8 Pricing and the investment decision*

Introduction

Recently there has been a discussion (Eichner, 1973) and series of exchanges (Hazledine, 1974; R. Robinson, 1974; Eichner, 1974, 1975; De Lorme and Rubin, 1975) concerning the determination of the size of margins in industries characterized by 'oligopoly-*cum*-price leadership' (Kaldor, 1970, p. 3). The focus of the discussion has been the demand for and supply of finance for investment purposes obtained as a result of varying the firm's mark-up policy. One element of the investment decision, its finance aspect, has been singled out as a prime determinant of the mark-up under oligopoly. However, in principle, three main decisions with regard to investment expenditure may be distinguished (the decisions, of course, may be made simultaneously): first, the *amount* of extra capacity to be laid down each period; second, the *sort* of investment to be done, that is, the choice between alternative ways of producing the same product; and third, the method and cost of *finance*.[1] The main aim of this article is to incorporate *all* of these aspects of the investment decision into a theory of the determination of the mark-up. It will become obvious as the argument proceeds that we are extending Salter's pioneering analysis of technical progress and the investment decision (Salter, 1960) into a non-perfectly competitive setting.

The link between the pricing decisions of oligopolistic firms and investment plans and levels of expenditure has been a feature of much of the Post-Keynesian literature.[2] However, until the recent exchanges, there has been some ambiguity and lack of detailed analysis concerning the exact nature of the relationship between the firm's pricing and investment decisions.[3] Indeed, Katzner and Weintraub, while postulating a link between pricing and the investment decision at the level of the firm, decided that for their purposes 'this phenomenon may be ignored' (Katzner and Weintraub, 1974, p. 488).

We hope that this article will help further to clarify some of the issues involved. It may be that such a relationship, when properly defined, will help to provide an explanation of the determination of the margin above costs in cost-based theories of pricing in oligopoly. The lack of such an explanation in the past (with the possible exception of Kalecki's work and now, of course, Adrian Wood's important new book, *A Theory of Profits*), provides a clue to the tardiness of many economists in accepting the (many) empirical verifications of cost-based pricing theories.[4]

In *section I* of the article we state the problem that we are examining in general terms and list our assumptions. *Section II* contains an analysis of the pricing and investment decision for a firm where there is only one possible 'best-practice' technique of production available at any moment of time. *Section III* considers the problems involved when the firm does have a choice between different techniques. We end the article by listing our conclusions.

I

The focus of the article is a manufacturing firm which is the price leader operating in an oligopolistic market environment characterized by mutual interdependence. We assume that the firm produces only one product. The means of producing output in the short period are taken to be fixed, as are the input-output coefficients which determine the technique of production for each 'vintage' of plant. Consequently, the firm faces constant costs per unit of output up to the point of (technically determined) full-capacity utilization of each vintage of plant. When the capacity of each vintage of equipment is exhausted, its unit costs curve becomes perfectly inelastic. Furthermore, it is assumed that the firm's *primary* goal is to maximize the growth in the value of its sales subject to a minimum profit constraint.[5] It is also assumed that the firm retains the bulk of its profits and that the greater part of investment is funded from internal sources.[6]

As we assume a market structure of oligopoly, there is no force pushing the firm to full-capacity utilization of plant. The actual rate of capacity utilization will depend on the level of demand; however, it is likely that the firm will *attempt* to operate at less than full capacity, for operating at less than full capacity gives the firm a safety margin with which to accommodate sudden swings in demand. Rothschild's maxim that oligopolistic firms are concerned to a very large extent with security so that they attempt '"to hold what they hold", - and should an opportunity arise - to launch an offensive into rival territory' (Rothschild, 1947, p. 310), makes plausible the proposition that when firms are engaged in constrained battles over market shares under conditions of uncertainty, they will not want to be caught without extra capacity with which to accommodate sudden increases in orders.

The firm may plan *ex ante* to under-utilize its stock of capital equipment, and so the capital utilization rate becomes an economic decision-variable. Recently it has been shown that under conditions of uncertainty in imperfect competition, the firm will attempt to operate its plant, on average, below the full capacity rate (Smith, 1969, pp. 56–7). The firm may plan *ex ante* to under-utilize its stock of capital equipment, not only because of random demand shifts, but also, for example, where product demand changes rhythmically (and predictably) so that there are peak loads on the plant of the firm, and where input prices also vary rhythmically so that it becomes rational for the firm not to use part of its productive capacity in high cost periods. Of course, there will be unavoidable or unplanned periods of idleness due to maintenance time, unwanted accidents and unanticipated events. For example, idleness would result from deficient short-period effective demand.[7]

The firm has to decide on its price and its desired productive capacity. It is plausible that both of these decisions are related to the investment decision in all its aspects, the amount of extra capacity to be laid down in each period, the choice of techniques (if such a choice be available) and the methods and cost of finance. The trend in the ratio of the *actual* rate of capacity utilization to the *desired* rate of capacity utilization gives the firm an indication of what would be for it a '*proper*' investment policy. A '*proper*' investment policy would provide a more or less constant *average* level of capacity utilization over the cycle at the chosen mark-up and resulting output price. As the firm is assumed to retain the bulk of its profits and as the greater part of investment is financed from internal sources, we argue that the firm attempts to set its margin so that the periodic accrual of retained profits will be sufficient to finance its investment plans. In other words, the firm has a double objective in setting its mark-up. First, the resulting price must be such as to be consistent with its expectations, in very general terms, of demand for its product, and second, the price must be such as to provide sufficient retained profits to finance its investment plans. When firms are successful in setting mark-ups which yield sufficient retained profits with which to expand capacity in the desired manner in step with the growth in market demand, a stable situation is possible where investment keeps capacity growing in step with market demand in a tranquil world of stable market shares.[8]

To recapitulate, then, it is assumed that, first, the firm (which we take to be the price leader for the current pricing period) makes a decision on future investment plans on the basis of the relation between the trend in actual rates of capacity utilization, and some desired rate of plant utilization, given its expectations about the future growth of market demand and the expected profitability of various alternative investment projects. It then chooses a mark-up that will produce the required level of retained profits with which to finance the desired investment expenditure, and persists with the implied price, allowing capacity utilization to vary with the level of demand around some average expected level associated with the chosen mark-up. These decisions are made with reference to the state of demand that experience suggests to the firm as being reasonable. That is to say, the mark-up policy of the firm is influenced by the general state of business confidence and this same state of confidence also determines the firm's investment plans. Investment plans and the size of the mark-up are inexorably linked through the demand for and supply of funds in the form of retained profits with which the firm finances proposed investment projects. The actual price, however, is determined directly far less by current demand than by the mark-up which the firm considers necessary in order to be able to increase its capacity sufficiently to meet the expected future level of demand.

II

Our analysis of the pricing and investment decision under oligopoly begins by dividing time into price-making and investment plan-making units – similar to Hicksian 'weeks' but *much longer*, certainly far longer than the 'weeks' which are appropriate for short-period production decisions. The price-making period may not be of the same length as the investment plan-making period. Although it is plausible that both the price and the investment plan-making decisions will be made on the same 'day' because of the interdependence of the two decisions, it is possible that there will be overlaps between successive pricing and investment plan-making periods. These overlaps are related to the fact that investment plans, and the laying down of new capacity, have a long gestation period, and over that gestation period pricing decisions may have to be revamped in the light of changed business conditions (*e.g.* unexpected changes in the prices of investment goods, changes in government economic policies which affect the state of business confidence, and so on). There is also a possibility that while maintaining the price of its product, the firm may revise its investment plans as conditions alter from those which were expected at the beginning of the relevant decision-making period.[9] For simplicity, however, we abstract from these puzzles and collapse the two periods into one.

We assume that decisions on prices and investment expenditure are taken at the *beginning* of the period and then are held for that length of time. Furthermore, we suppose that the firm at the beginning of the current period has formed expectations about the levels of money wages and raw materials prices, and likely tax rates, as well as about its sales - prices *and* quantities - for this and the next period. It has also formed expectations about the scrap values of existing equipment.[10] Let the firm know now the capacity which will be in operation by the start of the current period. (This newly installed capacity is expected to cope with the expected demand of the current period and is the result of plans made in the past, for simplicity, in the last period.)

These assumptions allow us to draw up the *expected* marginal cost curve (*EMC*) for *existing* vintages for the firm for the next period: see Figure 8.1. It is a step function with each step showing the output to be catered for by different vintages of equipment which were laid down in previous periods. Each step shows the marginal (equals average variable) cost of each segment of output *plus* the scrap value;[11] itself a declining function of age, of each set of vintages. For example, *OA* is the output which will be catered for by the most recently laid down capacity, the result of plans which were made in the previous period.

From the *EMC* curve for existing vintages we can establish, given the

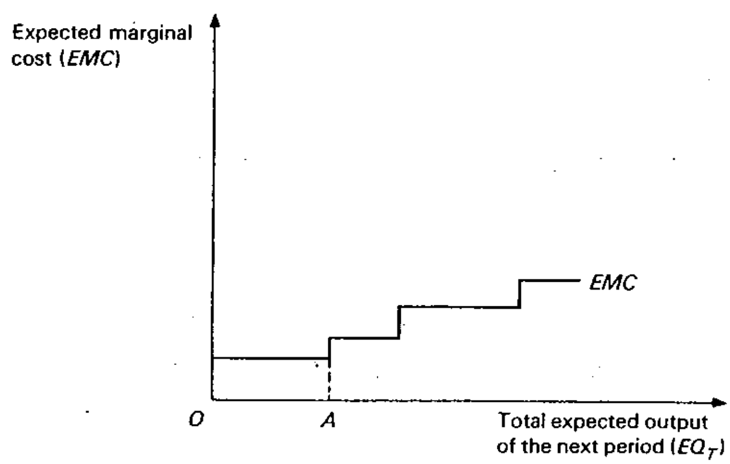

Figure 8.1

expectations of the firm with respect to demand for its product in the next period and the scrapping rule for 'old' vintages, the amount of new capacity which would have to be provided for the next period at various prices.

The expected sales-expected price relationship of the *next* period, *dd*, is now superimposed on the expected marginal cost function. The expected sales-expected price relationship is drawn as a nearly vertical line in order to indicate the relative independence of expected quantities – 'normal' quantities – over at least a *range* of prices: see Figure 8.2. This is the essence of the market situation with which the article is dealing and is consistent with the 'normal' pricing hypothesis associated with Neild, Godley and Nordhaus and others.[12]

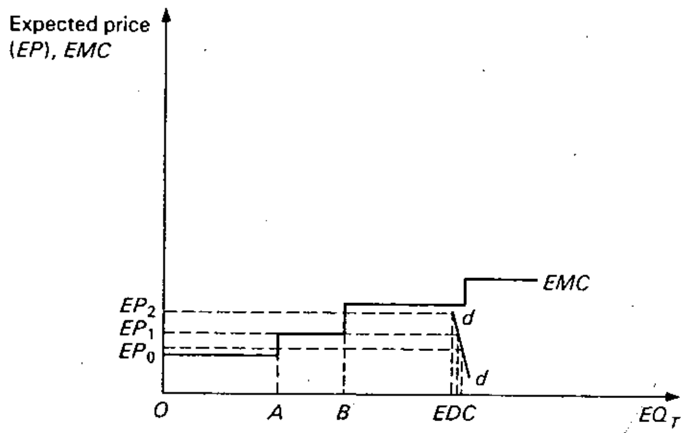

Figure 8.2

We argue that the price of the firm's output moves in relation to the requirements of the firm for internally generated funds with which to maintain its overall growth goals through investment in additional productive capacity *and* in relation to 'normal' prime costs. A 'normal' variable is defined as *'the value that variable would take, other things equal, if output were on its trend path'* (Godley and Nordhaus, 1972, p. 854). Following Neild (and Godley), it is argued that businessmen, whilst not conscious of the trend in output, unconsciously introduce it into their prices as they make new costings whenever new equipment (or new products) are introduced (Neild, 1963, p. 4, and in private correspondence with us). That is, the trend in unit costs reflects the trend in output. Therefore the price is fixed on the basis of the costs implied by this trend, ignoring short-period variations in unit prime costs which stem exclusively from alterations in rates of capacity utilization as demand changes over the course of the trade cycle. That is, neither *temporary* changes in prime costs, nor *temporary* changes in product demand directly influence to any significant extent output price. It is predominantly output and not price which fluctuates with the level of demand in the course of the business cycle.[13] There is ample empirical evidence which serves to justify this pricing assumption.[14]

If the firm were to set its price between EP_0 and EP_1 (strictly speaking, just below EP_1) in Figure 8.2, existing capacity would cater for an output rate of *OA*, and output rates of between *AC* and *AD* would have to be catered for by new capacity which would be the outcome of investment plans made and carried out during the current period. We assume that existing fossils are scrapped, or at least retired to emergency standby, when expected marginal cost is equal to or greater than expected price. Though this seemingly perfectly competitive version of the more general rule that when quasi-rents are zero at marginal revenue equals marginal cost, machines are scrapped, or at least temporarily retired, it is, of course, consistent with a situation in which output is expected to be independent of price, at least over a range.[15] In these situations only price has a meaning and Nuti's argument that in a world of imperfect competition marginal cost will be *less* than the selling price (so that there would be a contradiction in the scrapping rule)[16] will not hold. The traditional demand and marginal revenue curves of imperfect competition are not relevant in this model because of the independence of price and quantities over a range of prices. Therefore the difference between price and marginal revenue is not only irrelevant but, in fact, non-existent.

If the price were to be between EP_1 and EP_2, *OB* would be produced by what would be the then existing capacity, and *BD* to *BE* would have to be catered for by new investment planned and carried out during the current period.[17] The expected price-output to be catered for by new investment relationship is shown as P_1P_1 in Figure 8.3. It is defined by the *expectations* of the firm concerning price and the output to be catered for by new investment for the next period. It has been derived from Figure 8.2 by plotting the respective expected output levels against the corresponding prices.

As has been argued by, for example, Joan Robinson (1971b, chapters 7 and 8, especially pp. 103–7, and Robinson and Eatwell, 1973, p. 143) and Atkinson and Stiglitz (1969), firms, in deciding on

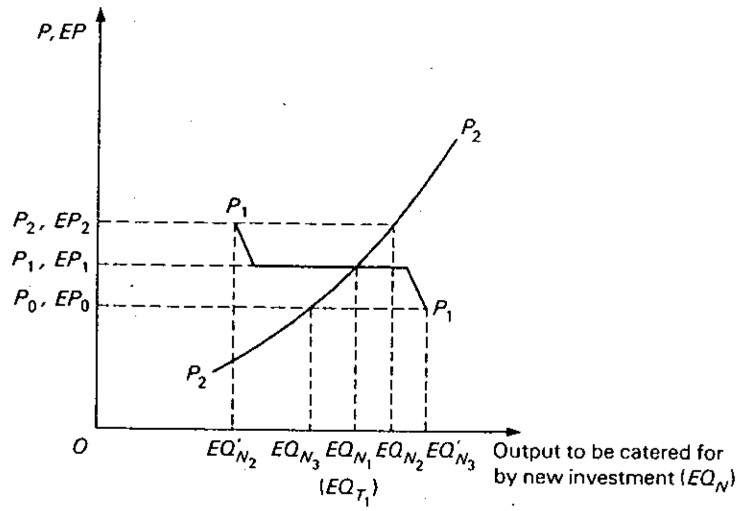

Figure 8.3

the technique of production to be installed in each period, instead of facing a range of superior techniques from which they might choose, may be limited to a single 'best-practice' technique, that is, the *ex ante* production function may be a single point. Joan Robinson and Eatwell write:

> all the controversies that have been going on about the concept of a 'given state of technical knowledge' represented by a book of blueprints belong to the sphere of economic doctrines rather than to the analysis of an actual economy. Obviously, in industry in real life, a great number of alternative blueprints for different techniques do not coexist in time. In real life, techniques are continually being invented, and each is blueprinted only when it seems likely to be used. (Robinson and Eatwell, 1973, p. 143)

The reason why Joan Robinson argues that at any moment of time the *ex ante* production function is restricted to a *point* rather than to a differentiable curve with each point on the curve representing a different production process, or, at least, to a series of points, has as much to do with the nature of the inventive process, as with the nature of the investment decision under conditions of uncertainty. For each point on the Salter iso-quant there will be a different production process, and associated with each process there will be a fund of technical knowledge specific to that technique. In the process of technical progress, as a specific technique is improved, the improvement may have little or no effect on other techniques of producing the same product. This is simply an effect of the nature of the inventive process.

In addition a firm, in considering investment expenditure, will assess as best it can the supplies of labour available to it, as well as taking into account its present stock of plant, its buildings, its physical environment and its fund of technical knowledge. The choice therefore is limited severely.

> The most important influence upon the choice of technique is not the cost of finance or 'factor prices' but the rate of investment relative to the availability of labour . . .. A large firm whose plants provide an appreciable proportion of the jobs in particular regions has to consider, when planning investment, [*inter alia*] how much more labour it will be able to recruit. It will generally find it necessary to carry out expansion, at least partly, by raising investment per man employed. It is not provided with a predigested 'book of blueprints' of techniques; it must find out what the possibilities are and assess them as best it may. (Joan Robinson, 1971b, p. 106)[18]

According to this view, the whole idea of a 'technical frontier' is blurred in a changing world where expectations play an important role and where knowledge and experience do not just appear independently of the firm's actions, but have to be learnt and gathered by the firm itself. Joan Robinson argues that a move from one technique of production to another *around* the *ex ante* production function, even at the level of the firm 'cannot be represented as adding some capital to a pre-existing stock' (Robinson and Eatwell, 1973, p. 143). She argues that the Salter iso-quant neglects time; time, as it were, runs at right angles from the page at every point on the iso-quant (Joan Robinson, 1971b, p. 104; see also Penrose, 1959, pp. 85–7). Each process has its own past and this past will dominate the future possibilities available to the firm. To move *around* an iso-quant entails a switch *between* time profiles, and, so it is argued, in a world in which time only moves in one direction this is impossible without either redoing the whole capital stock, or embarking on a long future. Hence it is argued that there is only the single point *ex ante* production function.

If there is only one 'best-practice' technique at any moment of time, then given its expectations with respect to marginal costs and demand during the current period, the payout ratio, and the proportion of investment to be financed externally, the firm will have a certain set of expectations concerning the flow over the current period of retained profits for investment expenditure purposes. These expectations will define a unique relationship between the output to be catered for by new investment expenditure and the price that is needed to provide the flow of finance with which to fund that portion of investment expenditure which is to be met by retained profits (assuming that the prices of investment goods are known). This relationship is shown as the upward sloping line, P_2P_2, in Figure 8.3.

In Figure 8.3, the P_2P_2 curve is shown as intersecting the P_1P_1 relationship at a price of P_1 and at an output to be catered for by new investment expenditure level of EQ_{N_1} (which implies total capacity of EQ_{T_1}). It is only at this point that the two expectations sets - the expectations of the firm with respect to price and output to be catered for by new investment *and* its expectations concerning the flow of retained profits for investment expenditure purposes, which define the P_1P_1 and P_2P_2 relationships respectively - are consistent one with the other. For example, if the price were to be P_2, the expectations of the firm concerning the relationship between price and output to be catered for by new investment would suggest to it that capacity be expanded to EQ'_{N_2}. However, at that price, P_2, the expectations of the firm would suggest to it that sufficient funds could be obtained to finance new capacity of EQ_{N_2}. Alternatively, if the price were to be P_0, expectations would suggest an expansion of capacity by an amount EQ'_{N_3} whilst funds to finance new investment at that price can only be expected to cater for an expansion of capacity of EQ_{N_3}. Thus only at the intersection point of the P_1P_1, P_2P_2 relationships are the two expectation sets consistent.

At this stage, it should be pointed out that our analysis leads to the same price being set for both the current and next period and that this might lead to inconsistencies when more than two periods are considered. That is, the price chosen must do two jobs. First, it must provide, during the current period, the funds necessary to lay down the capacity required by the beginning of the next period, but second, it must be consistent with demand conditions in the next period which, together with the scrapping rule, determine the amount of capacity which needs to be laid down. Therefore, as soon as investment plans are formulated in the next period on the basis of demand conditions in the period following, the price so set in the next period may be inconsistent with demand conditions and with the marginal capacity of that period.

However, the apparent inconsistency only arises from the assumption of dividing time into regular discrete periods. In the actual world, demand conditions will change irregularly. Similarly, the firm will not regularly be making investment expenditure plans at the 'beginning' of some arbitrary time period based on a set of demand conditions at a fixed point in the future as periodic analysis implies. Rather a price will be set irregularly on the basis of future demand which the firm considers reasonable. The price will be consistent both with the funds requirements for investment purposes from retained profits and with demand conditions for the foreseeable future.

However, as demand and cost conditions change, the firm will come to realize that its existing capacity is inadequate, and that new investment expenditure is required. At this point, the firm will decide if the flow of funds for investment purposes is adequate at the current price. If it is not, the pricing and investment decision process will begin once again. In other words, decisions will be made at irregular intervals as conditions dictate their necessity, that is to say, as the firm comes to realize that its current price and/or capacity is inadequate for the conditions expected in the near future.[19]

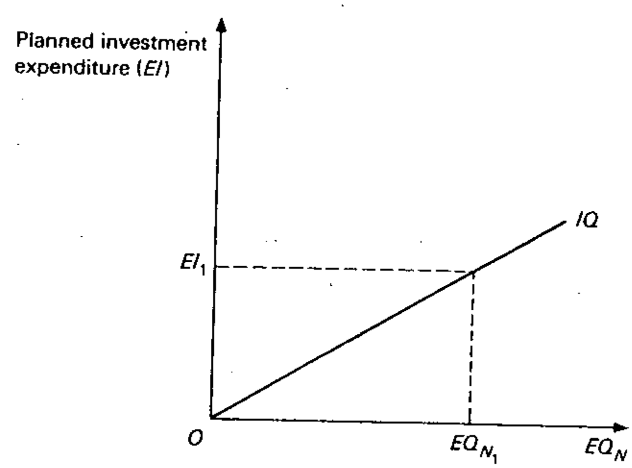

Figure 8.4

The intersection point shows that new capacity of EQ_{N_1}, making possible an output rate of EQ_{T_1} will be installed. With only one 'best-practice' technique there will be a unique level of investment expenditure associated with each expected level of output (which the investment expenditures are to cater for). In Figure 8.4, the relationship between planned investment expenditure and expected rates of output is shown by the IQ curve; with an expected output rate from new capacity of EQ_N, investment expenditure of EI_I needs to be undertaken.

To arrive at the price P_1 (the actual price which is to be determined for the current period) in Figure 8.3, the payout ratio, the prices of investment goods *and* the proportion of investment to be financed from retained profits *all* need to be known. We assume that the prices of investment goods are known and given. We suppose that the firm is either a price-taker in a competitive market for investment goods, or that the firm possesses some monopsonistic power which enables it to bargain over the prices of investment goods. In either case, the firm would know the prices of investment goods at the time that it makes investment decisions. The payout ratio can be taken as given. It is assumed that in a large oligopolistic manufacturing firm, the dividend payout to shareholders is considered by the management of the firm to be simply another claim on its funds. Shareholders in such firms are assumed to be diffuse, lacking in leadership and unable to give more than a passing thought to the affairs of 'their' companies. They have become passive rentiers whose major concern is the current market price of their shares and the size of their dividends. The management of the firm will set the payout ratio of the firm so that they will pay out only sufficient dividends to forestall take-over bids by other management groups plus whatever additional amounts are necessary to minimize the cost of obtaining funds on the capital market. What remains of the firm's net profits will be used to finance planned investment expenditure.[20]

The question now remains of how the firm will determine the split between external financing of planned investment expenditure by going to the capital market, and financing investment internally through retained profits. This is the crucial question upon which the P_2P_2 relationship depends in Figure 8.3, and has been the focus of recent exchanges concerning the determination of the size of the mark-up under oligopoly. Eichner (1973) has argued that by varying the margin above costs and reinvesting all retentions, the firm can *expect* to alter its flow of retained profits over time in two ways. First, cash flows can be expected to be increased by the increased returns to the investment project thereby being financed, and second, cash flows can be expected to be reduced over the long-period time horizon of the firm by the cumulative effects of substitution away from the firm's product expected as a result of the higher mark-up, from the entry of new firms into the industry and from anti-trust intervention by government. The substitution effect does *not* contradict the pricing hypothesis of this article, for a short-period demand curve is *not* being considered. Every decision which is made, is made in a short-period situation, but it has short-period and long-period consequences. 'Decisions are long period decisions if they bind us into long period commitments [as investment obviously does] and therefore require us to have *expectations* about the long period. [This] is a long period in the *historical* future' (Krimpas, 1974, p. 49; our emphasis). It has been argued that in the (Marshallian) short period, there is a range of prices over which the expected level of output is independent of the price. However, once the price is outside the relevant range, and/or once the time horizon of the firm lengthens, the firm may *expect* that one of the consequences of a decision made in the here and now to raise the mark-up will be for some substitution away from its product to occur, and that this will result in a decline in cash flows over time.[21]

These effects determine the firm's demand and supply functions respectively for funds for investment purposes, although Hazledine has argued that an element of the demand curve for internally generated investment funds will be the ability of firms to obtain a rate of return commensurate with that obtained from new investment projects by lending funds on the money market.[22] An implicit interest rate for internally generated funds can be obtained by expressing as a percentage, the ratio of the funds expected to be lost because of the substitution, entry and anti-trust intervention effects, to the additional funds generated in the meantime from the higher mark-up. (Both the numerator and denominator of this ratio will be suitably discounted if the firm uses time discounting procedures.) The implicit interest rate is a function of the size of the margin and of the firm's time horizon. A comparison of this rate with the relevant market rate of interest at which a *comparable* sum of finance could be obtained from the capital market for planned investment expenditure gives the trade-off between internal and external financing, and so determines the size of the mark-up (and so the price) which the firm needs to set in order to generate over time the funds required for its planned investment expenditure.

This price will be both a minimum *and* a maximum, given the firm's investment plans, when the firm's primary goal is to maximize under constraint the growth of its sales. As the firm increases, in conditions of uncertainty, the amount of investment funds that it wishes to obtain (either by external or internal methods), it will be taking greater and greater risks. In an uncertain world the firm will be a risk minimizer (Kalecki, 1937). Such a firm would not be expected to sacrifice expected future sales by increasing its mark-up over and above that level necessary to accommodate its definite planned investment expenditure for the next period. It is these calculations which determine the shape and position of the P_2P_2 curve and so give the unique price-expected quantity configuration in Figure 8.3.[23]

III

If, however, there *is* more than one 'best-practice' technique at any moment of time, that is, when a Salter iso-quant (or at least a small arc of it around 'neighbouring' techniques – see Harcourt, 1972, p. 56) exists, a problem arises, for there will be a number of ways of producing a unit of output (and therefore level of output if it is assumed that the *ex ante* production function exhibits constant returns to scale). Which technique will be chosen will not, as we shall see below, be independent of the price, regardless of the investment decision rule that is used. In this situation, therefore, P_2P_2 in Figure 8.3 is not a unique relationship but merely one of a *family* of possible relationships, each member of which is defined both by the price *and* by the investment decision rule which is used. There are now three possible relationships between two variables, P and EQ_N. For EQ_N determines the extra capacity required which in turn depends on the investment-decision rule *and* on the price. But EQ_N itself also depends upon planned investment expenditure, given the payout ratio and the proportion of that investment expenditure which is to be financed from external funds. What is to be done?

Suppose it is assumed that the expected level of output is independent of the price, at least over a certain range of prices: see *dd* in Figure 8.2. This assumption is consistent with the cost-based 'normal' pricing hypothesis of this article. Now two relationships can be defined. The first is that between investment expenditure and price, given the investment-decision rule which is used, the current price of investment goods and the level of output which is to be catered for by the new capacity. This relationship is given by the *II* curve in Figure 8.5. There is a different *II* curve for each investment-decision rule. An analysis of the *ordering* of the relative investment intensities of investment projects as a result of the use of different investment-decision rules has been done by Harcourt (1969b). He showed that in a given technological framework, that is, with a given 'book of blueprints', and with given expectations by businessmen concerning future movements in prices and money wage rates, the pay-off period criterion (*POPC*) usually results in the choice of a technique which is more investment-intensive (less labour-intensive) than those resulting from discounted cash-flow procedures (*DCF*). The accounting rate of profit criterion could not be

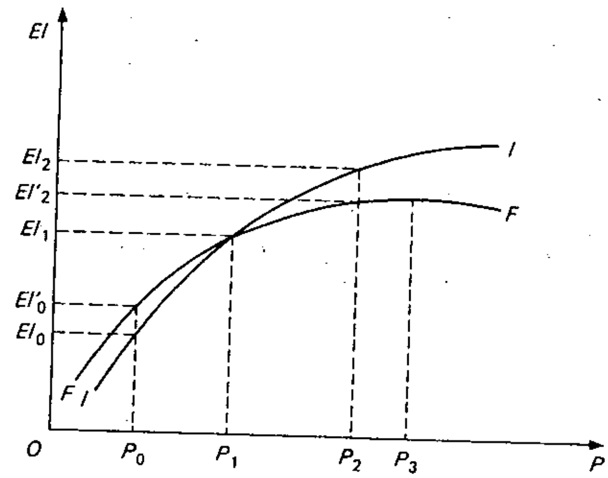

Figure 8.5

graded precisely; it was also shown that among the *DCF* criteria, the present value rule results in a more investment-intensive technique being chosen than when the internal rate of return rule is used.

If we know the level of output to be catered for by new investment, the second relationship that can be defined is that between price and the funds available for investment expenditure, given the expectations of the firm with respect to marginal costs, its sales - prices and quantities - during the current period, the payout ratio and the externally financed proportion of the planned investment expenditure: see *FF* in Figure 8.5. There is a family of *FF* curves, each member of which corresponds to a different level of output to be catered for by new investment.

Although the stability properties of the intersection of the *II* and *FF* curves are not, we argue, relevant for the present analysis, the *shapes* and positions of the curves are of some importance if there is to be a unique price-investment solution for a given level of output to be catered for, such as at P_1, EI_1 in Figure 8.5. The first thing that can be said is that there is no reason why the *II* and *FF* curves should coincide, since the two relationships are completely independent of one another and, as will be seen below, there are positive reasons why the curves will diverge on either side of the intersection point.

It can be shown that when the pay-off period criterion is considered for the choice of techniques, and the price is (conceptually) increased, the investment intensity of the technique chosen increases but at a

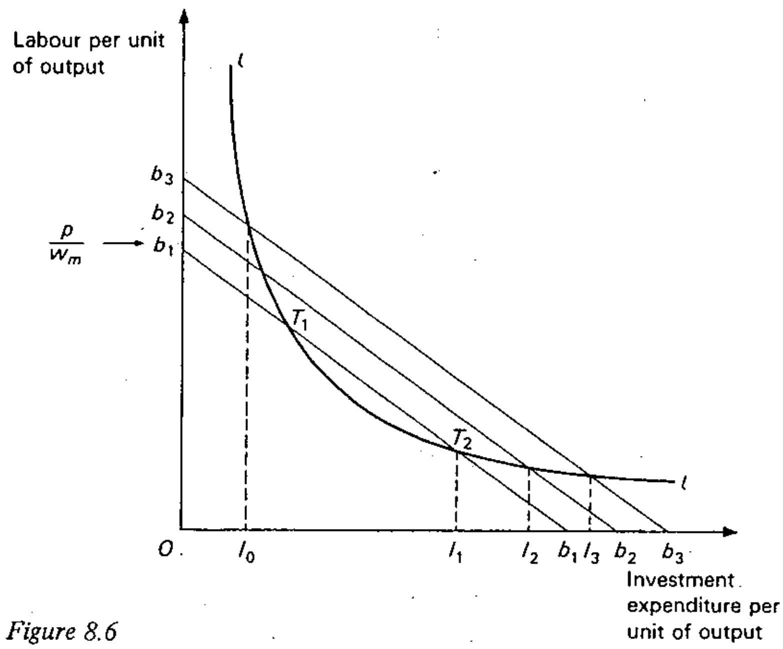

Figure 8.6

decreasing rate. In Figure 8.6, the line, *ll*, is the Salter iso-quant showing the various configurations of labour and investment expenditure which may be used to produce a unit of output. The line $b_1 b_1$ is the *POPC* constraint, for the *POPC* is:

maximize: $b(p - w_m l)$
subject to: $b(p - w_m l) \geq I$
where: b = the pay-off period
p = the product price
w_m = the money wage rate
l = the labour requirements per unit of output
I = the investment expenditure per unit of output.

The *equality* form of the constraint may be written as

$$l = \frac{p}{w_m} - \frac{1}{bw_m} I$$

which is a straight line with the slope of $1/bw_m$ and an intercept of p/w_m on the vertical axis.

The technique chosen by the *POPC* is that associated with the second intersection of $b_1 b_1$ with *ll* (i.e. at T_2) where *ll* cuts $b_1 b_1$ from required for intended investment at that price, EI_0. However, if the price were to be relatively high, for example, P_2, the technique chosen according to the *II* curve will be relatively investment-intensive, for example, EI_2 in Figure 8.5 or I_3 in Figure 8.6. It is plausible to expect that the funds generated for investment at that price, EI'_2 in Figure 8.5, will be *less than* those *actually* required for the planned investment which the firm would want to carry out at that price, EI_2. We saw above that the *II* curve increases at a decreasing rate. It was also shown that the *FF* curve may in fact eventually decline, for the flow of retained profits for planned investment expenditure may decrease absolutely given a sufficiently large increase in margins and/or a sufficiently long time horizon. Therefore, for the most part, a *unique* intersection point between the *II* and *FF* curves can be expected, giving a unique price-planned investment expenditure solution for a given level of output to be catered for.

Bliss has shown that there is an interesting exception to this conclusion *if* the present value rule is used, and *if* the elasticity of substitution of the Salter iso-quant, *ll* in Figure 8.6, is 'large' (Bliss, 1968a). We argued above that with the orders of magnitude likely to be encountered in the real world, when the *PV* choice of technique decision rule is used, a positive relationship between price and investment intensity can be expected. Suppose that the elasticity of substitution of the *ll* curve in Figure 8.6 is 'large' and that businessmen have the plausible expectation that money wage rates will rise *faster* than the price of their product because money wages are expected to reflect increases in prices *and* overall productivity (that is to say, businessmen expect *real* wages in terms of *their* product to rise over time). Then there will be a positive relationship between the expected economic length of life of investment projects and investment intensity. If the possibilities of substitution of investment for labour are very great, and the price is conceptually increased, small (proportionate) increases in investment expenditure will lead to large savings in labour, and so to considerable (proportionate) increases in expected economic lives. It follows that in these circumstances there may not be a unique choice of technique because there may be more than one point where the present value of investment expenditure is at a maximum. Therefore the *II* curve *may* not be a smoothly rising concave-to-the-origin curve such as *II* is in Figure 8.5. Rather it may have bumps in it, which may result in multiple price-investment expenditure solutions, depending on the position of the *FF* curve. Bardhan has shown that Bliss's result holds *only* if the elasticity of substitution of the *ex ante* production function is greater than unity (Bardhan, 1969). This gives precision to our term, 'large'.

In the 'oligopoly-*cum*-price leadership' world that is under discussion in this article, it is more likely that the firm will use a *POPC* rather than a *PV* rule for the choice of technique so as to reduce the effects of uncertainty, and so there would not be the *possibility* of multiple intersection points between the *II* and *FF* curves. If, however, a *PV* rule is used, and the elasticity of substitution of the *ex ante* production function is greater than one, such a possibility must be considered, even if it is unlikely. The possibility would become an empirical question.

The question remains, given the shapes and slopes of the *II* and *FF* curves, of whether there will be a price so determined that falls within the range of prices for which output may be regarded as being independent of price (or whether there will be a positive intersection of the *II* and *FF* curves at all). If the price so determined does *not* fall within the relevant range, then the payout ratio and/or the investment-decision rule will have to give until a price is obtained which will serve both to finance the investment expenditure *and* be consistent with the expected level of output. Or the expected level of output will have to change until a price is found which will do the financing task, given the investment-decision rule, the payout ratio and the externally financed proportion of investment expenditure. That is to say, either *FF* or *II* will have to change in order to give a compatible price. We may conceive of this as an iterative process taking place until all the expectation sets of the firm – the price-expected quantity expectations, the price-flow of funds expectations and the price-investment expenditure expectations – are consistent one with another.

Conclusion

The article set out to examine the relationship between the pricing decisions and investment expenditure plans of an oligopolistic firm. The relationship, if it holds, provides, we argued, a theory of the determination of the size of the mark-up in cost-based theories of pricing in oligopoly. It was assumed that over a range of prices in the short period, prices and quantities are independent, an assumption which was based on the empirical work of Neild, Godley and Nordhaus and others. When all aspects of the investment decision are considered – the *amount* of extra capacity to be laid down each period, the choice of technique and the method and cost of finance – it was established by the use of a simple model that, for the most part, a unique solution could be found for the size of the margin above 'normal' prime costs and the level of planned investment expenditure, given the firm's expectations about the future level of demand. A situation under which multiple solutions may be arrived at was also examined briefly.

Notes

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1 There is another aspect to the investment decision which lies behind the three elements indicated in our argument, namely, the choice of product. The firm, in making an investment decision, will design its plans in order to fit its choice of product. However, for simplicity, we abstract from this aspect of the investment decision.

2 We follow Kregel (1973) in the use of the term 'Post-Keynesian' with which to describe the theories and approaches now associated with Cambridge (England) economists and their followers. For examples of Post-Keynesians who have postulated a link between the pricing and investment decisions, see Asimakopulos (1970, 1975a, 1975b, 1977), Eichner (1973, 1976), Harcourt (1972, pp. 210–14), Harris (1974), Kaldor and Mirrlees (1962), Kaldor (1966, 1970), Kalecki (1971, pp. 110–23), Katzner and Weintraub (1974), Kregel (1973, pp. 135–41), Krimpas (1974, p. 39), Joan Robinson (1971b, chapters 2 and 7) and Wood (1975, chapters 1–3). The postulated link between price and planned investment expenditure is not merely a theoretical or 'as if' construct. In a recent article concerning the British National Board for Prices and Incomes (N.B.P.I.), Pickering notes that one of the criteria used by the N.B.P.I. for approving 'a higher price depends . . . upon the effect which a particular level of profit has on the firm's ability to finance future investment, either to expand productive capacity or merely to replace existing capacity' (Pickering, 1971, p. 232).

3 In a recent article, Harris examined the simple model in Harcourt (1972, pp. 210–14) in which a relationship between price and investment expenditure was postulated. He argued that in Harcourt's model '[no] direct causal relationship between investment and price formulation at the micro level is implied' (Harris, 1974, p. 148, n. 10). The aim of the present article is, in fact, to posit such a direct causal relationship at the level of the firm and so provide some microeconomic foundations for the macro model in *Some Cambridge Controversies* . . .. It will also be seen that the model provides a microeconomic argument with which to support the oft-stated claim that Keynes's world is essentially that of quantity rather than price adjustment in the face of variations in the level of demand.

4 See, for example, Eckstein and Fromm (1968), Godley and Nordhaus (1972), Lanzillotti (1958), Means (1972), Neild (1963), Yordon (1961). This is a

small but representative sample of a very large (and increasing) population of studies supporting cost-based pricing theories.

5 We argue that it is not possible empirically to distinguish between profit maximization over time and the maximization of growth over time in a world in which the growth of firms depends in large part on their ability to generate investment funds on the basis of retained profits. See, for example, the uncertain findings of Hall (1967, p. 154), and Mabry and Siders (1967, p. 377). Mabry and Siders state that their results suggest 'that the sales maximization hypothesis is not inconsistent with the profit maximizing hypothesis in the long-run'. See also, the conclusions of Penrose (1959, pp. 26–30) on profit maximization over time.

6 See Anderson (1964, p. 25). He estimates that over 90 per cent of the investment in manufacturing industry in the U.S. is financed internally from retained profits. See, also, Bosworth (1971).

7 For a survey of the theory of capital utilization, see Winston (1974).

8 'Tranquility is a minimum prerequisite for the adjustment of short period disequilibrium to internal long period equilibria. You can define normal profit, from the upward and the lower end, as that rate of profit which, in the relevant sense dependent on the richness of the model, keeps the *relative* position of the firm intact, with respect to the product market, the financial market, and also the "power" market' (Krimpas, 1974, p. 86).

9 See Asimakopulos (1977, pp. 330, 340–2) for a discussion of the possibility of revamping investment decisions in the light of changed conditions due to the long gestation period of investment plans and the laying down of new capacity. Lags between investment decisions and actual investment expenditure play a prominent role in the work of Kalecki (1971, especially p. 110).

10 We suppose expected scrap value to be a declining function of age, first, because the machines themselves are older, and second, because less and less labour-intensive methods of production may have been installed as time goes by.

11 For simplicity, scrap values may be considered to be zero. However, if scrap values are to be included, they must, on Marshallian grounds, be *added* to marginal costs. The firm will be indifferent as between scrapping a vintage and keeping it in operation if the price is greater than marginal cost by the amount of scrap value. A more sophisticated approach for a firm using discounting procedures (e.g. *DCF* rules for the choice of technique) would be to scrap if the discounted cash flows earned in excess of marginal costs, if the vintage were to be kept in operation, were just less than the discounted cash flow that could be earned by using the funds from scrapping in the next-best alternative profit-earning project.

12 See Godley and Nordhaus (1972), Neild (1963), Norman (1973) and Pesaran (1974). The same pricing hypothesis is made by other writers in this area. See, for example, Eichner (1973, pp. 1184–9), Kalecki (1971, pp. 49–61) and Wood (1975, p. 61).

13 The assumption that it is predominantly output and not price that responds to changes in demand in the manufacturing sector of modern capitalist economies is quite common in Post-Keynesian literature. For example, Pasinetti (1974a, p. 33) writes: 'The basic feature remains, by contrast with more primitive societies, that among the factors concurring to determining prices, fluctuations of demand have become *unimportant*. Therefore, the traditional response mechanism of price changes having become inoperative, another response mechanism is

brought into use. *To changes in demand, producers respond by changing production.*' Our emphasis.

14 See notes 4 and 12.

15 See the exchanges between Nuti (1969), Joan Robinson (1969a) and Kaldor (1970).

16 Under imperfect competition price is greater than marginal cost at the relevant level of output. Therefore equipment cannot be scrapped when price is equal to marginal cost *and* when quasi-rents are zero in conditions of imperfect competition. It should be noted, however, that if quasi-fixed costs (for example, overhead labour costs such as wages for maintenance staff and cleaners) are considered, there will always be a gap between price and *short-period* marginal prime costs when quasi-rents are zero: see Joan Robinson (1969a). In such a situation the marginal plant (the oldest vintage) is scrapped when its average prime cost (equal to the *long-period* marginal cost) is equal to price and quasi-rent is zero. For simplicity, we assume that there are no quasi-fixed costs.

17 In passing, we note that our theoretical framework is consistent with the empirical findings of Bitros and Kelejian (1974) that one of the major determinants of the replacement ratio, the ratio of scrappage to the stock of capital (measured in physical units) 'varies systematically with respect to cyclical variables', and thus invalidates the often stated claim that replacement investment may be treated as a constant proportion of the capital stock: see, for example, Jorgenson (1965, p. 51). Their findings lead them to argue that it is *gross* investment (rather than net investment) and scrappage which are the decision variables governing the potential services of the means of production. This viewpoint is also consistent with our model.

18 The expansion of the firm will be limited also by the amount of 'managerial services' available for expansion: see Penrose (1959, pp. 196-212).

19 Wood (1975, pp. 92-7) also confronts this problem when he extends his argument from a static to a dynamic context. He writes: 'the firm's current activities are always based on target policies which cover a period of several years ahead, but at comparatively short intervals, in the light of informational feedback from its current activities, it reviews and, where necessary, alters its long run targets, at the same time as making adjustments towards them in the face of disequilibrium' (p. 95).

20 See Eichner (1976, chapter 2) and Robinson and Eatwell (1973, p. 233). We do not mean to imply that the decision to be made by the firm about the payout ratio is a simple one. As Wood (1975, pp. 40-52) shows, the decision is indeed complex. However, *once the target payout ratio is established* (and once established it tends to remain *fairly* constant: see Wood, 1975, p. 49, n. *), its *strategic* importance to the firm is minimal.

21 For a discussion of the distinction between the 'long' and 'short period' concepts, see Joan Robinson (1971b, pp. 16-18).

22 Hazledine (1974). For an alternative to this essentially neoclassical view, see Wood (1975, pp. 8-9)

23 In order to extend the analysis from the level of the firm to that of the industry, we assume that the prices for price followers be determined in the following manner: let there be n firms, where n is a small number; also let $P_i = \alpha_i P_j$ $(i = 1 \ldots n - 1)$ where P_j is the price of the price leader. If $\alpha_i = 1$ then all firms match the movements in the price set by the price leader. If $\alpha \neq 1$ (it may

be >1 or <1), then the proportionality of each firm's price to that of the price leader is preserved. α may be $\neq 1$ due to product differentiation, the geographical position of firms and so on.