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Application of social discount rate for assessment of public investment projects

Vilma Kazlauskienė^{a,*}

^a Kaunas University of Technology, K. Donelaičio g. 73, Kaunas LT-44249, Lithuania

Abstract

The article is aimed to analyse problems of determination of social discount rate (hereafter SDR) used for cost-benefit analysis of public investment projects. The relevance of this problem analysis is determined by both discussions and different viewpoints of scientists on the choice of the most appropriate approach to determine SDR and absence of methodically based SDR on the Lithuania's national level. In this article the critical analysis of SDR determination approaches has been performed and examples of foreign countries' practice in determining SDR have been analysed. References for further researches related to SDR application in assessment of investment projects in Lithuanian public sector are presented. This article seeks to encourage discussions of Lithuanian scientists related to assessment of SDR in the investment projects cost-benefit analysis. The results of this article provide presumptions for further SDR researches aimed to prepare the methodology for determining SDR based on Lithuanian data.

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Introduction

The choice of SDR is one of the most relevant decisions on cost-benefit analysis (Moore, Boardman, & Vining, 2013; Burgess, & Zerbe, 2011). This is the critical parameter determining social-economic value of investment projects (Zhuang, Hang, Lin, et. al., 2007; Harrison, 2010; Hepburn, 2006). Though foreign scientific literature started to analyze problems of SDR determination in the third decade of the XX century, nowadays active

* Corresponding author. Tel.: +370-674-70936.
E-mail address: vilma.kazlauskiene@ktu.lt

discussions of foreign scientists analysing methods of SDR determination, their advantages and disadvantages, the need for countries to determine the SDR based on their detailed data disclose the relevance of SDR researches. Scientific literature (Moore, Boardman, & Vining, 2013; Burgess, & Zerbe, 2013, 2011; Park, 2012; Halicioglu, & Karatas, 2011; Scarborough, 2011; Shelunstsova, 2009; Evans, & Sezer, 2005; Spackman, 2004; Kula, 2004 and others) analyzes problems in choosing the appropriate method for SDR determination in evaluating public sector investment projects, initiates discussions related to suitability of SDR determination methods, presents practical examples of SDR methods' application in different countries.

The works of Lithuanian scientists fragmentarily analyse the problem of SDR determination. Ginevičius, & Bruzgé (2008) discussed the suitability of the cost-benefit analysis method in evaluating regulation tools accepted by the state. Baranauskienė (2013) presented the critical standpoint to the application of cost-benefit analysis. Baranauskienė, & Aleknevičienė (2014) carried out the research that grounds the SDR importance on public project decision. In Lithuania greater attention is paid to SDR only in methodical publications; however, they present instructions how to discount cost and benefit related to investments.

Though the works of foreign authors, who analyse the question of public projects cost-benefit analysis, discuss SDR determination, the answer to the following essential questions is not attained: what approach should be applied in determining SDR?; Should the same uniform SDR be applied in evaluation of public projects in different countries? This article seeks to answer these controversial questions.

The aim of the article is to reveal the peculiarities of SDR application for assessment of public investment projects. In order to achieve the aforementioned aim and to answer the problem questions, a critical analysis of SDR approaches has been performed and the importance of SDR approach selection in assessing the public investment projects has been revealed in the first section of the paper. In the second section, SDR levels, established by the different countries, are given and reasoning behind using SDR level, calculated by the specific country, instead of using unified, EC recommended SDR level for the assessment of public investment projects is provided.

The research is performed by applying methods of scientific and methodical literature analysis, systematization, and interpretation.

1. SDR determination approaches

Discounting is the standard method applied in financial calculations and the basis of inter-temporal choice in economics. In mathematical viewpoint SDR is aimed to calculate the present value of public project's net benefit. In economic viewpoint it reflects the rate at which a society is willing to trade present for future consumption (Halicioglu, & Karatas, 2011). In a perfectly competitive economy, appropriate SDR is the market interest rate (Zhuang, Hang, Lin, et. al., 2007). However, markets are distorted, the market interest rate is not used for investment projects cost-benefit analysis.

The works of the authors who analyse SDR problems present four alternative SDR determination approaches: social rate of time preference (SRTP); social opportunity cost of capital (SOC); weighted average approach; shadow price of capital (SPC) approach. In essence, these different approaches reflect differing views on how public projects affect domestic consumption, private investment, and cost of international borrowing (Harrison, 2010). The SRTP approach is based on the idea that the fundamental goal in welfare economics is to maximize the utility of society (Moore, Boardman, & Vining, 2013). The SRTP is the rate at which a society is willing to renounce a unit of current consumption in exchange for more future consumption (Zhuang, Hang, Lin, et. al., 2007). This rate equals the current and deferred value of consumption for society. Different SRTP determination methods are presented in the literature. By the first method SRTP is determined considering the interest rate of Government bonds or other low risk securities. The second and most often mentioned approach to SDR determination refers to the economic growth model of Ramsey (1928), British economist. Referring to this model the SRTP is calculated by the formula:

$$SRTP = p + e * g \quad (1)$$

where:

p – utility discount rate;

e – elasticity of marginal utility of consumption;

g – the rate of growth of consumption per capita.

Though in mathematical viewpoint the SDR calculation by applying the classical formula of Ramsey is not complicated, main problems are related to the determination of SRTP parameters. The utility discount rate (p) is most discussed because choosing a value of this parameter requires interfering how much today’s society cares for future societies (Halicioglu, & Karatas, 2011). In literature the utility discount rate is divided into two elements: the rate of pure time preference; life chances. There is no uniform opinion on the first element. Due to ethical ground this element is often equated to zero (Hepburn, 2006; Evans, & Sezer, 2005). According to Zhuang, Hang, Lin, et. al. (2007), it fluctuates in the diapason of 0 – 0.5 percent in empirical SDR researches that do not ignore this element. The second element of utility discount rate evaluates annual level of death-rate in the country and most often it is calculated as the proportion of the number of deaths and the number of the population. As the performed researches on utility discount rate (Scarborough, 2011; Zhuang, Hang, Lin, et. al., 2007; Evans, & Sezer, 2005) show, this rate changes from 0.05 to 3 percent. Elasticity of marginal utility of consumption (e) evaluates the dynamics of consumption over time. It can be calculated by applying three approaches: direct survey methods; indirect behavioural evidence; revealed social values. As examples of this element determination by different approaches show, it fluctuates from 1 to 2 percent. Such differences are determined by sensitivity of results to model specification, level of aggregation in the data, choice of estimators, sample size, and the length of sample periods (Zhuang, Hang, Lin, et. al., 2007). The rate of growth of consumption per capita (g) is dependent on forecast growth of income (Scarborough, 2011). This component most often is determined by evaluating GDP growth rates and due to its determination least discussion question arise. The main problem is related only to too optimistic prognoses (Burgess & Zerbe, 2013). In determining the rate of growth of consumption per capita it is particularly important to consider long-term period (over 30 years) by retrospective data (Zhuang, Hang, Lin, et. al., 2007). Considering the researches this rate ranges in the diapason of 1-4.6 percent. As Evans, & Sezer (2005) observe, the rate of growth of consumption per capita is the main factor determining SRTP fluctuations. As SRTP calculations carried out on the example of different countries by applying the classical formula of Ramsey show, the SDR, determined by SRTP approach, fluctuates from 1.4 to 8 percent due to different sizes of this formula parameters.

SOC approach is based on the fact that available resources are scarce, and private and public projects compete with one another for funds. According to this approach, the return of public sector investments have to be not less than the return of private investments. SOC can be determined as marginal pretax rate of return on riskless private investments (Zhuang, Hang, Lin, et. al., 2007). Besides the above-mentioned SDR determination approaches, two more approaches (weighted average approach; shadow price of capital approach), which could be used for inter-temporal discounting, are mentioned in literature, although they are rarely applied in evaluation of public investment projects (The Guide to Cost Benefit Analysis of Investment Projects, 2014).

Having summed up the researches performed by the scientists who analyse SDR approaches (Scarborough, 2011; Harrison, 2010; Shelunstsova, 2009; Zhuang, Hang, Lin, et. al., 2007; Spackman, 2004), main criticized features of SDR determination approaches are presented in Table 1.

Table 1. Criticism of SDR determination approaches.

| Approach | Major Criticism |
|--|--|
| Social Rate of Time Preference (SRTP) | Ignores the fact that public investment could displace private investment. Different methods applied to determine the model components influence different results of SDR calculation. |
| Social Opportunity Cost of Capital (SOC) Weighted Average | Ignores the fact that public investment displaces current consumption. Determining the weights attached to SRTP, SOC and international borrowing rate could be difficult. |
| Shadow Price of Capital | It is complicated to apply in practice. |

In scientific publications, cost-benefit analysis guides, methodological publications (The Guide to Cost Benefit Analysis of Investment Projects, 2014; Scarborough, 2011; Harrison, 2010) SRTP and SOC approaches are named as main and most suitable approaches to determine SDR. SRTP is appropriate when the government is considering new government activities (Young, 2002). The SOC approach is suggested to be applied only when estimations of SRTP are unavailable or clearly unreliable (Young, 2002). The analysis of literature shows that most discussions emerge due to the application of these approaches, the choice of the most appropriate approach. As the united

opinion on the most suitable SDR approach does not exist, the analysis of scientists' researches shows that the priority is given to the SRTP approach more and more often. Though in applying these approaches, uniform SDR results must be obtained (Young, 2002); the practical researches, performed on the example of foreign countries (Moore, Boardman, & Vining, 2013; Scarborough, 2011) show that the higher SDR is obtained by applying the SOC approach. This reveals the importance of the choice of SDR determination approach in calculations of the cost and benefit of public projects.

2. The practice of SDR application in assessing the public projects in foreign countries and Lithuania

Though the questions of SDR determination have been analysed in scientific literature since the third decade of XX century, the practical researches on grounding its level have become especially relevant when the assessment of the public projects, financed by the EU have started. In 1990 the European Commission prepared the first version of the Guide to Cost Benefit Analysis of Investment Projects, in which it presented the recommended SDR level. The last and currently valid edition of the Guide to Cost Benefit Analysis of Investment Projects was prepared in 2014. In this Guide, it is recommended to use 5 percent SDR for assessment of public projects and it is emphasized that it is possible to apply the SDR, based on calculations of the country; however, such rate has to be regulated by laws and legal acts. Foreign countries (Germany, United Kingdom, France, Norway, Australia and others) have prepared methodologies for SDR determination, which analyse SDR determination models, their components, present detailed SDR calculations. The analysis of foreign countries' practice of application of SDR in public project assessment shows that the countries, in which SDR is confirmed by legal documents not only change level of the rates, but also its determination approaches. For example, in the United Kingdom, from 1967 to 1980, the SDR, calculated by applying SOC approach, fluctuated in the range of 8-5 percent, and since 1980, when the SRPT approach for SDR was applied, has changed from 6 to 3.5 percent. In addition, for the projects longer than 30 years this country applies decreasing SDR (for 0-30 year projects 3.5 percent; for 31-75 year – 3 percent; for 76-125 year – 2.5 percent; for 126-200 year – 2 percent; for 201-300 year – 1.5 percent; over 301 year – 1 percent). Actually, currently countries less often make the decision to change the SDR determination approach, and the SDR is renewed every 3-5 years. Though European Commission recommends using uniform 5 percent SDR for assessment of public projects, research of the various countries cases shows that this rate fluctuates within fairly wide diapason. Table 2 presents the SDR, calculated on the example of different EU and non-EU countries.

Table 2. SDR of different countries.

| Country | Approach | SDR (percent) | Source |
|------------------|---------------------------|---|------------------------------|
| EU countries | | | |
| Germany | SRTP | 4.3 | Evans, & Sezer (2005) |
| | SRTP | 3 | Hepburn (2006) |
| France | SRTP | 4 | Zhuang et al. (2007) |
| | SRTP | 8 | Hepburn (2006) |
| Italy | SRTP | 5 | Zhuang et al. (2007) |
| United Kingdom | SRTP | 3.5; different rates for long-term projects over 30 years | Zhuang et al.(2007) |
| Non-EU countries | | | |
| USA | SRTP | 3.5 | Moore et al. (2013) |
| | SOC | 6-8 | Burgess, & Zerbe (2011) |
| Canada | SOC | 10 | Zhuang et al. (2007) |
| Turkey | SRTP | 5.06 | Halicioglu, & Karatas (2011) |
| Norway | Government borrowing rate | 3.5 | Zhuang et al. (2007) |
| Australia | SOC | 8 (annually reviewed) | Zhuang et al. (2007) |
| Mexico | SOC | 10.4 | Coppola et al. (2014) |
| India | SOC | 12 | Zhuang et al. (2007) |
| Russia | SRTP | 11.5 | Shelunstova (2009) |

Such diapason of SDR level makes one doubt about the validity of the recommendation to apply the uniform SDR

for all EU countries and raise scientist's discussions of on the universality of such rate level. The SDR researches performed on the example of different countries ground the importance of the applied approach and the data used in the calculations. Evans, & Sezer (2005) calculated the SDR of the EU countries by the SRTP approach fluctuated from 2.3 percent (for Denmark) to 5.6 percent (for Ireland). Zhuang, Hang, Lin, et. al. (2007) performed the research on the example of different countries; it showed that SDR can fluctuate from 1 to 15 percent. The research showed that the rates of developed countries are noticeably lower (2-3 percent) than SDR of developing countries (10-15 percent). As the performed researches show, the SRTP approach is more often applied in developed countries, and the SOC method – in developing ones. The SOC approach is particularly popular in the USA (Shelunstsova, 2009; Spackman, 2004). Though such countries as Germany, the United Kingdom, France have confirmed the SDR levels applied for public projects cost-benefit analysis at state level, they often differ from the SDR, calculated during various researches. This shows the need to perform more extensive researches, which would allow grounding the SDR level applied in public project cost-benefit analysis.

Having analysed the SDR determination practice in foreign countries, it is evident that SDR level should not be universal for all states. According to Zhuang, Liang, Lin, & De Guzman (2007), countries differ in economic structure, capital scarcity, stage of financial development, efficiency of financial intermediation, impediments faced in accessing the international capital market, and social time preference. All these factors have to be estimated when choosing SDR.

As Lithuanian practice of assessment of public investment projects is noticeably shorter than of most foreign countries, there is a lack of researches of SDR determination by different approaches. Though the works of Lithuanian authors recognize the SDR importance in performing cost-benefit analysis of public projects (Baranauskienė, 2013; Baranauskienė, & Aleknevičienė, 2014) and point out the necessity of determination of SDR level at national level, but deeper SDR researches, during which possibilities to apply theoretical models for SDR determination would be analysed and SDR calculations based on the data of Lithuania would be presented, are missing. In Lithuania, there are several methodologies, prepared for the public investment projects preparation (Methodology for Preparation of Investment Projects for Obtaining Financing from EU Structural Funds and State Budget (2011); Methodology for Planning State Capital Investments (2001 and its later modifications); Methodical Guide to Social Cost-Benefit Analysis, Guide to Final Assessment of Decisions Impact (2011)), but they present instructions how to discount investments related cost and benefit, i.e. to determine their present value. They do not suggest scientific discussions related to SDR determination problems, do not analyse SDR determination models and do not solve problems related to SDR determination substantiation. Though, in Lithuania in preparing the investment projects financed by the EU, most frequently the five-percent SDR suggested by the European Commission is applied; this rate is of recommendatory character and it is not endorsed at national level. Currently in Lithuania the researches are not carried out and the SDR is not substantiated and regulated by laws and legal acts. The relevance of SDR determination question is determined by that the methodology for the state capital investment evaluation does not specifically define SDR, which would be applied in evaluating investment decisions, made at national level. Application of the SDR, which is not substantiated by calculations, reduces the reliability of the obtained results.

Analysis of the SDR researches, performed by scientists of foreign countries, shows that determination of SDR, using approaches, discussed in the first section of the paper (specially, SRTP approach), is often based on fairly long period retrospective data. For example, the SDR determination (by SRTP approach) research by Evans & Sezer (2005) is based on the 35 year data; Moore, Boardman, & Vining (2013), determining the SDR for the USA, used 60 year data for determination of SDR by SRTP approach, and 50 year retrospective data for determination of SDR by SOC approach. Due to transition from the planned to market economy in Lithuania, relevant statistical data is available only from year 1992. Unfortunately, the information presented by the official statistics refers to even shorter period. Therefore, it can be stated that the lack of reliable statistical data is one of the limitations for application of the SDR models. In spite of this limitation, it is necessary to expand the SDR researches, which would form the prerequisites for application of SDR in public projects assessment in Lithuania, where SDR would be based on the Lithuania related data.

Conclusions

The performed analysis has shown that the applied SDR determination approach makes significant influence for the SDR level. The analysis of SDR determination approaches as well as the researches performed by foreign researchers allows stating that the most appropriate approach is the SRTP approach. The SDR calculated by this approach best reflects the main purpose of public investment projects – to enhance social benefit for society. The analysis of SDR determination practice applied in foreign countries presupposes the conclusion that one universal SDR level suitable for all countries should not be used. As the application of different SDR approaches determine different results, it is necessary to consider the possibility of application of uniform methodology of SDR calculations. Results can be different due to differences of states (economic, social, demographic and so on); however, methodological basis of the SDR determination should be uniform. The main problem with calculations of the SDR for Lithuania is the lack of statistical data. As the SDR researches performed on the example of foreign countries show, rather long-term retrospective data (30-50 years) are used in calculations of this rate. In Lithuania it is possible to use only much shorter period. Referring to the performed analysis, recommendations for further researches are presented: 1) to develop the researches substantiating the application of the declining SDR in the assessment of long-term public projects. This aspect is particularly relevant in evaluation of over 30-year long investment projects, outcomes of which are particularly sensitive to the level of the discount rate; 2) as indicators of the investment projects' evaluation sensitively react to SDR changes, it is reasonable to explore the factors influencing SDR; 3) to develop the researches by Lithuanian scientists, in which the application of the appropriate SDR approach for cost-benefit analysis of Lithuanian public projects would be substantiated. The application of SDR approaches in the practice of investment projects evaluation in Lithuanian public sector, the research on the factors influencing SDR are the object of the further researches by the author.

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