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Summary:

The discount rate in Norwegian transport projects – a recommendation

The Norwegian official discount rate for cost benefit analysis is set by the Ministry of Finance. Since the start of year 2000, the discount rate consists of a risk free rate plus a risk premium. The risk premium only takes into account the relevant part of risk, i.e., the risk that cannot be eliminated by holding a diversified portfolio of assets. Assets in this connection include infrastructure projects, and the relevant risk is the contribution which the project makes to the risk of net national income.

The Capital Asset Pricing Model (CAPM) is used to make this approach operational. There, the risk premium consists of the product of the premium that the market requires to hold the stock exchange index (the market portfolio), and a parameter beta. Beta is the covariance of the rate of return of the project and the rate of return of the market portfolio, divided by the variance of the rate of return of the market portfolio. Applying this approach, projects with a risk profile similar to the stock exchange index should get a beta of one, while projects with less systematic risk (less covariance with the market portfolio) should get a lower beta. To apply the approach to the uncertain future net annual benefits of a given infrastructure project, however, one has to identify assets in the market with a similar distribution of their uncertain rate of return over the future states of the world.

Recently, the Ministry of Finance has issued a revised version of its guidelines on cost benefit analysis. There, the risk free rate is set to 2 % per annum, while the required premium for holding the market portfolio is set to 4 %. Most public projects are thought to have only moderate systematic risk, so the normal discount rate for public projects is set to 4 %. The government agencies in charge of projects could, however, set rates higher than 4 % if the project benefits are sensitive to business cycle fluctuations, or if annual costs involve a large fixed or unrecoverable part. Indeed, for large projects and for groups of projects with similar risk, beta should be set by a concrete analysis of the particular case.

The Ministry of Transport and Communications has commissioned TOI to estimate betas for groups of transport projects and to recommend discount rates for the transport agencies based on this. In our work, we have not applied the CAPM, since it seems difficult to find assets priced in the market with similar rate of return profiles as the typical transport infrastructure project. Instead, we have applied a model of investing in non-tradable assets originally due to Lund (1987, 1993b). The model is modified to take account of the typical benefits of transport projects, including time savings. The value of time (and, more generally, most unit prices) are considered to depend on the net wage (or the cost of labour when it comes to freight transport), and this is one of the sources of systematic risk. The other is the predicted volume of traffic, which will also partially depend on the income level (as well as on demographic variables). Annual net benefits are assumed to be proportional to the product of these two uncertain variables. Under reasonable assumptions, the model takes on the same form as the CAPM, although with a different formula for beta, as shown in the following formulas (formulas (31) and (32) of the text):

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Suppose R_0 is one plus the risk free rate, R_1 is one plus the uncertain return on the project, and R_m is one plus the return on the market portfolio. Also, let C_1 be uncertain household consumption in period 1 (the last period in a two-period model), w_1 be the hourly wage (a proxy for unit values like the value of time) and a_1 an indicator of the amount of transport activity of the type affected by the project. Then the investment criterion is

$$E[R_1] - R_0 \geq \beta\left(E[R_m] - R_0\right)$$

where

$$\beta = R_0 \frac{\dfrac{\operatorname{cov}\left(C_1, \dfrac{w_1 a_1}{E[w_1 a_1]}\right)}{\operatorname{cov}(C_1, R_m)}}{1 - \dfrac{\operatorname{cov}\left(C_1, \dfrac{w_1 a_1}{E[w_1 a_1]}\right)}{\operatorname{cov}(C_1, R_m)}\left(E[R_m] - R_0\right)}$$

We have estimated beta for different modes of transport, using data from Statistics Norway, the Oslo Stock Exchange, and TOI transport statistics. We have also explored the use of local transport data from the city of Oslo, but decided not to use it. Based on this, on a concern about data quality and the robustness of the method, and on the need for simple rules in practical applications, etc., our recommendation to the Ministry of Transport and communications is to use the following discount rates:

- Air and short sea shipping except seaborne passenger transport: 5 % per annum
- Railway, private car, bus, and local public transport: 4.5 % per annum

Current practice in Norwegian transport cost benefit analysis is to keep unit prices constant over the entire period of analysis. In reality, some increase in the unit prices can be expected with the growth in income. Thus the unit prices cannot be considered to be expectation values. This is somewhat inconsistent with the Ministry of Finance guidelines and the approach to the discount rate. Until this practice is changed, it is suggested to reduce the discount rate by 0.5 %.