INVESTMENT BEHAVIOUR OF FIRMS : A CRITICAL EVALUATION OF SOME IMPORTANT CONTRIBUTIONS

By
NICHOLAS ANTONAKIS
University of York, U.K.

1. INTRODUCTION

The economic literature is full of attempts concerning the modelling of investment behaviour by individual firms. Theoretical and empirical contributions have resulted in a large number of conflicting arguments and conclusions. On the other hand, the lack of a survey study, aimed at presenting the current debate on investment decisions of firms in a systematic manner, becomes increasingly perceptible. The purpose of this paper is to provide a selective review of the various investment theories, from a critical point of view. The analysis is concentrated on the firm level and takes account of both theoretical and empirical contributions.

Section 2 deals with the theories of investment behaviour. The starting point is the Rigid Accelerator model, whose naive spirit gave rise to the formulation of the Flexible Accelerator model and its variants.

The Neoclassical Theory of investment behaviour, the most powerful version of the Flexible Accelerator model, is examined in more detail in Section 3. Conditions of uncertainty are introduced in the model, making thus explicit the importance expectations about the future can have, on the undertaking of investment projects by individual firms.

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Section 4 analyses the results of some important empirical studies in this context. In this section we also consider some recent contributions, such as the vintage approach, the «clay-clay» and «putty-clay» models of investment behaviour.

Some concluding remarks at the end of the paper, state the principal reasons for our lack of a generally accepted theory of investment behaviour by individual firms.

2. A CRITICAL APPRAISAL OF THE THEORIES OF INVESTMENT BEHAVIOUR

The act of investment involves the acquisition of goods which are destined not to be consumed or entirely used up in the current period. It is therefore a means by which individuals or groups can attempt to influence their own well-being by the sacrifice of current consumption. Investment by individuals may take the form of the direct purchase of capital assets which are either intangible, such as education, or tangible, such as houses. Investment by individual firms may take many forms such as training for their employees, knowledge by Research and Development and investment in fixed capital stock. This last form of investment is the most crucial for both the individual firm and the short and long-term economic future of the country in which the firm operates.

If a firm is to undertake an investment project, it must attempt to predict the pattern of those future events which are relevant to the success or failure of the project. It is this aspect of the decision to acquire fixed caqital — the fact that it is so crucially influenced by expectations about events a long way in the future- which distinguishes it from most other purchasing decisions. Therefore the role of uncertainty about the future and the consequent formation of expectations is crucial for the investment decisions of the individual firm.

In what follows, we analyse the various theories of investment behaviour developed in the literature, with a more detailed consideration of the Neoclassical Theory of investment and its derivatives coming as a result of the relaxation of some conventional assumptions.

2.1. The Rigid Accelerator Theory

The simplest theory of investment demand is the Rigid Accelerator Theory, formally elaborated by Clark (1917). Investment is simply proportional to changes in output, i.e.

$$I_t = a(Q_t - Q_{t-1})$$

where a is a constant of proportionality and Q is the level of output. This form of investment behaviour does not come necessarily from a profit maximisation objective. It could be argued that this model considers only demand (or changes in demand) as determinant of investment behaviour, although output is not a very good proxy of demand because it is restricted by capacity. Rigid (or Naive) Accelerator theory assumes that firms are always in equilibrium, i.e. these is no excess capacity. To argue that investment is proportional to changes in output requires the assumption that capital is optimally adjusted in each period. This is really a comparative static analysis of an essentially dynamic phenomenon, namely investment. This approach has been characterised as a caricature of the arguments of the acceleration theorists (Junankar, 1972), and it has been rejected in tests by Kujnets (1935), Tinbergen (1938), Chenery (1952), Koyck (1954) and Hickman (1957).

2.2. The Flexible Accelerator Theory

A more elaborate approach is given by the Flexible Accelerator Theory, originated by Chenery (1952) and Koyck (1954). It overcomes one of the major shortcomings of the naive accelerator, namely that capital stock is always optimally adjusted. Capital is adjusted towards its desired level by a certain proportion of the discrepancy between desired and actual capital in each period, i.e.

$$K_t - K_{t-1} = (1 - a)(K_t^* - K_{t-1}) \quad 0 < a < 1$$

where K_t = actual capital in period t and K_t = desired capital in period t. This-flexible accelerator mechanism can be transformed into a complete theory of inve stment behaviour by adding a model of replacement investment and a specification of the desired level of capital. A simple model widely adopted for empirical work is that replacement investment is proportional to actual capital stock.

This version of replacement investment has been supported on grounds of empirical validity (Meyer and Kuh, 1957 ; Jorgenson, 1963 ; Jorgenson and Stephenson, 1967 b). Under this assumption the accounting definition for change in capital may be written as

$$K_t - K_{t-1} = I_t - \delta K_{t-1}$$

where δ is the rate of replacement, a fixed constant. Combining the accounting identity given above with the flexible accelerator mechanism we ger

$$I_t - \delta K_{t-1} = (1 - a)(K_t^* - K_{t-1})$$

and therefore a model of investment expenditure

$$I_t = (1 - a)(K_t^* - K_{t-1}) + \delta K_{t-1}$$

To complete the theory of investment behaviour, it is necessary to add to the flexible accelerator mechanism and the model of replacement investment, a specification of the desired level of capital stock. Chenery (1952) and Koyck (1954) assume that the level of desired capital is proportional to output. This is known as the Capacity Utilisation or Accelerator Theory of investment. An alternative specification is that desired capital is proportional to profit, because profit may be a measure of profit expectations (Tinbergen, 1938), and the rate of investment may be constrained by the supply of funds (Meyer and Kuh, 1957; Anderson, 1964; Meyer and Glauber, 1964). This is the so-called Liquidity Theory of investment. Kuh's extensive study of thirty different equation forms for the capacity utilisation and profit theories concludes that «the acceleration sales model is superior to the internal fund flow, profit model» (Kuh, 1963).

Grunfeld (1960) incorporates profits into a flexible accelerator model and finds that the partial correlation of profits and investment, given capital stock, is insignificant. He concludes «our results do not confirm the hypothesis that profits are a good measure of those expected profits that will tend to induce investment expenditures» (Grunfeld, 1960). He suggests that discounted future earnings less the costs of future additions to capital provides a better measure of expected profits than current realised profits, so that desired capital is proportional **to** the market value of the firm. This is known as the Expected **Profits** Theory of investment behaviour.

In general, we could argue that the Flexible Accelerator models, considered thus far, do not take explicit account of factor prices and therefore they are not amenable to a discussion of the effect of investment incentives. This is a serious shortcoming which is overcome in the Neoclassical Theory.

2.3. The Neoclassical Theory of Investment Behaviour

The Neoclassical Theory of investment behaviour was considered as a serious alternative to the Rigid Accelerator Theory as an explanation of investment. Its origins are found in the works of Roos and Von Sjeliski (1943) and Roos (1958). The theory is based on an optimal path for capital accumulation, according to which the desired level of capital services at every period is derived from a maximisation of the present value of future expected net revenue, over an infinite number of years. The desired level of capital services thus derived is a function of relative prices and not output. The cost of capital incorporates **the** rate of interest. Tinbergen (1939) tested empirically the Neoclassical Theory of investment behaviour and found a significant effect for interest rates in only one of five sets of data he examined. Negative results were also reported by Klein (1950, 1951). However, in these early studies, neoclassical theory was used mainly to provide a list of variables to be entered in a linear regression, with investment expenditure as the dependent variable. Little or no attention was paid to the manner in which the cost of capital and the price of investment goods enter the demand for capital services. The role of the taxation of the business income was ignored. Most of these shortcomings were overcome in the restatement of the Neoclassical Theory by Jorgenson and his associates.

2.4. Restatement of Neoclassical Theory

A re-evaluation of the Neoclassical Theory of optimal capital accumulation as an explanation of investment behaviour was undertaken by Jorgenson and Stephenson (1967). In developing their own theory they assume (as it is assumed by the Neoclassical Theory in a dynamic context) that the criterion for optimal accumulation is to maximise the present value of the firm. The differences with the conventional Neoclassical Theory is the definition of the cost of capital and the definition of the present value. The cost of capital incorporates a rate of interest component, a depreciation component and a capital gain or loss component. The present value of the firm is defined as the integral of discounted revenue less discounted outlays less discounted direct taxes. The productive process may be characterised by a production function relating flows of output to Mows of labour and capital services and the firm supplies capital services to itself through the acquisition of investment goods. Present value of the firm is maximised subject to two constraints. First, the production function F(Q, L, K) = 0 (where Q = level of output, L = labour and K = capital), which is assumed to be twice differentiable with positive marginal productivities of both inputs. Secondly, net investment is equal to total (gross) investment less replacement investment. Where replacement is proportional to capital stock, this constraint takes the, form

$$K_t - K_{t-1} = I_t - \delta K_{t-1}$$

From this maximisation problem they obtain the desired capital and labour services as functions of relative prices w/p and c/p, where w —wage per unit of labour, c = cost per unit of capital and ρ = price per unit of output. The de sired level of capital services is also a function of the output level. The dependence on output level is usually overlooked in most references of this theory, but this is stated clearly in the article (Jorgenson and Stephenson, 1967a). Substituting **the** expression for desired capital into the function

$$I_t = m(s)(K^*_t - K^*_{t-1}) + \delta K_t$$

(K^*_t = desired level of capital in period t, m(s) = a power series in the lag operator), which is an alternative form of the flexible accelerator model, they derive gross investment in every period as a function of relative prices and output.

Jorgenson and Stephenson (1967 b) tested their theory by applying it to quarterly data for investment expenditures for all of manufacturing and for total durable and total nondurable manufacturing. They have also applied it to quarterly data for fifteen sub-industries of manufacturing and therefore they have subjected it to a far more stringent test. The overall conclusion is that a theory of investment behaviour based on the Neoclassical Theory of optimal accumulation of capital provides a highly satisfactory explanation of actual investment expenditure for the sample period. The relationship between investment and its underlying determinants is of critical importance in the appraisal of policies for economic stabilisation. The results of Jorgenson and Stephenson suggest that policy instruments that play a role in the determination of investment expenditures include the tax structure and instruments that affect the cost of capital. The role of the tax structure is very direct. The effects of changes in the tax rate, tax treatment of depreciation and allowances for investment expenditures can be assessed directly from the empirical results. However, the cost of capital employed in the study is not directly related to the instruments of monetary policy and before the efficacy of monetary policy in the determination of investment expenditures can be assessed, the relationship between monetary instruments and the cost of capital must be investigated.

In assessing the effects of tax changes on investment expenditures, the time structure of the relationship is of critical importance. The average time elapsed between changes in tax policy and changes in investment expenditures must be measured and the form of the lag must be characterised. If the effects of changes in tax policy are concentrated in a short period of time, the use of policies to stimulate investment expenditures as a means of economic stabilisation requires very precise control of the time of policy measures. If the effects are distributed over long periods of time, much less precision in the control of the time of policy measures will suffice.

Jorgenson and Siebert (1968) compared the theory of investment behaviour based on the Neoclassical Theory of the firm with alternative ones based on considerations of liquidity, expected profits and capacity utilisation. For any of the conventional measures of the goodness of fit, the performance of the neoclassical theory was superior to that of the alternatives. Their results showed that inflation had a substantial impact on investment and that during investment boom periods speculative motives for investment, arising from high rates of capital gain on assets, played an important role in explaining levels of investment both during the investment peak and into the subsequent period of decline in investment expenditures.

The above results can be used in supporting the Neoclassical notion of the *profit maximising* firm because, although tests have been proposed that would discriminate between the classical theory of the firm and alternatives to it (Williamson (1964) for example), empirical confirmation of alternatives to the Classical Theory is lacking, at least so far. However, the Jorgenson-Stephenson version of the Classical Theory of the firm must be carefully distinguished from the atemporal theory of elementary text-books. To maximise the welfare of the shareholders of the firm, businessmen should maximise the market value of the firm at every point in time. We must stress, however, that the Jorgenson-Stephenson model is developed under conditions of *certainty*. The problem to be solved in further development of the theory of the firm is not to provide an alternative to the Neoclassical Theory, but to provide a specialisation of this theory that will preserve the basic results concerning optimal production and capital accumulation while providing much more specific implications with regard to the organisation and control of the corporation (Jorgenson and Stephenson, 1967).

3. THE NEOCLASSICAL THEORY OF INVESTMENT RECONSIDERED

In view of the empirical support given to the Neoclassical Theory of investment behaviour, we analyse its basic concepts as well as some extensions of it, resulting from the relaxation of some basic assumptions.

To start the analysis and develop a simple model we make two crucial assumptions : First there exists a perfect capital market. The existence of a perfect capital market enables any individual, by using appropriate borrowing and lending policies, to convert one income stream into any other with the same present value. The simplicity of the perfect capital market world breaks down completely if individuals are uncertain about, or have different expectations concerning the future values of the interest rate. Therefore the second assumption is that the world is one of *perfect certainty* concerning the future.

In a world of certainty and with a perfect capital market, maximisation of the present value of the income stream produced by a firm over an infinite number of years is the objective consistent with individuals maximising the utility of consumption. Furthermore, if we assume exponential decay (an assumption supported by Jorgenson's empirical results), homogeneity of capital over time and no adjustment costs then the age structure of capital stock is of no significance and the ability to adjust capital stock costlessly and instantaneously ensures that the correct amount of capital can be employed to each instant of time, independently of the capital purchased and employed during the previous instant. In this model we further assume twice differentiable production function and strictly diminishing returns to scale everywhere. In that case, demands of capital and labour service are simply functions of current prices, and the intertemporal maximisation problems is revealed to be essentially static. There is no question of expectations about the future influencing the present, since the capital stock can be freely adjusted when the future arrives. According to this simple model, the rate of investment of the present value maximising firm may be derived from its demand for capital services. This model implies that a fall in the rate of interest will be followed by an increase in gross capital purchases. However, it does not provide an investment demand function with a well defined partial derivative. The assumption of costless and instantaneous adjustment of capital, leads to the questionable result that an instantaneous increase in the price of capita! will be followed by purchases of capital goods tending towards infinity, because the firm has the prospect of capital gains to be made.

The above mentioned weakness of the model leads us to relax the perfect competition assumption in the output market (and assume that the firm faces a known downward sloping demand curve for its product) and the strictly diminishing returns to scale everywhere assumption (and assume the existence of constant returns to scale everywhere). In this new formulation of the problem, first-order conditions for maximisation state that the marginal revenue product of each factor is equal to its marginal cost and the relationship between optimal capital stock, investment and cost parameters is much the same as in the perfectly competitive case.

Thus far we have relied on the assumption of costless and instantaneous changes in the firm's capital stock, which is not realistic given the nature of capital goods. A further consequence was that the firm could ignore the future in making optimal investment decisions and that it would buy and sell large amounts of fixed capital solely for the purpose of making capital gains. Therefore, at this point, we will relax the assumption of costless capital stock adjustment and we will assume that adjustment costs are a function of gross investment, are increasing with the absolute size of the rate of investment or disinvestment and furthermore rise at an ever-increasing rate, that is we assume that the adjustment cost function is strictly convex. In that case from the productivity of capital condition we observe that since the time path of capital stock depends upon, among other things, the current rate of investment, this condition does not give a decision rule for determining the current level of investment. However, the capital productivity condition does reduce to such a decision rule in the situation in which there are constant returns to scale in production. In such a situation, the capital productivity condition determines the level of investment solely in terms of current and future prices. When adjustment costs are strictly convex, investment will be characterised by a smooth pattern.

Consider now a firm in equilibrium facing factor prices which are expected to remain fixed. Suppose that the demand for its product increases both sharply and unexpectedly. Because of the costs involved in making capital stock adjustments, it will not immediately purchase a block of capital to give it the necessary capacity to satisfy the new level of demand but will only gradually increase its stock of fixed capital towards this higher level. The gap between capacity and the higher level of demand is then closed by simultaneously raising the output price and hiring more labour. Then, as time goes on, the output price reverts its long-run equilibrium level as the firm's capacity catches up. In the case where the firm has some expectation that demand will increase at some point in the future, the existence of adjustment costs will provide an incentive for the firm to anticipate this demand increase by raising its current rate of investment.

The strictly convexity of the cost of adjustment function is plausible in the case in which the firm's demand for a type of capital is a significant proportion of the total demand and thus, as the firm's rate of investment and hence demand for new capital goods increases, the price it has to pay rises above the basic price (an explanation given by Keynes). It is difficult, however, to argue that such monopsonistic elements always exist at the firm level and consequently other possible reasons for the existence of adjustment costs should be considered. There may be costs associated with the installation of new capital goods but there seems to be no very good reason why such costs should be increasing at the margin. In fact it seems very more plausible that large indivisibilities give rise to diminishing costs over a considerable range. There may also be fixed costs associated with the installation of new capital equipment. Therefore it would be reasonable to assume an adjustment cost function for positive investment which has a fixed cost element and is strictly concave up to a certain level after which it is linear or strictly convex. Up until, now, we have made the assumption that the owners of the firm face certainty or certain expectations about the future. We must drop this assumption now, and try to discover how the firm's uncertaintly about future events will affect its current investment decisions. This element of the analysis provides explicitly the role of capital durable goods : Capital goods provide the linkage between the present and the future because their economic life lasts, normally, for a number of years and therefore the individual firm has to try to anticipate future events which will affect the success or failure of the project. Uncertaintly about the future and the consequent formation of expectations are the vital elements that must govern any reliable theory of investment behaviour.

The problem in an uncertain world is the definition of the objective function. Corresponding to any investment plan, the firm receives a sequence of net income returns which are not known with certainty and are consequently random variables. The problem of defining the firm's objective function is essentially the problem of determining how it chooses the best from a large number of different random income streams. In the case of uncertain income streams, it is no longer possible to use the present value concept as a criterion to current investment decisions, because different individuals could prefer different investment plans, because they have different consumption preferences. There are basically two possibilities available. The first is simply to assign arbitrarily some plausible objective to the firm, making use of the concept of risk aversion. In that case we could assume that firms maximise the expected value of some utility function of profits where the utility function is increasing in profits but at a decreasing rate, that is, it is strictly concave. The second possibility is to make some probably implausible assumptions and use them to derive an objective for the firm from the underlying expected utility maximising behaviour of the firm's owners. Thus, if we assume the existence of a very large number of firms whose profits are more or less uncorrected in any period, then the individual firm should choose an investment policy which maximises the mean return of its shares and since each firm has fixed number of shares, that is equivalent to maximising the mean profit. Therefore firms should maximise expected profits of, in a dynamic context, expected present value.

Consider now the effects of increasing demand uncertainty on firm's capacity. For the risk-neutral imperfectly competitive firm it is not possible to say, a priori, what these effects will be. However, we can say that with constant elasticity of linear or quadratic demand curves, the optimal capacity is inversely related to the level of uncertainty. When demand levels are uncertain, risk-averse behaviour is bound to lower capacity levels and the optimal capacity level is a declining function of the degree of risk aversion.

Then we ask about the effects of wage uncertainty on the desired level of capital stock. When the wage falls, the output effect dominates the substitution effect and if capital were a variable factor, its use would rise. Since it is fixed, its marginal revenue product rises at an ever increasing rate. This convexity gives rise to an increasing level of capital stock when wage uncertainty increases. Conversely, if there is a high degree of substitutability, then as the wage level falls the large substitution effect lowers the marginal revenue product of capital at an ever-increasing rate. Since it is moving downwards, this makes the function concave thereby giving rise to a decreasing level of capital stock as uncertainty increases.

We could say, therefore, that the firm confronted with the problem of determining its optimal capital stock under conditions of uncertainty about the future values of the relevant variables is presented with a trade-off. A rather large capital stock would provide the firm with flexibility in production and enable it to reap large profits in a world which turns out favourably. On the other hand this same capital stock could well lead to losses if the economic clinate turns out to be bad. The flexibility provided by a large capital stock is less necessary to the firm which is able to increase output easily by intensifying the use of its capital stock by employing more labour. In this case the dangers inherent in ordering a larger capital stock will tend to be the dominant factor, and uncertainty will lead to lower investment orders.

4. EMPIRICAL EVIDENCE ON INVESTMENT BEHAVIOUR

In Section 2 we considered some empirical results rejecting the various theories of investment behaviour except that of the Neoclassical notion of the Profit maximising firm. In this section we will have a more carefull look at the results of some important empirical works, analysing simultaneously the most recent contributions on investment theory.

As was pointed out in Section 2, the literature on the econometrics of investment behaviour has been centred on two approaches. First, there are the models employing the accelerator and capital stock adjustment principles, and secondly the re is the work presented by Jorgenson and his associates, in which investment oimis determined by the optimal path of the capital stock, which in turn is derived from a Cobb-Douglas production function and the usual neoclassical competitive assumptions. Models based on the flexible accelerator do not take explicit account of factor prices and thus are not amenable to a discussion of the effect of investment incentives. On the other hand, Joigenson's model can be criticised on the grounds that there is no independent test on the influence of factor prices, since the cost of capital is subsumed with in the accelerator term. Coen (1969) obtained very different results using a CES production function and Thurow

(1969) using a modified form of Jorgenson's function to allow for disequilibrium behaviour, found that the results implied implausible values for the parameters of the production function. A more generalised neoclassical model has been developed by Feldstein and Flemming (1971) who relax the assumption that the technology is Cobb-Douglas and test the influence of output changes and the cost of capital separately.

In much the same spirit, King (1972) analyses investment behaviour in the context of a vintage production model. A vintage model has been proposed by Bischoff (1969) but he assumes constant returns to scale and that a constant proportion of existing capacity is scrapped each year. This means that the age of the oldest plant in use does not appear as a variable in his model.

The problem that has arisen in employing the vintage approach in empirical studies has been difficulty of using it for econometric estimation. Sometimes, a form has been used which allows the data to determine whether the degree of substitutability between factors is more restricted ex post than ex ante, and if it is, whether there is any possibility of substitution at all ex post. This estimation method, however, requires knowledge of the output from each vintage of equipment, which is information that is not generally available, and it also uses certain special features of the electricity supply industry to which it is applied. Without such detailed, information, models of the vintage type cannot generally be estimated unless further . assumptions are imposed. One such assumption is that factor proportions are fixed ex ante as well as ex post, the so called «clay-clay» version of the vintage model. The other is the «putty-clay» version with firms free to choose factor proportions ex ante but not to vary them ex post. The effect of such restrictions is to slow down the response of the aggregate capital-output ratio to relative price changes, since the capital-labour ratio on all existing capital stock is fixed. On the other hand, it would not affect the response rate to changes in demand. For the derivation of an investment demand equation of this type, we assume that the ex ante choices open to the firm may be described by a constant returns to scale production function. The maximisation problem yields an equation of the form

$$I_t = V_t(Q_t - (1 - \delta) Q_{t-1})$$

This equation is typical of putty-clay technology. The optimal investment at time is equal to the product of the optimal capital-output ratio to be chosen at t(Vt) and the total additions to output required in period t. The cost of capital does not appear. If we assume a constant wage, then the optimal capital-output ratio depends on the normal cost of capital without the capital gains term. As we can see from the above considerations, the putty-clay technology assumption, which has been extensively used in empirical analysis, yields totally different results compared with those obtained by Jorgenson, where the relative price change and in particular the speculative motive for capital gains is the principal determinant of investment.

Most studies adopting the putty-clay approach have needed to impose **the** condition that the optimal service life of capital equipment remains constantt through time. Malcomson (1979) presented an estimation method for the putty-clay model that allows both ex ante choice of technique and a variable life of capital equipment. The ex ante production function here is the Cobb-Douglas. This version of the model incorporates full intertemporal optimisation of investment and replacement decisions rather than relying on «rules of thumb» for these decisions. Following Malcomson's own words, «while rules of thumb may well be applied by firms in practice, the usual justification is that these rules are adopted because they provide reasonable approximations to optimal policies under conditions in which carrying out a full optimisation process is costly. In that case, unless one knows the actual rules of thumb used, it seems better to assume that firm's rules approximate optimal choices rather than to impose some particular rules arbitrarily» (Malcomson, 1979).

Turning now to some actual estimates of the elasticity of desired capital stock with respect to demand proxies, we have a sample of the following results :

Study	Data	Elasticity
Bischoff (1969)	US manufacturing equipment	**1.033**
Eisner (1970)	US manufacturing equipment	0.988
Coen (1971)	US manufacturing structures & equipment	0.90-0.99

In fact, under constant returns to scale, one would expect the elasticity to be insignificantly different from unity.

Consider now some of the empirical evidence concerning estimates of the elasticity of desired capital stock with respect to relative prices. The following table shows some estimates of this elasticity (Elasticity of DCS/RP).

Study	Data	Elasticity of DCS/RP
Bischoff (1969)	US manufacturing equipment	0.828
Eisner (1970)	US manufacturing equipment	0.876
Rowley (1970)	UK fixed capital	0.85
Coen (1971)	US manufacturing structure & equipment	0.55-0.57
Feldstein-Flemming (1971)	UK fixed capital	0.38-0.49
Boatwright-Eaton (1972)	UK manufacturing plant and equipment	0.47-0.65

All these results have emerged from models which allow both ex ante and ex post substitution. However Bischoff (1971 a, b) provides some evidence that ruling out ex post substitution provides a preferable investment demand specification. The conclusion is very much in favour of the putty-clay model. In the putty-clay models described by Bischoff, he estimates a long-run elasticity of capital equipment expenditure with respect to relative prices which is close to unity.

5. CONCLUSION

The analysis of Investment behaviour outlined above was general and inevitably so will be the conclusion. There is much in the debate in the literature as to the determinants of investment by individual firms. The lack of a generally accepted theory of investment is due to two principal factors.

First, is the methodology followed by researchers on their effort to find reliable relationships among economic variables. Almost always, there is initially a suspicion that a variable or a set of variables can get us to the truth. Next comes the empirical investigation with the particular idea being applied to a set of data. Once econometric techniques have approved the reliability of the idea, a new theory is established. Economic theory is full of such examples, the most «famous» one probably being the Phillips relationship between the rate of change in money wages and the level of unemployment, with Lipsey (1960) coming to fill the theoretical gap created by the establishment of this purely statistical relationship by Phillips (1958). Lipsey also provided the solution in the case of the expectations-augmented Phillips curve.

Perhaps, this way of approaching the truth in Economics is not promising. Economics is logic, and only thinking within the boundaries of logic can get us to the truth. In the case of investment behaviour of individual firms, it is reasonable to assert that both current and expected levels of demand and relative factor prices are likely to affect and determine the current level of investment. It is reasonable to assert that taxation imposed on business income must be taken into account and therefore the present value of the income stream of the firm must be modified in the way Jorgenson and Stephenson proposed. In addition it is reasonable to argue that firms are profit maximisers (in the static or dynamic sense). The author is aware of the considerable literature developed for the discussion of this assumption. However, at least so far, there is no empirical evidence justifying the adoption of any other alternative behavioural assumption. In contrast, in spite of most economists' viewpoint that there does not exist evidence in favour of profit maximisation, there does exist (Goldston, 1969). The crucial concluding remark here, is that empirical evidence *should* approve or disapprove, but *not generate* a theory.

A reliable theory of investment behaviour by individual firms should include all the determinants mentioned above. It is not accidental the fact that Jorgenson's model has been proved superior to the others, in empirical work. It is derived from a well established theory and it is quite general. The fact that one or more coefficients of the model may well be found insignificant in empirical applications, cannot reject the theory. After all, investment decisions are determined, in a part, «by those unexplained waves of optimism and pessimism called animal spirit» (Keynes, 1936). And this is the second reason for our lack of a generally accepted investment theory.

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