

ANIMAL SPIRITS OR COLD CALCULATION?

AN INTRODUCTION TO INVESTMENT APPRAISAL

By M.H. Cadman (The Statistician) March 1973

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The story about the company that put on a TV advertisement featuring a golden retriever, that had little, if any, effect on the sales of its household consumer products but brought in a dozen or more orders for golden retrievers, serves to make the points that in investment it is the unexpected that is to be expected and that profit, in its most fundamental economic sense of the variance between expectation and actual, is always a surprise, pleasant if positive, not so pleasant if negative. Profit, in the normal accounting/legal usage, is the amount of gain made by a business between two specific dates by a process in which the capital element, the investment proper, is not consumed but is maintained. This amount of gain, in the words of Lord Justice Fletcher Moulton, "can only be ascertained by a comparison of the assets of the business at the two dates". (1)

The Nature of the Investment Decision

The starting point of investment appraisal is generally the assumption that the purpose of capital investment is to end up with more money than one started with, and that the process of appraisal is one of deriving a forecast of cash flows. Ideally one looks at the inter-action between all cash flows in the total system, but in practice it is usual to draw a line somewhere to define a project as a limited system of cause, i.e. investment, and related effect, i.e. cash flows. One does not start by forecasting cash flows but by forecasting physical futures - bricks and concrete, plant and machinery with some specifiable capacity to produce motor cars, litres of paint or plastic sacks, total markets and market shares from which are derived sales forecasts, and so on. Forecasting, as it has been said, is always hazardous particularly when it is concerned with the future. In approaching investment appraisal as a matter of cold calculation, this forecasting is, or should be, where 90% (or thereabouts) of the effort goes - not so much in progressively refining the forecasts, if by refining one means convincing oneself that particular forecasts will come right, but in defining the uncertainties.

It is remarkable how scant attention is often paid to sales forecasting, in particular where, often, highly optimistic animal spirits prevent any attempt at cold calculation. Cold calculation can have a very invigorating effect; as one sales manager remarked in a company that brought in a formal process of risk analysis of major capital investments, it was not until the introduction of this discipline that his sales staff began to understand the meaning of sales forecasting. Ultimately the forecasts are expressed as a pair of time series of cash outflows and inflows - or as a single series of net cash flows.

The next step in the traditional approach is to calculate whether a particular time series of net cash flows represents an attractive project or not i.e. meets some chosen criterion of a profit

function. If the cash flows were both certain and complete the calculation of this would be easy. But the cash flow estimates are never certain and seldom if ever complete. Resolving the problems of uncertainty is central in all investment decisions, and this aspect will be returned to later. As regards completeness, there are two principal factors in respect of which the cash flow estimates are likely to be incomplete - the cost of capital and currency debasement.

In so far as a decision to invest depends on an assessment of the profits of a project after all costs have been allowed for, the conventional method is to relate the profit (after depreciation) in any year to the capital assets employed, this ratio being the conventional Return on Investment (RoI.) As long as this ratio is respectable, in comparison with other businesses or with what the particular business has achieved before, the project - or business - would be judged to have been profitable. As a measure of achieved profitability RoI is highly suspect, and as an estimate of future profitability it is scarcely serviceable at all. Over the whole life of a project - and without an estimate of the life it is not possible to set up a depreciation schedule - the ratio varies from year to year because both the denominator, the capital base, should normally vary according to the amount of working capital employed, and the numerator, the trading income minus depreciation, goes up and down with changes in sales income and revenue expenditure. Hence RoI provides no single figure of profitability of a project over its whole life. But for all their shortcomings, the numerator and denominator correspond with figures in the profit-and-loss account and in the balance sheet and RoI is, in concept, a useful, possibly the only way, of demonstrating how efficiently the capital property of a business has been employed in any accounting period.

Irving Fisher's rate of return over cost (2) and Lord Keynes's marginal efficiency of capital (3) of the 1930's anticipated the now fairly widespread use of discounted cash flow (DCF) methods of investment appraisal. Since a project starts with no assets, any assets necessary for the project can be acquired only by incurring a liability. All other financial obligations including tax having been met in each year's account, there remains the obligation of servicing the outstanding liability by way of interest. The rate of interest at which the project just breaks even - all interest paid and the liability liquidated - is called the DCF rate of return and is a constant annual rate of return on a varying liability. DCF is like an overdraft from a bank. It probably corresponds with nothing in the real world of a multi-project business and to that extent is unrealistic, and yet it is a reliable and serviceable indicator of profitability for most projects either in the form of the DCF rate of return or, better still, in the form of the net present worth at the cost of capital. The cost of capital is a forecast of the future obligations in respect of a company's present and future financial liabilities.

The other factor in respect of which the cash flow estimates are likely to be less than complete is currency debasement, a more precise term to describe that shrinking of the money scale, by which we attempt to measure the values of goods and services, than the popular "inflation". The amount of gain made by a business should mean true gain, not pseudo-gain boosted by a shrinking money scale. True gain is measured not by money, but by the value of money. We cannot dismiss this as a matter of accountancy; it is a matter of statistics in the first place to establish what change has taken place in the value of money since the last count. In investment appraisal it is then just something else to be taken note of in forecasting future prices

- including the price demanded for money which is reflected in the cost of capital to a business.

The investment decision involves a sifting process. The coarse sieve is to reject investments that fall outside the policy of the business, and does not generally involve any detailed financial appraisal. Almost always there is more than one way of implementing a project that is compatible with a policy, and the second sieve is to eliminate all those alternatives that are not, apparently, financially viable. The final sifting process is concerned with finding the best of the viable alternatives. It is now time to consider the nature of this sieve.

The Objective Function in Investment Decisions

In the preceding section it was stated that "resolving the problems of uncertainty is central in all investment decisions". "Man's economic behaviour", wrote Alfred Marshall, "is based upon a delicate balance between the search for satisfaction and the avoidance of sacrifice" (4) - or, as Shakespeare expressed it in Henry IV, Part 2, Act 1, Scene 3,

"..... in an early Spring
We see th'appearing buds; which to prove fruit
Hope gives not so much warrant as despair
That frosts will bite them!"

If these sentiments are realistic, what meaning can be attached to the words "profit maximisation" as the objective of an investment policy? If one accepted as a definition of profit not the amount of gain made by a business but the variance between plan and out-turn it might be possible to attach some meaning to profit minimization as an objective.

The duty of a business, if it is to survive as a business, is to meet its obligations to its creditors and to provide a standard of service to its shareholders by way of dividends and increasing share price, that will bear comparison with what competitive investment opportunities can offer; in short, to meet its cost of capital now and in the future. This "and in the future" is important; not only is a business likely to need to increase its dividends to be competitive, but also to add to its assets by investing more than its depreciation provisions. To be competitive it will need to sustain growth of assets, income and earnings.

The objective, then, is to achieve a series of earnings year by year that will put a business up with the leaders - or out in front. It is more important, probably, to manage a business in such a way that the probability of achieving these targets is as high as it can be, than to set out to overtop these targets if this were to mean lowering the probability of achieving them. In other words, if it were possible to come up with a business plan that offered complete certainty of meeting the financial obligations of the business - and was within all the constraints within which the business had to operate, of commercial and social policies, for example - there would be no point in rejecting that plan in favour of one that offered more profit but some probability, however small, of failing to meet these obligations. But no such plan is possible, except perhaps in the imagination of those who subscribe to what D.B. Hertz calls the "forced-fit philosophy" (5) who would be less concerned to make the right investment decisions than to make their decisions come right. At the other extreme, the attitude that denies the sense of planning at all because "anything may happen and probably will" presupposes a degree of disorderliness in human affairs that is not demonstrated by the facts. Keynes suggested that this attitude was perhaps not uncommon; "In former times ... investment depended ... on individuals who embarked on business as a way of

life, not relying on a precise calculation of prospective profit ... If human nature felt no temptation to take a chance, no satisfaction (profit apart) in constructing a factory, a railway, a mine or a farm, there might not be much investment merely as a result of cold calculation" (3). Keynes had more to say about the extreme precariousness of the basis of knowledge on which our estimates of prospective yield have to be made and threw down the challenge: "The social object of skilled investment should be to defeat the dark forces of time and ignorance which envelop our future".

Our understanding of the process of business economics has come on some way since Keynes thanks not only to systems of management accounting in the wide sense that provide a better recording of relevant facts but also to the illumination of these facts through sound interpretation by statistical methods. The temptation, however, to be guided more by those facts about which we feel somewhat confident, even though they may be less relevant, than other facts about which our knowledge is vague and scanty, must be resisted. In an early application of a Monte Carlo simulation in a so-called risk analysis of a capital investment project, a forecast was made of the probability distribution of profit. In the event, the actual profit in one particular year turned out to be near the extreme downside limit of the distribution, the one-in-a-million chance. Yet the actual outcomes of all the factors which had been forecast as probability distributions were well within the limits. The combination of the actual results for these factors with the single-figure forecasts for the other factors that had been taken into account gave a figure for profit well above the actual profit. The difference was attributable in part to the other factors that had been taken into account as single-figure estimates but mainly to yet other factors again that had been either ignored or rejected as incalculable, but which were indeed more telling.

We shall return to some problems of forecasting shortly. For the moment let us suppose that it is possible to make forecasts in terms of probability distributions that are sufficiently complete and credible for decision-makers to act as though they really did believe in them. If this were not the case, an objective function in terms of probability would have little use in any scheme of cold calculation.

There is one more aspect to be considered before this objective function is stated. That aspect is risk. Risk in this context, is the consequence of bad chance. Not the worst then could possibly happen, for this is likely to be something too disastrous but hopefully too remote to need to be taken into account in an investment decision, but a bad outcome which is probable enough to be taken seriously. One may make a journey, for example knowing that there is always a remote possibility that one will not reach one's destination because of some catastrophe. To plan every journey with this possibility in the forefront of one's mind is scarcely realistic. Experience, however, may show that 90% of journeys are completed within ten minutes of the expected time of arrival. If to be late on one occasion in ten were acceptable, one might be content to plan to arrive "on time". If it were not acceptable, contentment would demand an earlier start. My use of the word contentment is deliberate. Happiness, it has been said, is the capacity to meet disaster. In the context of investment decisions, this capacity is the capacity to survive financially. It is the debt-capacity or creditworthiness of a business. The limit of debt-capacity is the down-side constraint determining the spread of an acceptable probability distribution of earnings.

The objective, then, of a scheme of investment appraisal is to proceed with those projects that, in total, offer the best chance

of meeting the continuing financial obligations of a business within a constraint of risk. In manufacturing industry there are a great many other constraints; legal and moral constraints, for example, and powerful practical constraints where the nature of a business precludes any short-term reshaping of the entire business by switching in and out of products and markets as though one were buying and selling shares. The greater part of the activities of an on-going concern, and, to a great extent its debt-capacity, are determined by past investment decisions - which can be reversed, it is true, but not all at once! It might appear that the objective stated above is impractical because it implies that the entire activities of a business must go into the melting-pot at every point of decision. But it is not as impractical as that! The fairly widespread adoption of formal corporate planning cycles over the past few years has meant that in many companies the entire activities are reviewed at regular intervals. This process can be used to define the characteristics, in terms of a cash flow profile, in particular, of new investment projects to complement the ongoing activities until the next review - the sorts of cards one wants, and those to be discarded, if you like, to make a better hand.

One final point before we leave this matter of the objective function in investment decisions: if the decision process is to be meaningful it must be predicated on an objective such that one can say at the time the decision is made - and not one week, one year or even ten years later - "This is (or was) a good decision".

Information for Investment Decisions

The outstanding fact, wrote Keynes, is the extreme precariousness of the basis of knowledge on which our estimates of prospective yield have to be made. Yet when, a few years ago, a large British company carried out an analysis of actual performances, against the statements put forward in the expenditure proposals, of a sample of capital investment projects sanctioned up to several years previously, the outstanding fact was not how far out the predictions had been, but, by and large, how well things had been made to turn out. This is not to dispute the observation of Keynes at the time of writing, nor even its validity at the time the expenditures referred to were proposed. Rather it is to say that in spite of the precariousness of the basis of knowledge, investment decisions were made that were sufficiently good to allow, in my earlier words, things to be made to turn out well enough.

Lest these remarks should appear complacent, it should be pointed out that both the single-figure forecasts of specific variables in the expenditure proposals and the assumptions underlying them, where these had been recorded, were often quite wide of the mark. That animal spirits were strong was evident in the over-optimism of many of the statements in the proposals - an over-optimism engendered to a large extent by turning a blind-eye to the competition. But there were animal spirits, too, among the managers who subsequent to the investment decisions had the task of trying to make those dreams come true. The ship having weighed anchor, there is more than one way of navigating through unknown waters towards the distant harbour. It is not my purpose in this short paper to discuss in detail the whole field of forecasting. A forecast is a conjectural estimate of something future, says the dictionary, and a conjecture is a formation of opinion on insufficient grounds! Precarious indeed is the basis of investment appraisal.

The important thing about a forecast is that it is itself a decision. The investment decision is only one decision in a continuing series of decisions. Before it comes a hierarchy of

decisions by forecasters, firstly of general states of the world, then of the states of particular sectors of supply, technology and markets, for example, before the final stage of inventing numbers to fit these generalisations. The forecasters are not peering through a fog trying to catch glimpses of what would be obvious if only the fog could be dispersed. Rather their skill is to anticipate how others may react in circumstances that they themselves may cause to arise - or may be trying to prevent.

The adoption of DCF in many companies over the past 10-15 years should have had a great liberating effect on forecasters. The important thing about DCF is not the discounting but the setting down of estimated cash flows year by year over periods of time far beyond what many would consider practical or realistic in normal budgeting and planning exercises. What is the honest number-inventor to say when asked to set down a sales volume or a price or a conversion efficiency ten years ahead? He must demand the freedom to express and indeed to quantify his uncertainty. If one takes DCF seriously, if one wants to be realistic and not merely political, one must surely think in terms of alternative propositions and their probability distributions. For, as Professor Shackle (6) put it, if decision is to be interesting and more than the mere exercise of taste, it must be a choice between possible courses of action each of which appears capable of leading to one of many possible results.

Whether a forecast is expressed as a single-figure or as a probability distribution, its quality is not to be measured by how near it was to what subsequently happened but by how useful it was to the decision-maker at the time the decision had to be made. It is largely a question of the decision-maker's confidence, based less perhaps on a forecaster's past record of hits and misses than on how he arrived at his forecast.

In this regard there has been accumulating over the years a number of valuable studies, the results of which are stated as general propositions against which specific forecasts may be tested. Particularly valuable are those studies concerned with the learning curve. A forecast that implies a high margin of profit when one is breaking into a business in which the established leaders have a massive accumulated experience must be suspect, (but not necessarily invalid, because in going from the general to the particular it is possible that the particular lies outside the limits of the general). This may be put another way: that it is unlikely that profitability will increase with a static or declining market share. The point about these general tests of the authenticity of a forecast is that they serve as checks not so much on the general assumptions about the states of the world and of particular sectors as on the numbers attached to sales volumes and prices that are used in the quantitative models.

A Note on Investment Appraisal Models

In the end, the relevant information to enable an informed judgement to be made in arriving at an investment decision must be put together and analysed. True, the information may be scanty; true, one may wish for one-armed advisers who do not say "On the one hand this may happen but on the other, that may happen". But without information, and more likely than not, conflicting information, there is no basis for analysis, no basis for decision.

The simplest form of model is a single-stream cash flow model using single-figure estimates of selected variables, such as sales volume, price, variable costs, direct and indirect costs and so on. In this class of model the numbers game may be played to

lend weight to a qualitative argument. The model is just part of the politics. It is likely to be played down or even abandoned if it cannot be used to justify a decision that owes much more to animal spirits than cold calculation.

This simple model, however, may be extended very easily to serve both the advocate and the judge of a particular course of action - by changing the values of the variables, singly and collectively, and seeing what happens. Analysing the sensitivity of the result to changes in the inputs is unlikely to produce any surprises. The value of doing it lies mainly in defining the limiting values of individual or linked variables, only within which a good result may be expected. In this approach one does not anticipate the probabilities of the values of the variables; these are normally considered after the results of the sensitivity analysis are available. To a point, this extension of the simple model is still essentially political, but the politics can be played by the opposers as well as by the proponents of a particular course of action.

Assessing the probabilities of the limited number of sets of values explored in a sensitivity analysis may present considerable difficulties. One person may look at a set of sales forecasts and prices and regard it as the mean of a normal or skewed distribution. Another may totally reject the premise on which this set of forecasts is based, having in mind a probability distribution of sales volumes based on a fundamentally different pricing strategy. The mean value of this distribution may lie right outside the 90% limits of the other. This situation is unlikely to be resolved by any compromise; the two viewpoints are too far apart for this. In a sense, both may be right. To accept one might require an investment four or five times as large as the other. The investment decision is not simply a go/no-go decision, but a matter of how large an investment. The decision and the forecasts appropriate to that decision are inter-linked. There is a different set of forecasts for each decision, and the results of the sensitivity analysis may be set out as a decision or pay-off table showing the sensitivity of the results of each course of action to variations in the forecasts related to that course of action.

While the immediate decision is to settle or not to settle on a course of action now, it may be helpful to look ahead to a branching series of possible subsequent decisions. To do so is not necessarily to pre-empt any particular future course of action. A sequential analysis of this kind may show that some immediate decisions, which by their nature allow greater freedom subsequently to increase the investment or to pull out, do not necessarily involve any severe financial penalty for this freedom. Such decisions may be preferred as offering a happier balance between the satisfaction one seeks and the sacrifice one hopes to avoid.

The types of model described so far are all variations on the simple single-stream model using single-figure estimates mentioned earlier. In the later examples the forecaster is allowed to express his uncertainty by using different values of the variables, and the decision-maker by examining more than one possible course of action at more than one point in time. Quantitatively, the objective function remains a profit function.

When the forecasters put their forecasts in terms of probability distributions, a totally different approach to investment decisions becomes possible. The result of combining the probability distributions of the variables is a probability distribution of the profit function, and, no less important, an indication of the financial risk that may arise each year. This is the additional investment that may be called for if the

project is to get through its initial period of cash-hunger and become a cash-generating project. If this additional investment is within the debt-capacity of the project ... but unless the project is the entire business, it is almost meaningless to talk of the debt-capacity of the project, when it is the debt-capacity of the business as a whole that is involved in underwriting not just one project, but all the projects.

Capital investment planning is not so different in principle from production planning. Production capacity and stocks at any time are limited. It is foolish to accept more orders than can be met from stocks and production. Whether any individual order can safely be accepted requires up-to-date knowledge of the uncommitted stocks and production capacity. When orders are coming in thick and fast they must be planned together and not piecemeal. So, too, with capital investment planning, the demands on the capital investment capacity, which includes the debt-capacity, should generally be planned together. It is usually enough to go through the total planning exercise at intervals of six months or a year. Then as each individual project comes up for a decision, it can normally be accepted or rejected on its merits and within a constraint of the capital investment capacity already reserved, as it were, for it.

The periodic planning of the whole capital programme is an exercise in portfolio selection, the preferred portfolios being those with combined probability distributions of the profit function that show acceptable relationships between the mean values of the profit function, the annual net cash flows, the spreads of the distributions (e.g. the standard deviations if the distributions are normal), and the constraints of debt-capacities year by year. The process is iterative, for the debt-capacity and the cost of capital will be affected not only by the recent history of the business, but by the selection of projects that make up a particular portfolio of capital projects.

All this adds up to quite a lot of cold calculation. Whether it is all worth-while is a matter on which opinions vary. At one extreme there is the view that if you have to do a lot of calculation for a project in order to arrive at a decision, that in itself is sufficient indication that the project is not worth doing. Keynes observed that "most probably, of our decisions to do something positive the full consequences of which will be drawn out over many days to come, can only be taken as a result of animal spirits, of a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities. Enterprise only pretends to itself to be actuated mainly by the statements in its own prospectus, however candid and sincere". But for all that, Keynes was for a balance of cold calculation and unbridled imagination. Individual initiative, he wrote, will only be adequate when reasonable calculation is supplemented and supported by animal spirits so that the thought of ultimate loss which often overtakes pioneers, as experience undoubtedly tells us and them, is put aside as a healthy man puts aside the experience of death.

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