Risk-adjusted Social Discount Rates

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The choice of the discount rate is a key determinant of most long-term investment projects. There is no consensus among economists about which discount rate should be used, whether it should be common to all projects and to all sectors, or whether it should be adjusted for the riskiness of the project under scrutiny. In this paper, we claim that the answer to this last question should be positive, as recommended by all classical theories of asset pricing. We refine the methodology to estimate the corresponding risk premia and show that the adjustment of project-specific discount rates to projects' risk can significantly improve public investment decisions. According to our results, this is particularly true regarding investments in core infrastructure carrying goods or services, such as such as energy transmission and distribution assets. All this matters a lot for the energy sector, confronted today to an immense transitional challenge with the necessity to decarbonize our economies.

We take a normative approach to this question by examining the investment decision rules that are compatible with the intertemporal social welfare. Because our society is averse to risk, one should penalize projects that contribute the most to the collective risk. This can be done by adjusting the project-specific discount rate positively for the macro-risk contribution of the project. As shown for example in the Consumption-based Capital Asset Pricing Model (CCAPM), the risk-adjustment of the discount rate should be proportional of the "beta" of the project, which is a measure of the statistical relation between the net benefit of the project and aggregate consumption. For example, most macro-prevention projects have a negative beta, since their benefit materialize in recession, i.e., when aggregate consumption is low. This justifies using a discount rate lower than the risk-free discount rate.

Among the various applications of our methodological analysis, we consider a class of investments in transportation infrastructures, such as a railway infrastructure or an electricity network. We show that their social betas vary greatly, exhibiting a decreasing term structure starting from a surprisingly large value at short maturities, when capacity is under-utilized. In the electricity sector, we show that projects of cross-border connection have a negative beta from the viewpoint of the country that predominantly uses the infrastructure to export electricity. This is due to the fact that in a recession, the demand for electricity will be reduced, thereby rendering the connection more useful to export its excess electricity. Thus, the net benefit of this cross-border high voltage line will be larger when aggregate consumption will be smaller. Given the long lifetime of these infrastructures, this provides a strong argument to raise electricity interconnections for countries with a comparative advantage to produce electricity.

Although the applications of our model are mostly devoted to the electricity sector, our aim is to address the general question of the determinants of the risk-adjustment of discount rates. Contrary to financial assets for which purely financial betas can easily be estimated by regressing the asset return on the market return, it is often the case that no data is available to estimate the social beta of specific public investment projects. Estimating project-specific social betas therefore remains a challenge, especially as the literature is scarce on these issues. We link the risk-adjust-

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ment coefficient beta of a project to the price and income elasticities of supply and demand. As an illustration, we provide a rough estimate of the social beta of a generic investment in the electricity sector in France and discuss its relationship with the market beta of companies listed in the sector.

This work is part of the attempts to convince public decision-makers to adopt more efficient discounting rules. This is all the more important for investments in core infrastructures with capacity constraints. Institutions in charge must constantly anticipate the growth in demand and allocate investments accordingly between maintenance, renewal and extension of their networks. The decreasing term structure highlighted in our work can play a crucial role in determining the optimal timing of such investments. The estimation carried on the electric cross-border link provides, to our knowledge, the first real-case based example of a negative beta and illustrates how adjusting social betas to risk can drastically change the discounted net present value of public investment projects.