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Relative price changes and financial decisions

Ian Cooper

Relative price changes are the essence of financial profitability. Suppose that you buy a property for £100 000. You hold it for a year and sell it. Was it a good decision? This depends on what has happened to the price of the property relative to the interest rate on the debt used to finance the purchase. This comparison involves comparing the price change of the property with another price: the interest rate is the price of the time-value of money.

Before the property is purchased one is faced with a slightly different problem. The price change in the property must be forecast relative to the interest rate. Note that the interest rate is known at the time of the decision to purchase the property, whereas the price change of the asset to be bought is uncertain. It is easy to see, in this case, that the profitability of the financial decision depends almost entirely on a relative price change. Since the return to a speculative asset purchase of this sort is the price change of the property, the link between the relative price change and profitability is obvious. It is slightly less obvious that decisions to invest in continuing operations are just as dependent for their success upon relative price changes.

Suppose that a decision is made to develop a new product. The product requires investment in capital assets and overheads and will generate a contribution stream. The contribution is equal to the volume of product sold multiplied by the gross margin per unit. The profitability of the project depends, therefore, on the gross margin. But the gross margin is determined by the difference between the sales price and the direct cost

per unit: the relative prices of output and input.

The purpose of this chapter is to demonstrate in detail how relative price changes should be incorporated into good financial decisions. In the next section two important notions are introduced: the real interest rate and real price changes. Next is illustrated, with a detailed example, the incorporation of relative price changes into cash flow analysis of decisions. The section which follows on page 72 explains a common misconception: that constant prices are the same as a constant price level. The magnitude of relative price changes is then illustrated, and forecasting price changes is then discussed. Finally, two common errors made by those analysing financial decisions are illustrated, and the chapter concludes with a short summary of the major points.

REAL INTEREST RATES AND REAL PRICE CHANGES

Let us return to the example of buying property. Suppose that the property made a return of 20 per cent over the year, including price appreciation. The general inflation rate was 8 per cent. We can state this information in two different ways. The return was 20 per cent stated in nominal, or 'money-of-the-day', terms. This return was 12 per cent in excess of the rate of inflation. The latter is called 'real' terms. This restatement in real terms is just a convention and should not be thought of as having any significance beyond that.

Is this return good or bad? Suppose that we compare it with the return we would normally require for an investment of this type and risk level. This 'required return' might be 16 per cent in nominal terms. We can also state the required return in 'real' terms by subtracting the inflation rate. In this case the real required return is 8 per cent (16 per cent minus the 8 per cent inflation rate).

This procedure is summarized in Table 4.1. Note that the comparison between what was earned and what was required gives the same result whether we make the comparison in nominal or real units. The investment earned 4 per cent more than the required return. The procedure of adjusting for inflation has not changed the basic message as to whether this was, or was not, a good investment. Indeed, the adjustment is merely a mechanical calculation, it cannot change what has happened. It would be odd, therefore, if it resulted in a different impression of the profitability of the investment.

Table 4.1
Nominal and real returns

	Return earned (%)	Return required (%)	Excess return (%)
Nominal return	20	16	4
Less inflation	−8	−8	
Real return	12	8	4

We can go a bit further with the breakdown between real and nominal rates. The required return is normally viewed as consisting of the interest rate plus a premium for risk. In this case the 16 per cent nominal required return consists of a 10 per cent nominal interest rate plus a risk premium of 6 per cent. We can equally think of the real required return as consisting of a 2 per cent real interest rate plus the same 6 per cent risk premium. This is illustrated in the lower half of Table 4.2.

Table 4.2
Nominal and real required returns

	Interest rate(%)	+	Risk premium(%)	=	Required return(%)
Nominal	10	+	6	=	16
Real	2	+	6	=	8

Everything so far is purely mechanical. It affects the way that information is presented, but it does not affect the content of the information, or its implication for financial decisions. Yet the inability to keep clear this 'nominal' versus 'real' distinction leads to some very odd statements and decisions in practice. It is probably the largest single source of confusion in the way that people think about financial decisions.

NOMINAL PRICE CHANGES

Although general inflation in the last example was 8 per cent, the price of the property changed by a different amount. Table 4.3 shows that the

property grew in value by 15 per cent and gave a rental yield of 5 per cent. This resulted in an overall return to the property of 20 per cent. The 15 per cent price appreciation can be thought of as 8 per cent general inflation plus a positive relative price appreciation of 7 per cent. This relative price movement was the key to the profitability of the investment.

Table 4.3
Cash flow analysis including relative price change and general inflation (nominal terms)

Time	0	1
Property purchase and sale	− 100	+ 115
Property rent		+ 5
Total	− 100	+ 120
PV at 16 per cent	− 100	+ 103.4

Suppose we switch perspective and are now trying to make the decision as to whether or not to purchase the property. Suppose that the rental yield is known, and the 15 per cent price appreciation now represents our expectation of what will happen to the value of the property. The cash flows are as before, but they are now forecasts. The standard way to analyse the decision is to take the present value of the future cash flows, using the required rate of return of 16 per cent to perform the discounting calculation. This results in a net present value (NPV) of 3.4. This is equal to the present value of the forecast future cash flow of 103.4 less the investment of 100.

Would this be different if we exclude the impact of general inflation? The answer is no. Table 4.4 shows why: in this table, the cash flows are shown in 'real' terms, with the impact of the 8 per cent general inflation rate excluded. The value of the property now inflates at 6.5 per cent, which is the relative price move of the property compared with the general inflation rate. The 6.5 per cent is not quite the same as the 7 per cent obtained by simply subtracting 8 per cent inflation from the 15 per cent property price appreciation. The latter is an approximation. The correct procedure is shown at the foot of Table 4.4.

Table 4.4
Cash flow analysis showing general inflation, including relative price changes (real terms)

Time	0	1
Property purchase and sale	− 100	+ 106.5*
Rental		+ 4.6†
Total	− 100	+ 111.1
PV at 7.4%‡	− 100	+ 103.4

*106.5 = 115/1.08. †4.6 = 5/1.08. ‡1.074 = 1.16/1.08.

Although Table 4.4 presents the information about the investment in a different way to Table 4.3, the net result of the analysis is the same. Since the cash flows are in real terms, they should be discounted at a real discount rate. The appropriate real discount rate is the 16 per cent nominal required return adjusted for the 8 per cent inflation rate. This gives 7.4 per cent. Discounted at this rate, the present values of the cash flows are exactly the same as before.

Given that there is no difference, other than presentation, between the two types of financial analysis, what reason is there to prefer one form to the other? On the whole, those who use the 'real' style of analysis tend to do so either because they think it is easy (which is a mistake) or because they believe that it facilitates aggregation across different currencies (which is also a mistake). Many companies have a strong preference for including in their financial decision-making procedures the impact of all future price changes, including general inflation. This requires that the financial analysis be in nominal terms. This approach almost always leads to fewer errors of the type discussed in the section 'Common Errors' on page 76. Forecasts of cash flows should be made in 'nominal' units including all forecasts of inflation and relative price changes. These should be discounted at a rate which reflects the nominal interest rate plus an appropriate risk premium. The nominal interest rate is the actual rate charged by lenders, since part of this is an allowance for general inflation.

If, for reasons of exposition, it is desired to restate the analysis in real

terms, then the cash flows and the discount rate should both be adjusted for the general inflation forecast. This adjustment is illustrated by the steps taken to convert Table 4.3 to Table 4.4.

CONSTANT PRICES AND CONSTANT PRICE LEVELS

Some people confuse the 'real terms' financial analysis outlined in the previous section with something very different: assuming that prices remain unchanged. The difference is that real analysis assumes that the general level of prices remains unchanged, which is very different to assuming that all prices stay the same. Table 4.5 illustrates this with an example of an operating project. This project is very simple and is a stylized version of real projects.

Table 4.5
Analysis of operating project: nominal terms

Time (yrs)	0	1	2	3	4
Capital investment	−200				+40
Sales revenue*		+300	+315	+331	+348
Operating costs†		−200	−240	−288	−346
Working capital‡	−50	−10	−12	−15	+87
Net cash flow	−250	+78	+63	+28	+129
Present value at 15%	−250	+78	+48	+18	+74

*Constant volume of 100. Initial price 3. Price increase of 5% pa.
†Constant volume of 100. Initial cost 2. Cost increases of 20% pa.
‡Working capital required is 25% of operating costs.

The cash flows in Table 4.5 include forecasts of particular rates of sales price and unit cost increases. These are 5 per cent and 20 per cent, respectively. The net present value of the cash flows is −32 using a discount rate of 15 per cent.

Table 4.6 restates the same cash flows in 'real terms' after allowing for a general inflation rate of 10 per cent. The discount rate is also adjusted by this amount of forecast inflation, to give a real discount rate of 4.5 per

cent. A comparison of Tables 4.5 and 4.6 shows that the overall result of the appraisal is unchanged. The net present value of the project and the present value of each future cash flow are the same. The difference here lies entirely in presentation rather than substance.

Table 4.6
Analysis of operating project: real terms (10% inflation)

Time (yrs)	0	1	2	3	4
Capital investment	−200				+27
Sales revenue		+273	+260	+249	+238
Operating costs		−182	−198	−216	−236
Working capital	−50	−9	−10	−11	+59
Net cash flow	−250	+82	+52	+21	+88
Present value at 4.5%*	−250	+78	+48	+18	+74

*1.045 = 1.15/1.10

Table 4.7, however, presents a completely different picture. In Table 4.7 the same volume forecasts have been used, but the price and unit costs figures used throughout the four years are those pertaining to the first year. The net present value is now +152. This huge swing in apparent profitability is caused by a simple, but common, error. The error is confusing real terms, which means at a constant general price level, with constant prices, which means all prices and costs staying the same. The latter omits the relative price moves which are the main cause of profitability, or the lack of it.

It is quite easy to see this by looking again at Table 4.6, the analysis of the project in real terms. In this case, although the impact of general inflation has been excluded from the cash flows, there are still two large relative price changes included. The first is the 5 per cent real price decline of the output. The second is the 10 per cent real rise of the operating costs. The analysis in Table 4.7 has omitted the impact of these relative price changes. It is based upon the false assumption that prices in the future, when adjusted for the general rate of inflation, will be the same as they are today.

Table 4.7
Analysis of operating project: constant prices

Time (yrs)	0	1	2	3	4
Capital investment	−200				+27
Sales revenue*		+300	+300	+300	+300
Operating costs†		−200	−200	−200	−200
Working capital‡	−50	0	0	0	+50
Net cash flow	−250	+100	+100	+100	+177
Present value at 4.5%	−250	+96	+92	+88	+148

*Volume of 100 multiplied by price of 3.
†Volume of 100 multiplied by unit cost of 2.
‡25% of operating costs

RELATIVE PRICE CHANGES

Table 4.8 shows the changes in four price indices measured relative to the retail price index (RPI) for the period 1980–85. These real price changes show some common features. Year-to-year relative price changes are large in some years for all the series. These short-term swings are caused by temporary supply and demand shifts which can change the real price by significant amounts over a single year. Over the medium term, represented by the entire six year period, the effects of these short-term imbalances even out. Average real price moves over the six years are not large, when stated as a percentage per annum, but do have a large cumulative effect. These medium-term real price moves are caused by medium-term changes in supply and demand resulting from changing wealth levels, consumption patterns, productivity, substitution and technology.

The price moves illustrated in Table 4.8 are for inputs and outputs aggregated across fairly broad groups. If the table included, for instance, the inputs purchased by an individual company for an individual project we would see even larger year-to-year swings. We are, therefore, left with the conclusion that relative price changes can be large in the short term and cumulatively large in the medium to long term. Since these relative

price changes are one key to profitable financial decisions, we are confronted with a crucial question: can we forecast relative price changes?

Table 4.8
Real price changes: price change relative to RPI, %

Year	Oil	Manufacturing wages	Instrument Input	Engineering Output	Food Input	Food Output
1980	+37	+4	−5	−5	−12	−7
1981	+16	−3	−8	−2	−3	−3
1982	−5	−4	−3	0	−2	−2
1983	−8	−4	0	−1	0	−1
1984	+1	−1	+2	0	+2	+1
1985	−6*	0	−1	−2	−7	−3
Average	+4	−1	−2	−2	−4	−2

*First three quarters

FORECASTING RELATIVE PRICE CHANGES

The last section illustrated relative price changes in both the short term and the medium term. Short-term changes are caused by temporary shifts in supply and demand. The real oil price rise in 1980 was induced by the OPEC cartel, the real price fall of food inputs in 1985 was caused by agricultural surpluses. The long-run changes, though small as annual averages, have a large cumulative impact. They are caused by innovation, changes in wealth and demand patterns, competition and substitution. The real decline in input prices for instrument engineering has been caused by innovation in the industries that supply instrument components. The real decline in the output price for this industry has been caused by competition within the industry by those who use the cheapest available inputs.

Can one forecast these changes? Short-term forecasting requires detailed knowledge of the demand and supply conditions in a particular

market. Knowledge of the possible success of OPEC in reforming the oil cartel would clearly help in forecasting the short-term move in the real oil price. Knowledge of the EEC policy on food surpluses would help in forecasting the short-term price change of outputs from the food industry. Thus detailed analysis of individual markets is vital to short-term forecasting of relative price changes. It is a mistake, however, to make medium-term and long-term forecasts based on extrapolation of these short-term forecasts. There are powerful economic forces that mean that short-term supply and demand imbalances cannot persist indefinitely.

For medium-term and long-term changes in relative prices this powerful set of economic forces comes into play. Those forecasters who predicted that the oil price could continuously rise at a rate far in excess of general inflation ignored three powerful economic phenomena: substitution, competition, and innovation. Substitution by users of energy reduced their dependence on oil. Competition destroyed the OPEC cartel in its original form. Innovation in response to the jump in the real price of oil facilitated both of these effects.

Thus those who forecast medium- and long-term real price changes for a particular product, commodity, or input face the burden of proving that such real price changes will be sustainable in the face of substitution, competition and innovation. It is clear that such long-term changes do occur, but the long-term behaviour of a price is quite different to its short-term behaviour. Demand and supply changes induce responses from current and potential competitors and from consumers of the product. One must be very careful if one bases financial decisions on medium-term price forecasts that do not incorporate the effects of this competition and substitution.

COMMON ERRORS

In making financial decisions using forecasts of cash flows, the best technique is to make all forecasts in nominal or 'money-of-the-day' units which include all forecast price changes including the general inflation forecast. These cash flows should then be discounted at a nominal discount rate which is equal to the nominal interest rate plus a risk premium. Those who approach the problem differently expose themselves to a host of potential errors. Two common ones involve the treatment of tax and working capital. The problem with tax arises because many tax cash flows are paid some time after they are incurred.

Suppose, for instance, that a nominal tax liability of £100 is incurred now and paid one year later. This gives rise to a nominal payment of £100 in year 1. If inflation is expected to be 10 per cent the inflation adjusted real equivalent of this is only £91, since the amount of the tax payment is not indexed for the inflation between incurring and paying the tax. A common error is to allow for the postponement of the tax payment but not to recognize that its real value falls. This is illustrated in the third row of Table 4.9. Here the tax cash flow has been lagged by one year to allow for the delay in payment, but not adjusted to keep it in 'real' terms.

Table 4.9
Treatment of tax cash flows

Tax of 100 incurred in year zero, paid in year one. Inflation rate 10%

Time	0 (tax incurred)	1 (tax paid)
Nominal cash flow		−100
Real cash flow		− 91*
Incorrect real		−100

*91 = 100/1.1

Table 4.10
Treatment of working capital

Constant working capital stock of 100 real, inflation 10%

Time	0	1
Nominal stock	100	110
Nominal cash flow		−10
Real stock	100	100
Real cash flow		−9.1*
Real stock	100	100
Incorrect real cash flow		0

*9.1 = 10/1.1

A similar misconception can arise with working capital flows. Table 4.10 illustrates a situation where, because of the impact of inflation, cash is being invested in working capital to maintain its real level. This cash flow is correctly stated in nominal terms and real terms in the first two blocks of Table 4.10. Note that the correct real cash flow is obtained by first analysing the situation in nominal terms and then converting the cash flow to real terms. A common mistake is to perform the forecast in the way shown in the third block. Because the real level of working capital is constant, it is tempting to believe that no cash flow is required to maintain the working capital balance. This is incorrect, and the correct treatment is given in the second block. Although the real level of working capital is constant, there is still a cash flow required to sustain this level of working capital.

CONCLUSIONS

The impact of relative price changes on the profitability of financial decisions is enormous. There are no short-cut techniques for dealing with this problem. Those who believe that making decisions in 'real' units, that omit the impact of inflation, helps address the problem are usually making one of a number of large errors. The most common of these is to confuse the analysis of financial decisions in real terms (which is merely a presentational device) with the forecast that all relative prices will remain the same (which is almost always wrong).

Good financial analysis confronts directly the issue of which prices will move relative to each other and the general inflation rate and by how much. Short-term forecasts of these price moves should be based upon detailed knowledge of current demand and supply conditions and imminent changes in these. Long-term forecasts should not be extrapolations of these short-term effects. They should explicitly recognize the powerful medium-term impacts of substitution, competition and innovation. These economic forces limit the size of plausible forecasts of medium-term real price changes.

FURTHER READING

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