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Comment on Burgess and Zerbe's "Appropriate Discounting for Benefit-Cost Analysis"

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Abstract

This is a comment on a paper by David F. Burgess and Richard O. Zerbe. It derives a different set of conclusions than the cited authors do from the customary premises underlying benefit-cost analysis. It concludes that capital should be shadow priced, and that the appropriate discount rate to use in benefit-cost analysis is the interest rate of the capital market to which the public sector has access. It proposes that a plausible source of the great divergence in approaches to discounting stems from different answers being given to the question of whether present day consumption has a future consumption opportunity cost.

KEYWORDS: discount rate, Benefit-Cost Analysis, shadow price of capital

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1. Introduction

This note offers comments on David F. Burgess and Richard O. Zerbe's "Appropriate Discounting for Benefit-Cost Analysis" (2011). Their proposal to draw conclusions about the appropriate discount rate from the basic premises of benefit-cost analysis is very useful. I have attempted something similar in Szekeres (2011), and while I find myself in agreement with many of Burgess and Zerbe's statements, I disagree with their practical recommendation. This note explains why. Some of the points made in this note are discussed at greater length in Szekeres (2011).

2. The discounting paradigm

The text-book discounting paradigm is well known, but it is worth re-stating briefly, because some of the proposed approaches to discounting have implicitly or explicitly abandoned it. The paradigm describes a consumer optimizing his consumption path. He has an endowment of income in different time periods and an inter-temporal utility function that describes his consumption preferences. His optimization problem is to reach the consumption path affording the highest possible utility by availing himself of the services of the capital markets to which he has access to either save or borrow. Optimality is reached when the marginal rate of substitution of his utility function corresponds to the interest rate of the capital market to which he has access, thereby defining the time value of money for the decision maker. The key assumption behind the paradigm is that present day consumption has a future consumption opportunity cost, which is measured by the interest rate prevailing in the market to which the decision maker has access.

A decision maker might not face a single interest rate. He might face several at the same time (such as one for lending and one for borrowing) and interest rates may not be constant through time, so there might not be a single discount rate to use in computing present values, but several. Be that as it may, as long as the correct discount rate is used for each transaction (or potential transaction), the net present value (NPV) computed will be the equivalent of present day cash. No inter-temporal utility function will then be needed to evaluate the feasibility of the investment considered, as positive cash amounts are always worth taking, regardless of time preference.

The foregoing describes how an individual should optimize his lending and borrowing decisions. Society as a whole (assuming for now a large closed economy) does not face a capital market budget line, however, but rather a transformation curve that can convert present day consumption forgone into future consumption, and which will do so at varying rates, as a function of the quantities

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to be converted. Optimality is reached when the highest possible indifference curve derived from the social welfare function is tangent to this transformation curve. The point of tangency will define both the marginal product of capital and the relative time value of consumption in adjacent time periods. It is important to note that the interest rate observed at the optimality point is a result of the optimization, and not one of its parameters. This optimization is not the business of benefit-cost analysis, therefore, as it is not a partial equilibrium problem.

Benefit-cost analysis takes the consumption path chosen by society as a given (whether it has been optimized or not) and only looks at relatively small investments that do not imply significant deviations from it. Therefore, for purposes of benefit-cost analyses, the public sector, acting on behalf of society, will face exactly the same problem as the individual decision maker. As the capital market is its incremental source of funds, it must use the interest rate of the market to which it has access as its hurdle discount rate when appraising public sector investments. Otherwise it would fail to maximize welfare.

3. Accounting for the welfare opportunity cost of public investments

No mention has been made hitherto of capital market distortions, which cause two interest rates to coexist simultaneously in the same market. Taxes are the most common form of such distortion. "The wedge between the two rates is explained by the capital income tax" (Burgess and Zerbe, 2011:4).

When multiple prices exist in a given market, benefit-cost analysis resorts to the estimation of shadow prices to calculate the welfare value of the good or service being traded in it. It is unsurprising therefore that many have proposed to define a shadow or Social Discount Rate to replace observed market rates. "Ignoring the unrealistic first-best world, in which case the market rate of interest [of an undistorted market] is ruled out, the main choices for the [Social Discount Rate] reduce to opting for the [Social Time Preference Rate] or the [Social Opportunity Cost Rate] or some combination of the two" is how one textbook of benefit-cost analysis describes the problem (Robert J. Brent 2006:363).

The way in which benefit-cost analysis accounts for capital market distortions lies at the heart of the discount rate dispute. Burgess and Zerbe (2011) support the Social Opportunity Cost (SOC) approach, even though they show conditions under which it is equivalent to the Social Time Preference (STP) approach. They state that "The SOC approach is justified by the straightforward principles of applied welfare economics—demand price measures marginal benefit, competitive supply price measures marginal cost, and adding up (i.e. dollars of benefits and costs) are valued independently of to whom they accrue" (2011:3). "The SOC rate is a weighted average rate that takes into account both the displacement of capital and foregone consumption, and in an open economy the use of foreign funds" (2011:5). In other words, the SOC rate is a shadow or

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social discount rate obtained as a weighted average of observed interest rates.

While the motivation implied in these arguments is entirely correct, the practical recommendation that Burgess and Zerbe propose is not. There are two reasons for this:

1. The first reason is generic and applies not just to the SOC approach: the distortions of the capital markets should not be corrected through a shadow or social discount rate. There are several arguments to buttress this assertion, the main one being that "Displacing private investments in distorted capital markets causes both welfare losses and resource savings, which are distributed through time. While these losses and savings are a function of the taxes affecting, and the interest rates prevailing in, the relevant markets, they are measured in dollars and are incurred over time. To measure the marginal effect of displacing a unit of private investment, the losses caused and the resources saved need to be netted for every time period of the analysis. This is as far as the analogy with the shadow pricing of goods and services can be taken, however. Going further to average market interest rates to derive a social discount rate is wrong, because the functions computing present values and annuities are not linear. The time profile of the welfare losses and resource savings caused by crowding out private sector investments is not exponential, but adjusting the discount rate does have exponential effects and, consequently, will not yield a correct measure of the welfare effects" (Szekeres, 2011).

2. The second reason is that the rate of return of the displaced private sector investments overstates their welfare opportunity costs. This is so because savers and borrowers are not in the same market. Their markets are bridged by intermediaries who add value and have costs (including, but not limited to, provisions for bad loans). When public sector investments displace private sector investments, the willingness to pay for loans by private investors is lost. But this willingness to pay is a gross welfare loss. It is equal to the sum of the cost of providing the loan plus the tax due on it. The cost that would have been incurred by financial intermediaries is also foregone due to the displacement, however, leaving only the tax revenue loss as the measure of the net welfare opportunity cost of displacing private sector investments.[1]

[1] It is not necessary to assume the absence of risk. Benefit-cost analysis deals with the real world, in which there is uncertainty. High return investments typically are riskier, and for this reason supplying them with funds is costlier. Crowding out investments from higher return markets will therefore generate higher forgone taxes. The cost of public funds also reflects perceptions of risk by the markets, and for this reason it is very variable across countries.

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The correct way to deal with the welfare consequences of the crowding out of private sector investments and of inducing additional savings is to quantify the corresponding flows directly, and add them to the costs of the project. This means computing the weighted averages of taxes that would have been paid on investments crowed out (which will add costs to the project) and of incremental taxes paid by savers on interest earned (which measures the amount by which interests paid overstate welfare costs). This procedure is called shadow pricing of capital. Under some circumstances the net welfare impact flows can be capitalized into a single shadow price of capital factor.[2]

While computing weighted average interest rates is incorrect, the kind of detailed analysis of the likely composition of the source of funds for public sector investments presented by Burgess and Zerbe (2011) is very useful, nonetheless. It should be used not to compute weighted average interest rates, however, but rather to calculate taxes foregone or paid. It is these that directly measure the net difference between incremental welfare benefits and costs.

"The conclusion that can be derived for [benefit-cost analysis] and discounting from the foregoing is that using a hurdle discount rate by itself is not enough. The two distinct objectives of ensuring (a) that the distortions of the capital market are properly adjusted for, and (b) that public sector resources are efficiently allocated, cannot possibly be fulfilled by a single shadow or social discount rate. In fact, shadow or social discount rates cannot fulfill either objective. Objective (a) can only be fulfilled by the shadow price of capital, which is not a discount rate, and objective (b) can only be fulfilled by the marginal cost of funds of the public sector, which is not a shadow price" (Szekeres, 2011).

To attain two objectives two instruments are needed: discounting measures the direct opportunity cost of public funds and the shadow price of capital measures the additional welfare impact caused by market distortions. The former is measured by the financial cost of public borrowing, as valued by the capital markets, and the shadow price of capital estimates the welfare costs of having raised incremental funds. The latter has to be added to the costs of the project.[3]

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[2] Some authors call this the accounting price of investment.

[3] In BCA, all shadow prices convert costs and benefits of any kind whatsoever into the numeraire. The numeraire itself does not have to be shadow priced, of course, as it is the unit of account. The proposed procedure is thus easiest to apply when public sector income is used as a numeraire, a common choice in BCA. For cases when the numeraire is expressed in foreign exchange, Jean Drèze and Nicholas Stern (1990) state: "The rate of fall of the social value of a unit of foreign exchange is then equal to the interest rate on world capital markets." For the treatment of cases when a consumption numeraire is used, see Szekeres (2011).

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4. The appropriate discount rate

The appropriate discount rate to be used in the cost benefit analysis of public sector projects is the interest cost of incremental public funds. This was the conclusion of Section 2, reached for the situation in which there is no capital market distortion, and also remains the conclusion of Section 3, which discussed how to account for the effects of capital market distortions. This section will present three additional arguments to support this recommendation.

1. As benefit-cost analysis is used to maximize the welfare impact of public sector investments, it must use the discount rate that reflects the opportunity cost of funds of the public sector, otherwise welfare will not be maximized. This is so even if the analysis is conducted using a consumption numearaire, rather than the also widely used public sector income numeraire. For a further elaboration of this point see Szekeres (2011).
2. Benefit-cost analysis measures net welfare surplus, deducting resource and external costs from gross welfare generated. Discounting deducts the opportunity cost of capital (which is why interest costs must never be present in net project flows). Therefore discounting at any rate other than that which measures this opportunity cost will incorrectly state the capital costs of the projects and yield incorrect NPV results. (Remember that net additional welfare opportunity costs should already have been accounted for in the net flow of the projects through the shadow pricing of capital.) A numerical example of this effect is provided in the Appendix.[4]
3. Discounting also defines the relative value of units of net benefit accruing in different time periods. In the course of doing benefit-cost analyses, all project benefits will have been converted to a numeraire using shadow prices and distribution weights, if germane, and the shadow price of capital adjustment will have been effected. Project net flows will have been properly valued and will have been expressed in units of public income accruing across time (directly, if a public income numeraire was used, or by conversion into it if not). The relative value of units of project

[4] The Appendix is available on-line as an additional file. It shows, for a set of hypothetical cases, that if the net flow of financing is removed from the projects' flows, then the conclusions of of the BCA change when the STP or SOC discount rates are used, but remain invariant when the appropriate discount rate is used. Furthermore, the computed NPV is unchanged in the latter case, which shows that the only the appropriate discount rate accounts correctly for the financial opportunity cost of public funds. (The welfare effects beyond this cost should be added to the project flows).

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> net-flow will therefore be the same as the relative time value of public income, which is given by the interest rate at which the public sector can transfer its income across time through the capital markets. This is why the marginal cost of public funds defines the relative time value of everything that was quantified in the analysis. Discounting at any other rate would distort the time value of all benefits and costs quantified.

This last argument is another reason why discounting at the SOC rate is not appropriate. Burgess and Zerbe acknowledge this criticism. "A frequent point of criticism regarding rates that arise from the SOC and related approaches is that they will materially reduce effects felt very far in the future. However, there is nothing inherently wrong with this. Nor will this mean that really large effects that occur in the future will necessarily be ignored" (2011:10). The defense offered is not convincing. They give a numerical example showing that discounted future amounts could still be large. But that is not the point. What matters is not whether the discounting effect is actually large or small, but rather whether it is of the correct magnitude. My contention is that the SOC rate is not a rate at which the public sector could move public sector resources from the present into the future. Therefore it does not define the time value of money for the public sector and therefore it should not be used to define the relative time value of net benefits accruing in different periods of time.

5. Other approaches to discounting

Reflecting on the disagreements that surround the question of discounting, Burgess and Zerbe are right in stating that "Part of the problem lies in the fact that proponents of different approaches to discounting are frequently unclear about what they are maximizing, or what function the discount rate is supposed to perform" (2011:1). Exploring some further aspects of this question is particularly pertinent when writing about what benefit-cost analysis has to say about discounting, because it is the mistaken application of a benefit-cost analysis technique that has contributed to the confusion. The mistake was to treat interest rates as simple prices that can readily be used to compute willingness to pay. They are not. Rather, interest rates define schedules of payments. Those payments do measure willingness to pay, but interest rates are not linear functions of them. Failing to recognize this has lead many into the blind alley of seeking to define a social discount rate, or of computing weighted average interest rates.

Even though Burgess and Zerbe (2011:4) state in their reconciliation of the SOC and STP approaches that "the STP rate will equal the after tax rate of return [of the capital market]," they concede in a footnote that "The STP rate is interpreted by some as a 'politically determined' rate that may lie below the after tax rate of return." Indeed a good portion of the literature on discounting is about

what the STP rate should be and it deals with matters largely unrelated to capital markets. Brent (2006:369) states that because individuals have a "defective telescopic faculty" many authors consider that an authoritarian shadow discount rate will better reflect society's responsibility for future generations.

Most proponents of the STP approach have abandoned considering the opportunity cost of capital, and focus instead on the inter-temporal valuation of consumption, often on the basis of theoretical utility functions and growth models, none of which rests on solid empirical foundations. But inter-temporal distribution weighting is not the same thing as discounting to account for the opportunity cost of capital and thus to reflect the time value of money. In benefit-cost analysis income distribution weighting is an act of valuation that is optional, whereas accounting for the opportunity cost of a resource is not.

Because much of the discourse on discounting has become essentially one of inter-temporal distribution weighting, it is not surprising that the question has also become the subject of ethical discussions, as briefly surveyed by Burgess and Zerbe (2011). The perception of the effects of discounting has also correspondingly changed. Higher discount rates are viewed as harming future generations. This might be explained by the fact that inter-temporal distribution weighting resembles a zero sum game.

Using the discount rates proposed by these approaches would only be consistent with the benefit-cost analysis methodology if a situation existed in which capital had no opportunity cost, such as when selecting projects using a fixed budget that must be spent and cannot be expanded. The relative time value of benefits needed for project comparison can then only be based on inter-temporal distribution weights, which are intrinsically subjective or political, unlike other aspects of benefit-cost analysis, which are merely error-prone.

In contrast, accepting the premise that capital does have an opportunity cost leads to a rather different view. "Our point is that it is the market rate of return—not our attitudes toward future generations or our moral view of discounting—that determines the appropriate discount rate. To evaluate climate mitigation policy with a lower rate of return unnecessarily harms either current or future generations, or both. Future generations would not thank us for investing in a low-return project" (Gary S. Becker *et al*, 2010:17). The discounting paradigm is indeed equally valid for all utility functions, as long as the consumption path can be optimized and it is not exogenously determined. "From an economic and empirical perspective the choice of a discount rate is not about the philosophical choice of the correct ethical weight to be applied to the welfare of our and other peoples' great-grandchildren, nor is it about the way we 'should' discount marginal dollars of their income because they will be richer" (Gary Becker *et al*, 2010:16).

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The discrepancies in the differing approaches to discounting are fundamentally rooted in their relation to a basic question: does present day consumption have a future consumption opportunity cost or not?

6. Conclusions

Burgess and Zerbe state "the marginal source of funding for all projects is the capital market" and "If a particular tax is being proposed to finance a particular project, the revenue from the tax could be used to pay down the debt instead of funding the project, so an alternative use of funds for any project is to pay down the debt" (2011:7) This then defines the opportunity cost of funds of the public sector.

If we accept that the objective of the public sector should be to maximize the social welfare impact of the funds that it finds worthwhile to raise, and we accept that this impact should be measured by BCA, then we should also accept the basic assumptions underlying the BCA method:

- BCA is a partial-equilibrium analysis technique that aims to measure the net welfare impact of a public sector intervention. These measurements are conducted by reference to the existing real life situation and making them requires forecasting the expected real life consequences of the intervention considered.
- Benefits and costs are measured by the changes in consumers' and producers' surpluses (or changes in willingness to pay or to supply) induced by the intervention being analyzed. Income distribution weights, if applied, modify these values by reference to an implied social welfare function.
- BCA requires the correct valuation of the opportunity cost of all resources used, capital included.

Accepting these assumptions leads to the conclusion that, having shadow priced capital and having added the corresponding welfare cost to the net flows of the projects, the appropriate discount rate to use in benefit-cost analysis is the interest rate of the capital market to which the public sector has access.

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