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Application of Social Discount Rate in Public Projects

SUMMARY: The ongoing co-financing system of the Cohesion and Structural Funds of the European Union will come to an end in 2013. Based on the experiences of the 2007–2013 financing period, the allocation of public resources will be reconsidered. By analysing the difference between the evaluation of private and public projects as well as the interoperability between the two methods, the application of the EU project evaluation model shows several anomalies. The case of a public project for public lighting illustrates well that in case actual investment return (financial rate of return – FRR) is higher than the discount rate applied by the European Union for the calculation of the financial net present value, but lower than the expected return on private projects, projects of value to the community will not be implemented. Regarding the post-2013 period, in our view, in the case of the projects co-financed by the European Union, the increased protection of environmental values through the discount rate is of utmost importance, which assumes the relinquishment of the principle of a discount rate that is constant in space and time and the expansion of consistency criteria applied in private projects to public projects.

KEYWORDS: evaluation of public projects, social discount rate, capital budgeting
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The significance of the evaluation of public projects has increased.[1] In the case of public investments, transparency and the traceability of the utilisation of public funds require that clear financial-economic methods be available during project evaluation, methods that ensure the grasping of the rate of contribution to community welfare. By public projects we mean projects implemented at a local, micro-regional, national or international level, which according to the objective of the investment can be infrastructural, environmental protection, energy efficiency, healthcare and education expenditures. Significant funds have been used for years now to finance public projects. The most significant development fund in the European Union – the Structural and Cohesion Funds – provides 347 billion euros of co-financing between 2007–2013 for projects that serve the economic and social cohesion of the Member States, and the national development programmes of the individual Member States also ensure considerable resources for the implementation of public projects. The developments realised with public funds have shaped Member State economies considerably, yet it is lesser known what the order of public fund allocation is, why they apply discount cash-flow-based methods (typically used for private projects) to classify projects or how justified it is in the case of newly acceding countries to apply the 5 and 5.5 per cent dis-

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count rate when evaluating projects realised through EU tenders.

CHARACTERISTICS OF PUBLIC PROJECTS

The aim of public projects is to serve the growth of the economy and welfare in a given country or region, while values of the natural environment are preserved or at least maintained. The subject of welfare growth is a matter of intense debate in economic literature. The complexity of economic decisions is shown by the fact that ethical-moral elements that reach beyond narrow rationality such as intuitiveness, the pursuit of security and environmentally-conscious behaviour also play roles in rational decisions considering gained and sacrificed advantages and disadvantages. In our study, we will examine the decision backgrounds of public projects where decisions regarding the allocation of public funds were made on the basis of financial-economic aspects, by comparing costs and benefits.

Significant results have been achieved in the field of public project evaluation theory. Research on the matter stretches back several decades; however, no synthesis of research results has been achieved that would lead to simply and easily applicable practical methods in public project evaluation. Our goal is to present the methodological framework of the evaluation of public projects, and through this the complexity of cost-benefit analysis and the difference of the DCF-based evaluation of public and private projects,[2] during which we will be paying special attention to the system-oriented presentation of the social discount rate (SDR).

In the case of private projects, i.e. projects organised on a business basis, in the DCF (discounted cash-flow) method, the methodological foundations of calculating future investment-related cash-flows and the generation of capital cost/discount rate are clear, but naturally the practical difficulties of estimation must also be considered. Among the DCF techniques of cash-flow evaluation, the NPV (net present value), the internal rate of return, the profitability index and the discount payment period are the best known. When discounting the cash-flows of private projects, we use a discount rate[3] appropriate for the risk-level of the given cash-flows. The DCF methods applied during the evaluation of private investments calculate with narrowly interpreted business-type cash expenditures and revenues, and the duration of the projects is typically under 10 years. Furthermore, due to technological shifts these projects cannot be considered projects spanning generations. The extension of DCF-based evaluation methods applied in case of private projects to the evaluation of public projects requires that we examine the similarities and differences of public and private projects in detail.

The goal of public projects is to create value for the narrower or broader community. In general we say that the objective is to increase social utility and welfare. The difference of the application of the DCF method in private and public projects is provided by the fact that in many respects public projects concern different fields and time-spans and different social classes.

The main differences of public and private projects:

- *The complex approach to the effects of public projects* – The evaluation of public projects stands for the consideration of community, environmental and natural values. We have to examine not only narrowly interpreted return on investment, but indirect effects on the environment and externalities as well. *Malik* (2011) feels that the current practice of discounting is in contrast with the holistic approach to the environment.

- *The timeline of the effects of public projects* – Public projects have a positive effect on social utility which is typically felt in the long-term as well, for instance through environmental-natural effects. The distribution of cost/benefit between generations could be a significant aspect of the evaluation of public projects (Kula, 2006; Weitzman, 2001).
- *The scope of public interest* – The monitoring of public interest is in itself a complex matter. In the case of very few projects is it possible to show that equal value is created for all of society. The various projects usually generate a direct increase in welfare only for smaller communities or social groups. Through changes or damage to the environment, a given project could also negatively impact other groups (from the aspect of fund utilisation, infrastructural investments concern the tax-paying community and could damage the natural values of certain local communities, and the positive impact of use does not concern the same group). From the aspect of the utilisation of public funds, the projects represent the establishment of a fragile equilibrium between the communities, which is often the topic of political debate (Schelling, 1995).

Therefore on the one hand, when evaluating public projects, it is important to clearly define objectives: *for which community and for which period* the given project represents value. On the other hand, project impacts must be managed in a complex manner, by demonstrating externalities and indirect effects. In order to get an evaluation method, the basic DCF method must be supplemented by multi-lateral analysis and evaluation, the comprehensive framework for which is provided by the cost-benefit analysis. Cost-benefit analysis differs from traditional financial analysis in that it takes all costs and benefits into account, not from the aspect of private (project owner) interest but from the standpoint of community interest. Instead of the distorted and subsidised prices present, public evaluation is performed at adjusted prices (shadow price) and calculates with the discount rate determined from the aspect of the community. With respect to practice, both the application of the shadow price and the quantification of external effects constitute problems to be resolved. Besides the calculation of the cash-flows of economic evaluation, the real challenge is selecting the discount rate (SDR).

SOCIAL DISCOUNT RATE

Discounting is a standard financial technique and the basis of intertemporal choice in economics. When making intertemporal choices, economic players make decisions on the trade-off between costs and benefits present at various times. Discounting creates the future and present equivalence of financial instruments. In a general case, the social discount rate is the rate at which the whole of the community/ society is willing to trade current benefit for future benefit. *Table 1* shows the different, mutually exclusive cash-flows of two projects, Project *A* and *B*. Only one of the projects can be implemented for the community. Projects *A* and *B* are different from one another; initial investment expenditure and future benefits are different. Which project is worth implementing? The result of the net present value calculation with various discount rates is shown in *Chart 1*.

In the case of *Project B*, net present value remains positive with all (shown in *Chart 1*) interest rates used for discounting, i.e. if the interest rate used for discounting remains in the range between 0 and 12 per cent, the project is worth implementing. In contrast, for *Project A,* net present value is positive for discount rates in the range between 0 and 6 per cent. *Project A* shall only be competitive with *Project B* with an expected return of 0 and 1

Table 1

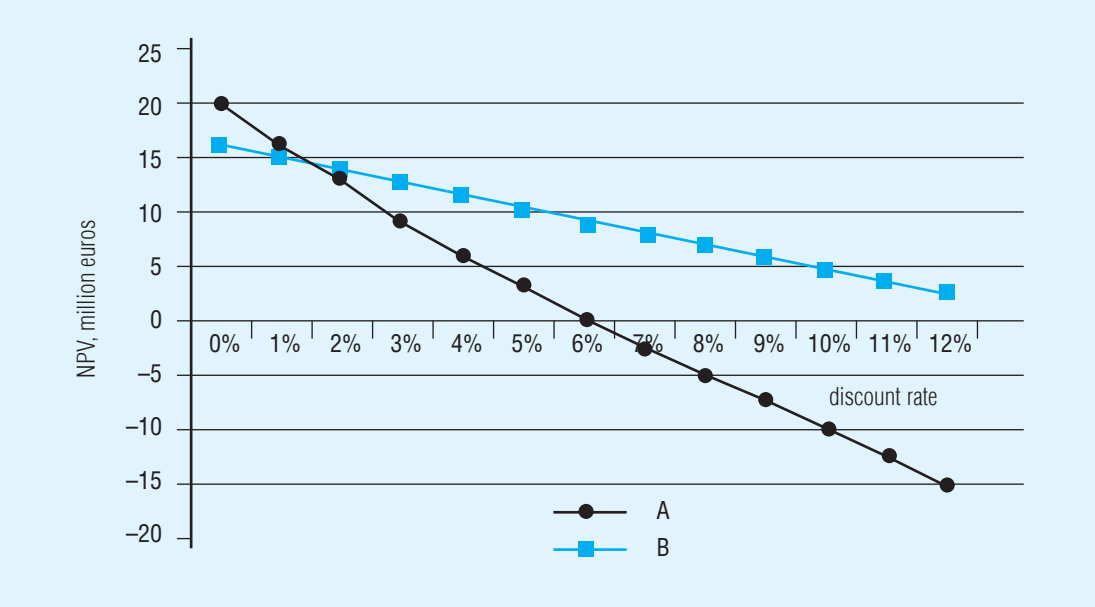
CASH-FLOWS OF TWO PUBLIC PROJECTS, IN MILLION EUROS

Project *A*		Project *B*	
Investment expenditure	Net cash-flow/benefit	Investment expenditure	Net cash-flow/benefit
–70		-50	
–10	0	0	+22
0	+20	0	+22
0	+20	0	+22
0	+20	0	0
0	+20	0	0
0	+20	0	0

Source: authors' own editing

Chart 1

THE EFFECT OF DISCOUNT RATE SELECTION ON THE NET PRESENT VALUE OF THE PROJECT



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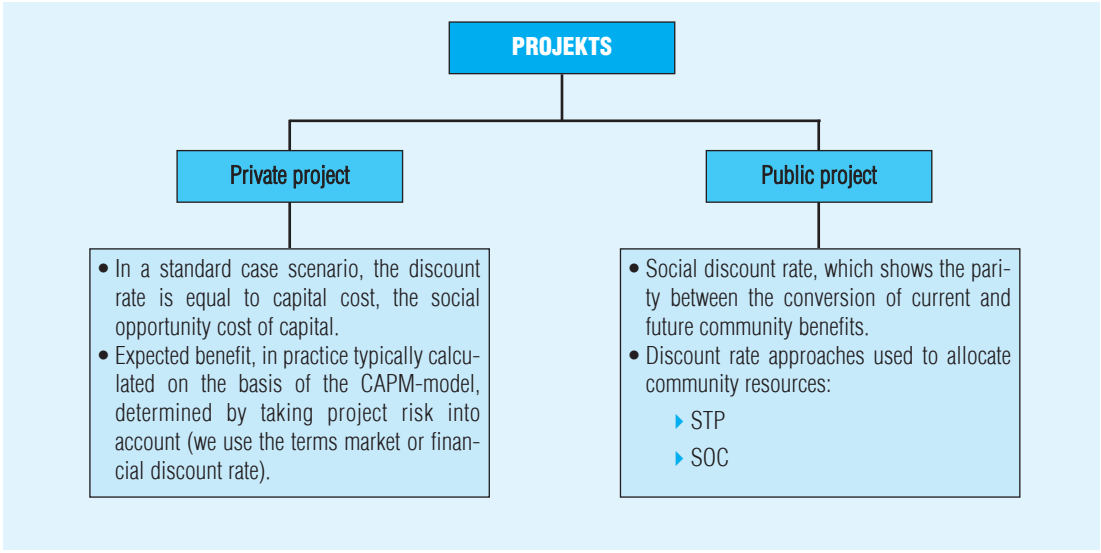
per cent, as this is when net present value is higher.

In the case of public projects, the subsidisation of zero discount rate is significant, primarily in terms of projects serving environmental protection. Discount rates that are lower than zero or than market interest rates allow for projects to go ahead that would otherwise not make it through the screening process, despite a high social utility. The discount rates applied during the evaluation of private and public projects are considerably different from one another *(see Chart 2)*.

How do we determine the discount rate used for public projects? If we do not take the issue of risk into account, the selection of the discount rate progresses along the lines of two considerations, on the one hand, the social rate of time preference (SRTP), and on the other hand, the social opportunity cost of capital

Chart 2

DISCOUNT RATES OF PRIVATE AND PUBLIC PROJECTS



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(SOC), which is based on the marginal productivity of capital (Pearce – Ulph, 1995; Markandya – Pearce, 1991; Guide, 2008; Buchholz – Schumacher, 2010).

Social rate of time preference, SRTP

The social rate of time preference is the rate at which society is willing to renounce one unit of consumption in the hope of higher consumption in the future. Because of public projects, society is giving up present-day consumption. With the selected discount rate, the current and deferred value of consumption for society is equal. The social rate of time preference shows what the trade-off is between present and future community consumption.

When defining SRTP in practice, we distinguish two basic methods.

❶ In the given economy, the value of SRTP is provided by the after-tax yields of government bonds or the yields of other lower-risk, marketable securities. The method is relatively simple; the only counterargument that we can raise is that individuals do not follow the same preferences when making individual decisions as when making decisions as members of a community. Due to this community attitude, the whole of society/ community finds lower alternative cost acceptable as well, as a result of which social discount rate will be lower than the individual rate of time preference.

❷ The generally accepted method of calculating SRTP is the so-called Ramsey formula (Ramsey, 1928) which represents constant discount rate application and is derived from the growth model.

The Ramsey formula: $S = \rho + \mu g$

Where:

S = social discount rate,

ρ = pure rate of time preference; the rate at which the individual discounts future utility/welfare,

μ = the elasticity of the marginal utility of consumption (the indicator of the change of utility in light of income/consumption),

g = the expected rate of growth of per capita income/consumption.

In the Ramsey model, social discount rate is made up of two components.

- The first component is the pure rate of time preference, the rate of discounting future utility, which expresses what future consumption individuals find acceptable in exchange for current consumption. The pure rate of time preference can be derived from the theory of cardinal utility, which assumes a positive and constant rate for the individual in the trade-off between present and future consumption; furthermore, we are also assuming that the accumulation of individual preferences can be enforced at a social level. The extension of both the positive rate and individual preferences to a social level is controversial and highly debated.[4]
- The second component of the Ramsey formula comprises the effects of two parameters. The first parameter is the annual growth rate of per capita consumption, while the other is the elasticity of the marginal utility of future consumption (according to the theory of marginal utility, the utility of a one unit growth of future greater consumption has a decreasing tendency).

During *practical application,* there is no common position on the determination of the first component of the Ramsey formula; researchers determine its value between 1–3 per cent using a number of different methods. Today, the effects of two factors are distinguished in the rate of time preference[5]. The first element is consumer 'impatience', the trade-off ratio between future and present consumption, which we call pure rate of time preference, and the other element is the risk of life chance (which other authors call the risk of disasters occurring), the risk that the individual will not be alive at the future date in question and cannot enforce the benefit of the trade-off. The rate of time preference increases with the decrease of life chance. *Arrow* (1995) determined its value at 1 per cent which, based on the consumer saving behaviour observed, reflects the pure rate of time preference of community consumption. *Pearce* and *Ulph* (1995) determine the pure rate of time preference at 1.1 per cent, which stands for an average mortality rate with respect to England. While Arrow calculates the pure rate of time preference using only the first component, i.e. consumer impatience; Pearce and Ulph use the second component, the risk that society will be unable to exploit the benefits of deferred consumption. During the practical approach to the second component of the Ramsey Formula, the grasping of the expected rate of per capita GDP growth poses the least problems. In practice, the elasticity of the marginal utility of consumption is determined on the basis of direct questionnaire surveys or the examination of indirect consumer behaviour. *Evans* (2006), for instance, has determined a rate of 1.6 with respect to England for the 1963–2002 period based on the results of the examination of indirect consumer behaviour.

Social Opportunity Cost of Capital, SOC

The social opportunity cost of capital is based on the fact that available resources are scarce, and private and public projects compete with one another for funds. The social opportunity cost of capital is the benefit of an investment of similar risk. The returns of public projects cannot fall behind those of private projects; otherwise increasing community welfare would require the reallocation of funds to the private sector.

The real interest return before taxes of high quality, high-grade corporate bonds provides a good estimation of the value of SOC (Moore et al., 2004). A counterargument against bond return is the fact that we are trying to reflect the marginal productivity of capital, but the corporate bond return provides an average

rather than a marginal value. Another counter-argument is that investors have built a premium corresponding to the bond risk into the bond return, which is usually higher than the risk of public projects.

The approach to SDR using SRTP and SOC rates is based on a micro-economical approach and their translation into practice is debated.[6] The parameters for the approach, releasing the closed frameworks of utility models, now only connect to the theory as theoretical starting points and for the most part do not form a consistent system. Research concerning the social discount rate has today been given new meaning by environmental protection and energy-saving considerations, which at the same time have raised new questions.

1. Discount rate and the protection of natural resources

According to environmentalists, the higher the discount rate, the less the present generation is interested in protecting the environment for future generations. Due to the high discount rate, they defer and fail to implement projects serving the protection of the environment, the net present values of which are negative.[7] Within the current practice of public projects, for discounting we apply a discount rate that is constant in time, i.e. we calculate with an identical rate of time preference for the conversion of each year's consumption, thereby underestimating the values of the far-distant future. The discounting function will be exponential, depending on the passing of time the value of the discount factor will become lower and lower, thus continuously decreasing the present value of far-distant future cash-flows. The application of zero social discount rate primarily arose in connection with climate protection. The zero rate of time preference indicates that the future generation is handled identically to the present generation, while in the case of positive discount rate; the generation closer to the present is favoured over the future generation. According to more moderate opinions, it would better serve the proper consideration of impact spanning generations if in the case of intergenerational projects; the discount rate would have a decreasing rate over time (Markandya – Pearce, 1991; Hansen, 2006; Traeger, 2011). In this case, the function of the discount rate will be hyperbolic. At the same time, there are no efficient procedures regarding the rate of decrease or the adjustment of discount rates, only individual solutions and recommendations (Stern-report, 2006; Moore et al., 2004; Sáez – Requena 2007).

2. Impact spanning generations

In connection with long-term public projects, it has been said for some time now that the application of methods used for private projects and the discount rate constant in time mean that they disregard the needs and interests of future generations (the current generation utilises natural resources intensely, excluding future generations from this utilisation or restricting their access). On a community-level, compensation spanning generations has not yet been resolved. The typically long duration of public projects often stretches beyond the life-span of the generation that, by renouncing present consumption, ensures resources for a public project that will serve a future generation. The conversion of the consumption of the current generation between the present and the future impacts the consumption and welfare of the second and third generations. This relationship is known; however its impact with regard to the discount rate is undeveloped.

3. Discount rates of developing and developed countries

The expected rates of returns of investments may vary from country to country, and accordingly there might also be considerable devia-

tions in discount rates. In countries where consumption is relatively low, people are willing to trade consumption for future consumption in lieu of higher interest rates, and in countries where ensuring current consumption is vital, the rate of time preference is high. In developing countries, the World Bank typically calculates with a real interest return rate of 10 per cent (Zhuang et al., 2007). Long-term public projects – such as afforestation and soil protection – cannot be implemented with such a discount rate. The high discount rate in the poorest developing countries is understandable; as satisfying immediate needs is more important, the present is prioritised and encouraging people to save does not work even with such high real interest rates. The high discount rate is a consequence of poverty; at the same time, however, this high discount rate could further damage the environment due to the intense utilisation of resources and loss of environmental investments.

There is no unified, single view in economic literature regarding the social discount rate. The rationality assuming theory of intertemporal choices is thrown into doubt by the moral and ethical considerations raised by the protection of natural resources, and consequently the insufficient answers to intergenerational questions. On a theoretical level, the new aspects cannot be integrated into developed models, while practice applies differing solutions.

SOCIAL DISCOUNT RATE IN EUROPEAN UNION PROJECTS

In the case of projects realised through European Union co-financing, we distinguish two project evaluation techniques:

- *financial net present value (FNPV)*, the goal of which is to calculate financial return indicators based on project cash-flows,
- *economic net present value (ENPV)*, within which we indicate how much welfare growth a given project results in for the given country or region (Guide, 2008).

In terms of form, *financial net present value* employs the method of net present value calculation utilised in the case of private projects; however, it does not do so consistently. The discount rate aligned to cash-flows is not project-specific and is not determined according to the DCF method. Financial analysis takes narrowly interpreted project costs and benefits into account, and calculates cash-flows according to the cash-flow calculation of private projects. The discount rate, however, does not directly match the risk levels of cash-flows; it is calculated based on general investor expectations and is constant in both space and time. For countries affected by the Cohesion Fund, the European Commission recommends the application of a 5 per cent real discount rate to calculate financial net present value, and 3 per cent for all other Member States for the period 2007–2013. The financial discount rate represents the average financial benefit of an investment portfolio realised at an EU level. The financial net present value calculation uses the technique of private project evaluation, but in terms of function serves to lay the foundations of the decision regarding supportability. In *Table 2*, we present a project which serves community goals; the financial analysis of the model of the modernisation of public lighting in a settlement,[8] which is a suitable tool to shed light on the differences in the EU's financial and private project evaluations. The project's cash-flows include those arising during implementation as a private project. The net present value of cash-flows calculated with a 5 per cent financial discount rate is positive; the internal rate of return is greater than 5 per cent, and accordingly the project is not eligible for EU co-financing. As a result, in the case of a lack of public funds, the project can be implemented

Table 2

THE FINANCIAL RETURN CALCULATION OF A PUBLIC LIGHTING PROJECT BASED ON EU REGULATIONS AND THE EXPECTED BENEFITS OF THE PRIVATE PROJECT, IN MILLION EUROS

Return on investment costs	Total local governments examined
Original value (net) of investment (HUF)	140 921 314 000
Total energy cost savings (HUF/year)	14 054 066 720
Total maintenance cost savings (HUF/year)	3 850 735 417
Total savings (HUF/year)	17 904 802 137
Project lifespan	12.5
A) Return on investment costs according to EU regulations	
Financial discount rate, EU	5.00 per cent
FNPV(C)[10] public (EU) project	22 579 009 044
B) Return on investment costs as a private project	
$r_{E.U}$ (the unleveraged asset yield of companies in the sector)	8.69 per cent
FNPV (C) private project	–7 589 777 520
FRR(C)	7.64 per cent

Source: authors' own editing

with private funds. The expected rate of return of a private project is typically higher than the financial discount rate of the EU. The net present value of the public lighting modernisation as a private project is negative, and therefore its implementation is not expedient either as a public or as a private project.

In summary: as a public project, it is not eligible for grants in accordance with the application of EU regulations; at the same time, however, the project's return does not reach expectations as a private project and as a result private investors provide no support either.

It raises further problems that the use of the average rate of the reference 5 per cent discount rate does not ensure the consistency which technical literature prescribes as a condition of the application of DCF models; the capital cost must be adapted to the riskiness of the cash-flow. In the case of financial discounting, an expected benefit calculated with asset risk can be consistently fitted to cash-flow discounting, the application of which – beyond allowing for the determination of supportability – ensures the determination of the minimum rate of the subsidy.

Financial evaluation, the calculation of the ENPV expands the scope of costs and benefits; all impacts must be taken into consideration which the project owner, beyond its direct benefit, generates for the narrower or broader community. The application of the economic analysis method comprises the following five steps:

- transformation of market prices,
- monetisation of non-market impacts,
- inclusion of further indirect impacts,
- determination of cash-flows and social discount rate that is consistent with cash-flows,
- calculation of economic performance indicators, economic net present value (ENPV), economic internal rate of return and cost/benefit ratio indicators.

Financial analysis therefore answers the question as to how great a social welfare increase the project examined results in for the community. As part of financial analysis, it is a fundamental task, in the first step, to supplement the cash-flows of the public interest investment that is narrowly treated as a financial project with the cash-flow relevant to the

community, and to determine the capital cost assigned to this cash-flow. In the second step, the total cash-flow of the project (adjusted cash-flow of private project ± net cash-flow of other external impacts) must be discounted by the social discount rate. The application of the ENPV method provides an answer as to whether the project can be recommended for implementation on a community level (in exceptional cases it is possible that a project is implemented despite negative ENPV, provided there is evidence that it contributes to increasing community welfare, but the rate of this contribution cannot be quantified [e.g. preservation of biological diversity, cultural heritage, etc.]).

Unique features of cash-flows

During financial analysis, cash-flows are 'broadly' interpreted, we take into account not only revenues and expenditures that can be grasped in an accounting-financial sense – which are relevant in the case of private projects – but also the secondary impacts of the project, i.e. what costs-benefits arise for the community and society. The project could impact the environment, people's health, employment, etc. The secondary impacts of the project can be formulated relatively clearly; however, expressing it in quantified form poses difficulties.

The cash-flows calculated during the financial evaluation connect the benefits provided to the community that private projects do not take into account through two points. The first one is the so-called shadow price method, which is to be applied if market prices are distorted and do not express the actual costs of resource utilisation, or if no market price is available. The second option is to integrate external impacts as a separate point. Both approaches aim at determining what other cash-flows, benefits or costs arise on a community level compared to private projects.

Unique features of the social discount rate

For the period 2007–2013, the European Commission recommends a social discount rate of 5.5 per cent for countries using the Cohesion Fund, and 3.5 per cent for all other Member States. The differences in social discount rates arise from the socio-economic conditions of the various Member States (e.g. long-term growth opportunities). The social discount rates of the various countries show significant differences. Naturally, the guide allows for the various countries to set the social discount rate characteristic of the given country themselves. If a Member State applies a social discount rate that is different from that recommended by the European Commission, it is obliged to apply this rate for all public projects. In past years, France, Germany and England have all determined social discount rates according to their own methods. Though the social discount rates were determined using different methods, the rates have since moved closer to one another. In France, the SDR was determined according to the rate of the marginal productivity of capital (SOC-), and in 2005 decreased it from the earlier 8 per cent to 4 per cent. In Germany, the SDR was determined based on long-term government securities yields (one of the methods of grasping the SRTP), and in 2004 was decreased from 4 per cent to 3 per cent. In England, the discount rate was determined as the result of compromise using the SRTP and SOC methods, and was dropped from 6 to 3.5 per cent (Evans, 2006). Today, all three countries apply the 3.5 per cent rate to evaluate their public projects as recommended by the European Commission. Hungarian projects co-financed by the EU also

apply the discount rate recommended by the European Commission.

Based on observations, during the calculation of the social discount rate, the use of the rate of time preference approach (SRTP) increases. The social discount rate recommended by the EU is also based on this time preference, or more precisely on the Ramsey formula. Social discount rate with the legends used in the EU:

$$r = eg + p$$

Where:

r = the real social discount rate of public funds,

g = the growth rate of expenditures,

e = the elasticity of marginal social welfare growth,

p = the pure rate of time preference.

Component p of the social discount rate, the pure rate of time preference reflects consumer impatience, or more generally the current value attributed to future marginal utilities. Researchers today distinguish two impacts within the time preference parameter of SDR calculation. One of these is the pure time preference impact resulting from deferred consumption; the other is the probability that the community will be able to avail of the future utility derived from renounced goods. According to the guide (Guide, 2008), the rate of time preference was calculated on the basis of expected lifespan and other individual factors. A value of approximately 1 per cent was determined for the rate of time preference *(see Table 3)*, which is almost identical to the 1 per cent mortality rate typical of countries in the region. It is not uncommon in STP approaches that only one impact is enforced within the time preference factor. Based on ethical considerations, the compensation for the deferral of consumption is often considered zero; they do not find the impatience reflected in individual preferences acceptable from the aspect of equity between generations.

The first component of the SRTP formula shows the change of marginal utility of a 1 euro increase in real income. The parameters featured in the formula are country-specific values, especially the increase in consumption index, which is directly dependent on the GDP and shows considerable differences in the 27 Member States. Table 3 shows certain parameters of STP calculation in various Member

Table 3

SOCIAL DISCOUNT RATE IN VARIOUS EUROPEAN COUNTRIES BASED ON THE STP APPROACH

'Central' countries	g	e	p	SDR
Austria	1.9	1.63	1.0	4.1
Denmark	1.9	1.28	1.1	3.5
France	2.0	1.26	0.9	3.4
Italy	1.3	1.79	1.0	3.3
Germany	1.3	1.61	1.0	3.1
Netherlands	1.3	1.44	0.9	2.8
Sweden	2.5	1.20	1.1	4.1
Cohesion Fund countries	g	e	p	SDR
Czech Republic	3.5	1.31	1.1	5.7
Hungary	4.0	1.68	1.4	8.1
Poland	3.8	1.12	1.0	5.3
Slovakia	4.5	1.47	1.0	7.7

Source: Guide (2008), p. 209

States; the data shown was prepared based on research conducted for the period 2000–2008. Value *e* of the elasticity of the marginal utility of consumption is the most difficult to grasp. The elasticity of the marginal utility of consumption can take on a value between 1-2, in line with economic-behavioural approaches. The preferences uncovered based on economic-behavioural and taxation databases were incorporated in the data on the EU's marginal utility of consumption. Of the studies prepared for the formulation of the EU social discount rate, *Evans et al.* (2006) uncovered the possibility of the tax-based approach to community preferences. According to the tax approach, the government uses the progressivity of taxes to express that the marginal utility of consumption is higher for people with low incomes, i.e. the income they possess is better utilised as measured on a social scale than the income generated by people with higher incomes.

In Table 3, there are considerable differences in the STP parameters of the two country groups. Significant deviation is primarily shown by the GDP growth rate – this in itself justifies the application of different social discount rates – in at least two fields: firstly in mature economies and secondly in fast-growing Member States. The SDR average of developed or 'central' Member States is 3.51 per cent, which justifies the 3.5 per cent economic rate for these Member States. In the case of developing Member States concerned, the EU has made a recommendation for an SDR of 5.5 per cent (*Table 4* only shows the data of a few countries).

Table 4 presents economic net present value calculation through the economic return calculation of a settlement's public lighting project. In comparison to the FNPV, the increase of the ENPV is the result of the change in cash-flow[9] and capital cost.

The economic net present value of the project is positive and the utility it provides to the community exceeds its costs. At the same time, according to the calculation of *Table 2*, it cannot be recommended for community support as its financial net present value is positive with the application of a 5 per cent community financial discount rate. We have arrived at a difficult to interpret situation, namely that while the project produces a positive present value after the calculation of financial returns, economic analysis shows that implemented as a public project it would allow for a considerable increase in social welfare.

Table 4

THE ECONOMIC RETURNS OF A PUBLIC LIGHTING PROJECT

The economic returns of Project *A* as a public project	Total local governments examined
Original value (net) of investment	140 921 314 000
Total energy cost savings (HUF/year)	14 054 066 720
Total maintenance cost savings (HUF/year)	3 850 735 417
External impacts arising from public lighting (HUF/year)	15 853 213 076
Project lifespan	12.5
$r_{E,U}$ (the unleveraged asset yield of companies in the sector)	8.69%
SDR	5.50%
Return indicators calculated according to EU regulations:	
ENPV(C)	45 246 624 530
ERR	11,30%
B/C	1.36

Source: authors' own editing

The recommendation of the European Commission (Guide, 2008) states that the allocation of public funds has no objective, well-definable method; the formulation of work hypotheses, estimation, the development of alternatives and risk analysis could help communities select the best projects. The success of public projects greatly depends on the local institutional system's level of development, the transparency of decisions and adapting the methods to local conditions.

In 2013, the ongoing co-financing system of the Cohesion and Structural Funds of the European Union will come to an end. New fund allocation methods may be introduced in the new development period, which is why it is necessary to thoroughly analyse previous methodological frameworks and identify contradictions. In addition to the above, we will now take account of the issues that reach beyond the analysis of the given project. We feel that there are several points where the methodological recommendation of the European Commission deviates from the consensus solution developed within social discount rate theory.

- In order to evaluate EU projects, a discount rate that is constant in time, exponential discounting is employed. The application of the decreasing discount rate, which has been appearing on a theoretical level for some time, is not featured in background materials either.
- In its recommendation, the EU does not distinguish between the SDR applied during the evaluation of intra and intergenerational projects. (on a Member State level, they plan to ensure the protection of natural resources through fines, contributions collected in the form of taxes and the identification of natural resources as production factors). Keeping the long-term community discount rate below the rate of the intragenerational social discount rate is justified primarily by the environmental-economic approach, as this would create a more advantageous position for community intergenerational projects (Markandya – Pearce, 1991).
- Reference values that are identical not just in time, but in space as well are authoritative with respect to the community discount rate. This competition poses a disadvantage for countries and projects where the local community discount rate and the expected return of private projects in the case of co-financing is considerably higher than the recommended community discount rate. Significant differences in the discount rates shown in *Table 3* among the various countries would justify the use of discount rates that vary from country to country; however, this in not typical of Cohesion Fund countries. The reason for this was the fact that developing discount rates that vary in time and from country to country and the annual maintenance of these rates is highly information-dependent, and the application of a differentiated rate could become the source of further disputes among Member States, which problems the universal discount rates in part resolve.
- In EU project evaluation, the community (economic) discount rate, albeit only slightly, exceeds the financial discount rate. Due to the higher social discount rate, in the case of public projects, the conversion in time is performed at a higher rate.

SUMMARY

On the one hand, we searched the practice of public project evaluation for the appearance of theoretical consistency criteria which are strictly specified within private project evaluation. In the absence of these – due to the riskiness of cash-flows and the inconsistency of adapting capital cost – the end result in the case of the reviewed project is that social and community support for the project is rejected

based on the FNPV analysis, despite the ENPV evaluation showing social welfare increase if implemented. We have also shown that besides the problem of adapting financial discount rates that are inappropriately selected for cash-flows, the EU practice of selecting community discount rates clashes with theoretical expectations on many points; it does not distinguish between intergenerational and intragenerational projects; it does not reflect the impact of differences in country development, and, contrary to expectations, no decrease of the community discount rate is observed compared to the financial discount rate. These make the efficient allocation of public funds highly debatable.

Notes

[1] The content of this study is connected to the accomplishment of the objectives of the project "Development of a quality-oriented and harmonised education and R+D+I strategy and functional model at BME". Implementation of the project is supported by the New Széchenyi Plan (Project ID: TÁMOP-4.2.1/B-09/1/KMR-2010-0002).

[2] By expanding the external effects of traditional cost-benefit analysis, we are applying a new social cost-benefit analysis. It is also used for ECBA (Environmental Cost-Benefit Analysis), Sáez – Requena (2007).

[3] By discount rate, we mean the interest rate applied during discounting.

[4] Among other things, the theory of utility considers the efficiency at which generations are able to produce products unchanged over time. We can list at least two reasons that influence productivity between generations: technological development and greater available capital. According to environment-oriented research, the positive rate of time preference of the utility-centred approach reallocates resources between the current, less productive generation and the future, more productive generation and as such is ethically questionable (Pearce – Ulph, 1995).

[5] The use of the terms time preference and pure rate of time preference is not consistent and standard in technical literature. Authors who distinguish between the effects of the two factors use the rate of time preference to express the joint size of the two factors, and the pure rate of time preference is used to indicate the first component.

[6] Sandmo – Dréze (1971), Burgess (1989) and others have recommended the simultaneous application of the SRTP and the SOC-type approach to the method of weighted average; furthermore, the rethinking and review of the two basic approaches led to the formulation of the shadow price of capital (SPC-) method (Bradford, 1975).

[7] The literature on environmental protection only considers zero or decreasing social discount rates acceptable, the theoretical substantiation of which is supported by the fact that the second component of the Ramsey formula assumes there is growth in the economy and that in the future per capita consumption will increase. According to their arguments, there are limits growth and 2–3 per cent economic growth cannot be sustained in the long-term due to the limited nature of natural resources. In this case, the first component of the formula could provide the basis for the calculation of the social discount rate (Markandya – Pearce, 1991).

[8] The model's example is based on an actual project plan, on a survey regarding an investment plan for public lighting modernisation connected to the domestic local government sector. The data do not

cover the whole of the local government sector; the figures serve to present the methodology of financial analysis.

[9] When calculating cash-flows, we have, among others, introduced the following external impact.

- The most important positive external impact of the public lighting LED project is the decrease in the emission of greenhouse gases. Besides the direct decrease of energy consumption, the drop in CO_2 emissions has been calculated as a secondary impact, and quantified according to the prices pertaining to the trading of CO_2 quotas.
- In the public lighting system, the luminous flux for the area to be lit is on average 15–30 per cent greater and emits a white light that is better adapted to the human eye's ability to perceive light. One of the difficult to quantify impacts of increased luminous flux is the improvement of traffic safety. The EU Guide (2008) presents the impact of the decrease of public road accidents through a motorway construction case study, and the accident-decreasing effect of the public lighting project can be considered an analogy of this case study.
- The public lighting project has a dual impact on employment. The production of the old light fixtures has been discontinued, and manufacturing capacity has been terminated. The manufacturing of new LED lights requires the employment of a new workforce. The external impacts of employment growth can be calculated based on the EU Guide (2008).

[10] In the case of projects implemented using EU co-financing, further return indicators must be calculated. Indicators featured in the examined project:
FNPV(C) and ENPV(C) = Financial/Economic Rate of Return, the financial/economic net present value of the return on investment,
FRR(C) and ERR = Financial/Economic Rate of Return, the financial/economic internal rate of return of the investment,
B/C = Benefit/Cost ratio.

Literature

Arrow, K. (1995): Intergenerational Equity and the Rate of Discount in Long-Term Social Investment. *IEA World Congress*, December, Tunis

Bradford, D. (1975): Constraints on Government Investment Opportunities, and the Choice of Discount Rate. *American Economic Review* 65 (5). pp. 887–899

Buchholz, W. – Schumacher, J. (2010): Discounting and Welfare Analysis over Time: Choosing the ç. *European Journal of Political Economy.* Vol. 26. pp. 372–385

Burges, D. F. (1989): The Social Opportunity Cost of Capital in the Presence of Labour Market Distortions. *The Canadian Journal of Economics.* Vol. 22, No. 2, May. pp. 245–262

Evans, D. (2006): Social Discount Rates for the European Union. *Working Paper, Fifth Milan European Economic Workshop.* Milan

Hansen, A. (2006): Do Declining Discount Rates Lead to Time Inconsistent Economic Advice? *Ecological Economics.* Vol. 60. pp. 138–144

Kula, E. (2006): The Social Discount Rate in Cost-Benefit Analysis: the British Experience and Lessons to be Learned. *Working Paper* 19. (Milan European Economy Workshops)

Markandya, A. – Pearce, A. (1991): Development, the Environment, and the Social Rate of Discount. *The World Bank Research Observer.* Vol. 6, No. 2 (Jul., 1991), pp. 137–152

MALIK, A. S. (2011): Justice to Nature and to the Disadvantaged. *World Futures.* Vol. 67. 2, pp. 106–114

MOORE, M. A. – BOARDMAN, A. E. – VINNING, A. – WEIMER, D. L. – GREENBERG, D. H. (2004): Just Give Me a Number. Practical Values for the Social Discount Rate. *Journal of Public Policy Analysis and Management.* 23(4). pp. 789–812

PEARCE, D. – ULPH, D. (1995): A Social Discount Rate for the United Kingdom. *CSERGE Working Paper GEC*

RAMSEY, F. (1928): A Mathematical Theory of Saving. *Economic Journal.* 38. pp. 543–559

SANDRO, A. – DRÉZE, J. (1971): Discount Rates for Public Investments in Closed and Open Economies. *Economica.* No. 38. pp. 395–412

SÁEZ, C. A. – REQUENA, J. C. (2007): Reconciling Sustainability and Discounting in Cost-Benefit Analysis: A Methodological Proposal. *Ecological Economics.* Vol. 60. pp. 712–725

STERN, N. (2006): The Economics of Climate Change: The Stern Review. *Cambridge University Press*

SCHELLING, T. C. (1995): Intergenerational Discounting. *Energy Policy.* Vol. 23, No. 4/5, pp. 395–401

TRAEGER, C. P. (2011): Sustainability, Limited Substitutability, and Non-Constant Social Discount Rates. *Journal of Environmental Economics and Management.* Vol. 62, pp. 215–228

WEITZMAN, M. (2001): Gamma Discounting. *American Economic Review.* 91(1), pp. 260–271

ZHUANG, J. – LIANG, Z. – LIN, T. – GUZMAN, F. (2007): Theory and Practice in the Choice of Social Discount Rate for Cost-Benefit Analysis: a Survey. *ERD Working Paper.* No. 94.

Guide to Cost-Benefit Analysis of Investment Project. July 2008. European Commission