

Statistical and Social Inquiry Society of Ireland

Estimating Irish Prices

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1 INTRODUCTION

In statistical studies of costs and prices it is usual to attribute a particular pricing policy to entrepreneurs – that of full-cost pricing. The objects of this paper are first, to examine the implications of the assumption of full-cost pricing for the statistical analysis and interpretation of the cost-price relation, and secondly, to examine possible modifications which may be introduced to make this assumption approximate more closely to the real world.

In this context, it will be useful to compare two studies of costs and wholesale prices in Irish Transportable Goods Industries, “A Statistical Study on Wages, Prices and Employment in the Irish Manufacturing Sector”,¹ by C St J O’Herlihy, and an unpublished study by W Black, J V Simpson and D G Slattery. Reference will also be made to two similar studies of British Manufacturing costs and prices, “Pricing and Employment in the Trade Cycle”,² by R R Neild, and “The Interrelationship between Cost and Price Changes, 1946-1959. A Study of Inflation in Post-War Britain,”³ by L A Dicks-Mireaux.

2 THE BASIC PRICING EQUATION

(a) *Formulation*

The pricing equations used in studies of this nature follow a similar pattern though there are some differences in the interpretation of the economic theory on which they are founded. Since these differences have important consequences both regarding the choice of relevant data, and the interpretation of statistical results, it is proposed in this section to compare the formation of the pricing equations in the studies mentioned in the previous section.

There is a substantial amount of common ground and this provides a suitable starting point. At any given level of output, variable cost per unit output is the sum of labour cost per unit output and materials (includ-

¹ Economic Research Institute, Dublin, Publication Number 29

² National Institute of Economic and Social Research, Occasional Papers XXI

³ Oxford Economic Papers, October, 1961

ing fuel) cost per unit output. Each of these components of variable cost per unit output is a product factor cost per unit input times the number of units input required to make one unit of output. This relationship between variable cost per unit output and input costs may be written as,

$$C = bW + dM \quad (1)$$

where C is variable cost per unit output

W is labour cost per unit input

M is materials cost per unit input

b is the number of units of labour input per unit output

d is the number of units of materials input per unit output

Assuming that entrepreneurs cover fixed costs and profits per unit output by "marking-up" variable cost per unit output, the pricing equation may be written as,

$$\begin{aligned} P &= f_0 + f_1 C \\ &= f_0 + f_1 bW + f_1 dM \end{aligned} \quad (2)$$

This formulation allows for several possible courses of action by entrepreneurs. They may calculate fixed costs and profits as a proportion of variable costs (f_1) or as a constant amount per unit of output (f_0), or as a combination of the two. This form of the pricing equation is the one used in the study by Black et al., and in the study by Neild.

O'Herlihy follows a different line of reasoning.⁴ Starting with the variable cost per unit output equation (equation (1) above), he then assumes all other costs to be constant per unit output, and thus obtains a total cost (excluding profits) per unit output equation of the form

$$C_1 = a + bW + dM \quad (3)$$

where C_1 is total cost per unit output, a is overhead cost per unit output and W, M, b and d are as before.

Entrepreneurs are then assumed to calculate price per unit output as a proportion of total cost per unit output, so that the price equation is

$$\begin{aligned} P &= gC_1 \\ &= ga + gbW + gdM \end{aligned} \quad (4)$$

This implies that the value of "g" must be greater than unity otherwise price per unit is less than total cost per unit. There is no similar restriction on the proportional mark-up (f_1) in equation (2), since its value will partly depend on the value of f_0 .

(b) Pricing behaviour

Materials and labour requirements per unit output (d and b respectively in equations (2) and (4)) are likely to be affected by technological developments. However, in the case of materials, the ratio of input to output is unlikely to change substantially over the ten to fourteen year periods which

⁴ He also subdivides materials into imported materials and domestic agriculture products. However, he later concludes that due to its long run stability, (it rose by only 2 per cent between 1953 and 1963), the price index of agricultural products may not have contributed to output price changes in this period. In any event, this does not affect the present argument.

are covered in the studies. In all cases therefore, "d" has been assumed to remain constant.

The same cannot be assumed of "b", the ratio of labour input to output, which is the reciprocal of labour productivity (II), defined as units of output per unit labour input. Labour productivity in Transportable Goods Industries rose by over 50 per cent between 1953 and 1965, thus b cannot be assumed to remain constant. However, since the pricing equation is an attempt to formalise entrepreneurs' pricing policy, attention must be focussed, not on the actual changes in labour productivity but rather on how entrepreneurs may reasonably be supposed to react to these changes. If the pricing policy is such that adjustments are made to allow for short-term variations in labour productivity (i.e. from quarter to quarter), this would require a system of continual costing changes which would be difficult to implement. A more reasonable assumption would seem to be that prices are calculated in relation to longer term changes in labour productivity, not only because this policy would be simpler to implement, but also because entrepreneurs are unlikely to amend policy on the basis of short-term experience.

Whichever assumption is made, the relevant labour cost element is labour cost per unit output, i.e., labour cost per unit input deflated by labour productivity. In the former case the deflator will be actual productivity, in the latter a trend of labour productivity. In the studies by Black et al. and Neild, the deflator used was a trend of labour productivity.⁵

O'Herlihy's line of reasoning is similar to that above, but he allows for long term changes in productivity in introducing an indicator of productivity as an extra variable in the pricing equation rather than by adjusting labour costs. With these qualifications in mind, the pricing policy formalised in equation (2) may now be rewritten as,

$$P = f_0 + f_1 \bar{W} + f_1 dM \quad (2a)$$

where \bar{W} indicates labour cost per unit output calculated on the basis of the trend of labour productivity, and P, M, f_1 , f_0 and d are as before. The alternative policy, as shown by equation (4) is now amended to become,

$$P = ga + gbW + gdM + h\pi \quad (4a)$$

where h is the effect of changes in labour productivity on price

π is labour productivity⁶

and all other symbols are as before.

This latter form of the price equation is similar to the one adopted by Dicks-Mireaux,⁷ who used a two-equation model to examine, among other things, the interrelationship between wage and price changes.

(c) Assumptions and limitations

The pricing policies outlined above assume that profit margins bear a constant relationship to input costs, since output price is calculated by

⁵ Neild, *op cit*, carried out regressions using both deflators and concluded that the trend of labour productivity was "the most satisfactory of those considered", and thereafter confined attention to the pricing equation which used this deflator.

⁶ O'Herlihy considers several indicators of labour productivity. This will be dealt with in Section 3(b).

⁷ In place of a "materials used" price index, Dicks-Mireaux used an import price index.

marking-up costs. This implies that entrepreneurs have some notion of a profit margin per unit output which they consider satisfactory or normal, and furthermore that this normal profit margin is constant throughout the period under consideration. If this is the case, then the sum of the coefficients of labour cost and materials cost in pricing equation (4a) should be less than unity, since the coefficients represent the weights of these inputs in total cost.⁸ If profit margins are above normal the sum of the coefficients should exceed unity. The formulation of equation (2a) is less rigorous in that it allows for the possibility that the mark-up may take any variation of the basic form, price equals "x" per cent of variable cost plus "y" shillings. Hence there is no corresponding limitation on the variable cost coefficients.

There is evidence to suggest that, in fact, profit margins did not remain constant in the Irish manufacturing sector. Using Geary's figures for the structure of Irish industry,⁹ O'Herlihy estimated that between 1953 and 1963, increases in variable costs should have caused output price to rise by 13.5 per cent. The actual increase was 22.4 per cent. Furthermore Nevin's¹⁰ estimates of capital stock show that capital stock, at 1958 prices, increased at an annual average rate of 1.5 per cent. Over the same period, output increased at an annual average rate of 2.8 per cent, so that the extra increase in output prices can scarcely be attributed to increased overheads.

These calculations can only be regarded as approximations but they serve to indicate that the basic pricing equations are probably too restrictive in assuming that profit margins remain constant over time. Even if entrepreneurs seek a normal profit margin, their concept of what constitutes an acceptable profit margin at any given time, may be subject to change. During periods of declining demand, for example, they may be willing to see profit margins reduced in expectation of recovery from this setback by expanding profit margins in periods of increasing demand.¹¹ In this context, the pricing equations as formulated above, are dealing with average rather than normal profit margins. If, over time, the ups and downs in demand were to cancel each other, the basic pricing equations with their assumption of constant profit margins may provide a useful approximation to the truth. However, since entrepreneurs' reactions to ups and downs may not be symmetrical, it seems advisable to concede that the equations are inadequate in this respect.

⁸ From the estimates in R. C. Geary's *Towards an Input-Output Decision Model for Ireland*, Economic Research Institute, Reprint number 8, their sum should be about 0.70.

⁹ Op cit.

¹⁰ E. Nevin, *The Capital Stock of Irish Industry*, Economic Research Institute, paper number 17.

¹¹ See for example, E. Nevin, *The Cost Structure of Irish Industry, 1950-1960*, Economic Research Institute, paper number 22, where he points out that in 1950-53 and again in 1957-60, increased prices were due not only to increased costs, but also to "purely inflationary increases in profits". Comparing these two periods with 1954-56, a period during which profit margins fell, he concludes that "changed demand conditions must underlie the contrast", and that the fall in profit margins is due to the "reduced buoyancy of final demand, at home and abroad".

Further evidence of an additional influence at work on output price was found in the study by Black et al. Although a high degree of explanation¹² was achieved in regressions using the basic pricing equation, the regression residuals exhibited significant positive autocorrelation,¹³ a possible cause of which is the omission from the pricing equation of some systematic explanatory variable. In his study of British manufacturing prices, Neild also records the presence of autocorrelation in the regression residuals of the basic pricing equation¹⁴

3. THE MODIFIED PRICING EQUATION

(a) *Selection of an indicator of market conditions*

It is apparent that some modification must be made to the basic pricing equations to take account of the influence of market conditions on output price. The various attempts to find a suitable indicator of market conditions are now considered.

In calculating a normal profit margin, entrepreneurs presumably have regard to the conditions which they expect to prevail in their outlet market. If these expected conditions occur, then profit margins do not deviate from the norm. If, on the other hand, conditions turn out better (worse) than expected, profit margins will tend to widen (narrow). A first step, then, is to define "expected" conditions.

O'Herlihy adopts the view that entrepreneurs' expectations about the future will be strongly influenced by events in the immediate past, and proposes four alternative definitions of expected conditions. The first is that entrepreneurs expect output to increase by 3 per cent per annum,¹⁵ the second, that they expect the previous year's change in output to be repeated in the current year, the third and fourth, that they expect the average change over the preceding two and three years respectively, to be repeated in the current year. In each case, deviations from expected conditions are measured by subtracting the expected change from the actual change. The deviations, identified as θ_1 , θ_2 , θ_3 and θ_4 , are the indicators of market conditions. O'Herlihy refers to them as demand-pull factors, since they show the way in which actual output deviates from expected output in response to changes in demand.

In the study by Black et al., the level of activity in the manufacturing

¹² The criterion was the standard error of estimate, which provides a measure of the effectiveness of the explanation of output price achieved by a regression equation by showing the average variation not accounted for by the equation.

¹³ The regression residuals are calculated by estimating a series of values of the dependent variable (output price) using the regression equation, and then subtracting each estimated value from the corresponding actual value. If the residuals show an excessive bunching of positive and negative values the presence of autocorrelation may be suspected. It can be tested for using the Durbin-Watson test described in Durbin, J., and Watson, G. S., *Testing for Serial Correlation in Least Squares Regression*, parts I and II, Biometrika, 1950 and 1951.

¹⁴ *Op cit*, page 20.

¹⁵ O'Herlihy carried out regressions on both annual and quarterly data, but only examined possible modifications to the basic pricing equation for the annual results which cover the period 1953-63. During this period the annual average rate of increase of output was about 4½ per cent, though in 1956 and again in 1957, output fell.

sector was used to reflect market conditions. Instead of defining "expected" conditions, this study undertook the additional task of attempting to evaluate a level of activity which represented "expected" conditions, i.e., a level of activity at which profit margins would remain constant. The level of activity was defined as output expressed as a percentage of capacity output. A capacity index was estimated in a manner similar to that used by Professor Paish in his study of industrial capacity and utilisation in the U.K.,¹⁶ where production at a low level of unemployment is taken as industrial capacity. A difficulty with unemployment figures for Irish transportable goods industries is that they do not always reflect movements in employment. Thus, for example, in 1966 and 1967 when employment was increasing, it was found that unemployment was also increasing. However, the level of activity index was found to move closely in line with employment.¹⁷

Similarly, Neild does not define "expected" conditions. He allows for the influence of the market by using an index of excess demand for labour in the manufacturing sector. This provides an approximate measure of the excess of unfilled vacancies over unemployment.¹⁸ Thus zero excess demand for labour would indicate full employment. This could scarcely be considered as "expected" conditions, and unfortunately Neild does not attempt to evaluate "expected" conditions in terms of the excess demand for labour. This index was used as a proxy for an index of orders for manufactured goods, for which there was no series available. A feature of the excess demand for labour index is that it incorporates the actions of entrepreneurs, because "the demand for labour is related to that for final products only via the mediation of entrepreneurs."¹⁹ However, the exact nature of the relationship is not explored either by Dow, Dicks-Mireaux or by Neild, though the former comment on the likelihood of a dampening effect during the transmission of excess demand for products to the labour market.²⁰ Neild points out that there is likely to be a time-lag between changes in demand for final products and the corresponding changes in excess demand for labour. He assumes however, that the major part of the reaction occurs within three months.²¹ This assumption is based on his findings about the time-lag relationship between output and employment.

¹⁶ See F. W. Paish, *Studies in an Inflationary Economy*, Macmillan and Co., (1962) chap. 17.

¹⁷ The problems involved in the estimation of the capacity index for Irish manufacturing industry are discussed at length in the paper by Black et al.

¹⁸ See Dow, J. C. R., and Dicks-Mireaux, L. A., *The Excess Demand for Labour*, Oxford Economic Papers, vol. 10, 1958.

¹⁹ Op. cit.

²⁰ Op. cit. Three reasons are given, (a) entrepreneurs may not compete among themselves for labour, lest in so doing they bid up wages, (b) the bottleneck may be caused by a shortage of factors other than labour, (c) entrepreneurs may simply refrain from attempting to meet the excess demand for final products.

²¹ Neild's basic price equation assumed geometric "tails" to the distributed lag effects of changes in labour and materials costs on output price. This additional assumption then presumably allowed him to incorporate excess demand for labour into the original framework by introducing the current value of excess demand for labour into the price equation.

(b) *The use of the indicator*

The indicator to reflect the influence of market conditions on output price may be considered in the calculations in one of two ways. It may be introduced as a future explanatory variable for regression, or may be examined with the regression residuals from the basic pricing equation in an attempt to establish a relationship between the two.

In his study of British prices, Dicks-Mireaux also uses the excess demand for labour index to reflect market conditions.

O'Herlihy tries both methods. To a basic pricing equation, which includes hourly earnings, agricultural prices, imported materials prices and a trend,²² as explanatory variables, he adds in turn, each of the four indicators. In each case, the regression coefficient of the indicator is positive showing that output price will tend to move in the same direction as excess demand. This is in agreement with expectation, indicating that profit margins will rise (fall) as demand exceeds (falls below) expected demand. Thus for example, he found that if output in any given year rises by 1 per cent more than the average change of the two previous years, expanding profit margins will increase output prices by an additional 0.3 per cent.

The regressions are repeated with the previous year's output price as a further explanatory variable, to allow for the possibility that the effects of changes in the explanatory variables on output price may not be fully realised within a year. The full effect is now found by dividing the regression coefficient (which is an estimate of the short run effect) by the complement of the coefficient of last year's output price. The two sets of estimates are shown for comparison.

ESTIMATES OF FULL EFFECT OF DEMAND-PULL ON OUTPUT PRICE

	Equations without lagged price	Equations with lagged price
θ_1	316	090
θ_2	173	043
θ_3	286	176
θ_4	323	— 063

The latter estimates are much smaller than the former, and in the case of θ_4 yield a negative result, which is contradictory to what one would expect. The coefficients of last year's output price are all in the region of 0.5, which suggests that approximately 50 per cent of the full effect remains unaccounted for after a year, so that one would have expected the latter estimates to be greater than the former. However, the necessarily high correlation between the current and previous years' prices could account for the apparent significance of the latter as a factor explaining the current year's price, and may only serve to mask the influence of the other factors.

The equation which afforded the best explanation²³ of output prices was of the basic form and included the level of output to measure the effects of changes in labour productivity.²⁴ The other explanatory variables were

wages, domestic agricultural products price, imported materials price, a time trend and the previous year's output price. The residuals from this equation were regressed on each of the four demand-pull variables in turn, but each yielded a coefficient of determination less than 0.02. At first glance, these results may seem to contradict those obtained by introducing the demand-pull variables into the regression equation. However, the use of the level of output as an indicator of labour productivity may be the cause of the difficulty. Eckstein and Wilson²⁵ working on American data found that changes in the utilisation of capacity were the main cause of variations in labour productivity, and in the study by Black et al., the indications were that the same was true of Irish data. In the latter case it was found that cyclical variations in labour productivity had a positive correlation²⁶ with cyclical variations in the utilisation of capacity. The typical length of the cycle in the period 1954 to 1966 was two years, so that the "best" equation may well have accounted, not only for the effect of changes in productivity, but also for the effect of market conditions.²⁷ The fact that this equation had the smallest standard error of estimate would seem to confirm this. Hence the lack of correlation between the regression residuals and the demand-pull variables is hardly surprising. The use of the time-trend variable, in place of output or productivity, in the regressions with the demand-pull variables could also explain why the demand-pull variables showed so well there.

An examination of the sums of the variable cost coefficients show that when last year's output price is included as an explanatory variable, the sums are always greater than unity. When last year's output price is omitted the sums are always less than unity. The results of O'Herlihy's later calculations using quarterly data, and those of Black et al., indicate that the lagged response of output price to changes in input costs is largely completed within a year,²⁸ so that the inclusion of last year's output price in some of the regressions here may only be confusing the issue. Of those which omit last year's output price, the equation with θ_3 as an indicator of market conditions yields a sum of variable cost coefficients

²² To reflect the effect of productivity changes on output prices.

²³ It had the smallest standard error of estimate of all the regression equations, including those with the demand-pull variables.

²⁴ O'Herlihy used at various times, a time trend, actual productivity and output to account for labour productivity changes. In each case a negative regression coefficient was expected. This was obtained only in the case of the output variable. He concludes that entrepreneurs use output increases as an indicator of productivity changes.

²⁵ Eckstein, O., and Wilson, T. A., *Short-run productivity behaviour in U.S. Manufacturing*, Review of Economic Studies, 1964.

²⁶ The coefficient of correlation was 0.73.

²⁷ The inclusion of a time trend, which has the same effect as converting the data to deviations from estimated linear trends, might reinforce this effect. See, for example, Tintner, G., *Econometrics*, J. Wiley and Sons (1952) pp. 301-3.

²⁸ See O'Herlihy, p. 28, where he concludes that after nine months less than 30 per cent of the effects of a change in wages or materials cost remains outstanding, and Black et al., p. 17 where it is concluded that within twelve months output price would be fully adjusted to a change in materials cost, and 90 per cent adjusted to a change in labour cost.

equal to 0.71. This is close to Geary's estimate²⁹ of the weight of variable costs in output price, and this may perhaps be taken to indicate that entrepreneurs base their expectations of normal market conditions on their experience of the two previous years. This equation also has the smallest standard error of estimate of the set of equations which omit last year's output price.

It should be emphasised that O'Herlihy does not explicitly draw these conclusions. He largely restricts his comments to the results of the regressions and does not speculate at length on their interpretation. Later in the study, however, he remarks, "the best estimate of the 'expected' seems to be the continuation of the previous two years experience", so that the present comments may not be out of keeping with his intentions.

The price study by Black et al. attempted to take the analysis of the market effect a stage further by trying to evaluate "expected" conditions. The principal aim of the study was to obtain a regression equation which would be suitable for short-term forecasting of output prices, and to derive an adjustment factor for the forecasts, that would take account of market conditions. Preliminary regressions on equations without the previous quarter's output price showed that the regression residuals were significantly autocorrelated. When the previous quarter's output price was included as an additional explanatory variable the degree of explanation achieved was increased,³⁰ and the regression residuals were apparently random. It has been shown³¹ however that the presence of the lagged dependent variable may mask the presence of autocorrelation. When autocorrelation is present, the application of least-squares to equations containing lagged dependent variables is likely to yield biased estimates.³² However, this does not preclude the use of such equations for forecasting, so that the criterion for selecting a forecasting equation was simply that of choosing the one with the smallest standard error of estimate.

The regression residuals from the best equation were then regressed on the current level of activity. The coefficients of determination for first, and second degree fitted lines were both less than 0.5, indicating that less than 50 per cent of the divergence between actual and estimated prices was explained by these relationships with the level of activity. However one point of interest emerges. The second degree relationship shows that actual and estimate price levels coincide when production is operating at about 97 per cent capacity.

The estimations described thus far, assume that although the amount of the adjustment in output price, due to changes in input costs, might be influenced by market conditions, the length of time which elapses from start to finish of the adjustment process would remain the same. This may not in fact be the case. To examine the possibility that changing market conditions might influence output price by prolonging or foreshortening the

²⁹ Op. cit.

³⁰ i.e. the standard error of estimate was reduced.

³¹ See Nerlove, M., and Wallis, K. F., *Use of the Durbin Watson Statistic in Inappropriate Situations*, *Econometrica*, Vol. 34, 1966, pp. 235-238.

³² See, for example, Johnston, J., *Econometric Methods*, McGraw-Hill, (1963) Chap. 8.

adjustment period, Black et al calculated a new series of residuals which they call "horizontal differences". These are measured in units of time, and show the time-lag between the time estimated price reaches a given level and the time actual price reaches the same level. Thus for example, if estimated price rises before actual price, the delay may be due to the reluctance of entrepreneurs to pass on cost increases, because of declining demand. On the other hand if actual price rises before estimated, this may be due to entrepreneurs passing on cost increases faster than usual because market conditions are better than expected. The horizontal differences were regressed on the level of activity and the coefficient of linear determination was 0.65. This would seem to indicate that market conditions are more likely to affect the speed with which entrepreneurs adjust output prices in response to cost changes, rather than the amount by which output prices are changed. However since the adjustment of output prices is spread over time, and since the period of adjustment appears to fluctuate with changing market conditions, an attempt to establish the existence of a relationship between the first set of residuals and the current level of activity is almost certain to fail. The relationship is more likely to be a lagged one.

The fitted regression line between the horizontal differences and the level of activity indicated that the period of adjustment would be stable when production was operating at about 97 per cent capacity. If the level of activity rose (fell) by one percentage point, the lag structures would be shortened (prolonged) by $1\frac{1}{2}$ to 2 months. Hence in calculating output prices entrepreneurs would appear to expect market conditions to be such that production will operate at 97 per cent capacity.

As noted above, Neild also found significant positive autocorrelation in the residuals from the "best" equation. He accordingly introduced the index of excess demand for labour in cumulative form as a further explanatory variable, but found that, "this added nothing useful to the explanation of prices". His regressions covered two periods, 1953-60 and 1950-60, i.e., excluding and including the Korean war period. In both cases the regression coefficient of the additional variable was negative, and statistically significant only in the latter case. The negative sign, which implies that when market conditions are good (bad), profit margins will be reduced (increased) runs counter to expectation, and Neild attributes the significance of the variable in the 1950-60 period to some peculiarity of the Korean War period. While rejecting the hypothesis that this particular indicator of market conditions exerts a significant influence on output price, he points out that a different indicator or a more complex formulation using the present indicator, might be more successful.

The regression residuals and horizontal differences from Neild's "best" equation were examined in relation to Paish's index of percentage utilisation of capacity, but no significant relationship was established.

Dicks-Mireaux correlated regression residuals from a price equation which included only wages and import prices as explanatory variables, with current excess demand for labour. He found the correlation was small and negative (-0.41). It should however be noted that the regression variables were expressed as annual percentage changes, while excess

demand for labour was expressed as a level

It could be argued that since current excess demand for labour reflects past market conditions rather than present, its effect on output price would not necessarily show up in the forms tried by Neild and Dicks-Mireaux. As against this, Dicks-Mireaux was using annual data which would be less sensitive to lag structures, which are more likely to be in terms of months rather than years. However, as in Neild's study, it would seem that the suitability of excess demand for labour as an indicator of market conditions could only be judged by examining the nature of its relationship with the final demand for products. This, is of course, a counsel of perfection, since the availability of the latter would presumably remove the need to use the index of excess demand for labour.

4 CONCLUSIONS

It seems fairly well established that market conditions, and entrepreneurs' expectations of market conditions, exert considerable influence on output prices through the media of profit margins. The precise nature of the role played by profit margins is less clear. The evidence, such as it is, would seem to suggest that profit margins fluctuate because market conditions affect the speed with which cost changes are passed on to output prices. Unfortunately, studies of costs and prices tend to regard this aspect of pricing behaviour as a secondary consideration. They are more concerned with structural analyses of (supposedly constant) time-lag relationships between costs and prices, or with forecasting, and this could be a serious omission. A closer investigation of profit margin behaviour seems necessary for a fuller understanding of pricing policies. Of the various approaches examined above, that which considers the effect of market conditions on the structures of the input costs-output price distributed lags, seems likely to be the most useful.

Finally, although there is general agreement on the nature of market conditions, there is considerable divergence of opinion as to how this factor should be quantified. It is hoped that this paper may have shed some light on this difficult area.

DISCUSSION

*Mr P M Lyons*⁴ For many years I have been a convert to the idea of full-cost pricing. In learning economics I was not convinced of the classical theories of pricing. They appeared meaningless and remote from reality. On discovering, mainly from the work of Hall and Hitch, of the theory of full-cost pricing, I was immediately attracted to this theory. I think Mr Slattery's paper takes the investigation a major step forward in Irish circumstances. It has brought home, however, the difficulties of analysing this phenomenon.

If I might take him up on one or two minor points first of all. He attaches great weight to the idea of "labour productivity". This is a dangerous attitude in my view because it presumes that labour is the only

factor of production which makes a contribution to increased output. To many people, especially trade unionists, a rise in output greater than a rise in employment is supposed to be a sign of greater labour productivity, as if no other inputs mattered. This does not take into account changes in the efficiency or productivity of other inputs, especially capital.

With the same labour force but with an identical amount of capital, it may well be that labour productivity has risen. But we have no definite measure of this. Changes in the apparent level of productivity can occur for several reasons:

- 1 There may be an increase in the quantity or the quality of machines manipulated by the same labour force,
- 2 An increase in demand may allow a firm to increase production towards its capacity level without increasing employment or capital.
- 3 The labour force may be willing to work harder, to avoid industrial disputes, to co-operate better with the management, and so on.

A very detailed study of the relative contribution of the various inputs is long overdue.

Mr Slattery also considers the effect of unemployment upon pricing. One wonders whether the recorded unemployment statistics are really a measure of unemployment. As in other countries, some people register as unemployed who do not want to work or who are unemployable. In addition, in Ireland, we share a common labour market with Britain. Those who cannot get a position here can always emigrate, although this is undesirable. I do not therefore consider that undue emphasis should be placed upon the level of unemployment.

The analysis presented by Mr Slattery certainly explains the prices that entrepreneurs should charge, and a detailed study it is. To my mind it does not explain fully the price that is charged. He tackles the problem from one end – price is based upon cost plus profit expected. While manufacturers can be expected to follow a logical approach such as is outlined, there is no evidence to suggest that they perform such an operation. In fixing his price the manufacturer will look at other items besides costs and profits.

In fixing his price, he will study what the market will bear. As his basic idea is to maximise profits he will charge as high a price as he thinks he will get away with. Another important factor is the extent of competition. In a monopolistic situation, full-cost pricing as described, can take place. In a competitive situation, the price must be fixed in relation to the prices of competing firms. While in Ireland many firms have internal monopolies, they still face competition from exports, and this increases as tariff barriers fall. This aspect will be a decisive one in most cases. A further influence will be that of the general economic climate combined with the elasticity of demand for the product. Too steep an increase in price might have a severely deleterious effect upon demand.

Mr Slattery also considers the influence of the expectations of entrepreneurs. This is treading on treacherous ground, as manufacturers generally tend to be over-optimistic or over-pessimistic, more often the former. I have long wanted to do a study comparing the results of the

former Economic Research Institute inquiry into the expectations of managers with the eventual outcome revealed by the Quarterly Industrial Inquiry Too often people will tell you what they think you expect them to tell you rather than what they actually believe

One wonders also whether Irish businessmen are sufficiently sophisticated to operate in the manner described by Mr Slattery This is undoubtedly the way to fix prices, but I doubt whether it is undertaken in practice

My dealings with the Central Statistical Office have persuaded me that the average businessman is not particularly numerate In questionnaires which I have sent out in the last two years to hundreds of Irish firms, it has been revealed that people are reluctant to provide information, or less charitably perhaps they do not possess it

What is required I feel is a detailed survey of the actual manner in which entrepreneurs decide upon the price of their products This survey will not be easy to perform, and it may well be that the results will be somewhat horrifying

Mr Slattery's statistical work was detailed and thorough, and I certainly found it most interesting But strange things can occur when statistically analysing information In a study on Italian agriculture, Eera Cao-Pinna discovered in her Cobh-Douglas function the power of the labour input factor was negative

In any form of correlation analysis we must remember that in no circumstances does a close mathematical relationship prove a close causal relationship A strong correlation was found, for instance, between the birthrate in India and the number of Protestant clergymen ordained It is not to be presumed that these were in any way related In certain cases, however, for some mystifying reason, statistical relationships do work In a particular field in which I am interested, that of election statistics, we have the concept of "swing" There is no such thing, as we would require to analyse the changes of attitude of an identical population at two different dates Nevertheless it infuriatingly works, especially in Britain, where the eventual outcome of an election can be predicted closely from the "swing" revealed in the first few results

May I, in conclusion, thank Mr Slattery most sincerely for his stimulating paper? He stated that he hoped that it would shed light on this difficult area It has indeed performed this function But it has also underlined how difficult an area this is, and I hope that it will be the spur for further investigation both by Mr Slattery and others

Mr W Brosnan, I would certainly endorse Mr Slattery's questioning of the assumption that profit margins remain constant over time As he points out himself, even if entrepreneurs seek a normal profit margin, their concept of such a margin is subject to change at any point of time It is hardly surprising, therefore, that there is evidence to suggest that profit margins did not remain constant in the Irish manufacturing sector during the periods in question

There are many reasons why profit margins can be expected to vary The degree of competition being experienced by firms will have an effect on

margins. If competition is severe firms may have to absorb some part of increased costs and suffer a reduction in profit margins. Even in industries where competition is less effective the operation of measures such as price surveillance could bring about similar results. Another consideration is the effect on profit margins of changes in firms' product mixes. Furthermore, as profit margins vary between industries, changes in the relative importance of groups within the total industrial sector are likely to alter overall profit margins.

The need for outside capital can also affect profit margins. For example, firms hoping to attract capital from outside sources must aim at a sufficiently attractive profit level. Such factors as growth prospects, capital structure and the reputation of management can affect the profit rate which is required. Even firms currently quoted on the Stock Exchange are liable to find a variation in required profit rate due to the prevailing dividend policy and such events as the releasing of large blocks of shares on the market.

Margins can also be affected by the amount of profits considered necessary for retention for ploughing back into the business. This could be of prime importance in the case of firms wishing to avoid too much reliance on outside finance. There are many such firms in Irish circumstances where, for example, the management may be reluctant to operate under the conditions which are likely to be imposed when finance is obtained from financial institutions. Even where these firms could issue shares instead of borrowing from financial institutions they may feel that they are increasing the risk of ultimate outside control.

It seems then that much more detailed work on profit margins is needed if we are to have a fuller understanding of pricing policies. To my mind such a study is likely to be more meaningful if a number of firms were investigated with a view to determining the factors taken into account in deciding their profit policies. It would not be an easy task, but could well prove rewarding.