

Conceptual Framework for Measurement and Application of Public Sector Opportunity Cost of Capital

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Abstract—In this paper, a conceptual framework for the measurement and application of opportunity cost of capital for the public sector budgetary purposes is elaborated. The paper fills the gap to offer a structured overview of discount rate classifications discussed in literature, also how these discount rates are measured and finally applied to various long-term investment opportunities faced by the public sector. The final result should give the answer to the question, whether there should be used different discount rates to different public sector investment projects or maybe there is the one and the only universal discount rate applicable to all cases?

Index Terms—Public sector investment, opportunity cost of capital, social opportunity cost, social rate of time preference.

I. INTRODUCTION

The topicality of the application of appropriate opportunity cost of capital in public sector has been proven by the number of researchers done on the field during the last century. Nevertheless, there is still an ongoing debate among scholars, what would be the most optimal long-term discount rate to use in case of public sector intra- and inter-generational investments. The main problem arises from the well-recognized fact that the government should allocate its budget to maximize social welfare [1]. When the net present value (NPV) is used as the basis of project or investment choice, the discount rate critically influences budget allocation; but yet there is no consensus on the optimal discount rate that would maximize social welfare [1].

Therefore, in terms of long period of timeframe, the right choice over the appropriate cost of capital on public sector level has a remarkable importance not only from theoretical viewpoint, but has also important practical implications by guaranteeing most efficient allocation of public sector resources in the long-run [2], for the next generations.

The aim of the current paper is to elaborate a conceptual framework for the classification, measurement and application of appropriate discount rate for public sector investments. In order to fulfill the aim, there is used an explorative qualitative methodology. At first, a thorough investigation of academic literature was done. Thereafter the findings were systemized and final result was presented in a Fig. 1, which is found in Appendix 1.

II. LITERATURE REVIEW

So far, the literature on public sector discounting has brought many important insights to the topic, but still there remain wide differences on some of the fundamental issues [3]. The main argue in literature goes around socially sensitive domains, such as [4]:

- 1) the adequate assessment of discount rate, being appropriate for the governmental projects and investments, and
- 2) the question about proper discounting method, depending on the discounting function.

The debate about the ethics on positive discounting of public sector cash flows states back to already 1920s, beginning with the seminal works on the topic of [5] and [6], who brought up the questions about the intra- and inter-generational views on discounting. According to normative perspective of social approach, based on [6], a popular argument is that „the ethical presumption that all individuals, including those living in different generations, should be valued the same“[7], i.e. the future generations ought to be given exactly the same weight as the current alive ones and therefore there should be no discounting of future relative to present utility. [8] Since then, a lot of discussions have been developed by several numbers of scholars about the application of appropriate discount rate used in public sector budgetary purposes.

III. METHODOLOGY

Regarding to the discounting method, there are two basic views in literature, which also correspond to the discount rate problem [4]:

- 1) exponentially discounted cash flow (CF) function, where it is assumed that the preferences are time-consistent;
- 2) hyperbolic and quasi-hyperbolic discount function, where the preferences are assumed to be time-inconsistent (i.e. present-based or hyperbolic preference).

The neoclassical way of thinking goes according to the exponential discounting path, where it is assumed that the agents have a stationary time preference and they discount the future at a constant exponential rate [9]. Therefore, when using the exponential discounting, there is an undervaluation of distant future events due to the geometrical reduction of the function $(1 + i)^{-t}$ [10] and the near to the present events are valued more.

However, there are some strong empirical evidences that people by nature are discounting hyperbolically, i.e. applying larger annual discount rates to near-term returns than to

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returns to the distant future [10], which is well observed in researches, based on animal and human behavior. For example, [11]-[13] concluded that the discount functions are generalized hyperbolas, i.e. events τ periods away are discounted with factor $(1 + \alpha\tau)^{-\gamma/\alpha}$, with $\alpha, \gamma > 0$. Such discount functions imply a monotonically falling discount rate, where the discount structure sets up a conflict between today's preferences and the preferences which will be held in the future, implying that preferences are dynamically inconsistent.¹ [14] Therefore, according to hyperbolic discounting, the discount rate declines as the time-horizon increases.

Quasi-hyperbolic function in discounting was first proposed by [15] for intergenerational analysis and then applied by [14] for intrapersonal analysis. [9] What concerns the discount rate corresponding to the way of discounting, then [9], [16] and [17] were the first scholars to understand that discount rates in the short run are higher than in the long run.

According to [3], there is possible to observe several various viewpoints about the appropriate discount rate applied to the long-term cash-flows from public sector investments, e.g.:

- 1) some would discount at a rate appropriate for a similar private investment;
- 2) others would advocate a rate reflecting the opportunity cost of displaced private sector investment;
- 3) some would say that the rate should instead reflect, wholly or in part, a „social time preference“ rate, perhaps derived from a risk-free market rate, or perhaps from other sources; they might also say that, as well as discounting, the impact of the public spending on private sector activity should be reflected by applying shadow prices;
- 4) some would say that, although public sector rates differ from those appropriate to the private sector, they too should vary with the type of investment.

Similar kind of views and arguments has been applied also in several intra- and intergenerational discussions (see for example [18]).

IV. CONCEPTUAL FRAMEWORK

For the current research, a theoretical conceptual framework (see Fig. 1 in Appendix 1) for classifying, measurement and application of discount rates for the public sector budgetary purposes was elaborated, in order to clarify the research question, whether there should be used different discount rates to different public sector investment projects or maybe there is the one and the only universal discount rate applicable to all cases.

As it is seen from Fig. 1 in Appendix 1, then the starting point is from the classification of discount rates. According to the literature, there are two different approaches – i.e., privately optimal financial approach and socially optimal

social approach for the measurement of discount rate. The social approach to discount rate estimation is discussed the most in academic literature, and it is possible to identify two different viewpoints or perspectives to how the discount rates are measured. These are normative or prescriptive viewpoint (which is basically based on the opinion of the assessor of the discount rate) and positive or descriptive viewpoint, where the efficiency criterion is taken into account.

The next step was to identify, according to theory, and model the classification of the discount rate measurement methods. The result of the analysis of the literature shows that there are two possible ways of measuring the discount rate under the financial approach – i.e., risk-adjusted discount rates and option-based models for calculating the appropriate discount rate. On the other hand, as it is widely seen from different kind of researches, the measurement methods under social approach are prevailing. Here, the well-described social rate of time preference (SRTP) method is classified as a normative approach to the assessment of discount rate and social opportunity cost (SOC) is viewed under the positive perspective.

The following step was to identify the discount rate measurement methods according to common practice. In this section the most difficult part was to find out the appropriate practical method for depicting the financial approach. It seems to the author that the appropriate method could be either the borrowing cost of public sector or the rate of the government.

Further, the application of previously identified types of discount rates by the public sector in practice was analyzed. In general, it seems to be clear, that in terms of cost-efficiency analysis and also cost-benefit analysis (CBA), the appropriate measurement method of discount rate to apply would be socially optimal approach. But in terms of, for example, cost-effectiveness analysis, lease-purchase analysis or governmental asset-sale analysis, the most appropriate way to choose the right discount rate, is to use the financial approach to value the appropriate opportunity cost of capital.

V. CONCLUSION

Despite of the almost a century-long discussion about the opportunity cost of capital for public sector, the actuality of the topic still holds. The current paper presents a structured conceptual framework over the research done so far, in order to clarify the classification issues of the discount rate, the possibilities of measurement methods and techniques in theory and in practice for the public sector and to which projects of those discount rate methods are appropriate to apply in practice.

The result of the qualitative research show that there are mainly two approaches to the measurement of opportunity cost of capital for the public sector and the application of them depends on the nature of the cash flows of the investment project and the analysis method used. Therefore, the final conclusion of the research would be the proposition that there is no universally existing discount rate that would be appropriate for all projects and for all occasions in terms of public sector. Instead, the decision-makers have to bear in

¹ For example, from today's perspective, the discount rate between two far off periods, t and $t+1$, is a long-term low discount rate. However, from the time t perspective, the discount rate between t and $t+1$ is a short-term high discount rate. [13]

mind that for different kind of projects should be applied different kind of discount rate. The actual methodology, how to measure the right discount rate, depends on the context and

the researcher, but the current framework gives some guidelines and directions to make the valuation process of the appropriate discount rate easier for the decision-makers.

APPENDIX

Appendix 1. Conceptual framework for the assessment of appropriate discount rate for public sector budgetary purposes.

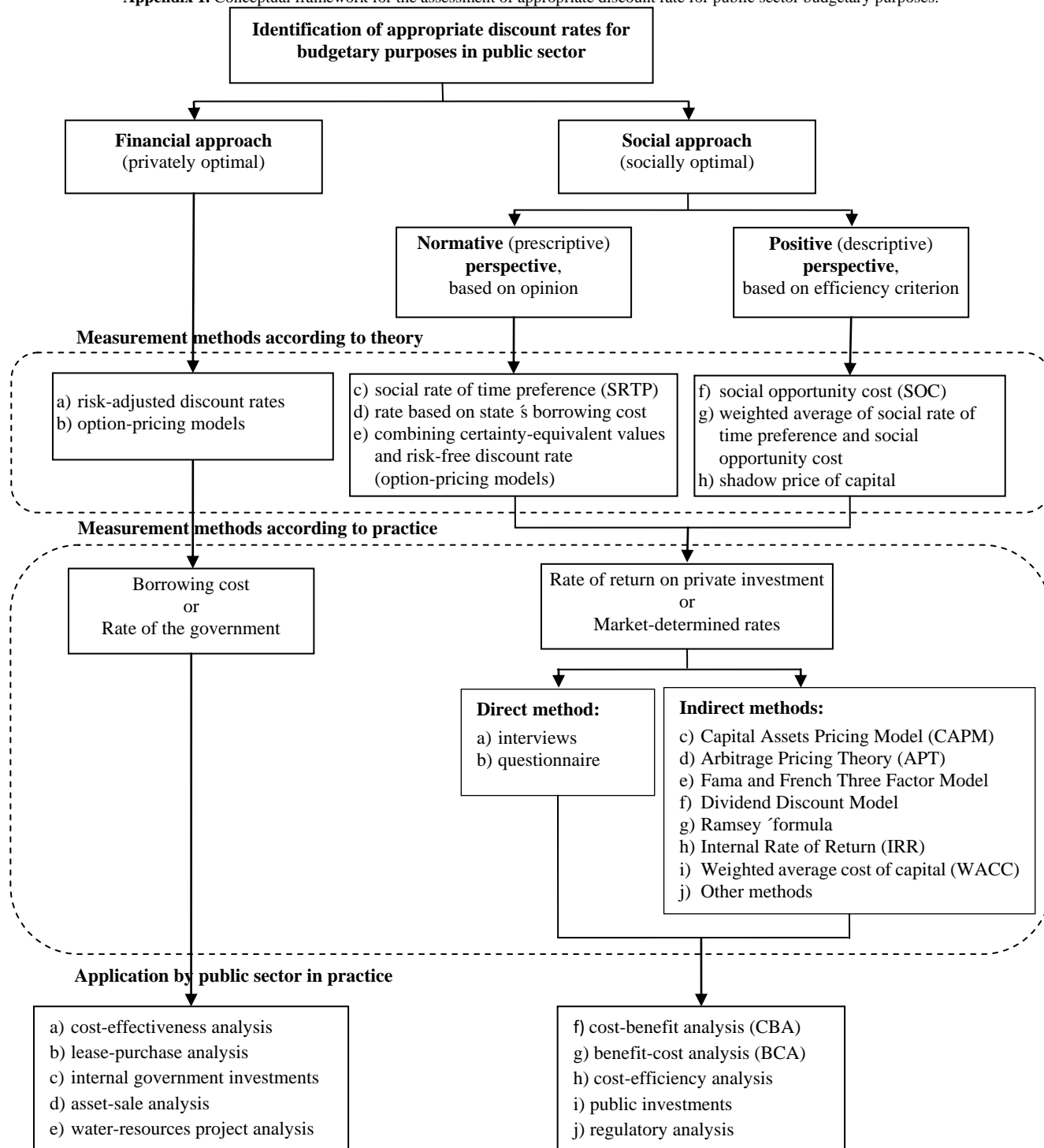


Fig. 1. The classification, measurement and application of discount rates in public sector according to theory and practice. (Source: compiled by the author, based on the literature).

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