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A back- of- the- envelope approach to assess the cost of capital for network regulators

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A key element of the regulation of privatised infrastructure monopolies is the allowed rate of return. This rate is critical at almost every stage of the privatisation and regulation process. It is needed to establish a benchmark against which the rate of return from concession bids can be measured. But it is also central to the calculation of the level of allowed revenue for a regulated company in preparation for the price reviews that are typically scheduled within 4 to 6 years after a concession is awarded or in the context of the renegotiation of a contract which often takes place well before the scheduled reviews.

The best approach requires large volumes of data that demands preparation--as discussed in a companion set of note and manual by R. Green. The rate of return can also be calculated through an estimation of the market determined cost of capital for a company. The problem is that this requires data often difficult to find in countries without a mature capital market. Hence, alternative approaches have to be used by the regulators. This note provides a back-of-the-envelope approach to calculate the after tax rate of return for infrastructure private monopolies that can be useful when little information is available to new regulators. [1]

How to compute the cost of capital

The standard approach adopted by regulatory agencies and governments is to use the weighted average cost of capital (WACC). Formally, WACC can be estimated by:

$$WACC = \left[(1-g)\times r_e\right] + \left[g \times r_d\right]$$

where:

g is the level of gearing/leverage in a company, i.e. the proportion of debt in the total capital structure (i.e. debt + equity);

r_d is the cost of debt finance. This is simply measured as risk free rate, r_f plus a debt premium over this rate, p_d . The premium is either measured directly from the yield of a company's bond or through comparator information—yields on new bonds are listed in the Financial Times at the date of issuance and are available from commercial information sources on a daily basis, as in Table 1-- and

r_e is the cost of equity finance; its estimation raises bigger problems and yet for privatised infrastructure monopolies, it is quite important since access to debt finance can be quite restricted for many developing countries privatisation projects.

Table 1: Example of Quoted Bonds Issued in 1996 and 1997

Company	*Bond value ($m)*	*Maturity (years)*	*Coupon*	*Spread (basis points)*
Osaka Gas	400	10	7.13	41
Companhia Utltragaz	60	8	9.00	263
Israel Elec. Corp	125	30	7.88	125
Hidroelect. Pidra Aguila	100	5	10.58	425

Source: Financial Times

Figuring the cost of equity finance

One of the common approaches adopted to measuring the cost of equity is the Capital Asset Pricing Model (CAPM). This estimates the cost of equity as:

$$r_e = r_f + \beta_e\left(r_m - r_f\right)$$

where:

1 Countries have corporate tax systems which often differentiate between debt and equity—for example, the US has double taxation of equity while the UK and Australia have imputation systems for equity, all three make interest payments tax deductible. Because of the differences that exist between countries the calculations and approach developed in this note concentrates on the estimation of a post-tax rate of return. But these have to also be studied carefully also. Companies are indeed interested in their pre-tax rate of return but this can only be calculated after a detailed investigation of the mechanics of the tax system.

r_e is the cost of equity finance;
r_f is the risk-free return;
β_e is the equity beta;
r_m is the level of market return; and
$r_m - r_f$ is the market risk premium.

Establishing the values for each of these items is relatively straight-forward when developed capital markets exist and companies are quoted on a stock exchange. Approximations have to be used in most less developed countries.

The risk-free rate (r_f). The risk-free rate of return is a benchmark figure against which all investments in an economy should be measured. Being risk-free requires the removal, or minimisation, of repayment risk. Owing to the ability of a government to raise finance through taxation, government bonds are normally taken as the base value for the calculation[2]. For a regulator in a developing country looking at what its concessionaire may be considering as a risk free rate a good proxy may be to look at the US or UK interest rate on a Treasury Bond for instance, rather than at local rates unless their government's bonds are quoted in US dollars and the government is widely believed to repay all current and future debts. A figure of 7 or 8% is not uncommon for this type of calculation.

The equity risk premium ($r_m - r_f$). The second standard measure in the estimation relates to the level of additional return that is required to persuade investors to hold equities in preference to the risk free instrument. There is much controversy surrounding the calculation of this element—recent UK regulatory experience has focused on figure between 4% and 6% while some parts of traditional finance theory suggests orders of magnitude of at most 2%. An alternative is to measure the historical spread between the yield on a government security and that of a general market index--in the US, this could be the spread between the yield on a 1 year Treasury Bill and the returns on the 500 Standard & Poor index. Evidence has suggested that figures between 8% and 10% are found when this approach is adopted, both the in the US and the UK. This may reflect a world-wide premium, to which a country specific premium may have to be adde. However, determining an exact figure fro this premium is impossible and so range should be employed. For most countries, using between 5% and 8% should establish a credible set of boundaries.

The equity beta (β_e). The final, and only company specific, element to be established is that of the equity beta. This measures the relative riskiness of the company's equity compared to the market as a whole. To accurately measure the equity beta it is normal to use at least three years worth of daily share price information and more preferable five years worth—especially if monthly data is used[3]. Since many of the projects that will be considered for privatisation in less developed countries will be provided either by unquoted companies or international firms it will not be possible to establish a specific beta value for the project from the available information. The next section is concerned with estimating this value when sufficient information is not available.[4]

Assessing company specific risks

A common concern for potential investors and regulators in infrastructure projects in developing countries is indeed to assess the relative risk level facing them in the specific sector in which private investment is sought (the β_e value that measure the company risk relative to market risk, i.e. that rusk is undiversifiable and so

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2 A further complication is offered through the existence of inflation risk. A few governments have issued index-linked bonds that minimise the inflation risk. However, the vast majority of governments only issue nominal bonds and so inflation risk exists.

3 There is a large academic literature on the subject of how the beta value should be measured. This is surveyed in an annex to Regulatory Structure and Risk and Infrastructure Firms: An International Comparison by Alexander, Mayer and Weeds, Policy Research Working Paper 1698, 1996, World Bank.

4 For a more general discussion of the techniques described here see Alexander, OXERA, 1995 or Industry Commission (Australia), 1996.

should be rewarded). The search for information is often easier for the investors than for the regulators. Some of these investors can rely on their international experience in developing countries. In the water sector for instance, the main players in the ongoing privatisation wave are essentially the same (two French and two British Companies) and in many cases, they join forces with local companies so they can gain local knowledge. Although competition is somewhat stronger in the other utilities, private investors should not have much problem getting a feeling for this risk in their own sector.

The challenge is greater for privatisation and regulatory teams. They need to understand what risk level the investors assigns to the project so they can set the rate of return at a level that is above the company's minimum and thus ensure that private companies decide to participate in the auction for the right to deliver the utilities services. They also have to be able to select a regulatory framework that uses the various options to redistribute risk between investors, governments and consumers as needed and this cannot be done without a good assessment of the cost of capital levels the potential investors are facing. They finally need it to ensure that the minimum price they need to obtain for the leasing or sale of their assets is not out of line with the potential the private investors see in the business. In other words, they need to have some idea of the upper and lower bounds for the cost of capital.

A recent study provides good first order estimates of average betas for each type of utility that could help regulators in developing countries. These figures establish sector specific benchmarks matching the international experience on risk levels in each industry with the risk level implied by various types of regulatory regime. Table 1 sets out the main results.

The Table gives empirical estimates of the *asset* betas but these can be converted to an equity beta through the use of the following relationship (assuming that the debt beta is zero to make it as simple a calculation as possible for now):

$$\beta_e = \frac{\beta_a}{1-g}$$

where:

β_a = asset beta

β_e = equity beta

g = gearing = $\frac{D}{D+E}$

So, an electricity company under a high-powered regulatory regime with a 50% gearing/leverage level could be expected to have an average equity beta of 1.14 (the 0.57 divided by 0.5).

Table 2: Average Sector Specific Betas

	High powered incentives (Price caps)	Intermediate (profit sharing)	Low powered incentives (rate of return)
Electricity	0.57	0.41	0.35
Gas	0.84	0.57	0.20
Energy	n.a.	0.64	0.25
Water	0,67	0.46	0.29
Telecoms	0.77	0.70	0.47
Average Beta	0.71	0.60	0.32

Source: Alexander, Mayer and Weeds, 1996

Trading-0ff regulatory choices and risk levels

The Table also illustrates quite well the interactions between the choices of regualtory regime and the levels of risks as perceived by the potential investors. Risk levels are much lower and quite significantly so under low powered regulatory regimes. What this implies is that if the country or the region in which the government is trying to attract private investors is a high risk country or region, one way of reducing the perceived risk level is to rely on a low powered regulatory regime. A regime that gives the eventual operator of the privatised monopoly a strong incentive to cut cost often does so by increasing the share of the total risk the private investors have to take on as is the case with price caps typically and this often ends up reducing

participation in competition for the market. Only the highest risk takers will participate and these may not always be the governments prefered partner.

Examples of the use of cost of capital

For many privatisation projects this table can provide helpful benchmarks to start thinking about the relevant value of the cost of capital. This section explains how to use this information in the gas sector and the water sector.

Gas Transit Pipelines.

There are discussions underway in many countries in the Middle-East and Former Soviet Union to establish pipelines to transit oil and gas to Pakistan and India. Similar projects are under consideration in Latin America between Bolivia and Brazil and maybe Argentina. What sort of rate of return should be allowed when assessing one of these pipelines?

Some of the facts that could help come up with a back of the envelope estimate would be the following. For most of these gas projects, the "privatisation" teams are considering relying on high-powered incentive based regulatory regimes. In most cases also, the pipeline are likely to be heavily debt financed, say 75% debt. Assuming that the risk-free rate is 8% and that the debt premium for this type of company is 1% (100 basis points), Table 3 sets out the range for the calculation of the allowed rate of return for a low (5%) and a high (8%) risk premium.

Table 3 : Rate of return for a gas transit pipeline

Element		*Low equity risk premium (5%)*	*High equity risk premium (8%)*
Risk-free rate	r_f	8.0	8.0
Gearing/leverage	g	0.75	0.75
Asset beta	β_a	0.84	0.84
Equity beta	β_e	3.36	3.36
Equity risk premium	r_m-r_f	5.0	8.0
Cost of equity	r_e	24.9	34.9
Debt premium	p_d	1.0	1.0
Cost of debt	r_d	9.0	9.0
Rate of return	WACC	13.0	15.5

The simulation shows that the benchmark cost of capital (WACC) could lie between 13% and 15.5%. Below this rate of return, private participation is unlikely. Allowing a rate much higher than the upper bound in this bracket boils down to being excessively generous to private investors, most probably at the expense of gas buyers. One option is of course to go for less-powered regulatory regime, which would cut the beta and hence the required minimum rate of return to a range between 9.8 and 10.4% instead.

A water concession.

Consider now the case of a water concession. This is a tricky market because of the small number of players as mentioed earlier. This means that private information is pretty well controlled by the potential concessionaires. How can a regulator ensure that this control of information does not lead to excessive prices of water for the clients of this companies. Again, the back-of-envelope approach discussed here suggests that the target rate of return could be calculated as follows.

Table 4:Rate of return for a water concession

Element	*Low equity risk premium (5%)*	*High equity risk premium (8%)*
Risk-free rate	7.0	7.0
Gearing/leverage	0.5	0.5
Asset beta	0.29	0.29
Equity beta	0.58	0.58
Equity risk premium	5.0	8.0
Cost of equity	9.9	11.6
Debt premium	2.5	2.5
Cost of debt	9.5	9.5
Rate of return	9.7	10.6

Assume that the water privatisation teams or the regulators consider that the risk levels are high in this sector. Many of the assets are underground and rehabilitation costs may end up higher than anyone would expect. This means that the appropriate regulatory regime in this case could be a low powered regime such as cost-plus regulation/rate of return regulation. Assume that

the company has a gearing/leverage level of 50% and faces a risk-free rate of 7%. Because the perceived risk levels may be high, the debt premium may be around 2.5% (250 basis points in the technical language). Table 3 shows how the rate of return can be computed in this case, again comparing the cases of low and high equity risk premium. In this case, the benchmark rate of return should be between 9.7% and 10.6%. A price cap would have required minimum rates of return varying between 11.6 and 13.6% instead and could imply higher tariff for the users.

Conclusions

Although lack of data and uncertain theoretical arguments make many governments and regulators wary of applying standard financial techniques to establishing a benchmark rate of return, it is an important tool that should not be lightly thrown away. This note has highlighted some of the ways in which a benchmark figure could be established even when there is a lack of data. The note should also make a strong case to stimulate efforts by regulators to reduce the problems of data availability. Until they overcome these problems however, regulators and governments can rely on the tool discussed here to achieve some benchmark figure as a frist order approximation for any type of utility when the regulator has very little access to relevent information.

References:

Alexander, Mayer and Weeds, "Regulatory Structure and Risk and Infrastructure Firms: An International Comparison", Policy Research Working Paper 1698, 1996, World Bank.

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