SERBIA: SUPPORTING THE IMPLEMENTATION OF PUBLIC INVESTMENT MANAGEMENT REFORM

SETTING THE DISCOUNT RATE FOR PUBLIC INVESTMENT PROJECTS IN SERBIA

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ABSTRACT

Serbia has continually developed its Public Investment Management (PIM) framework for the past several years. In July 2019, the Government of Serbia (GoS) adopted a new Decree on PIM which defines key documentation requirements for the pre-implementation stages of public investment projects, including appraisal, review of appraisal and selection of projects for financing. The Decree envisages for the Ministry of Finance (MoF) to annually estimate and publish a Financial Discount Rate (FDR) and Social Discount Rate (SDR) to be used by public institutions for financial and economic assessment of public investment projects. Official discount rates are essential to ensure a consistent basis for appraisal and enable comparisons of financial and economic indicators across projects and sectors in Serbia. This technical note is written in response to the request for support by the MoF with regard to development of sound estimates of FDR and SDR. The note provides an overview of methodological approaches for calculation of the rates, assesses their appropriateness for Serbia and suggests possible values of FDR and SDR for Serbia given available data. The calculations presented in the note suggest an FDR of 4% which reflects the current long-term government bond yield and expected macro-fiscal developments, especially given the turbulence amid the coronavirus pandemic. The SDR is estimated at 7.4% which is slightly higher than the levels observed in developed economies. However, the difference correctly displays the contrast in wealth and living standard.
ACKNOWLEDGEMENTS

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<tr>
<td>ATR</td>
<td>Average Tax Rate</td>
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<td>CBA</td>
<td>Cost-Benefit Analysis</td>
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<td>FDR</td>
<td>Financial Discount Rate</td>
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<td>GoS</td>
<td>Government of Serbia</td>
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<td>MoF</td>
<td>Ministry of Finance</td>
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<td>MTR</td>
<td>Marginal Tax Rate</td>
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<td>PIM</td>
<td>Public Investment Management</td>
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<td>PIMOCU</td>
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<td>PIP</td>
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<td>RSD</td>
<td>Serbian Dinar</td>
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<td>SDR</td>
<td>Social Discount Rate</td>
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<td>SOC</td>
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1. INTRODUCTION

1. The Government of Serbia (GoS) aims to increase the efficiency and effectiveness of public investment. With these goals in mind, the Ministry of Finance (MoF) has requested the World Bank to provide technical assistance to strengthen the Public Investment Management (PIM) framework. During 2019, a World Bank technical assistance team provided comprehensive methodological guidelines for the introduction of a new PIM framework.

2. The PIM reform process is ongoing and has so far resulted in the establishment of a new PIM Oversight and Coordination Unit (PIMOCU) and the introduction of a new and enhanced legal framework grounded in the methodological guidelines drafted by the Bank team. These guidelines cover most phases of the public investment project life-cycle – from pre-screening and selection to implementation monitoring and the review and rationalization of the public investment portfolio. The changes to the legal framework were initiated by the adoption of a new Decree on Capital Projects Management (hereinafter the PIM Decree) in July 2019. Most practical details required to operationalize the Decree were laid out in accompanying bylaws (Rulebooks in the Serbian terminology) which, among others, define investment documentation, introduce implementation monitoring mechanisms as well as lay out content and guidelines for preparing (pre-)feasibility studies.

3. Under the provisions of the new Rulebook on the contents of pre-feasibility and feasibility studies, the MoF is obliged to publish the values of financial (FDR) and social discount rates (SDR) to be used by public institutions (project proposers) when assessing the financial and economic worth of investment projects. The provisions, contained in Articles 19 and 28 of the Rulebook, require the MoF to publish the rates applicable for the assessment of public investment projects to be initiated during the next fiscal year on its website no later than September.

4. This note responds to the MoF’s request for support in calculating the FDR and SDR. It presents and compares available alternatives used to estimate FDR and SDR and provides current estimates of these for Serbia. Practical guidelines on how to estimate FDR and SDR will enable implementation of the legislative framework segment dealing with preparing pre-feasibility and feasibility studies. This note should be perceived as a guideline covering important aspects of discount rate calculation in the local context. It should not be confused with a comprehensive and exhaustive study covering all aspects of all available methodological procedures.

5. The rest of the note is organized as follows: Section 2 provides a brief conceptual background on discount rates, including the purpose of FDR and SDR. Section 3 lays out the approaches to calculating FDR and provides an estimate of FDR for Serbia. Section 4 discusses the differences in methods used to calculate SDR, provides a step-by-step guidance for implementing the Social Rate of Time Preference (SRTP) approach in Serbia and offers an estimate of SDR for the country.
2. CONCEPTUAL BACKGROUND

6. In general, the process of discounting a stream of future costs and benefits\(^1\) is based on the concept of “time value of money”\(^2\) and the compensation investors require for mobilizing their capital for a particular purpose in the form of required return. Alternatively, it can be viewed as a compensation required for substituting current for future consumption. Mathematically, it is the process by which the value of every investment-related cost or benefit is expected to occur at various points of time in the future is expressed in present-value terms. Discounting of these cost/benefit streams is done using a discount rate which is essentially determined by the implicit costs investors bear from not investing in another project with similar risk profile. These costs are commonly referred to as opportunity costs. In terms of return on investment, it is the returns foregone from not investing in the alternative project (i.e., required return). Investment action is typically taken if the sum of the present value of future net benefits (benefits minus costs) is higher than zero, while the investment option with the higher sum of the present value of expected net benefits would be prioritized. Discounting of cost and benefit streams generated by public investment projects is necessary for the calculation of performance indicators which ensure comparability between mutually exclusive investment alternatives and enable decision makers to better perform investment selection and prioritization.

7. The financial discount rate should be differentiated from the social discount rate. The two kinds of discount rates are used in two different types of analysis which have different perspectives. As the name implies, the financial discount rate is used to discount the cash stream in a financial analysis. A financial analysis takes the perspective of a project or operating entity and considers only the cash outflows (i.e., investment and operating expenses) and cash inflows (e.g., revenues from water tariffs) as a result of project implementation and subsequent operation. The social discount rate, on the other hand, is used as part of an economic analysis and represents the rate at which an economic stream of costs and benefits is discounted. An economic analysis is broader than the financial analysis. It takes the perspective of society as whole and includes the monetary value of social costs and benefits occurring to a society as a result of implementing a public investment project. The economic analysis captures both the financial outcomes of the project and the indirect (i.e., social) benefits and costs which are not directly associated with cash. These costs and benefits are often more challenging to express in monetary terms and may include, for example, health costs and benefits, time savings or losses, a reduction or increase in suffering, and productivity losses or increases. The theory behind the social discount rate will be discussed in more detail within the section laying out different methods for its calculation.

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\(^1\) The terms “costs” and “benefits” are used to capture both cash flows as well as cost/benefits which are not expressed in monetary terms, see further in paragraph 7.

\(^2\) The concept of “time value of money” implies that one dollar today is worth more than one dollar tomorrow because of the inherent assumption that investing the dollar today will bring back positive returns in the future and that, in case an individual opts for consumption instead, he/she will require compensation for the delay.
3. APPROACHES TO CALCULATION OF THE FINANCIAL DISCOUNT RATE

8. There are three commonly used approaches in setting the FDR. The basic idea behind all three of them is to find the best possible proxy for the opportunity cost of capital invested in a public investment project. The approaches rely on the following three different sources of data in fulfilling this objective: i) long-term interest rate on government bonds; ii) returns from the best alternative investment; and iii) referring to a specific interest rate or a rate of return from a well-established issuer of securities in a widely traded currency and then applying a multiplier to this minimum benchmark.

9. The approaches are:

- A commonly used approach is to estimate the actual cost of capital. A proxy for this estimation is represented by the real return on government bonds (the marginal direct cost of public funds), the long-term real interest rate on commercial loans (if the project needs private finance), or a weighted average of the two rates (Weighted Average Cost of Capital – WACC). The latter case is applied, particularly, when a project needs both public and private financing. Although it is a very practical and widespread approach, it does not reflect the actual opportunity cost of capital, because the best alternative investment should, in principle, produce higher earnings than the interest rate paid on public or private loans. For example, if the project is financed in equal proportions by public and private funds of which one costs 10% and the other costs 5%, the WACC would be 7.5%.

- A second, more accurate, approach is to consider the return lost from the best alternative investment in order to determine the maximum limit value for the discount rate. In this case, the alternative investment is not buying back of public or private debt but the return on an appropriate portfolio of financial assets.

- Finally, the FDR could be determined by using a specific interest rate or a rate of return from a well-established issuer of securities in a widely traded currency and then applying a multiplier to this minimum benchmark. Given the volatility of the international financial markets (including the risk of asset bubbles), however, this approach can lead to unstable and frequently changing values.

3.1. Setting the FDR for Public Investment Projects (PIPs) in Serbia

10. The possibilities to apply the above-mentioned approaches for setting the FDR depend on the availability of data at the country level. Well-established and developed capital markets will have an abundance of historical public investment related data which can be used as a useful benchmark when referring to the “best alternative” while their vibrant and deep capital markets will offer a range of opportunities to choose from when identifying the well-established issuer of securities. Unfortunately, the capital market in Serbia is highly bank-centered meaning that the corporate or non-government bond market is barely functional. Historical data on returns achieved from investing in public investment projects is not available.
11. Given these circumstances, Serbia should pursue the approach of setting its FDR by using an appropriate return on a long-term government bond (alternative 1 mentioned above). The long-term benchmark yield on 10-year government bonds is the most frequently used figure. Figure 1 below shows the most recent yields observed on the domestic government bond market. The orange curve is the Serbian dinar (RSD) securities denominated yield curve while the blue curve shows yields of EUR denominated government bonds.

Figure 1: RSD and EUR yield on Serbian government bonds, April 2020

Source: Ministry of Finance, Public Debt Administration.

12. It is recommended to use the domestic currency denominated yield curve. Authorities operate with two yield curves, so in theory it would seem sensible to choose the appropriate cost of capital depending on the currency of denomination of the source of funding for a particular project. Under the theory implied by interest rate parity, an investor should be indifferent whether to use one or the other interest rate since the difference between them is a mere reflection of the expected change in the exchange rate between the two currencies. In this case, it seems that the difference between the RSD yield and EUR yield on the same maturities means that RSD is expected to depreciate towards EUR to compensate for the difference. This is a theoretical observation. In practice the suggestion to opt for the yields observed on the RSD yield curve when choosing the discount rate is supported by the fact that public investment will be decided and implemented in the domestic financial environment and that all monetary flows will be denominated in RSD. This means that the project’s returns will, in reality, have to be higher than the cost of Euro denominated funding in order to compensate for the potential depreciation of RSD to EUR since repayments must be made in EUR. Finally, the majority of investors in long-term maturities of the government bond market come from the Euro area implying that the yield differential contains the premium for exchange rate risk and that parity should hold over the medium to long-term.
1.2. Recommended value of the FDR for Serbia

13. **The 10-year government bond yield is the reference yield that should serve as a starting point in determining the FDR.** Although it would be correct to match the yield used to the PIP investment horizon (e.g., for 7-year projects use yield on 7-year government bonds, for 10-year projects use 10-year government bonds, and so on), in practice the 10-year government bond yield is a consensus benchmark yield which should be used across the entire portfolio of public investments. Further, depending on the sector, most projects have investment time horizons of more than 10 years. At the same time, the maturities of more than 10 years on the government yield curve are highly illiquid (i.e., inactive) and thus may represent a very unreliable estimate of the true cost of capital to the government.

14. **Absent secondary market activity, the most recent yield achieved on primary market should be used.** It should be noted that the 10-year government yield seen at the yield curve in Figure 1 is the yield achieved on the primary market (i.e., at the auction) for government bonds held in July 2018. Since then there have been no other auction for government bonds of that maturity. The most recent auction of a comparable maturity was held in March 2020 for a 12-year bond. The yield achieved then was significantly lower than the one achieved previously for the 10-year bond (3.35 % versus 4.80 %). While the rest of the yield curve is upward sloping with auctions on primary market being held relatively recently for these maturities, a break can be observed exactly on the 10-year maturity. This implies that the true cost at which government would borrow for a 10-year period had the auction for it been held recently would be much lower and that the yield of 4.8% should be adjusted downwards for the purpose of our analysis. Using simple interpolation, the estimate of 10-year government bond yield can be calculated at 3.1%.

15. **The final estimate, however, should incorporate expected potential changes to the yield level.** In our case this refers to anticipated policy reactions to the economic slowdown due to the coronavirus pandemic and its effect on interest rates. Currently, the large-scale fiscal stimulus is expected to bring about a sizeable fiscal deficit of around 6% of GDP. This will bring the financing needs of the budget to more than 8 billion Euros. Serbia traditionally leans on external demand for its debt and while demand for liquidity will grow exponentially at the global level, it seems that a small open economy such as Serbia will see its interest rates, and particularly those for debt denominated in local currency, go up.

16. **The recommended FDR for Serbia should thus be in the vicinity of 4% in nominal terms.** This value corresponds exactly to the value of the FDR recommended for EU countries by the EU 2014-2020 Cost-Benefit Analysis (CBA) Guide.

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4 This note was drafted in May 2020, which is four months before the deadline for publishing the financial discount rate for fiscal year 2021. Hence, if a new primary auction for a RSD denominated 10-year bond is held in the meantime, the yield achieved at that auction should be used without adjustments.
4. CALCULATION OF THE SOCIAL DISCOUNT RATE

17. As opposed to the FDR, the SDR is applied to economic analyses which takes a wider social perspective. An economic analysis includes financial flows but also broader costs and benefits for which monetary values may not readily exist but must be estimated during the course of economic analysis. Determining the SDR effectively boils down to correctly estimating the return that the society requires for giving up current for future consumption or investing in one particular project instead of another one. In a world of perfectly competitive markets with no informational asymmetries, fiscal pressures and transaction costs, these rates would be equal to the ‘market rate’ which would be a commonly set equilibrium required rate of return for the entire society. The real world, however, departs from this ideal setting as there are multiple factors causing variations in the required rate of return of individual agents within a society. This effectively means that the concept of a ‘market rate’ remains theoretical. In practice, the investment and business environment in which individuals, companies and the public sector operate tends to vary around factors such as sector, tax environment, access to finance, market concentration, legislative framework, etc. Thus, one of the available methods needs to be utilized in order to come up with a consistent and unbiased estimate of an SDR for a public investment project.

18. The two most widely used approaches for estimation of the SDR are: i) the social opportunity cost of capital (SOC); and ii) the social rate of time preference (SRTP). Under the SOC approach, the discount rate is interpreted as the rate of return that the government foregoes when it invests public funds on behalf of society. Under the SRTP approach, the discount rate is interpreted as the rate of return required by a ‘socially-minded’ decision-maker in order to defer a unit of consumption from the present to the future.

4.1. Approaches to calculation of the SDR

4.1.1. The social opportunity cost of capital (SOC) approach

19. The SOC approach is based on the assumption that public and private projects substitute each other. Hence, the SDR estimated through the SOC approach is practically the return on a hypothetical next-best investment alternative earned from investing in a marginal project in the private sector. The notion of public and private investment projects being supplementary to each other is based on the existence of the crowding-out effect which implies that the funds invested in a public sector project will be unavailable to the private sector. Thus, the SDR obtained using this approach can be perceived as the rate of return that the economy is willing to sacrifice for having money transferred from the capital market to fund a public investment project.

20. In practice, there are several ways the SOC implied SDR can be calculated. One way is to follow the risk-free interest rate (typically on a government bond of a maturity similar to investment horizon) and add a risk premium of a magnitude proportional to the risk profile of the
project in question. It can also be calculated as the weighted average of a measure of efficiency of capital in the private sector (e.g., ROI), the marginal rate of time preference of consumers and the marginal cost of funding from abroad. The weights should ideally reflect the financing mix used for funding a particular investment.

21. From a practical standpoint, there are, however, several problematic aspects of the SOC approach. The assumption that public investment funding diverts the same amount of money from private investment and consumption is not realistic. The diversion takes place through the crowding out effect which assumes that public investments are funded exclusively by raising new debt which puts upward pressure on interest rates, thus making private investment and consumption less affordable on average. However, governments do not always finance their projects by issuing new debt. Also, the possibilities of public sector investment in the private sector and vice versa are quite limited in modern economies. Further, it is widely argued that an individual’s preference for consumption (i.e., giving up current for future consumption) is likely to vary depending on whether the individual is considering a private or public investment. Individuals will require significantly higher risk premiums when considering private investments because of the range of unsystematic risks involved. (Moore and Vining, 2018).

22. It is argued by many researchers that the SOC approach yields an upward biased SDR. This is because the private sector returns entail a risk premium which is normally eliminated through diversification in the public sector by exploiting the advantage of depth and size of its investment portfolio. Also, market returns of private investments include benefits of externalities and market distortions which have limited influence on the rate of return in public sector investment projects. This can make the private sector rate of return both higher or lower than what would be observed in a public sector investment project which represents a plausible alternative to it.

4.1.2. Social rate of time preference (SRTP) approach

23. The SRTP approach is based on the preference of individuals (and the society) for current over future consumption. This preference is usually considered to be a result of impatience and discomfort with delaying instant gratification. Methodologically, it is a process of aggregating social preferences over intertemporal inequalities – determining the optimal level of returns expected from the delays in consumption instigated by investment activities. It is commonly estimated from the Ramsey Rule formalized by the following equation:

\[ SDR = SRTP = p + e \cdot g \]

Where \( p \) is the pure time preference rate, \( e \) is the elasticity of the marginal utility with respect to consumption, and, \( g \), the expected per-capita consumption growth.

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5 This is the approach followed by the New Zealand Treasury. SOC is estimated as the average stock market return in a given year. For details please refer to Creedy and Passy (2018).
6 See Boardman et al. 2006.
7 See Ramsey (1928).
24. Opponents of this approach point to several weaknesses of the SRTP. Freeman et al. (2018) list a number of those including that it does not adequately reflect the opportunity cost of public funds: that there are controversies with estimating parameters that comprise the Ramsey rule based equation; that it does not account for uncertainties around the assumed consumption growth and, finally; that the concerns around intra-generational distribution of wealth is not adequately captured since the well-being of future generations is estimated by using the expected pattern of consumption of an average agent. Another argument against this method is of ethical nature. If we assume governments have equal responsibility for current and future generations, there is no ethical ground for compensating current generations for deferring consumption in the form of an SDR. This is why a large body research has evolved around the idea that SDR should be zero.8

25. These theoretical ambiguities have inspired the development of diverse approaches to estimation of various SDR components. By definition, the variation in these approaches correlates with differences in the level of SDR. To test this hypothesis, Drupp et al. (2018) ran a survey among more than 200 experts to estimate the SDR and its different components for a hypothetical global environment. The result of their survey is a notable variation among experts on the point estimates of SDR – going from zero to 10%, while the variation is even higher when the estimates of individual components of the SDR (based on the Ramsey rule) are put into perspective.9 The same research showed that the Ramsey Rule itself cannot explain these variations and that estimates of experts accounted for uncertainty, heterogeneity and relative prices of non-marketed goods which merit particular attention when estimating the SDR in the context of SRTP.

4.1.3. Comparison of alternatives

26. Since both of the most common methods suffer from shortcomings there is currently no optimal way to calculate the SDR. To reflect on these flaws, some research suggests that they be used interchangeably or even together depending on the particular circumstances surrounding an investment decision. Creedy and Passy (2018) argue that the SOC approach should be used when the goal of a project is precisely to substitute private investment, while SRTP should be used when the project is meant to displace private consumption. Also, they suggest that a weighted average between the SOC and SRTP estimated SDR should be used depending on the proportion of funds that would be invested to those that would be consumed had the funds been in the hands of private sector. These propositions are, however, not easily implementable due to various (mostly data-availability related) limitations. Some countries, such as China, have found a way around it and use a weighted average approach in their public investment decision making.

27. Most of the European countries follow the SRTP approach. Table 1 below compares the representation of both methods within a sample of 16 countries. It shows that the SRTP is the method of choice for most of the European countries, while the SOC method seems to be the preferred one for several European and Commonwealth countries excluding UK. Another category

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8 See for instance Broughel (2018).
9 The largest source of variation is the p parameter (i.e., utility discount rate) where the range of replies went from 0 to 8 %.
of countries included in the sample are the ones that use their 10-year government bond yield as a proxy for their SDR (e.g., Czech Republic and Hungary).\textsuperscript{10}

Table 1: Method used for estimating SDR

<table>
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<tr>
<th>SRTP approach</th>
<th>SOC approach</th>
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<td>Canada</td>
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<td>United Kingdom</td>
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### 4.2. Application of the SRTP in the Serbian Context

28. **It is recommended to follow the SRTP method in estimating the SDR for Serbia.** This suggestion is based on several arguments. The SOC method is associated with data limitations. In particular, it requires investment data from the private sector companies involved in industries where public investments are taking place, which are not readily available in Serbia. The SRTP approach to estimating the SDR, on the other hand, although methodologically challenging and suffering itself from certain data availability limitations, can be carried out in the local setting.\textsuperscript{11} Finally, the SRTP is the preferred method for a majority of EU countries.

29. **In the respective subsections below, the most common approaches are presented to estimate each of the parameters required for calculating the SDR using the SRTP approach.** This group of elements from the above equation includes \( p \) (the utility discount rate), \( e \) (the elasticity of the marginal utility with respect to consumption), and \( g \) (the expected per-capita consumption growth). At the end of the section, they are put back in the Ramsey equation to come up with a suggestion for the SDR.

### 4.2.1. The pure time preference rate (\( p \)) estimate

30. **This rate is the basis for SDR calculation under the SRTP approach and reflects the rate at which society prefers to be compensated for delaying their consumption.** For intergenerational projects (i.e., those extending to more than one generation) it basically represents

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\textsuperscript{10} Although a legitimate approach in the sense that it reflects the time preference, it is a time preference solely of those individuals investing in the government bond market while others may have developed many different views on how to invest their money and this decision would be based on various factors such as their wealth, risk aversion or age which further determines their required rate of return.

\textsuperscript{11} Recent World Bank publications on economic analysis of Bank financed projects recommend using the SRTP approach, see for example M. Fay, S. Hallegatte, A. Kraay and A. Vogt-Schilb (2016). A note by the operational arm of the World Bank (OPSQP) implicitly suggests using the SRTP approach by putting the level of the discount rate in the context of a country’s growth prospects within the Ramsey formula, see World Bank 2016.
the magnitude of intergenerational solidarity and readiness to give up current consumption for the well-being of future generations. In principle, the lower the preference for current over future consumption (i.e., the higher the indifference between consuming and investing), the lower the estimate of the $p$ parameter. The Stern Review of Stern et al. (2006) argues for the pure time preference rate of 0.1% which implies a near neutrality between consumption and investment. It is however based on the assumption that current generations would give up more than 50% of their income for investing purposes, which does not seem realistic. As reported by Lopez (2008), the typical range for $p$ is from 1% to 3% while most of the countries fall within the narrower range of 1% to 1.5%.

**Available methods for estimating $p$**

a) The approach used in the UK, described by Freeman et al. (2018), establishes $p$ as a **combination of two components**: one to account for pure time preference ($\delta$) and another for other types of risk ($\lambda$), such that:

$$p = \delta + \lambda$$

The pure time preference component contains the premium for personal myopia reflected in the preference for immediate rather than postponed gratifications (i.e., preference for consuming more now rather than waiting for the consumption benefits to grow and occur at a future point in time). On the other hand, the risk encompassed by $\lambda$ includes exogenous risk of societal collapse and catastrophic project failure. The Stern Review (2007) proposes a 0.1% SDR such that $\delta = 0\%$ and $\lambda = 0.1\%$. In practice, the UK Green Book takes a shorter-term perspective whereas both $\delta$ and the systemic risk measured by $\lambda$ is higher which makes the total SDR higher – the 2003 estimate of $\delta$ and $\lambda$ were 0.5 and 1% which makes the total $p$ equal 1.5%.

The two components comprising the pure time preference rate can be estimated in different ways but are typically determined based on a survey of relevant sources whereas relevant expert opinion is aggregated and analyzed. In the survey carried out by Drupp et al. (2018), the $p$ parameter was determined in the range between 0 and 8%, while mean and median values were 1.1% and 0.5%, respectively.

b) **Adjustment of a median value of $p$ observed elsewhere** based on proportional difference between death rates, as described in Lopez (2008). This procedure is based on the assumption that increased average life expectancy would be directly proportional to the tendency of current generations to sacrifice consumption for investment. In plain words, if a person is more likely to die earlier in relative terms (as measured by higher death rates) they will be less likely to give up current consumption and will require higher returns for investment which they might not benefit from. As the result, the value of $p$ in countries with comparably lower death rates and higher life expectancy will be lower.

**Value of the utility discount rate ($p$)**

31. **For practical reasons, it is suggested that Serbia follows the approach suggested by Lopez (2008).** This means that the rate of pure time preference ($p$) should be estimated by adjusting
the average of the estimate from developed countries for the differences in death rates by observing the statistics published in the World Bank World Development Indicators database.

**Figure 2: Crude death rate (annual, per 1000 people – Serbia and developed countries, 2018)**

![Crude Death Rate Chart](image)

*Source: WDI database, 2018 data.*

32. **The suggested pure time preference rate for Serbia is 2.35%**. Serbia is among the poorest European countries; it ranks 4<sup>th</sup> in the world by the death rate indicator<sup>12</sup> and has a track record of high emigration flows in the past few decades. These observations work in favor of current generations building a stronger than average preference for consumption as opposed to opting for long-term investing. This indicates that the pure rate of time preference for Serbia should rightfully be adjusted upwards compared to the levels observed in developed economies. For example, the difference between the death rates in UK and Serbia implies that the Serbian <i>p</i> should be adjusted by the coefficient of 1.57.<sup>13</sup> Currently the value of the pure time preference rate for UK stands at 1.5% which implies that the Serbian pure time preference rate should be in the vicinity of 1.5 x 1.57 = 2.35%.

4.2.2. Per capita consumption growth rate (<i>g</i>)

33. **The growth rate element together with the elasticity of marginal utility (<i>e</i>) represents the “wealth effect” in the SRTP equation based on the Ramsey rule as defined by Ramsey (1927).** The wealth effect is based on the idea that society should be compensated for the higher living standards induced by the investment made. The higher living standard is expressed in the expected increase in per capita consumption (<i>g</i>), while the size of the “wealth effect” relative to

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<sup>12</sup> The list is led by Bulgaria (15.4), Latvia (15), Ukraine (14.8) while Serbia ranks 4<sup>th</sup> with 14.6 deaths per 1,000 citizens in 2018.

<sup>13</sup> The crude death rate per 10,000 citizens in 2018 was 14.6 in Serbia and 9.3 in UK.
the expected consumption growth rate will depend on the society’s aversion to intertemporal inequality – measured by the $e$ parameter which is discussed in subsection 4.1.3.

Available methods

34. **The approach followed by virtually all countries is to estimate the expectations for the future value of $g$ based on the past per capita consumption growth rates.** The key methodological aspect within this approach is the choice of the period over which the average growth rate is calculated. Freeman et al. (2018) contributed to the update of the UK Green book estimate which runs its projection of $g$ based on the 1949-1999 period. Depending on the period chosen, the variations go from 0.21% for the 2007-2016 period to 2.5% for 1949-1998 period. In general, the period chosen has to be long enough to capture enough of both the downward and upward fluctuations in consumption growth that happen due to normal business cycles, natural catastrophes, military conflicts, etc. In some cases, it makes sense to exclude years of extreme circumstances with extraordinary one-off economic or political events. Finally, in some cases the simple average of past growth rates could be adjusted to reflect expected changes in the overall macroeconomic framework and country’s growth prospects in light of ongoing reform activities (Kula, 2004).

35. **Lopez (2008) follows this approach and estimates the $g$ parameter for nine Latin American countries excluding the 1980s when per capita consumption growth was negative in almost all Latin American countries.** He ran different scenarios based on research found in other studies dealing with economic prospects of these countries to come up with an average range of expected long-term consumption growth rate lying between 1.4% and 4.1%, with the overall average at 2.5%.

**Value of the per capita consumption growth rate ($g$)**

36. **For the purpose of estimating the future growth rate for Serbia, we look at the historical long-term average for growth in consumption.** The average consumption growth rate in Serbia was 3.2% in the period from 1996 onwards. It is suggested not to exclude any of the observations from calculation of the average, in particular 1999 – the year of NATO bombing – since growth in the years following the political changes in 2000 seem to have compensated for the sharp drop of 1999.

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The choice of the growth rate to be used when estimating SDR should in principle also factor in the growth outlook developed by relevant sources. Both the latest Fiscal Strategy and the IMF Country Report for Serbia envisage a 4% real GDP growth rate over the next 3 to 5-year period, although these estimates are not adjusted for the latest developments related to COVID-19. This period falls short of the average time horizon of public investment projects. Hence, after considering the potential growth fluctuations over the duration of the business cycle and aligning the growth estimate with the expected average time horizon of public investments, the estimate of the appropriate value of per capita consumption rate was kept at the level of the historical average of 3.2%. When using the SDR for economic analysis of investment projects, it is highly recommended to run a sensitivity analysis to determine how much the performance indicators (e.g., cost-benefit ratio and economic net present value) are likely to vary with changes in the SDR. Such a sensitivity analysis is already prescribed as part of the risk analysis in the rulebook laying out the methodology for conducting feasibility studies for public investment projects in Serbia.

4.2.3. The elasticity of the marginal utility with respect to consumption (e)

This parameter measures the magnitude of compensation required by current generations (in the form of SDR) for the expected growth of consumption of future generations (i.e., parameter \( g \)). It tells us what the overall societal tolerance for income inequality is, or, in other words, what is the marginal utility of income redistribution from rich to poor. A value of 1 implies indifference towards future growth, while a value below 1 shows tolerance for intergenerational income inequality, and a value above 1 signals that society wants the expected increase in welfare to be distributed more evenly across generations. Lopez (2008) reports on several studies where this parameter was estimated in ranges from 1 to very high and likely implausible levels of 10 and above. In the early 2000s Evans and Sezer (2004) estimated the SDR for Australia, France, Germany, Japan, UK and USA and found the range of values to be between...
1.3 and 1.7. The most recent and most comprehensive research focused on estimating \( e \) was done by Groom and Maddison (2018). They run six different methods\(^\text{15}\) for estimating the elasticity parameter in the UK. Their meta-analysis combines estimates derived from all methods to arrive at a fixed effects pooled estimate of 1.51 with a 95% confidence interval between 1.42 and 1.59.\(^\text{16}\)

39. **The approaches for estimating \( e \) can be broadly grouped into those based on:** i) **stated preferences** where a sample of individuals is asked about their opinion relevant for estimating the parameter; and ii) **revealed preferences** where \( e \) is estimated based on secondary data using a structured statistical approach. In the subsection below we describe the sample-based approach and the Equal sacrifice approach which is the most widely used among the revealed preferences methods.

**Available methods**

a) **Stated preferences (i.e., survey-based) approach.** This is an approach where an estimate of \( e \) is derived from responses to questions structured to reveal preferences of a group of relevant people towards concepts such as risk and income inequality.

A well-structured and coherent example of applying this approach can be found in Atkinson et al. (2009). The authors surveyed over 3,000 people mostly from the UK, the United States, Canada, Australia and Mexico. The estimate of \( e \) is based on how respondents expressed their views on risk aversion, intertemporal substitution and distribution of income. Individuals were asked to choose among different spending and saving patterns of their governments over time in order to estimate the intertemporal substitution to help inform the preference for current over future consumption. Risk aversion is estimated through a complex set of three-stage questions with binary outcomes where risk-reward increases with every step, while income inequality aversion is measured by presenting the survey participants with a choice between a set of income distributions.

b) **The Equal sacrifice approach.** It is a widely used method deriving \( e \) from the structure of personal income tax. Using this approach, the marginal utility of consumption can be determined by using the values of: i) the effective marginal tax rate (MTR); and ii) the average tax rate (ATR) through the following formula:

\[
e = \frac{\ln(1 - \text{MTR})}{\ln(1 - \text{ATR})}
\]

Caution should be exercised when estimating \( e \) based on official tax rates due to potential tax evasion which can be sizeable in some countries. Therefore, a reasonable estimate of the degree of tax evasion should be built into the estimate. Another issue to consider is that effective tax rates can change with income levels in some countries with more complex progressive taxation system. Ways to overcome this include those applied by Lopez (2008) who calculates both average and effective income tax rates along the entire income range.

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\(\text{15}\) Including Equal sacrifice (weighted and historical), Euler equation, Additive preferences and Subjective wellbeing

\(\text{16}\) The 2003 Green Book used in the UK as the reference for evaluating public investment proposals, suggests the value of 1 for \( e \).
distribution (i.e., at 20, 40, 60 and 80% sample cut-off points). On the other hand, Groom and Madison (2018) run a simple Ordinary Least Squares (i.e., OLS)\textsuperscript{17} regression with MTR as the dependent and ATR as the independent variable where individual observations are weighted according to the number of individuals belonging to each earnings category.

Value of the elasticity of the marginal utility with respect to consumption (e)

40. **Since running a survey is beyond the scope of this exercise, the elasticity parameter is estimated using the Equal sacrifice approach.** However, from the description laid out above, it is obvious that it requires up-to-date and complete data on the distribution of income and tax across the population which are not readily and publicly available in Serbia.\textsuperscript{18} Instead, these distributions will be estimated using just the level of income tax rate.

41. Given the absence of income distribution data, a suitable proxy is needed to estimate the level of the e parameter. The standard income tax rate in Serbia is set at 10%. Individuals earning more than three times the average salary are taxed an additional 10%, while those earning more than six times the average salaries are obliged to pay 15% tax on the additional income. While the average tax rate in Serbia is 10%, the marginal tax rate could be anywhere between 10% and 25% depending on the level of gross earnings. If the lower bracket of the range was taken for the MTR, the e parameter would be equal to 1. As mentioned before, the unity value implies indifference about the distribution of wealth which does not seem realistic but is seen in practice (e.g., the UK). On the other hand, if we assume the value of MTR is at the upper end of the range, the e would be equal to 2.7 which seems to be an overestimation based on values observed elsewhere. The issue with both approaches, however, is the existence of an improbable underlying assumption that all individuals fall within the same income bracket – within the lowest one in the former, and within the highest one in the latter case. This is why, in order to precisely estimate the value of e, it is absolutely necessary to obtain data on the income distribution so that appropriate weights can be attached to each value of MTR.

42. Temporarily, due to data limitations, Serbia can apply a rudimentary adjustment method where elasticity is estimated using the Gini coefficient\textsuperscript{19} as a proxy for income distribution. The value of the coefficient ranges from 0 to 100, where 0 indicates perfect equality – a situation that mirrors the one where all citizens fall within the lowest income category, and 100 indicates perfect inequality – circumstances in which those who earn income are taxed at the highest MTR. The latest value of the Gini coefficient for Serbia is 36.2 (2017). This value may suggest the point which carries the most weight along the income distribution line. So, it makes sense to use this value as the coefficient (expressed in percentage terms) to interpolate between the

\textsuperscript{17} Method for estimating parameters in a linear regression model whereas the parameter values are set by the principle of minimizing the sum of squared differences between the observed and estimated values of the dependent variable.

\textsuperscript{18} We expect the most complete records to be in possession of the Central Registry of Mandatory Social Insurance (CROSO).

\textsuperscript{19} OECD defines the Gini coefficient as a: “… measure of the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution.”
two points of the range calculated above. Finally, the $e$ parameter for Serbia can be estimated through the following equation:

$$1 + 36.2\% \times (2.7 - 1) = 1 + 0.62 = 1.62$$

4.3. Recommended value of the SDR for Serbia

The assessment above results in the following estimates for the parameters specified in the Ramsey equation:

$$1 + 36.2\% \times (2.7 - 1) = 1 + 0.62 = 1.62$$

44. Based on the above values, the SDR is estimated in the following manner:

$$SDR = p + e \times g$$

$$SDR = 2.3\% + 1.6 \times 3.2\%$$

$$SDR = 7.4\%$$

45. The level of SDR which will be used to run economic analysis of public investment projects for Serbia should be at the level of 7.4%. This is suggested by the above application of the SRTP approach given the described limitations resulting from unavailability of data. Bearing in mind the differences in wealth, death rate and living standards, this value is broadly in line with the SDR used in other European countries shown in Table 3 below.

### Table 2: Summary of parameter values for estimating SDR

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pure time preference rate</td>
<td>$P$</td>
</tr>
<tr>
<td>elasticity of the marginal utility</td>
<td>$E$</td>
</tr>
<tr>
<td>with respect to consumption</td>
<td></td>
</tr>
<tr>
<td>expected consumption growth</td>
<td>$G$</td>
</tr>
</tbody>
</table>

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### Table 3: Value of SDR in European countries using SRTP approach

<table>
<thead>
<tr>
<th>Country</th>
<th>Value of SDR (SRTP method)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>3%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>3.50%</td>
</tr>
<tr>
<td>Sweden</td>
<td>3.50%</td>
</tr>
<tr>
<td>France</td>
<td>4%</td>
</tr>
<tr>
<td>Spain*</td>
<td>4% - 6%</td>
</tr>
<tr>
<td>Czech Republic**</td>
<td>4.75%</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>5%</td>
</tr>
<tr>
<td>Italy</td>
<td>5%</td>
</tr>
<tr>
<td>Malta</td>
<td>5.50%</td>
</tr>
<tr>
<td>Estonia**</td>
<td>6.50%</td>
</tr>
</tbody>
</table>

Notes: *Spain uses 6% SDR for transport and 4% for environment; **estimates by Florio and Sirtori 2013.


