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THE FEASIBILITY OF FINANCING INVESTMENTS USING BORROWED MONEY DURING A PERIOD OF INFLATION AND HIGH INTEREST RATES

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SUMMARY

High interest rates provide a mechanism to compensate lenders for the erosion in the purchasing power of money during a period of inflation (Section 2). As long as high interest rates do no more than compensate precisely for the decline in the purchasing power of money caused by inflation the profitability of investments financed with borrowed funds will be unaltered compared with the profitability in a period of low inflation and interest rates. Although profitability may be unchanged, the ability of businesses to service borrowed funds may be adversely affected in the short term (Section 3).

The ability to service borrowed money will be reduced in a period of inflation and high interest rates if lending institutions require money interest charges to be paid in full as they accrue. Such a requirement will effectively accelerate the rate of loan capital repayment in purchasing power terms. The ability to cover loan servicing obligations will be diminished more for loans repaid using the annuity method than for straight loans, when the whole of the principal is repaid at the end of the term. Although bank overdrafts provide the flexibility to accommodate an escalating level of borrowing in money terms, it is unlikely that overdraft facilities would be available to finance investment in long-term assets if such an outcome were anticipated (Section 4).

The longer the life of an asset acquired using borrowed funds, the more acute will be the problem of debt servicing in the years immediately following the time when the investment is made. This can be quantified by estimating the maximum level of capital gearing (or minimum percentage equity) which can be sustained in the first year following investment, for assets with different lengths of life. The maximum capital gearing will decrease (and the minimum percentage equity will increase) the longer the life of the asset and the higher the rates of inflation and money interest. A favourable age composition for a business's assets may make it possible to defer the time when an increase in borrowing in money terms has to be sought (Section 5).

Taxation exerts an important influence in that interest on money borrowed for business purposes is an allowable expense when computing taxable income. This will have the effect of improving after-tax profitability whe inflation and interest rates are high and it will also ameliorate debt servicing difficulties as long as businesses are able to utilize fully the tax relief available (Section 6).

Changes in interest rates may not be such as to compensate precisely for changes in the purchasing power of money caused by changes in the rate of inflation. A number of permutations of changes in inflation and interest rates are possible and several of these have been experienced in recent times when viewed on a year-to-year basis. Predicting the effect of each possible combination of changes in rates on the profitability and debt servicing ability of investments financed with borrowed money is difficult. This is especially so when taxation is taken into account (Section 7).

During a period of inflation and high interest rates some businesses may be prevented from undertaking profitable investments becuase they cannot support the debt servicing burden in the short term. On the other hand, more favourably placed businesses may be encouraged to make inherently unprofitable investments financed with borrowed money because they are "tax efficient". This suggests that conditions may exist for a misallocation of resources where borrowed funds are needed to acquire such resources. Modifications to both the tax system and loan servicing arrangements might be required to eliminate such opportunities. In the absence of such changes, uncertainty about the future level of inflation and interest rates may serve to depress the level of investment generally where borrowed funds are required (Section 8).

1. INTRODUCTION

The high rates of price increases experienced over the last decade have made us painfully aware that we now live in a world where inflation is a dominant factor. Whilst there can be no disagreement about the desirability of bringing inflation under control the reality of the situation is that whilst it persists we must not only live with it but also learn to recognise and anticipate the particular problems that follow in its wake. It would seem that we have made adjustments to accommodate inflation in some areas of our thinking but not in others. For example we recognise that if the index of input prices is rising faster than the index of output prices then profit margins will be squeezed. However, there are some areas where the adjustment process is lagging behind. One such area is in relation to interest payments on borrowed money.

The record levels of inflation experienced in recent years have been accompanied by record interest rates. That there is a tendency for interest rates to increase as the rate of inflation increases creates particular difficulties for individuals and businesses that have used borrowed money, or wish to use borrowed money, to purchase long-term assets. A relatively simple but familiar situation may serve as an example. The case which will be considered is that of a young couple who are trying to decide whether to buy a house on a mortgage or whether to rent a house instead.

In a period when inflation was at a very low level a young couple had relatively little difficulty in deciding whether to buy or rent a house. Suppose that the cost of renting was £650 per year and the purchase price of a house to buy was £10,000. Further suppose that the interest rate on a loan for house purchase was 5%. If they borrowed the whole of the purchase price the annual interest payment in the first year would be £500. Assuming that the alternative is paying a rent of £650 per year the couple would be left with £150 after paying interest to go towards repaying part of the £10,000 originally borrowed. In fact at 5% interest a loan of £10,000 could just be cleared in 30 years with an annual payment of £650. The proposition of buying their own house looks attractive and providing the couple can find £650 per year out of their income (which they would have had to have found to rent a house anyway) then doubtless they would decide to buy rather than rent.

Now consider the situation of a young couple faced with a similar decision in a period of high inflation. Suppose that the cost of renting is still £650 per annum but rents are expected to increase by 15% per annum in future years. Suppose that the purchase price of a house is still £10,000 and this is also expected to increase by 15% per year in future years. Further suppose that the couple anticipate that their salaries will increase by 15% annually in line with prices generally and that the £650 they can afford to pay for housing will increase proportionately. Finally suppose that mortgage interest rates have risen to 10% per annum. Under these circumstances the couple may well reason that as house prices, rents and salaries are all expected to increase by 15% per annum and that as interest rates are only 10% then buying their own house is even more justified than it was under conditions of low inflation and 5% interest rates. In this they are undoubtedly correct, but they may be unable to take advantage of this very attractive proposition of buying their own house. The interest payment on the loan in the first year will now work out as £1,000 and the annual payment to cover interest and repay the loan over 30 years now comes to £1,060. If the couple can only initially afford £650 per year for housing then the annual payments on the loan would be quite beyond

their means for the first few years, although the prospect is that they would more than be able to afford them after four or five years if salaries increase by 15% per annum as expected. So although house purchase is an even more attractive long-term proposition than it was in a period of low inflation and interest rates it is now simply infeasible because the couple cannot meet the repayments required in the short-term. The only way in which the couple would be able to buy their own house would be if the institution granting the loan were prepared to allow the amount of the borrowing actually to increase over the first few years after the couple had made the purchase. This is an unlikely prospect at the present time - and one which the couple might be reluctant to take up even if it were available.

Depressing though the above situation is, there is one which is even worse. Suppose the couple make their decision at a time of low inflation and interest rates and go ahead and buy a house on a mortgage. Then suppose that inflation suddenly takes off and interest rates also rise to the levels indicated in the second situation portrayed above. If this change occurs in the early years following the purchase of the house and the institution which provided the loan increases its interest rates then the couple may be in serious difficulties. At the worst they may be unable to meet the higher payments required and might be forced to sell the house. Of course building societies are very sympathetic to individuals who find themselves in such an unenviable position. Even if the sale of the house can be avoided the couple are likely to find themselves extremely short of cash after meeting the mortgage payments and subject to considerable mental anguish. However, if they can manage to get through the difficult period until their salaries are increased by higher wage rates to compensate for inflation they will have the consolation that the purchase of the house was even more profitable than they had originally envisaged.

The reader might well ask what this has to do with borrowing money to invest in a business. The point is that the situation is not dissimilar whether the money has been borrowed for house purchase or to purchase long-term business assets such as land, buildings, machinery or breeding livestock. Although resulting from rather more complex circumstances, farmers' experiences may be just as unpleasant and depressing as those confronting a young couple buying a house. The aim of this report is to try to set out in rather more detail the various facets of the problems which result from high interest rates in a period of inflation.

2. INTEREST RATES AND INFLATION - THE BASICS

Interest payments made by an individual or business can be regarded as the cost incurred in borrowing money; hence the annual rate of interest can be viewed as an indicator of the price of money borrowed for one year. An alternative perspective can be gained by looking at interest from the lender's point of view. Interest payments received by the lender represent a reward for lending money. In this context interest might also be viewed as a payment made to the lender to compensate him for the sacrifice incurred in lending the money. The sacrifice consists of voluntarily agreeing to postpone the time when he will spend the money on some goods or services which he desires. In effect, rather than spending his money immediately to buy something he wants, the lender agrees to defer the purchase for a period of time in exchange for a payment which is termed interest.

However, regarding interest as a payment to a lender to compensate him for the sacrifice he makes in deferring using the money for his own purposes is to over-simplify considerably the nature of interest. For example, it ignores that element of interest payments which constitutes a premium to the lender for the risk he is taking of the borrower defaulting on repayment. Nevertheless, this simple view of interest does provide a useful starting point when it comes to looking at interest rates in a period of inflation. This particular view of interest will be returned to later, following an equally simplistic view of inflation.

Inflation is a term used to describe a situation where a general tendency exists for the prices of most, if not all, goods and services to increase over time. In order to gain an impression of the extent of this tendency, price changes are usually recorded as an index and expressed as an annual percentage rate of change. Although it is more precise to think in terms of an annual percentage price change for a particular good or service it is also useful to have some means of assessing what is happening to prices generally. A large number of indices are calculated, but the General Index of Retail Prices (the R.P.I., or "cost of living index", as it is popularly termed) is the one most frequently used to gain an impression of the movement in prices generally. The R.P.I. attempts to measure the change in prices for a 'basket' of goods and services purchased by a middle income group family. For example, if a particular basket of goods and services purchased by a family in one week of a particular year costs £100 and an identical basket in the corresponding week one year later costs £115 then we can say that the general rate of inflation experienced by that particular family for that particular basket of goods and services is 15%.

An alternative, mirror-image, view of inflation is to regard it not as an increase in prices but as a fall in the purchasing power of money. In the case of the above family we can see that they needed an extra £15 to purchase an identical basket of goods and services in the second year over and above the £100 which was required in the first year. In fact £100 in the second year would only buy 87% (i.e.(100/115) x 100) of the amount in the basket purchased by £100 in the first year. Therefore the purchasing power of money has fallen to 87% of its purchasing power one year earlier.

Returning now to the matter of interest rates and the impact of inflation. Suppose that an individual (the head of the family in the above example) decides that he is prepared to postpone the purchase of the basket of goods and services which cost £100 for one year providing that he is rewarded or compensated for doing so. Assume that he requires a reward which will enable him to buy 5% more

goods and services in one year's time than if he spends the £100 immediately. Providing that he is able to find someone who is prepared to borrow the £100 for one year and pay 5% interest for the privilege, he can expect to receive £105 back in one year's time. However, £105 after one year will only buy a basket of goods and services which is 5% larger than the one he could have bought by spending the money immediately if the prices of the items in the basket have not changed over the year. If the prices of the items in the basket have increased by 15% over the year, then by the time he receives back the £100 plus the £5 interest it will only buy 91% (i.e. (105/115) x 100) of what he could have purchased if he had spent the money immediately instead of lending it. Obviously, if the potential lender had been able to anticipate that prices would increase by 15% during the period of the loan, he would have asked the borrower to pay considerably more for the privilege of having the use of his money. In fact to achieve his original objective of being able to buy 5% more goods and services after one year he would have had to have asked for £115 plus 5% of £115, i.e., £120.75 in total. The £115 represents the £100 lent plus £15 to compensate for the expected erosion in the purchasing power of money. The 5% interest also needs to be calculated on a base figure of £115 if the lender is to be able to increase his purchase of goods and services by 5% in real terms. Rather than spell out his requirements in this sort of detail, all the lender need ask for is an interest rate of 20.75%.

In practice, few private individuals are in a position to fix the interest rate on money they lend. They can only hope to find the highest rate the market has to offer. Therefore it may seem a waste of time specifying the make-up of interest rates in the above detail. However, it should be recognised that, in a period of inflation, market interest rates are simply money (or nominal) interest rates and as such can be thought of as comprising two elements. The first, and by far the larger element in recent times, comprises compensation for the decline in the purchasing power of money. Having made allowance for this, the second element represents what might be termed <u>real</u> interest. Using the above example the <u>real interest rate</u> can be calculated as follows:

$$\left[\left(\frac{120.75}{115}\right) - 1 \right] \times 100 = 5\%$$

It should also be clear that as only part of money interest payments represent real interest the remaining part must represent a repayment of capital in purchasing power terms. Because no division is made in practice between that part of money interest payments which is real interest and that which is in effect a repayment of real capital, considerable difficulties can arise for both lenders and borrowers. Suppose, for example, that the head of the family in the earlier illustration decided that he was prepared to extend the loan for a second year and that he still retained his original objective of wishing to be able to purchase an identical basket of goods at the end of a further year. He would not only have to re-lend the £100 but also £15 of the interest payment he had received at the end of the first year. If he spent the whole of the money interest of £20.75 and only re-lent £100 for a second term he would in fact be consuming part of the original real capital. Furthermore, he might find it difficult to lend out £115, because the present tax rules regard the whole of money interest as constituting income and not just the real interest element. Hence, in an inflationary period, when money interest rates have risen to compensate for inflation, taxing the whole of the money interest received is in effect taxing a part of capital when viewed in purchasing power terms.

It is perhaps relevant to point out that in recent years and indeed for quite prolonged periods in the mid-1970s the rate of inflation, as measured by the R.P.I., exceeded money interest rates and thus negative real interest rates prevailed. A lender would have experienced difficulty in trying to maintain his real capital intact. He would not have been helped in this matter by the operation of the tax system.

3. BORROWING MONEY DURING A PERIOD OF INFLATION

The previous section focused attention on the case of an individual lending money during a period of inflation. A simple lending situation was chosen deliberately as it is easier to outline the concepts involved than by considering borrowing situations, which are less easily simplified. The situation confronting the borrower during a period of inflation is nevertheless analogous in some respects to that confronting the lender. Both lenders and borrowers must consider the consequences of changes in prices during the period of the loan and the extent to which money interest rates compensate for those changes. Only by doing so can they obtain a realistic impression of the gains (profits) they can expect to make from either lending or borrowing. There are other factors, however, which must be considered by the business borrower, some of which were only alluded to indirectly in the simple lending illustration portrayed earlier.

The borrower must give particular attention to the source of money he is going to use to repay the borrowing and the interest on it. He must also take into account the timing of the repayment obligations. In a business context the source of money to repay the borrowing will usually be related to the purpose for which the money was originally borrowed. A business will often borrow money to buy a productive asset which will itself generate an income stream over its life which can be used to repay the borrowing. The asset purchased with borrowed money must clearly not only be able to pay for itself over its life (otherwise it would not be a profitable investment) but it must also generate an income stream over time which coincides with or precedes the times when repayments fall due. If the borrower is so rash as to agree to a repayment schedule which precedes the availability of funds to meet the repayments he can expect to experience acute financial embarrassment. Such an eventuality in a business situation is usually described as a liquidity problem. One consequence of inflation accompanied by high interest rates is that it distorts the relationship between the profitability and liquidity of an investment proposition. This was illustrated in the introductory section, where the situation confronting a young couple contemplating house purchase was contrasted between a time of low inflation and interest rates and a period of high inflation and interest rates. Further examples will now be considered in somewhat greater detail.

The investment proposition which will form the basis of the illustration is the purchase of an asset, such as a building or machine, costing £1,000, using borrowed money. It is assumed that the asset has a useful life of ten years, after which time it will be scrapped and have a zero resale value.

Case (i). Zero Inflation; 5 % Rate of Interest

The first situation to be portrayed is one of constant prices (i.e. zero inflation) and a 5% money interest rate. In this case the real rate of interest is clearly also 5%. It will be assumed that any income generated by the asset will be used to service the borrowing. For clarity of illustration the income will be set at a level just sufficient to pay interest and repay the original sum borrowed by the end of the life of the asset (year 10). In this context it is assumed that interest will be calculated on the balance of any borrowing outstanding at the start of each year. The annual sum needed to repay a loan of £1,000 borrowed at 5% interest over a ten year period by equal annual instalments can be found from amortization tables or directly from annuity formulae. In this particular case the sum required is £129.50 per annum. The schedule of income generated, the pattern of interest charges and the balance of borrowing outstanding at the beginning and end of each year are shown in Table 1.

TABLE 1. Income Generated by an Asset to Repay £10000 over 10 years at 5% Interest Under Conditions of Constant Prices.

Year	Annual Income Generated	Borrowing at Start Year	Interest for Year at 5%	Amount Outstanding Before Repayment for Year	Borrowing at End of Year
	£	£	£	£	£
1	129.50	1000.00	50.00	1050.00	920.50
2	129.50	920.50	46.02	966.52	837.02
3	129.50	837.02	41.84	878.86	749.36
4	129.50	749.36	37.47	786.83	657.33
5	129.50	657.33	32.87	692.20	560.70
6	129.50	560.70	28.02	588.72	459.22
7	129.50	459.22	22.96	482.18	352.68
8	129.50	352.68	17.62	370.30	240.80
9	129.50	240.80	12.04	252.84	123.34
10	129.50	123.34	6.16	129.50	NIL

From the figures in Table 1 it can be seen that the asset just pays for itself over its ten year life. Thus in terms of profitability it just breaks even, producing neither a surplus nor deficit in year 10. This result is hardly surprising in that the annual income was deliberately set at a level which would produce precisely this result. The figures in Table 1 will be used as a basis for comparing the outcomes of an investment in an identical asset but under circumstances of inflation and higher interest rates.

Case (ii): 15% Inflation; 20.75%Rate of Interest

Let us now assume that an exactly similar investment is made in an asset costing £1,000 under inflationary conditions where prices generally are rising by 15% per annum. The output from the investment is expected to be identical in terms of physical quantity in every year as in Case (i). However, it is assumed that prices received per unit of output will also increase at 15% per annum, in line with the general rate of inflation, and the increase will be effective from the first year onwards. We shall further assume that the money rate of interest has also increased, to a rate of 20.75% per annum. The real rate of interest will thus be exactly the same as in Case (i), namely 5% per annum, i.e.

$$\left[\left(\frac{120.75}{115}\right) - 1 \right] \times 100 = 5\%$$

Therefore the profitability of the investment in the asset will also be unchanged and it will just break even over a ten year life. In fact it has been suggested (Crabtree, 1978) that where a prediction can be made as to the

percentage annual price increase for the commodity being produced, it is possible to gain an indication of the level of income in current terms which will be needed for the investment to break even. All that is required is to calculate the amount of the annual payment at the real interest rate which would be needed to amortize the cost of the asset over its expected life. However, as Crabtree pointed out, there may be unexpected cash flow complications. The pattern of income generated by the machine and of interest charges, together with the balance of borrowing outstanding at the beginning and end of each year, are shown in Table 2.

TABLE 2. Income Increasing at a Rate of 15% per Year to Repay £1000 over 10 years at 20.75% Interest.

Year	Annual Income of £129.50, Increasing at 15% per year	Borrowing at Start of Year	Interest for Year at 20.75%	Amount Outstanding Before Repayment for Year	Borrowing at End of Year
	£	£	£	£	£
1	148.93	1000.00	207.50	1207.50	1058.57
2	171.27	1058.57	219.65	1278.22	1106.95
3	196.96	1106.95	229.69	1336.65	1139.69
4	226.50	1139.69	236.48	1376.17	1149.67
5	260.48	1149.67	238.56	1388.23	1127.75
6	299.55	1127.75	234.01	1361.76	1062.22
7	344.48	1062.22	220.41	1282.63	938.15
8	396.16	938.15	194.66	1132.81	736.65
9	455.58	736.68	152.86	889.51	433.93
10	523.93	433.93	90.00	523.93	NIL

From the figures in Table 2 it can be seen that income from the asset is just sufficient to pay interest and repay the borrowing by the end of year ten. Thus the investment just breaks even and has an identical profitability to a similar investment under conditions of zero inflation and a money interest rate of 5% (Case (i)). However, the crucial point is that the feasibility of the investment under conditions of higher interest rates is dramatically altered. A comparison of the figures in the final columns of Tables 1 and 2, which record the amount of borrowing at the end of each year over the life of the investment, shows them to be very different indeed. For ease of comparison the two sets of figures are put side by side in Table 3.

Under conditions of rising prices and high interest rates the borrowing actually increases over the first four years of the asset's life and only falls below £1,000, i.e. the amount originally borrowed, by the end of year seven. Admittedly the examples illustrate two extreme situations. Nevertheless, providing real interest rates and the level of profitability in real terms remain unchanged, the level of borrowing in money terms will fall more slowly (or even rise during the earlier years of the asset's life, as in the above example) under conditions of high interest rates and inflation instead of steadily falling as under conditions

of lower interest rates and inflation. Such an occurrence may create financial difficulties for the borrower, particularly in the early years.

However, this does not mean that the project is any less profitable. Indeed the profitability is identical under both sets of conditions. Furthermore the level of borrowing in real terms (i.e. in terms of the purchasing power of money) is also identical. As the overall level of prices in the economy is assumed to be increasing by 15% per annum, that is, at the same rate as the income generated by the investment (in Case (ii)), then the outstanding level of borrowing at the end of any particular year will be the same in real terms. This can be demonstrated

TABLE 3. Borrowing Outstanding at the End of Each Year for a £1000 Loan Repayable over 10 Years.

Year	5% Interest Rate and Constant Prices for Income	20.75% Interest Rate and Income Increasing at 15% per year	Deflating Factor to Reduce Money to the same Purchasing Power as Under Conditions of Constant Prices	Deflated Values for the Borrowing Outstanding under Inflation
	£	£		
1	920.50	1058.57	$1.15 = 1.15$	$\frac{1058.57}{1.15} = 920.50$
2	837.02	1106.95	$1.15^2 = 1.3225$	$\frac{1106.95}{1.3225} = 837.02$
3	749.36	1139.69	$1.15^3 = 1.5209$	$\frac{1139.69}{1.5209} = 749.36$
4	657.33	1149.67	$1.15^4 = 1.7490$	$\frac{1149.67}{1.7490} = 657.33$
5	560.70	1127.75	$1.15^5 = 2.0114$	$\frac{1127.75}{2.0114} = 560.68$
6	459.22	1062.22	$1.15^6 = 2.3131$	$\frac{1062.22}{2.3131} = 459.22$
7	352.68	938.15	$1.15^7 = 2.6600$	$\frac{938.15}{2.66} = 352.69$
8	240.80	736.65	$1.15^8 = 3.0590$	$\frac{736.65}{3.0590} = 240.82$
9	123.34	433.93	$1.15^9 = 3.5179$	$\frac{433.93}{3.5179} = 123.34$
10	NIL	NIL		

by deflating the figures in column two of Table 3 by a factor which is increasing at a compound annual rate of 15% and therefore reflects the decline in the purchasing power of money. The relevant factors are given in the third column of Table 3. When the values in the second column are divided by those in the third column the resulting product is identical (apart from small rounding errors) to the value in the first column for any particular year.

4. THE EFFECT OF DIFFERENT METHODS OF LOAN REPAYMENT

Providing the annual rate of price increases for the output from the investment is identical to the rate of price increases in the economy generally, and that this in turn is such that the real rate of interest rate is unchanged, then profitability will be unaffected in real terms. However the level of outstanding borrowing at any point in time will only be unaffected in real terms where the borrowing is repaid from income as it is generated. This is unlikely to be the case in practice because loan repayment schemes currently in use were developed under conditions of low inflation and interest rates. Under conditions of low or zero inflation real interest rates will be very close or identical to money interest rates. Therefore it was reasonable for the lender to expect and even require the borrower to pay interest charges as they accrued each year over the life of the loan. If this requirement could not be met it implied that the investment was not sufficiently profitable to justify the lender granting a loan in the first place.

Unfortunately the wide disparity between money and real interest rates which occurs during a period of inflation may render many profitable long-term investments incapable of servicing the loans needed to finance them where traditional loan repayment terms have to be met. The effects of three of the mostly commonly encountered borrowing arrangements will now be considered.

(i) Annuity Method of Loan Repayment Under this method an amount is calculated which, when paid annually, will cover interest on the loan and repay the principal over an agreed period of years. For example, the annual instalment required to repay a £1000 over 10 years when the interest rate is 5% is £129.50. If however the interest rate is 20.75% per annum, the annual instalment to repay a £1,000 loan over 10 years is £244.62. Now relate these two annual loan repayment instalments to the example of a £1,000 investment which was given in the preceding section. The annual instalment of £129.50 would apply under Case (i) circumstances and it can be seen from Table 1 that the investment would generate an income just capable of meeting this instalment in every year. The annual instalment of £244.62 would apply under Case (ii) circumstances and it can be seen from Table 2 that in the first four years the income generated by the investment is insufficient to meet the amount of the repayment required under an annuity method of loan repayment.

Hence, although profitability is unchanged, the effect of the repayment conditions which attach to annuity type loans may render the investment financially unfeasible under inflationary conditions. This is because it effectively causes capital repayments in real terms to be advanced in time. Table 4 shows the amount of borrowing outstanding in money and real terms assuming a £1,000 loan repaid using the annuity method under 5% and 20.75% money interest rates and zero and 15% inflation respectively.

From the figures in the second and third columns of Table 4 it can be seen that the bulk of the borrowing in real terms is paid off much faster under inflationary conditions than under a lower money rate of interest under non-inflationary conditions. In this instance almost three-quarters of the borrowing in real terms will be repaid by the end of year six under 20.75% money interest rate conditions whereas only just over half would have been repaid under non-inflationary conditions. Furthermore, whilst the annual capital repayment element (in real terms) is increasing over time under zero inflation and 5% interest rate conditions, it is decreasing under conditions of 20.75% interest rate and a 15% inflation rate. It is not surprising therefore that there might be reluctance to invest under conditions of high inflation and interest rates, not because profitability is reduced in real terms, but because of the increased burden of capital repayment in real terms which is demanded in the

TABLE 4. Borrowing Outstanding in Money and Real Terms under an Annuity Repayment Scheme.

Year	20.75% Interest and 15% Inflation		5% Interest and Zero Inflation
	£ Money	£ Purchasing Power	£ Money (= £ Purchasing Power)
0	1000	1000	1000
1	962.88	837.29	920.50
2	918.05	694.18	837.02
3	863.93	568.04	749.36
4	798.57	456.59	657.33
5	719.66	357.79	560.70
6	624.36	269.92	459.22
7	509.30	191.47	352.68
8	370.36	121.07	240.80
9	202.59	57.59	123.34
10	NIL	NIL	NIL

earlier years. Of course, if the investment generates an income which more than breaks even then the investment might still be feasible. However, the profitability would need to be of an order to give a 20% return, in real terms, on average capital invested for the income generated in the first year to be capable of covering the instalment required under a 20.75% interest rate annuity repayment scheme.

(ii) Straight Term loan. Under this method interest only is paid during the period of the loan and the capital is repaid at the end of the term. It might be supposed that this would overcome the problem, but, although it does ease it to some extent, it is far from being a complete remedy. Interest payments alone at 20.75% interest rates require an income of £207.5 per £1000 borrowed. Much of this interest payment really represents a repayment of capital in real terms, since by the end of year 10, with the purchasing power of money decreasing at the rate of 15% per annum, the original sum borrowed and still outstanding (£1000) will have a purchasing power in real terms of only £247. To be able to cover the interest payment in the first year the profitability of the investment project portrayed earlier, in Section 3, would have to be such as to give a return on capital, in real terms, in the order of 15%.

(iii) Bank Overdraft. This provides the most flexible of all borrowing arrangements. Agreement on the duration of an overdraft and how the borrowing will be reduced through time is usually arrived at after studying projections for the future cash flow of the business. Such an arrangement can therefore provide sufficient flexibility to allow the level of borrowing to increase, or at least reduce only very slowly, if necessary, during the early years of a project's life. However, it must be recognised that borrowing on overdraft is not generally regarded as an appropriate means of financing an investment in long-

term fixed assets. Banks see overdrafts primarily as a means of financing working capital and are unlikely to want to commit themselves to providing an escalating overdraft facility over a period of several years. Indeed they would usually expect investment in fixed assets to be financed by means of loans rather than overdrafts.

As bank overdraft facilities are unlikely to be available to finance investments in long-term fixed assets, and finance raised in the form of loans will usually require the borrower at least to be able to cover money interest due each year, many potentially profitable investment projects, in a period of high inflation and interest rates, will only be financially feasible if the borrower is able to supplement the income generated by the project in its early years with income from other sources. If the premise holds that the real underlying profitability of investments is independent of inflation and money interest rates, then it must be concluded that businesses will have to maintain a lower level of capital gearing (i.e. a lower proportion of borrowed funds to equity capital) in a period of high rates of interest and inflation than would be necessary in a period of low interest rates and inflation. Consequently a number of potentially profitable investments that would have been possible in a period of low inflation and interest rates will no longer be financially possible in a period of high inflation and interest rates.

5. THE EFFECT OF LENGTH OF ASSET LIFE ON SERVICING BORROWED CAPITAL

The extent of the difficulties encountered in servicing borrowed capital taken up to finance investment projects will not only depend on prevailing rates of money interest and inflation but also on the profitability of the investment, the type of asset being purchased and the tax position of the business making the investment. In this section the relative difficulty of servicing loans taken out to finance investments in different types of assets will be examined, ignoring taxation effects for the present.

(i) Working Capital comprises inputs such as raw materials and hired services which can only be used once, because they are irretrievably consumed in a single cycle of the production process: for example, an application of a chemical insecticide or one hour of an employee's time. When the finished products are sold at the end of the production cycle physical assets are converted back into financial assets, usually in the form of cash. Money which has been borrowed to finance investments in working capital is usually not repaid until the products have been sold. Indeed it would be foolhardy to borrow money for working capital purposes under terms which require repayment prior to the date of sale of the finished product. This being the case, it should be no more difficult to service borrowing taken out for working capital purposes under conditions of high money interest rates and rising prices than under conditions of low interest rates and constant prices. This is dependent, of course, on the investment being worthwhile and a willing lender being prepared to advance the necessary funds in the first instance.

(ii) Wasting Assets provide a flow of services to the business over a finite number of production cycles: for example, buildings and machinery. When products are sold at the end of each production cycle a proportion of the income generated will represent a recovery of the capital invested in wasting assets and the interest on the money borrowed to buy the assets in the first place. For the investment to be worthwhile such receipts over the life of the assets must clearly be sufficient to cover accumulated interest changes and the original cost of the asset. The illustration in Section 3 was based on an example of an investment in a wasting asset with a ten year life. In Section 4 it was shown that the feasibility of servicing a loan declined under conditions of high money interest rates and rising prices even though the profitability of the investment remained unchanged. The longer the life of a wasting asset the greater the difficulty of servicing the borrowing becomes with higher rates of money interest and rising prices, other things being equal. Conversely, the shorter the life of the asset, the less severe the difficulty. An illustration to demonstrate this will be provided shortly.

(iii) Non-wasting Assets are those which in theory can continue to provide a stream of services into infinity. Farm land is the classic example. Although used in the production process land is not consumed by it and, given a reasonable standard of husbandry, can be used repeatedly. Non-wasting assets therefore represent the opposite end of the spectrum to working capital. This is also true with regard to debt servicing: whilst borrowing for working capital purposes is the least difficult to service, borrowed money which is invested in non-wasting assets is the most difficult to service.

To illustrate the points made above, a number of investments in different

types of assets under a variety of rates of price increases and money interest rates will now be examined. In all cases the initial sum invested is £10,000. The range of projects to be considered are: an investment in working capital, investments in wasting assets with 5, 10, 15 and 30 year lives respectively, and an investment in a non-wasting asset over an indefinite period. The annual income streams generated by the various investments have been contrived so that all the projects are equally profitable. All the investments generate an identical internal rate of return of 5 percent and hence, when the annual cash flow streams are discounted at 5 percent, they produce identical net present value figures.

It is assumed that all the projects are to be wholly financed with borrowed money. Under conditions of constant prices a 5% money interest rate is assumed to be effective whilst under conditions of annual price increases of 5%, 10% and 15% money interest rates of 10.25%, 15.5% and 20.75% are assumed to be effective respectively. Hence in all cases the real interest rate is preserved at 5%.

Assumptions regarding the repayment terms for the loans are as follows. In the case of the investment in working capital, repayment of the loan in full plus interest is required after one year. As regards the investments in wasting assets, the loans have a duration equal to the life of the respective asset and are repayable by equal annual instalments comprising part capital and part interest, i.e. on an annuity basis. The amounts of the instalments are calculated by reference to the money interest rates assumed to prevail under any given set of price conditions. Finally, the terms of the loan to finance the investment in the non-wasting asset are that (money) interest only is required to be paid at yearly intervals, whilst the investment is maintained and repayment of principal is to be financed by the sale of the asset at some future date.

Given the above assumptions, all the projects just break even, i.e. they produce neither a profit nor loss over their lives. Furthermore, under conditions of constant prices and a 5% money interest rate, all the projects are just capable of servicing the loans taken out to finance the investment. However, under conditions of rising prices and money interest rates in excess of 5%, only the investment in working capital is capable of meeting the loan repayment conditions.

Table 5 shows the amount of income produced by each investment in its first year and also the amount required to service the loan under the various rates of price increase and money interest rates assumed. Proportionately it can be seen that the shortfall of income to cover the loan servicing obligation increases with the length of life of the assets and becomes increasingly pronounced at high rates of price increases and money interest rates. These results can perhaps be more easily seen if the income in the first year of each project's life is expressed as a percentage of the amount required to service the loan. Values based on figures from Table 5 are recorded in Table 6 and indicate the extreme nature of the problem for assets with very long lives under conditions of high money interest rates and price increases.

In interpreting the practical impact of these results one conclusion is readily apparent. If lenders rigidly impose repayment terms based on prevailing money interest rates, the total amount of borrowed finance which can be serviced by the income from the projects very rapidly falls to a fraction of the overall capital cost of the longer term investments. Take as an example the investment in the wasting asset with a 30 year life. Under conditions of a 5% annual increase in prices and a 10.25% money interest rate only 63% of the capital required could be in the form of borrowed money if the loan is to be serviced by the income generated by the asset in the first year. The remaining 37% of the money required would have to be provided by the business as equity capital. Remaining with this example and turning to the position where prices are increasing at an annual rate of 15% and where the money interest is 20.75%, then only 36% of the capital required

TABLE 5. The Feasibility of Servicing a £10,000 Loan taken out to finance Investments in Assets with Differing Economic Lives under a range of Levels of Price Increases and Money Interest Rates*

Investment Project		Constant Prices 5% Money Interest Rate		5% Annual Increase in Prices 10.25% Money Interest Rate		10% Annual Increase in Prices 15.5% Money Interest Rate		15% Annual Increase In Prices 20.75% Money Interest Rate	
Asset Type	Life in years	Annual Cash Income £	Annual Loan Instalment £	Cash Income in First Year £	Annual Loan Instalment £	Cash Income in First Year £	Annual Loan Instalment £	Cash Income in First Year £	Annual Loan Instalment £
Non-wasting	Infinite	500.00	500.00	525.00	1025.00	550.00	1550.00	575.00	2075.00
Wasting	30	650.51	650.51	683.03	1082.98	715.56	1570.83	748.00	2082.28
Wasting	15	963.42	963.42	1011.59	1333.55	1059.76	1751.71	1107.93	2205.37
Wasting	10	1295.05	1295.05	1359.80	1644.97	1424.56	2030.63	1489.31	2446.21
Wasting	5	2309.75	2309.75	2425.24	2654.84	2540.72	3018.55	2656.21	3399.14
Working Capital	1	10500.00	10500.00	11025.00	11025.00	11550.00	11550.00	12075.00	12075.00

* The real rate of interest has been preserved at 5% under each set of price increases and money interest rates. The projects all break even over their projected life span and are just capable of repaying the loan by the end of their lives. In the case of the non-wasting asset it is assumed that interest only is paid during the life of the investment and that the principal is to be repaid by the sale of the asset at some future date.

to finance the project could be borrowed and no less than 64% would have to be provided as equity capital if the repayment obligations are to be fulfilled in the first year.

TABLE 6. Income in the First Year as a Percentage of the Loan Instalment due under Various Rates of Annual Price Increases and Money Interest Rates.

Investment Project Asset Type - Life in year	Constant Prices 5% Money Interest Rate	5% Annual Price Increase, 10.25% Money Interest Rate	10% Annual Price Increase 15.5% Money Interest Rate	15% Annual Price Incr. 20.75% Money Interest Rate
Non-wasting - infinite	100	51	35	28
Wasting - 30 years	100	63	46	36
Wasting - 15 years	100	76	60	50
Wasting - 10 years	100	83	70	61
Wasting - 5 years	100	91	84	78
Working capital - 1 yr.	100	100	100	100

There are a number of further points which must be made. The above examples ignore the effects of taxation; these are of such importance that they will be considered separately in a later section. All the projects examined only just break even when they are wholly financed by borrowed money and it is unlikely that a businessman would consider any of them worth pursuing. If the projects were more profitable, say offering a 10% internal rate of return, rather than 5% as assumed, this would tend to reduce the difficulties. All the projects would then be capable of generating sufficient income in the first year to cover the full amount of the loan instalment due under conditions where prices are rising annually by 5% and where money interest rates are 10.25%. However, at higher rates of price increase and money interest all the projects (with the exception of the investment in working capital) would still fail to generate sufficient income to service the borrowed money in the first year. The shortfalls would be less in percentage terms but would still be significant. For example, the investment in the 30 year wasting asset would still only be capable of covering 59% of the annual instalment due on the loan in the first year under conditions of money interest rates of 20.25% and an annual rate of price increase of 15%. Only under circumstances where the real rate of return on the investment approaches the prevailing money interest rates will all the projects be capable of servicing the borrowing in the first year.

In the illustration it was assumed that lenders would be prepared to grant loans to be repaid over the life of the assets. This may not be the case in practice. For example, where an asset has an expected life of 30 years a lender may wish to see repayment over a shorter term, say 25 or even 20 years. In the case of loans granted for the purpose of acquiring non-wasting assets such as land it is usual for the lending institution to require not only interest charges to be covered but also for some part of the principal to be repaid during the term of the loan. Where such conditions as these are imposed the effect will be to make servicing the loan even more difficult, both under non-inflationary as well as inflationary conditions.

A business might well be able to borrow the whole of the amount required to

finance the investment providing income is available from other sources to make good the shortfall on the loan instalments in the early years. For example, income might be available from existing investments financed out of equity capital. If this is the case and existing investments are in the same type of assets as the new investment then the maximum possible gearing that will still enable the debt capital to be serviced can be readily determined. All that is necessary is to determine the income from the new investment in the first year as a percentage of the loan instalment for the full cost of the investment. For example, taking the investment in the 30 year wasting asset under conditions of a 15% annual increase in prices and a 20.75% money interest rate the relevant figure from Table 6 is 36%, which suggests a minimum percentage equity of 64%. Looking back to Table 5 it can be seen that a £10,000 investment in an asset with a 30 year life will produce an income of £748 whilst the loan instalment is £2082. Hence the business will need to have further investments in similar types of assets, financed out of equity capital, totalling £17,838 (i.e. (1334/748) x 10,000) to make up the shortfall of £1,334 (i.e. £2082 - £748). This suggests a maximum capital gearing of £1 of borrowed capital to every £1.78 of equity capital, which gives a percentage equity figure of 64%, as stated above.

It is unlikely that a business would invest in only one type of asset, as several different types of asset are usually required in production processes. Thus a business which wished to invest in long-term assets and which already holds a number of equity financed investments in short-term assets could operate with a lower percentage equity than a business which holds only long-term assets. An example, using figures from Table 5, would be of a business which wishes to invest £10,000 in an asset with a 30 year life but which already holds a number of assets with 5 years of life still to run. Under conditions of a 15% annual increase in prices and a 20.75% money interest rate the income shortfall on the 30 year asset in the first year is £1,334. The business would only need income from £5,023 (i.e. (1334/2656) x 10,000) invested in wasting assets with five years remaining life to make up the shortfall. This suggests a maximum percentage equity of as little as 33%.

A problem will arise, however, if it is the intention of the business to replace the short-term assets at the end of 5 years. As all of the income in the first year and much of that in years 2 to 5 will have to be used to service the loan on the new 30 year investment very little money can be set aside to form a reserve to finance the purchase of replacement short-term assets when the time comes. As a result the business will be forced to seek further borrowed money to finance the replacement assets. If new loan funds can be obtained the business will have succeeded indirectly in borrowing part of the money to meet money interest payments on the original investment! Had the business sought direct assistance to achieve this end it would almost certainly have been rebuffed.

Even allowing for the possibility of funding interest payments in the above manner the fact remains that the business will still have to maintain some minimum level of equity capital. In the context of farming businesses it is perhaps relevant to draw attention to the fact that up to 80% of the capital employed in owner-occupied farming businesses is in the form of non-wasting assets or very long-term wasting assets, namely land, improvements to land and buildings. This is a far higher proportion of total assets than for most businesses in other sectors of the economy and may partially explain why agricultural businesses have only been able to sustain a relatively low level of gearing in recent times.

6. THE TAXATION TREATMENT OF INTEREST PAYMENTS

Under certain circumstances the treatment of interest payments for income tax purposes may lessen the impact of high interest rates on the financial feasibility of investment projects in a period of inflation. Furthermore, the way in which the taxation system works may also improve the after tax profitability of investments financed with borrowed money. This is because the whole amount of interest paid on money borrowed for business purposes is an allowable expense for taxation purposes. This means that tax relief is given not only on the real interest element of interest payments but also on the component of money interest that constitutes compensation for the decline in the purchasing power of money and which therefore represents a repayment of real capital. However, it has to be remembered that the benefits of the tax system allowing relief for total interest payments will only be of any real significance where sufficient income exists to utilize the tax relief, or a large part of it.

To illustrate the effects of the treatment of interest for tax purposes the example of a £1000 investment under two contrasting money interest and inflationary conditions will be examined. In essence the investment and the two sets of conditions will be similar to those used in Section 3, except that certain aspects of taxation will be incorporated. To avoid introducing complications arising from accelerated depreciation allowances (such as the 100% first year capital allowance for machinery) -it will be assumed that tax allowances will be 10% per year on the straight-line basis for an asset with a ten year life. It will also be assumed that the business making the investment is subject to tax at a marginal rate of 30%. In order to focus attention on taxation of interest the tax relief on interest paid will be calculated separately, and to simplify the example it will be assumed that any tax due or tax relief given will apply in the year on which it was calculated to arise, (rather than be delayed by anything up to two years as would occur where businesses are assessed for tax on the preceding year basis). Finally, and again to emphasize the effect of the tax treatment of interest, any tax relief on interest payments will be treated as though it gives rise to a cash receipt to the business, rather than taking the form of an allowance that can be set off against income from the investment, or possibly income from elsewhere, as would be the case in practice. Table 7 shows the situation under zero inflation and money interest rates at 5%.

The figures in the final column of Table 7 are virtually identical to the corresponding figures in the final column of Table 1. The small difference is in part due to the fact that depreciation for tax purposes has been calculated on a straight-line basis at 10% per year, which results in a marginally accelerated repayment of the borrowing. In consequence, fractionally less interest is paid over the 10 years and rather than break even, as in the earlier example, the investment makes a small after tax profit over the 10 years of £4.80 and has made a net tax payment of £2.07. The profitability of the investment and rate with which the borrowing has been repaid after allowing for taxation (using simplified assumptions for depreciation) is virtually the same as portrayed in Table 1. Taxation effects under conditions of zero inflation have made no significant difference to the outcome, either in terms of profitability or the rate at which the borrowing has been reduced. However, under conditions of high money interest rates (20.75%) and inflation (15%), the effect of taxation is much more significant, even though the real interest rate has remained the same. This can be seen from Table 8, which extends the basic figures on which Table 2 was based to include taxation effects, using the simplified assumptions given below.

The figures in the final column of Table 8 are considerably different from those in the final column of Table 2. The difference is solely due to taxation effects, largely because the whole of the money interest has been given tax relief,

TABLE 7. The effects of Taxation on a £1000 Investment Financed with Borrowed Money at a 5% Interest Rate During a Period of Zero Inflation*

	1	2	3	4	5	6	7	8	9	10	11
	Annual Cash Income Generated	Depreciation Allowance for Tax (10% per year)	Taxable Income (After Depreciation) (1-2)	Tax Due at 30% On Income After Depreciation Allowances (30% of 3)	Loan at Start of year	Interest Due for year at 5%	Loan Plus Interest for Year (5+6)	Tax Relief on Interest Payment (30% of 6)	Net Tax Paid (or Refunded) (4-8)	Income to Reduce Loan (1-9)	Loan Outstanding at End of Year (7-10)
Year	£	£	£	£	£	£	£	£	£	£	£
1	129.50	100	29.50	8.85	1000.00	50.00	1050.00	15.00	(6.15)	135.65	914.35
2	129.50	100	29.50	8.85	914.35	45.72	960.07	13.72	(4.87)	134.37	825.70
3	129.50	100	29.50	8.85	825.70	41.28	866.98	12.38	(3.53)	133.03	733.95
4	129.50	100	29.50	8.85	733.95	36.69	770.64	11.01	(2.16)	131.66	638.98
5	129.50	100	29.50	8.85	638.98	31.95	670.93	9.58	(0.73)	130.23	540.69
6	129.50	100	29.50	8.85	540.69	27.04	567.73	8.11	0.74	128.76	438.97
7	129.50	100	29.50	8.85	438.97	21.95	460.92	6.58	2.27	127.23	333.69
8	129.50	100	29.50	8.85	333.69	16.68	350.37	5.00	3.85	125.65	224.72
9	129.50	100	29.50	8.85	224.72	11.23	235.95	3.37	5.48	124.02	111.93
10	129.50	100	29.50	8.85	111.93	5.60	117.53	1.68	7.17	122.33	(4.80)

* The income in each year (Column 1) is the same as was assumed in the earlier example in Table 1.

and it has been implicitly assumed that sufficient income is available to take full advantage of the tax relief on interest payments. From the final figure in the final column it can be seen that the investment after tax more than breaks even, and in fact the loan is more than paid off, leaving a surplus of £305.62. But this sum is in depreciated money, and converting it back to £s with equal purchasing power to when the investment was originally made gives a value of £75.54. Although this only represents an average annual return of approximately 1½% on average capital over the life of the investment it is still significant, because it is in real terms and has been created by taxation effects. This is not to say that the business has received a net tax refund of the amount of the surplus; on the contrary, if the figures in column 9 are summed they indicate a net tax payment of approximately £131. However, this is in current money terms; when the net tax payments and refunds for individual years are converted to the purchasing power of money when the investment was made there was a net tax refund of approximately £30. The remainder of the surplus was created because the net tax refunds (strictly speaking, tax relief) all occurred in the early years, which enables the borrowing to be repaid at a faster rate, thereby reducing the total amount of interest paid (when compared with the figures in Table 2). The taxation effect has had a significant impact on the borrowing pattern. The level of borrowing in money terms falls below the original sum borrowed by the end of year 3 as compared with year 7 (see Table 2).

Taxation effects may therefore not only improve the profitability of an investment in a period of inflation when borrowed money is used to finance the project, but may also operate in such a way as to reduce the problems of financial feasibility - though not of course to the point where the project shows a more rapid reduction of the loan in money terms than under conditions of zero inflation and the same real rate of interest. The higher the marginal rate of tax the greater the improvement to after tax profit and the greater the amelioration of the adverse effects of inflation on financial feasibility, where the business is able to make full use of the higher tax relief available. For example, the same investment as portrayed in Table 8, but where the marginal tax rate is 50%, would result in the level of borrowing being reduced to below £1000 by the end of year 1, the loan being completely repaid by the end of year 9, and a net of tax profit in real terms equivalent to a 2% return on average capital invested in the project.

It was assumed in the above example that the business would have sufficient taxable income available from sources other than the investment to be able to fully utilise the tax allowances available in the early years. In Table 8 depreciation and interest payments total £307.50 (£100 + £207.50) in year 1. However, the income generated by the investment was only £148.93. Therefore the business would need to have £158.57 (£307.50- £148.93) income from other sources potentially liable to tax at the 30% rate to be able to utilise the full amount of tax relief available. If the business had no taxable income other than that generated by the investment, the full amount of the increased tax relief due to higher interest payments could not be utilised. Obviously, if the relief cannot be utilised beyond being set off against the income generated by the investment itself, there will be little significant benefit in terms of enhancing the after tax profitability of the investment, nor in reducing the difficulties of servicing the loan. Therefore, where the only taxable income available to the business is that generated by the investment, the pattern of loan repayments will more closely follow that portrayed in Table 2 than that in Table 8.

A second implicit assumption made above was that the lender would be prepared to accept repayment as and when income became available. However, as discussed in Section 4, lenders may, and often do, impose pre-arranged repayment programmes which require the amount of borrowing outstanding to be reduced over the life of the loan. Where the income generated directly by the investment is insufficient to meet the loan instalment due in a particular year the business will have to make up the deficiency from other sources. Taking figures from Table 8, column 10, the income generated after tax relief was £196.50 in year 1. However, the

TABLE 8. The Effects of Taxation on a £1000 Investment Financed with Borrowed Money at 20.75% Interest During a Period of 15 percent Inflation*

	1	2	3	4	5	6	7	8	9	10	11
	Annual Cash Income Generated	Depreciation Allowance for tax (10% per year)	Taxable Income (After Depreciation) (1-2)	Tax Due at 30% On Income After Depreciation Allowances (30% of 3)	Loan at Start of year	Interest Due for year at 20.75%	Loan Plus Interest for year (5+6)	Tax Relief on Interest Payment (30% of 6)	Net Tax Paid (or Refunded) (4-8)	Income to Reduce Loan (1-9)	Loan Outstanding at end of Year (7-10)
Year	£	£	£	£	£	£	£	£	£	£	£
1	148.93	100	48.93	14.68	1000.00	207.50	1207.50	62.25	(47.57)	196.50	1011.00
2	171.27	100	71.27	21.38	1011.00	209.78	1220.78	62.93	(41.55)	212.82	1007.95
3	196.96	100	96.96	29.09	1007.95	209.16	1217.11	62.75	(33.66)	230.62	986.49
4	226.50	100	126.50	37.95	986.49	204.70	1191.19	61.41	(23.46)	249.96	941.23
5	260.48	100	160.48	48.14	941.23	195.31	1136.54	58.59	(10.45)	270.93	865.61
6	299.55	100	199.55	59.86	865.61	179.61	1045.22	53.88	5.98	293.57	751.65
7	344.48	100	244.48	73.34	751.65	155.96	907.61	46.79	26.55	317.93	589.68
8	396.16	100	296.16	88.85	589.68	122.36	712.04	36.71	52.14	344.02	368.02
9	445.58	100	345.58	103.67	368.02	76.36	444.38	22.91	80.76	364.82	79.56
10	523.92	100	423.92	127.18	79.56	16.51	96.07	4.95	122.23	401.69	(305.62)

* The income in each year (column 1) is the same as was assumed in the earlier example in Table 2.

annual instalment to repay a loan of £1000 over 10 years is £244.62 when based on an interest rate of 20.75%. Therefore, even if the business has sufficient taxable income from other sources to be able to utilize the total tax reliefs available in year one, it will still need to divert £48.12 (£244.62 - £196.50) of cash income from other uses to make up the instalment due on the loan. This assumes a marginal tax rate of 30%. At higher rates of tax the amount of cash income from other sources needed to make up the loan instalment would be less. For example, a business paying tax at a marginal rate of 60% would be able to cover the whole of the loan instalment due in the first year from income generated by the investment and tax savings on income which would otherwise have been liable to tax at 60%.

Accelerated depreciation allowances such as the 100% first year allowance for capital expenditure on machinery and equipment and the initial 20% allowance on agricultural buildings may under some circumstances both improve the profitability of an investment and ameliorate the difficulty of servicing the loan. However, the full benefit of accelerated depreciation allowances can only be gained where the business has sufficient taxable income available to enable the allowances to be fully utilized.

In Section 5 an attempt was made to calculate the maximum capital gearing (minimum percentage equity) that a business could sustain under different rates of inflation and interest when pre-arranged loan servicing conditions are imposed. It is relevant to point out that the increased tax relief due to higher interest payments and accelerated depreciation allowances will not result in any relaxation of these limits. This automatically follows, as the amelioration of loan servicing difficulties only arises because the amount of tax relief exceeds the amount of the loan instalment due. A business with a maximum capital gearing in the absence of tax is one where the total income available is just sufficient to cover the loan instalment due. Therefore where there is insufficient income to be able to utilize immediately the full amount of tax relief available, the business will be prevented, on the grounds of financial feasibility, from raising the capital gearing limit.

Of course the examples in this section have oversimplified taxation. For example, the majority of farm businesses are unincorporated and are assessed for tax on a preceding year basis. This will have the effect of diminishing the benefits suggested in the examples shown. Although tax has been oversimplified two conclusions can be drawn:

(i) where a business can fully utilize the tax allowances and reliefs this will enhance the after-tax profitability of investments and ameliorate the difficulties of servicing borrowed money during a period of high inflation and interest rates,

(ii) where a business is fully geared, taxation effects will not enable the gearing to be increased further and some of the potential benefits in terms of improving after-tax profitability will not be fully exploitable.

7. CHANGES IN INFLATION AND INTEREST RATES

In the examples in the preceding sections it was assumed that changes in the money interest rate would precisely compensate for changes in the rate of inflation in such a way that the real interest rate was preserved at the same level. In practice, of course, this is unlikely to happen. Indeed in recent times movements in money interest rates and the rate of inflation have been such as to produce marked changes in the real interest rate. Table 9 records money interest, real interest and annual inflation rates observed over the two decades to 1979. The rates recorded are those which were effective either at the end of the year (interest rates) or for the final quarter of a particular year (inflation rates). The money interest rate is based on bank rate (or the base rate for the clearing banks) plus 2% to reflect interest rates paid by commercial borrowers. The inflation rate is calculated from changes in the Retail Price Index over one year earlier. Finally the real interest rate has been calculated using the formula:

$$\left(\frac{100 + i}{100 + f} - 1\right)100$$

when i is the interest rate and f is the inflation rate.

Although the real interest rate has tended to vary from year to year there is a very marked contrast between the 1960s, when the range in variability was narrow and positive rates were maintained throughout, and the situation which prevailed in the 1970s. In the last decade fluctuations in real interest rates have been very much greater and negative rates of real interest have prevailed for long periods. Generally, rates of inflation and money interest have been substantially higher during the 1970s. The increase in the money interest rate has frequently been insufficient to compensate for the increase in the inflation rate and the real interest rate has therefore often been negative.

There are a number of possible permutations of changes in inflation and money interest rates that can cause the real interest rate to alter. The derivation of the different combinations that are possible is illustrated in Figure 1.

For convenience each combination of movements in inflation and money interest rates will be referred to as a 'case' and assigned a number from 1 to 12. The data in Table 9 for year-on-year changes in inflation and money interest rates indicates that no less than eight of the twelve cases have been experienced in the last two decades when viewed on a year to year basis. The years illustrating particular cases are noted in Figure 1. The direction of the change in the level of the real interest rate is also indicated for each case.

In a period of zero inflation a change in the real interest rate, solely resulting from a change in the money interest rate, has predictable consequences both for the profitability of an investment financed with borrowed funds and for the ability of the income generated by the investment to meet loan servicing obligations. When the interest rate increases a decline in profitability coupled with a diminished ability to cover loan servicing payments can be confidently predicted. Equally an improvement in profitability and loan servicing ability would be expected to result from a fall in interest rates. Of course under conditions of zero inflation the real interest rate will be identical to the money interest rate.

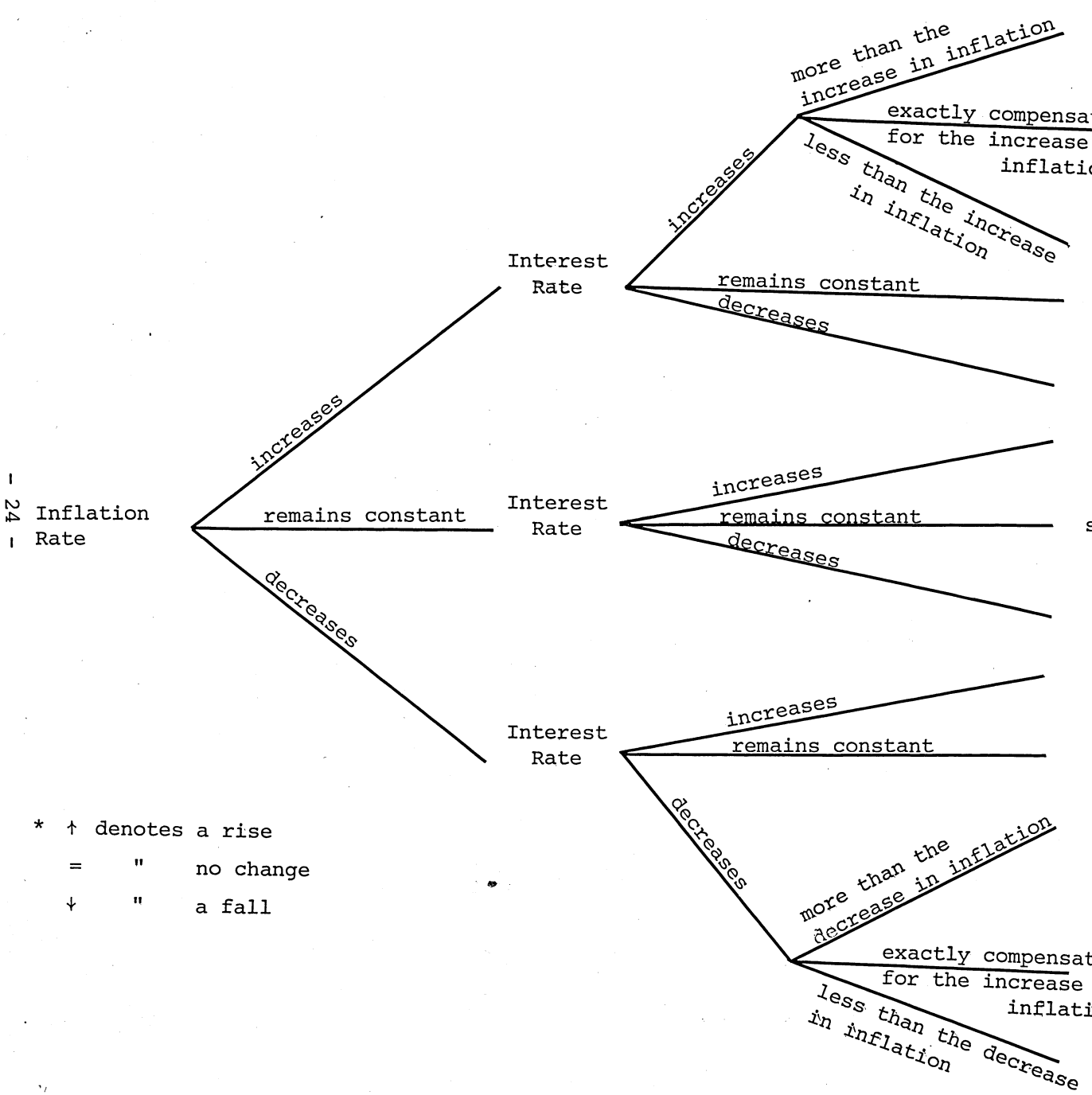
Unfortunately the consequences of a change in the real interest rate when it results from a combination of changes in the money interest rate and the rate of inflation are much more difficult to predict. Applying the guidelines appropriate to a situation of zero inflation is likely to be least helpful when trying to make

TABLE 9. Money Interest Rate, Inflation and Real Interest Rates,1960-1979.

	Money Interest Rates (%) *	Annual Rate of Inflation (%)*	Real Interest Rate (%)	Change in the Rate of Inflation over the year (%)	Change in the Rate of Money Interest over the year (%)
1960	7	1.6	5.3	+1.6	+1
1961	8	4.3	3.5	+2.7	+1
1962	6.5	2.6	3.8	-1.7	-1.5
1963	6	2.0	3.9	-0.6	-0.5
1964	9	4.5	4.3	+2.5	+3.0
1965	8	4.5	3.3	0.0	-1.0
1966	9	3.9	4.9	-0.6	+1.0
1967	10	2.2	7.6	1.7	+1.0
1968	9	5.6	3.2	+4.1	-1.0
1969	10	5.1	4.6	-0.5	+1.0
1970	9	7.7	1.2	+2.6	-1.0
1971	6.5	9.2	-2.5	+1.5	-2.5
1972	9.5	7.7	1.7	-1.5	+3.0
1973	15	10.4	4.2	+2.7	+5.5
1974	14	18.1	-3.5	+7.7	-1.0
1975	13	25.3	-9.8	+7.2	-1.0
1976	16	15.0	0.9	-10.3	+3.0
1977	9.5	13.0	-3.1	-2.0	-6.5
1978	14.5	8.1	5.9	-4.9	+5.0
1979	19	17.3	1.4	+9.2	+4.5

* Source: Economic Trends, Annual Supplement 1981.

Figure I. Possible Combination of Changes in Rates of Interest and Inflation.



Case	Effect on Real Interest Rate*	Examples from Recent Years
1	↑	1964, 1973
2	=	-
3	↓	1960, 1961, 1979
4	↓	-
5	↓	1968, 1970, 1971 1974, 1975
6	↑	-
steady state		-
7	↓	1965
8	↑	1966, 1967, 1969, 1972, 1976, 1978
9	↑	-
10	↓	1977
11	=	-
12	↑	1962, 1963

* ↑ denotes a rise
= " no change
↓ " a fall

predictions about an investment's ability to generate income to meet loan servicing obligations in the years immediately following the time when the rates change. Two factors are responsible for complicating the issue and they will now be considered.

(i) Lending institutions usually require money interest charges to be paid in full in the year in which they accrue. If this requirement is enforced when the money interest rate rises an increase in the annual cash payment to service the borrowing will be called for. The income generated by the investment in the short-term, relative to the higher annual loan servicing payment, will have declined and servicing the borrowing will be more difficult. This may occur even though the real interest rate has not changed (Case 2) or declined (Case 3). That is when there is an expectation that the profitability of the investment over its remaining life will be unchanged or even improved. Of course an increase in the money interest rate which more than compensates for a contemporaneous increase in the rate of inflation will result in an increase in the real interest rate (Case 1). The increase in the annual loan servicing payment and the resulting deterioration in the investment's loan servicing ability in the short-term will be greater than would have been experienced had an identical increase in the real interest rate occurred under conditions of zero inflation.

On the other hand,if borrowers are permitted to reduce annual loan servicing payments when money interest rates fall this may result in an easing of the debt servicing burden in the short-term. This may be so even when the real interest rate has remained unchanged or increased and the expected profitability of the investment over its remaining life has not changed or even declined. Such outcomes might result from combinations of movements in inflation and money interest rates represented by Cases 11 and 12 respectively. A further possibility is that the money interest rate may fall by more than the amount needed to compensate for a contemporaneous fall in the inflation rate (Case 10). In this case the loan servicing burden in the short-term may be eased to a greater degree than would have resulted from an identical fall in the real interest rate under conditions of zero inflation.

A fall in the rate of inflation when the money interest rate remains unchanged (Case 9) will increase the real interest rate and reduce the profitability of the investment over its remaining life. Interestingly the increase in the loan servicing burden in the short-term will be less than that which would have resulted from an equivalent increase in the real interest rate under conditions of zero inflation. However, servicing the debt will become increasingly difficult with the passage of time as the profitability of the investment will be reduced by the increase in the real interest rate. An opposite outcome will be experienced when the money interest rate remains unchanged and the rate of inflation increases (Case 4). The real interest rate will fall and profitability over the remaining years of the investment's life will improve. However, there will be little marked easing of the loan servicing burden in the short-term; instead there will be a gradual and accelerating easing of the burden with the passage of time.

An increase in the money interest rate occurring with a fall in the rate of inflation (Case 8) will increase the real interest rate and the profitability of the investment over its remaining life will be reduced. There will also be an immediate increase in loan servicing payments butthe deterioration in loan servicing ability in the short-term will be less marked than for an equivalent increase in real interest rates under conditions of zero inflation. However, loan servicing ability will deteriorate further over the remaining years of the investment's life. The reverse of this situation would be when a fall in the

money interest rate accompanies a rise in the rate of inflation (Case 5). The fall in the real rate of interest under these circumstances will not result in an easing of the loan servicing burden in the short-term to the extent which would be experienced by an equivalent fall in real interest rates under conditions of zero inflation. Over the remaining years of the investment's life a continuing further improvement in loan servicing ability can be expected.

Finally, only when money interest rates change with no change in the rate of inflation (Cases 6 and 7) will the consequences for profitability and loan servicing ability closely resemble those for an equivalent change in the real interest rate under conditions of zero inflation.

Taking a 10 year view, the change from low inflation and money interest rates in the 1960s to the higher rates in the 1970s was of a Case 3 nature. That is, the real interest rate fell, which, whilst improving the profitability of investments financed with borrowed money, also resulted in increased loan servicing difficulties in the short-term. In order to return to an era of low inflation and interest rates similar to those of the 1960s implies a Case 12 type change. That is, a fall in the rate of inflation accompanied by a less than compensating fall in money interest rates such that the real interest rate increases. It might be expected that a Case 12 type change will result in an improvement in short-term debt servicing ability even though the profitability of investments financed with borrowed funds will decline.

The consequences resulting from changes in the rates of inflation, money interest and real interest described above for the various cases ignores the impact of taxation, which is the second complicating factor.

(ii) Tax relief is given on money interest payments where borrowing is incurred for business purposes. As illustrated in Section 6, the after tax profitability of an investment financed with borrowed funds in a period of inflation and high money investment rates will be higher than for an identical investment under zero inflation and an equivalent real interest rate. Furthermore, there is the prospect that taxation will moderate the effects of changes in money interest rates and the ability of an investment to cover loan servicing commitments.

Of course some businesses may have insufficient income to be able to utilize fully the relief available. Other businesses, paying high marginal rates of tax, may be able to enjoy enhanced benefit. Such are the complexities of the tax system that it is beyond the scope of this report to consider them in great depth. In practice it is not only necessary to take into account tax relief for money interest but also the interaction of tax allowances for capital expenditure and possible liability for capital gains tax. In order to do so every investment project must be evaluated in the light of the particular tax circumstances of the individual business and the type of assets being acquired. An investment appraisal programme which specifically allows for inflation has recently been developed for a micro computer (Williams, 1981).

8. THE IMPLICATIONS FOR INVESTMENT GENERALLY

Widely fluctuating and generally high inflation and interest rates, when coupled with the terms under which loans are granted and the present tax arrangements which businesses are subjected to, may have important consequences for the allocation of resources generally.

During a period of high inflation the level of borrowing which a business can service may fall well below the level which could be borrowed on the basis of the collateral available to provide security for borrowed funds. The maximum level of capital gearing which a business can sustain is likely to be less than in a time when inflation and interest rates are lower. It is therefore possible to postulate that some businesses may be forced to forgo investments which are inherently profitable but which are financially unfeasible in the short-term.

On the other hand businesses which are potentially liable to high rates of tax and which have a low level of borrowing may be induced by the enhanced tax relief on interest payments during a period of high inflation to invest in projects which have an inherently low level of profitability. That is, some businesses may find it worthwhile to undertake investments financed with borrowed money which they would not consider in a period of low inflation and interest rates.

If some businesses have in fact embarked on inherently unprofitable investments whilst others have been forced to forgo profitable investments then this implies that resources have been misallocated. Unfortunately it is not known whether this has occurred to any significant extent and it would be extremely difficult to obtain meaningful figures to provide evidence one way or the other. Nevertheless, the conditions for a misallocation of resources may exist even if they have not been acted upon.

Of course, if inflation and money interest rates fall to more moderate levels then the problem will disappear and businesses which were forced to postpone profitable investments will find that they once again become financially feasible. It is also possible that businesses which invested in inherently unprofitable projects which have not run their full term will be unable to reap the benefits of enhanced tax relief on money interest payments.

If, on the other hand, inflation continues at a high level and evidence comes to light that a serious misallocation of resources is taking place, then more radical measures may have to be considered. These might entail restricting tax relief on interest payments to the real interest element. This would remove the incentive for businesses to invest in inherently unprofitable projects. In addition, if the lender were also only taxed on the real interest element this would increase the after tax returns on lending money. The difficulty of businesses being unable to service loans in the short-term might be overcome by the introduction of some form of index-linked loan. That is, a low rate of interest would be charged on the loan but the principal would be indexed up to compensate for the fall in the purchasing power of money. Alternatively, an arrangement whereby borrowers were required to pay less than the full amount of the money interest change in the early years of an investment project's life might be more easily implemented than full indexation. In this case the unpaid interest would be added to the outstanding balance of the loan. Obviously such drastic changes would still be difficult and costly to introduce and may even be politically unacceptable.

Finally, as long as uncertainty exists about the future level of inflation and monetary interest rates, businesses may be deterred from undertaking investment projects financed with borrowed money. This is because on the one hand they face the risk of not being able to service the borrowing in the short-term if the rates of inflation and monetary interest increase, whilst on the other hand there is the risk that the after tax profitability of the project may fall to an unacceptable level if inflation and monetary interest rates fall.

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