the 10% level of significance. The two years 1973 and 1974 appear to indicate instability in the parameters of the basic goods sector equation, with the null hypothesis being rejected in 1974 at even the 5% level. These were, of course, years of the first oil price shock and with a high proportion of public sector units in the basic goods sector, the initial period of reaction of the government may account for some of the apparent instability during this period. Only a more detailed study of price behaviour in the basic goods sector during this period can explain the nature of this instability and, in particular, substantiate whether the shift in parameters occurred as a result of a change in the mark-up function (β's) or the partial adjustment coefficient (λ).

5. Implications

This study emphasises the need for a variable mark-up price-setting function for Indian industry. In particular, it investigates the role of demand pressure and international prices in influencing price–cost margins. Only in the capital goods sector, the sector that is least protected by tariffs and quotas in Indian industry, are international prices found to play a significant part in determining price setting via their influence on short-run changes in the mark-up rates.

Two alternative versions of a model with variable mark-up rates are examined. For the consumer, intermediate and basic goods sectors, the preferred formulation is where the desired mark-up rate is variable and is directly influenced by demand pressure. The alternative formulation, in which only the speed of adjustment of actual prices to desired prices is influenced by demand pressure and international prices, is selected only for the capital goods sector. This implies that for the sectors other than capital goods, demand pressure represented by capacity utilisation has a permanent and

[14]We are unable to subject the selected equation for the capital goods sector to the same stability tests as the equation is non-linear in parameters and was estimated by non-linear least squares.

[15]Only the results of the Cusum of Squares test are reported here. The Cusum test was carried out for the same three sectors and in all cases there was no evidence of instability at a 10% level of significance.

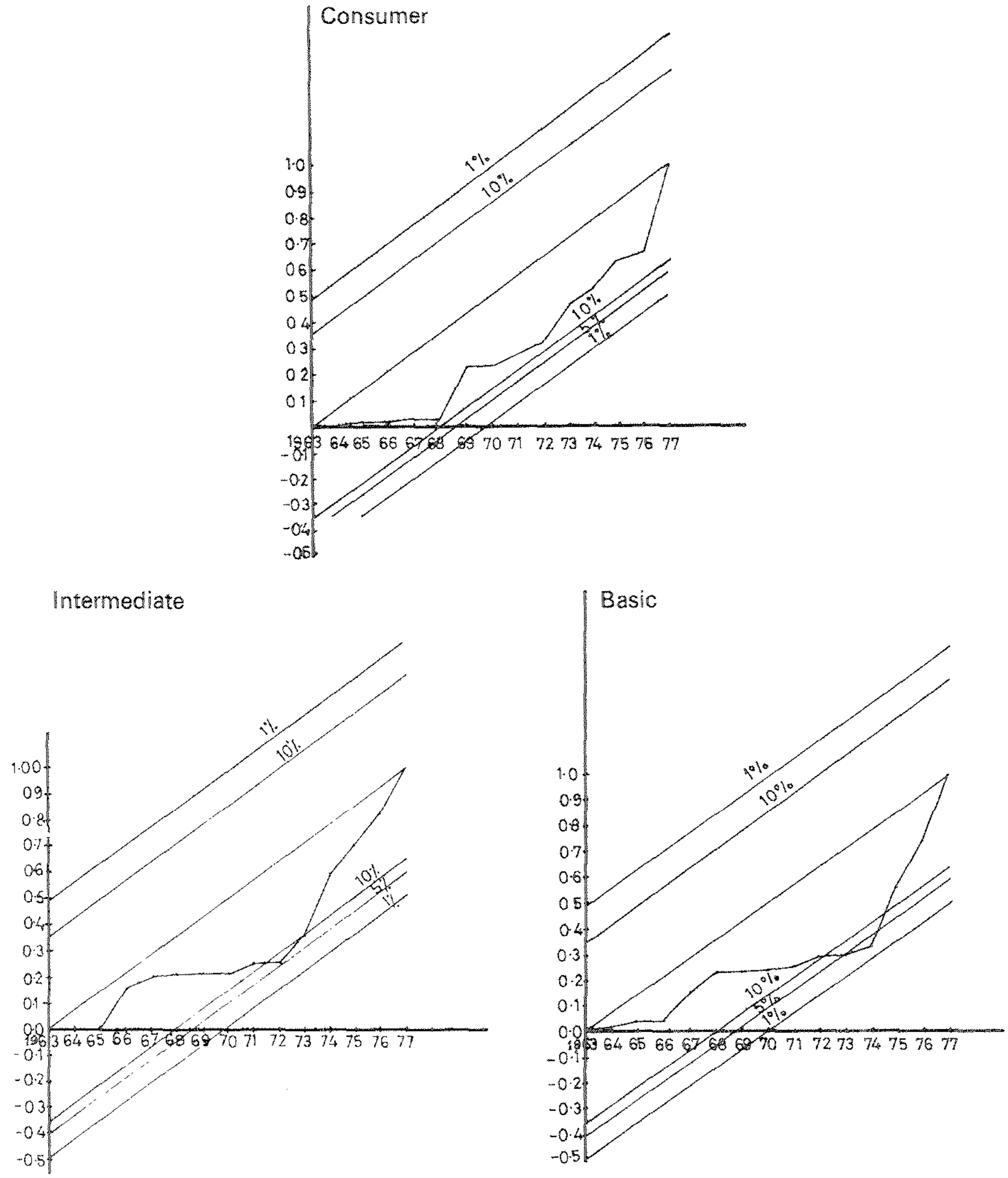

Fig. 3. Stability tests for selected price functions (Cusum of Squares).

significantly positive effect on mark-up rates and hence on prices; in the capital goods sector this effect is only transitory.

For the selected equations table 5 presents the short-run and the long-run elasticities of mark-up rates with respect to capacity utilisation. While there are substantial differences between the elasticities of the four sectors, the variation between short-run and long-run elasticities is major only in the

Table 5
Elasticities of mark-up rates with respect to capacity utilisation.[a]

	Elasticities	
Sector	Short run	Long run
Consumer	0.992	0.953
Capital	0.274	—
Intermediate	3.736	3.991
Basic	0.611	1.050

[a]Where mark-up rate is defined as $(P_t - C_t)/C_t$. All elasticities are computed at sample means. Elasticity of capital goods mark-up with respect to international prices is 0.320.

basic goods sector and of course in the capital goods sector where the long-run elasticity is zero.

There are significant differences in lags in adjustment of prices to costs across industries. The basic goods sector (with a λ value of 0.58) has the largest mean lag of around 1.7 years before prices adjust to changes in costs. Prices respond faster in the capital and intermediate goods sector for which the mean lags are around 1.2 and 1.1 years, respectively. The estimate of λ for the consumer goods sector at 1.04 (but not significantly different from 1) indicates approximately instantaneous adjustment of prices to costs. These estimates of lags appear to be intuitively quite plausible since the basic goods sector in India has been subject to government price controls more than the other sectors. The ranking of the other sectors is largely consistent with the relative time lags that exist between the purchase of labour and raw materials and their embodiment in output in these industries.

In the final analysis, therefore, even if a wage rate induced trade-off between industrial output and prices is absent in a developing economy, a mark-up trade-off cannot be ruled out. This would have an important bearing on policies that are geared to stimulate demand for industrial goods which, under this scenario, cannot ignore the effect on industrial prices.

Appendix A

Table A.1
Major industries in the four use-based categories (19-industry classification).[a]

Use-based category	Major industries	Weight in the general index of industrial production
Consumer goods	Spinning, weaving and finishing of textiles	16.84
	Pulp paper and paper board	2.22
	Miscellaneous food products	7.53
	Tobacco manufacture	2.22
	Sugar factories	2.79
		31.60
Capital goods	Machinery except electrical	5.55
	Electrical machinery appliances and supplies	4.92
	Ship building and repairing	0.52
	Railroad equipment	2.99
	Motor vehicles	3.03
	Repair of motor vehicles	0.07
	Metal products except machinery and transport equipment	2.54
		19.62
Intermediate goods	Rubber products	1.78
	Petroleum refinery products	1.62
	Structural clay products	0.65
		4.05
Basic goods	Chemical and chemical products	10.90
	Cement	1.17
	Iron and steel	7.04
	Non-ferrous basic metals	1.80
		20.91
All industries		76.18

[a]Electric light and power has been excluded.

Appendix B: Sources of data

Ex-factory prices. The ex-factory price of output was obtained by dividing output at current prices by output at constant prices. However, output at constant prices is not available and had to be derived. This was done by deflating current price output for 19 industries (from various volumes of the 'Annual Survey of Industries') by the relevant wholesale price index (from Central Statistical Organisation, 1981, 'Wages and Productivity in Selected Industries').

However, since wholesale prices include indirect taxes (mainly excise taxes) the derived series for output at constant prices were scaled down by one plus the excise tax rate. Excise tax rates were computed at the four-sector level by dividing the excise revenue (from the commodity-wise excise tax revenue statistics published by the Directorate General of Commercial Intelligence and Statistics) by output at current prices.

Capacity utilisation. Capacity utilisation was computed using the 'peak-to-peak' method where peak output for each year was obtained from monthly indices of industrial production (Central Statistical Organisation, Industrial Statistical Wing, Calcutta). This data was available directly from the Reserve Bank of India Bulletin, 1974, for the period 1960 to 1970. For the remaining years, 1971 to 1977, this series was computed using the same methodology at an 86-industry level of disaggregation.

Unit cost of production. Costs per unit of output for the four sectors were derived by dividing total costs by the value of output at constant ex-factory prices. Total costs were derived by adding up raw material costs, emoluments and depreciation (from Central Statistical Organisation, 'Wages and Productivity in Selected Industries').

International prices. The unit value index of imports for each of the four sectors was used as the relevant index of international prices. Imports at current and constant prices were obtained from Government of India, Ministry of Commerce, 'Basic Statistical Material on Foreign Trade, Production and Prices'.

Appendix C: Estimated results for alternative models of price formation

Abbreviations

P:	ex-factory price,
C:	unit costs,
U:	capacity utilisation,
I:	international prices,
subscript t:	time,
LLF:	log of the likelihood function,
PC:	Amemiya's prediction criterion.

Notes to the tables

(1) Dependent variable is first difference in prices (i.e., $P_t - P_{t-1}$).
(2) Theil's $\bar{R}^2$ has been adjusted for no constant term.
(3) Amemiya's prediction criterion is computed as $((T+K)/(T-1))(1-\bar{R}^2)(SST/T)$, where T is the number of observations, K is the number of variables, SST is the total sum of squares. We report PC without multiplying by (SST/T) since this is the same figure for all equations.
(4) * = selected equation from Hypothesis 1 alternatives: based on Amemiya's PC.
** = selected equation from Hypothesis 2 alternatives: based on likelihood ratio test.
(5) All equations have been estimated by Ordinary Least Squares except for eq. (9a) in each sector which has been estimated by Non-Linear Least Squares.

Table C.1
Estimated results for alternative models of price setting (dependent variable is $P_t - P_{t-1}$).

		Independent variables									
Hypothesis	Eq. no.	C_t	C_tU_{t-1}	C_tI_{t-1} (10^{-3})	$P_{t-1}U_{t-1}$	$P_{t-1}I_{t-1}$ (10^{-3})	P_{t-1}	$\bar{R}^2$	DW	LLF	PC
Consumer goods sector											
1	5a	1.4001	−0.2151	−0.3273			−1.1033	0.99	1.55	−26.28	0.02
		(13.07)	(2.06)	(3.76)			(33.22)				
1	5b		1.0901	0.6845			−0.8022	0.83	2.45	−48.80	0.21
			(9.61)	(4.72)			(9.26)				
1	5c*	1.0427	0.1255				−1.0413	0.99	2.01	−32.53	0.02
		(15.23)	(1.73)				(25.98)				
1	5a		1.0166				−0.6547	0.47	0.99	−56.89	0.62
			(5.82)				(5.21)				
2	9a		1.7464	−0.6154	−1.6083	0.5668		—	—	−31.86	—
2	9b**		1.5974		−1.4696			1.00	1.53	−32.61	—
			(28.71)		(26.80)						
Capital goods sector											
1	5a*	0.8551	0.0906	0.2063			−0.8276	0.96	2.36	−36.62	0.05
		(12.50)	(1.29)	(1.66)			(17.68)				
1	5b		0.7379	1.1114			−0.5513	0.52	1.29	−58.43	0.60
			(4.50)	(3.16)			(3.84)				
1	5c	0.9211	−0.0088				−0.7998	0.94	1.83	−38.24	0.08
		(15.60)	(0.23)				(17.26)				
1	5d		0.3347				−0.1511	0.08	1.04	−62.99	1.09
			(2.57)				(1.78)				
2	9a**		0.5781	4.0985	−0.5035	−3.5694		—	—	−31.53	—
2	9b		1.3624		−1.1958			0.91	1.75	−41.14	—
			(16.14)		(14.92)						

Intermediate goods sector											
1	5a	0.8308	0.2885	−0.1827			−0.9095	0.99	1.90	−32.81	0.01
		(3.16)	(0.94)	(1.52)			(27.49)				
1	5b		1.2480	0.1629			−0.9607	0.99	1.98	−37.64	0.01
			(29.09)	(2.54)			(26.01)				
1	5c*	0.4676	0.7043				−0.9361	1.00	1.98	−34.19	0.00
		(4.09)	(4.96)				(31.94)				
1	5d		1.2673				−0.9387	0.94	1.62	−40.87	0.07
			(25.71)				(22.39)				
2	9a**		1.4799	−1.5787	−1.2608	1.3453		—	—	−38.04	—
2	9b		1.2060		−1.0580			1.03	0.90	−42.65	—
			(23.21)		(20.08)						
Basic goods sector											
1	5a	0.7269	−0.0872	−0.1183			−0.5323	0.99	1.80	−36.78	0.02
		(8.33)	(0.75)	(1.82)			(13.06)				
1	5b		0.8263	0.3014			−0.6708	0.82	1.43	−52.47	0.22
			(8.57)	(3.05)			(7.43)				
1	5c*	0.6032	0.0900				−0.5822	1.00	1.69	−38.72	0.00
		(10.17)	(1.29)				(17.85)				
1	5d		0.6869				−0.5013	0.56	0.98	−56.79	0.52
			(6.50)				(5.66)				
2	9a		0.8569	−0.2535	−0.7333	0.2170		—	—	−38.55	—
2	9b**		0.8170		−0.7000			1.01	1.49	−38.71	—
			(21.84)		(19.49)						

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