Conference on Discount rate in the selection of public projects

Questions around Discount rate

motivated by my experience in financial interest rate

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Discounting in public projects

Brief presentation

I apologize

— To have no macroeconomic culture
— In particular in the evaluation of long term investment public project
— to use not exactly your vocabulary, but a vocabulary inspired by the market

A long experience in financial market

— A responsible of a well-known Master Program
— As a contributor to the abstract theory of interest rate, change of numeraire, yields curve dynamics
— and ten years of consulting in Model validation for the IRS products
— A large academic culture in portfolio/consumption optimization

A look from the outside

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About the Use of the Ramsey Rule

How conciliate this rule with the complexity of modeling so distant future

— Why a constant discount rate even (slightly modified) for such a long horizon
— How to explain a such dispersion in the solution
— For a "probabilist" as me, to have such a certainty on the preference rate for the present $\delta$ is very surprising, but I understand the idea of "prescriptive" approach
— The uncertainty is timidly introduced on the consumption rate...

First main question : What is a wrong discount rate ?

— What is the main question that we have to solve in the context of public project analysis with the discounting
— Given the ambiguity on the level of the rate, which strategy can be developed to increase the "robustness" of the NPV of the project ?
— If the NPV a good indicator ?

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Some more technical interrogations

Some theoretical remarks valid for different universes

• given the rate $\delta$, the basic tools are a) the dynamics of the consumption rate $c_t$ issued from $c_0$, and b) the marginal utility of the consumption $u'(c_t)$.

• Using small perturbation method, the links between discounting rate and growth is obtained by equaling the derivative $R_t = \delta - \frac{1}{T} \ln E[u'(c_t)]/u'(c_0)$.

• The Ramsey rule with constant parameters is obtained by assuming that the log of the dynamics of $c_t$ is given by a Brownian motion $(\mu, \sigma^2)$ issued from $\ln(c_0)$ and a power utility $u'(c) = c^{-1/\gamma}$ ($\gamma$ is the risk aversion coefficient).

Pricing kernel

• In finance $e^{-\delta t}u'(c_t)/u'(c_0) = Y_t(c_0)$ is called stochastic "pricing kernel".

• the NPV of a cash flow $B_t$ at time $t$ is given by $\mathbb{E}[B_t.Y_t(c_0)]$.

• In incomplete market, this marginal utility price holds only for small cash flow. For a large cash flow, "second order" premium is introduced.
At the equilibrium

Some consequences

• For no power utility and \( c_0 \)- linear consumption rate, \( R_{0,t} \) is depending of \( c_0 \) or from the wealth via some budget constraint.

• The theory said that the consumption has to be chosen optimally in an economy at the equilibrium.

• Only in very limited case the optimal solution is linear from its initial condition.

• Moreover when optimizing the equilibrium strategy for agents with different risk aversion, the utility of the representative agent is no longer a power function.

Financial theory of Interest rates

• May be used to test different theoretical models,

• for instance, many yield curves are decreasing in the long term, due the
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volatility of the rate
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Forward or backward point of views

At the equilibrium

- The optimisation is starting from the horizon
- and is going to the present by retropropagation
- Often complex to solve
- Principle of **Time consistency**

The forward Point of view

- The optimal consumption is given and diffusing to now to the future
- Allows some flexibility to integrate new knowledge

How to use these remarks

- In defining some indicators concerning the more important risks (= parameters)
- in addition to the use of the classical Ramsey rule

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Conclusion

Very complex task

- Complexity induces non linearity, introducing large bias in a priori too simple models
- The simplicity can only be used after identification of the main risk factors
- Simulation tools have become more efficient

Adaptative Criterium

- To Integrate that decision criterion has to become more adaptative
- To deal with the uncertainty of "climate model, or long term risk" and its impact on the discount rate, develop idea about vigilance, to detect in advance the future evolution

Thank you for your attention

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