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Agenda

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Indexation, investment and utility prices

The recent turmoil in capital markets has revived the debate on whether utility price controls should incorporate mechanisms to accommodate the uncertainty in financing costs. In this article, Julian Franks, Professor of Finance, London Business School, and Oxera Director, summarises some of the research that he has conducted with Professor Richard Brealey on this topic, and concludes that utility prices should be largely indexed to changes in the companies' cost of capital

A number of UK regulators have recently considered the possibility of indexing utility prices to changes in the companies' cost of capital. In preparation for the recent price reviews, a report commissioned by the UK rail regulator, the Office of Rail Regulation (ORR), and Ofwat, the regulator of the water industry in England and Wales, recommended that prices should be indexed to the cost of debt (but not equity) to reflect changes in the yields on AAA-rated debt.[1] In contrast, the UK Competition Commission recently recommended to the Civil Aviation Authority that it should not introduce any form of automatic adjustment of the cost of capital for airports, on the grounds that:

> indexation would start to erode one of the core foundations of RPI–X regulation—ie that shareholders are asked to manage cost risk for periods of five years at a time—without offering sufficient benefits to justify the apparently sub-optimal allocation of risk.[2]

This article contends that indexation could bring substantial benefits to consumers, and that most of the arguments put forward by the industry and the regulators against this proposal are largely misplaced. The rationale is that companies have little influence over the cost of capital and regulators currently use crude upward adjustments to the cost of capital (often termed 'headroom') to mitigate any under-investment problems. Indexation would largely remove the risk of under- and over-investment associated with variations in the cost of capital, and, therefore, the need for headroom. Better investment decisions and the reduction or elimination of headroom should result in lower prices. More up-to-date prices would also provide better price signals to consumers.

The rationale for indexation

UK regulators customarily review utility prices every five years. By providing utilities with the opportunity to capture the benefits of any productivity gains during this period, this regulatory lag offers an incentive for firms to improve efficiency.

During the review period, prices are commonly adjusted to reflect movements in the retail price index (RPI). Since variations in wage costs and some material costs may be correlated with fluctuations in the RPI, linking output prices to the RPI allows companies to pass through many of the cost variations that are beyond their control. This is generally uncontroversial and has never been challenged.

However, there are other costs that are not related to inflation, that are also largely beyond companies' control and for which there is currently no automatic adjustment. One of the most important of these costs is the cost of capital, which can be a substantial part of a company's cost base.

A regime that fixes prices for a period of several years regardless of fluctuations in the cost of capital cannot lead to optimal levels of investment. For example, were the cost of capital to rise substantially, companies would have an incentive to reduce their levels of new investment and the result would simply be a reduction of demand for the utility's output by rationing rather than by price.

One objection to indexation might be that regulated companies, owned by diversified investors, are better placed to bear the risks of changes in the cost of

This article is based on Brealey, R. and Franks, J. (2009), 'Indexation, Investment, and Utility Prices', *Oxford Review of Economic Policy*, **25**:3.

capital than consumers, consumers, whose sources of income are typically not diversified. For reasons of optimal risk-sharing, it is argued that utility companies should bear these risks.

This argument fails for three reasons. First, as already noted, one *advantage* of indexation is that it aligns prices more closely to costs and therefore leads to more efficient consumption decisions. Second, although this form of risk-sharing may impose costs on some consumers, it is not clear why the risks arising from changes in the cost of capital are a particular concern. For example, the fact that utility prices are already exposed to the risk of shifts in the RPI has not attracted as much controversy. Third, both the non-regulated and regulated companies do offer a variety of contracts that share risk with consumers. For example, gas and electricity companies, faced with highly volatile prices, have already offered consumers both variable and long-term fixed-price contracts. The consumer is able to choose, depending on their wealth and risk aversion, whether to take up these contracts. Indeed, one of the easiest risks for consumers to hedge is the risk of changes in the debt component of the cost of capital. Savers regularly choose whether to invest in fixed- or variable-rate instruments, and in the mortgage market borrowers can opt for fixed- or variable-rate mortgages.

Another common objection to indexation advanced by some regulated companies is that they would not have an incentive to reduce the cost of capital. However, it is not obvious that they have much discretion over these costs and, where they do, the incentives to best manage these costs can be preserved in the system of indexation.

The cost of capital for any project has two components: the cost of equity and the after-tax cost of debt. The cost of equity is equal to the risk-free rate plus a risk premium, which is commonly estimated from the capital asset pricing model (CAPM) as the product of the market risk premium and the project's beta. The risk-free rate and the market risk premium are outside the control of management, while the beta is determined by the characteristics of the project.

Consider now the cost of debt. This is composed of a risk-free rate plus a default spread. The company cannot influence the risk-free rate; nor can it influence the spread that it pays *given* the probability of default and the likely loss given default: once the default probability and the loss given default are known, the associated price of the debt is set by the market. Companies can take views on the term structure, adopt a particular security design, and adjust their leverage. However, in setting the cost of capital, regulators frequently use a 'notional' efficient capital structure rather than the actual capital structure of the company. In this case the utility's cost of debt for price control purposes is largely outside the company's control.

Headroom and the cost of capital

In calculating the cost of capital, UK regulators have typically allowed a degree of 'headroom', either by assuming a value for the risk-free rate that is higher than prevailing rates, or by selecting a point estimate for the cost of capital that is above the midpoint of the range obtained by combining the different weighted average cost of capital (WACC) components. For example, the Competition Commission reports a range of estimates for the cost of capital, and then chooses a point estimate at about the eightieth percentile of this range. In the case of the price control for Stansted Airport, the point chosen was about 0.73% above the mean of the distribution.[3]

There are two possible reasons for including some headroom in regulatory estimates of the cost of capital. First, the cost of capital can be estimated only with error. Decisions by a utility to invest depend not on the regulator's estimate of the cost of capital but on the unobservable estimate by the firm's management. Therefore, to be confident that sufficient investment will be undertaken, it may make sense for the regulator to include some headroom in the allowable cost of capital.

The second reason for including headroom is that, even if the firm shares the regulator's estimate of the cost of capital today, that cost will almost certainly change during the review period. In this case, the headroom is needed to cater for the possibility that the cost of capital will increase and that necessary investment projects will no longer be profitable.

Notice that both these reasons assume that the cost of under-investment is larger than that of over-investment. This may be because both regulators and companies may have an incentive to avoid the risk of highly visible output shortage and rationing. It is this asymmetry of costs, as perceived by regulators, that leads them to provide headroom in the cost of capital.

If headroom is a response to the risk of increases in the cost of capital during the review period then indexation of the cost of capital would mitigate, if not eliminate, the need for headroom. This would align utility prices more closely with costs, and would avoid the danger of over-investment when the cost of capital *declines* during the review period.

Are the gains from indexation significant?

An obvious question is whether the potential gains from indexation are worth worrying about. This depends on two factors: the relative importance of the cost of the utility's capital, and the uncertainty or variability

attached to changes in the cost of capital during a review period.

For most utilities, the cost of capital is an important component of costs. In the water sector, for example, the allowance made by Ofwat for the cost of capital represents 27% of allowed revenues in 2010–15.[4] In the case of Heathrow and Gatwick Airports, the cost of capital as a proportion of allowed revenues is 24% and 36%, respectively.

Regarding the magnitude of the uncertainty surrounding the cost of capital, it is useful to consider each component of the WACC separately.

Uncertainty in the risk-free interest rate

One possible experiment to assess the level of uncertainty surrounding interest rates is to compare the actual risk-free rate awarded to companies in past price control determinations with what the companies would have received if the risk-free rate had been indexed annually. Figure 1 reports the results of this exercise for 29 price control decisions conducted by six different regulators over the period 1993–2009. The minimum difference is 0.1%, the maximum is 1.5%, and the median is 0.8% (compared with a total cost of capital of around 6%).

Another way to examine this issue is to use past data on interest rates to estimate the error that is likely to arise from assuming that the interest rate does not change during the review period (here assumed to be five years). Since this involves estimating the likely magnitude of changes in bond yields over a five-year period, reliable estimates require a long dataset. Three series of bond yields cover the period from 1918 to 2008: the Debt Management Office data on the yields on British 2.5% Consols; Robert Shiller's data on long-term yields in the USA; and the Swedish Rijksbank data on Swedish government bond yields.[5]

In about half the cases, the change in the interest rate over the five-year review period is less than 0.5 of a percentage point. Nevertheless, in roughly 3% of occasions the change in the interest rate over the five years exceeds 5 percentage points. Table 1 summarises the results.

Uncertainty in the market risk premium

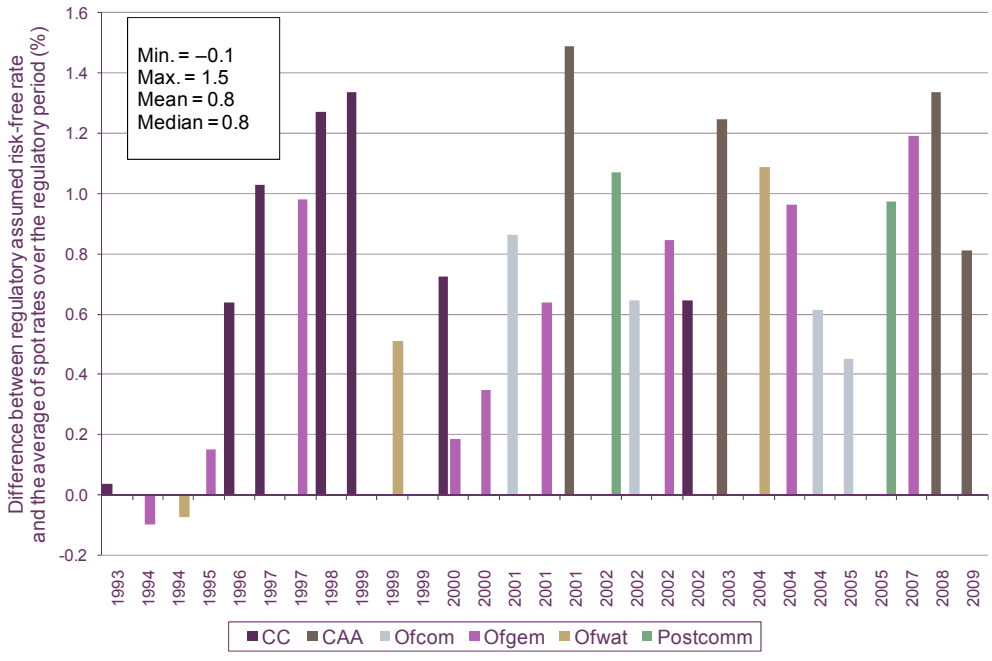
Unlike the risk-free interest rate, the *expected* market risk premium is unobservable. It is improbable, however, that this risk premium is constant. For example, Merton (1980) has suggested that the premium is likely to depend on the variance of the

Table 1 Magnitude of the yield changes over five-year periods

	Absolute five-year change in yield (%)	
	Mean	**Maximum**
UK	1.33	6.06
USA	1.21	7.51
Sweden	1.31	5.17

Source: Brealey and Franks (2009), op. cit.

Figure 1 Difference between setting risk-free rates for the control period and indexing them annually



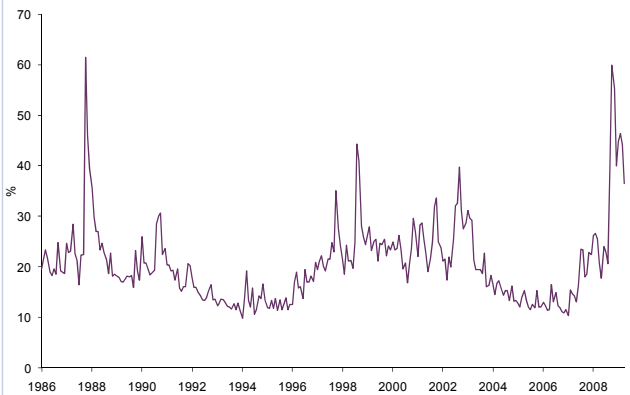
Source: Brealey and Franks (2009), op. cit.

market return.[6] In principle, the regulator could vary the premium as a function of the estimated volatility over the life of the utility's new investments.

Figure 2 shows the implied volatility of the US market since 1986 (VIXO up to 1995 and VIX thereafter). The VIX follows a mean reversion process of about 16%. This implies that deviations from the mean level of volatility have a half life of about six months only. For example, the maximum month-end level for the VIX/VIXO occurred in October 1987, when the implied volatility was 61.4% compared with a mean VIX of 20.5%. A company contemplating a five-year project at this point might have been tempted to use a very high value for the market risk premium. However, given the strong mean reversion in volatility, the *expected* average volatility over the life of the project was 22.9%, which is quite close to the mean value. This strong mean reversion in the volatility series suggests that, for any extended project, there may not be much to be gained from varying the required equity premium mechanically in accordance with the current level of volatility.

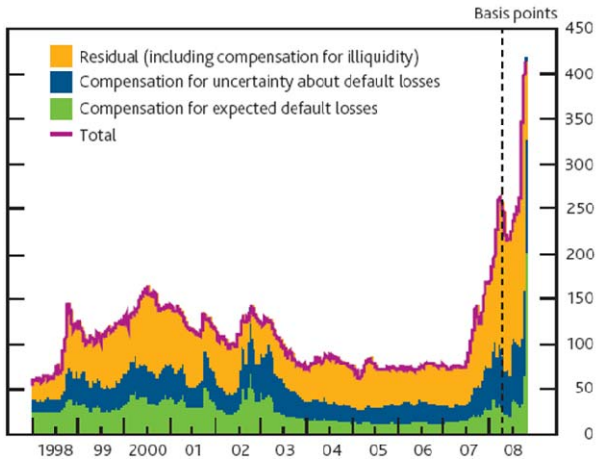
However, there may be other possible indications of shifts in the risk premium. One source of data is the debt market and the spread on lower-grade debt instruments such as BBB bonds. It is a reasonable assumption that the expected risk premium implied in the spreads on all BBB bonds must form a likely lower bound on the equity market premium. After all, for any firm, debt is a less risky security than equity. The spreads on BBB bonds in 2007/08 increased markedly, as shown in a Bank of England graph reproduced in Figure 3. Thus, while there might be little case for formal indexation of the risk premium, it might be appropriate for the regulator to retain the option of varying the assumed premium in particular cases and conditions. The recent period of market turbulence is a case in point when regulators may have wished to review the market equity premium.

Figure 2 VIX index of implied volatilities, 1986–2009



Source: Brealey and Franks (2009), op. cit.

Figure 3 Decomposition of sterling-denominated investment-grade corporate bond spreads



Source: Bank of England (2008), 'Financial Stability Report', October, London: Bank of England.

Uncertainty in the cost of debt

The cost of debt depends on both the risk-free rate and the default spread. To estimate the errors from assuming that yields on company bonds do *not* change during a review period, we examined the Federal Reserve series of yields on Aaa and Baa corporate bonds since 1919. Table 2 summarises the mean and maximum absolute change in the yields on these bonds over successive five-year periods.[7] In a quarter of the (overlapping) five-year periods, the change in Baa bond yields is less than 0.5 percentage points, but in about 5% of the cases the yield change is greater than 5 percentage points.

Overall uncertainty in present values

Suppose that, one year after the start of the review period, a utility is analysing a particular project. At this point, the rate of return that is allowed by the regulator is only one year out of date. On the other hand, any error in the allowed rate of return will not be corrected for another four years. By contrast, a utility contemplating a project four years into the review period will be faced with an allowed rate of return that is four years out of date, but the error will be corrected one year later when the regulator undertakes a new

Table 2 Absolute five-year change in yield (%)

Bond rating	Mean	Maximum
Aaa	1.25	7.23
Baa	1.66	8.06

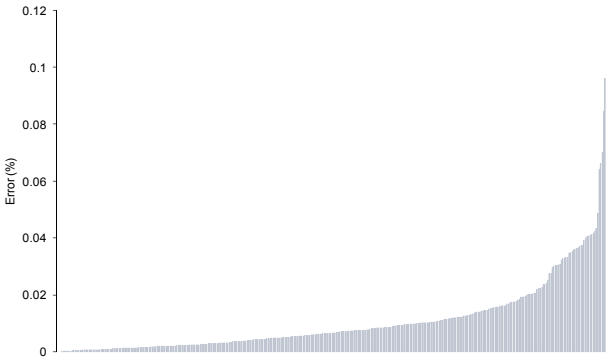
Source: Brealey and Franks (2009), op. cit.

review. If prices were indexed to the cost of capital, the allowed rate of return could be set so that, at each point, investments by the utility had zero net present value (NPV). If prices are not indexed, the NPV of identical projects could be positive or negative.

To assess the effect on project values of *not* indexing the cost of capital, it is possible to conduct a simulation that involves three main steps: first, hypothesising a notional ten-year investment that has a zero NPV in 1918, given the true cost of capital at that date;[8] second, recalculating the present value of this project assuming that 1918 was one year into a five-year review period, two years into the review period, and so on; and, third, repeating this exercise for each subsequent year. What this experiment delivers is a distribution of the absolute percentage errors in the NPV (Figure 4).

In many years, the effect on the present value from using an out-of-date cost of capital to set prices is very small.

Figure 4 Distribution of absolute percentage errors in the present value of hypothetical projects resulting from non-indexation



Source: Brealey and Franks (2009), op. cit.

However, during periods of volatile interest rates, such as the 1980s, the error induced in present values by not indexing is close to 10%. It is clear from these results that indexation is mostly valuable in periods of cost of capital volatility.

The error results from the lack of any price adjustment until the end of the current review period. Therefore, for shorter projects, the *percentage* error from not indexing would be larger than in the case of our hypothetical 10-year project. For longer projects it would be smaller.

This model can also be used to calculate how much headroom is needed in the absence of indexation to ensure that a zero-NPV project is not wrongly rejected. Suppose that our hypothetical ten-year project has a zero NPV at a cost of capital of 6%. The regulator can ensure that three-quarters of our hypothetical projects are not wrongly rejected, simply by adding headroom of 12 basis points (bp) to the cost of capital that is set at the start of the review period. However, to ensure that *none* of the hypothetical projects is wrongly rejected, the regulator would need to add headroom of about 90bp, a figure that is broadly similar to the headroom of 73bp given in the Stansted price control. Levels of headroom of this magnitude suggest that the regulator places a high cost on the risk of under-investment, or that high volatility can be expected over the particular price control period.

In conclusion, an important benefit of indexation is that it can deal with both the risk of under- and over-investment, while the headroom approach focuses on the risk of under-investment. By providing better price signals to consumers, it would also improve the pattern of consumption. This article has argued that these benefits outweigh any costs to changes in risk-sharing arrangements between consumers and companies.

Julian Franks

[1] Cambridge Economic Policy Associates (2007), 'Indexing the Allowed Rate of Return: ORR/Ofwat', September.
[2] Competition Commission (2007), 'BAA Ltd—a report on the economic regulation of the London airport companies', September.
[3] Competition Commission (2008), 'Stansted Airport Limited Q5 Price Control', October.
[4] Ofwat (2009), 'Future Water and Sewerage Charges 2010-2015: Final Determinations', November.
[5] The Consol series comprises average annual yields, and therefore understates the variation between yields at two different points in time.
[6] Merton, R.C. (1980), 'On Estimating the Expected Return on the Market: An Exploratory Investigation', *Journal of Financial Economics*, **8**, pp. 1–39.
[7] The changes reported are from the beginning to the end of each five-year period. For example, the maximum change from the beginning to *any* point during the period would be likely to be higher.
[8] We assumed that the cash flows on the project were based on a ten-year annuity and that the company cost of capital was 4% above the long-term interest rate. Thus, under an indexed regime, prices would be set to provide a return of 4% above the long-term rate in each year, and under a non-indexed regime they would be set to provide a return of 4% above the long-term rate at the start of the review period.

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