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David F. Burgess, *University of Western Ontario*
Richard O. Zerbe, *University of Washington, Seattle*

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Calculating the Social Opportunity Cost Discount Rate

David F. Burgess and Richard O. Zerbe

Abstract

Two comments in this issue of the Journal address our recent article in Volume 2, Issue 2. The fundamental issue with both comments is that they confuse the financial rate of return with the opportunity cost rate of return and therefore advocate for an inappropriate basis on which to calculate the government discount rate. That is, both comments confuse the financial cost of funds, or the borrowing rate, with the economic opportunity cost of funds. We hope that this exchange advances the subject by reducing confusion.

KEYWORDS: discount rate

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Two comments in this issue of the Journal address our recent article. One is entitled "On Bank Market Power and the Social Discount Rate," the other "Comments on 'Appropriate Discounting for Benefit-Cost Analysis.'" We will refer to these as "Market Power" and "Comments Paper." The fundamental issue with both comments is that they confuse the financial rate of return with the opportunity cost rate of return and therefore advocate for an inappropriate basis on which to calculate the government discount rate. That is, both comments confuse the financial cost of funds, or the borrowing rate, with the economic opportunity cost of funds. The "Market Power" comment uses financial rates of return affected by monopoly power to suggest that the correct discount rate should be lower when the rate used by banks with monopoly power are used to calculate the discount rate. The authors state that these bank rates will be higher than the competitive rate and the social discount rate will thus be overstated unless corrected. While this is of course true, the social cost of government spending is not determined using such financial rates nor by monopoly power. Rather, as is normally the case in welfare economics, we look at the marginal social cost of funds, which reflects the willingness to pay (demand price) of the displaced demanders of funds and the willingness to accept (supply price) of the induced suppliers of funds.

The welfare change is determined by the change in consumer surplus and producer surplus plus the change in government revenue and in externality effects. That is the welfare change will then be:

$$\Delta W = \Delta CS + \Delta PS + \Delta GR + \Delta EE \qquad (1)$$

Consider the simplest case, suggested by the "Comments Paper," in which there are no distortions in the economy and initially no government borrowing; it is a first best world. In the Figure below D_0 is the private demand for funds. The government project increases the demand for credit from D_0 to D_0. + G. In doing this it creates a change (loss) in consumer surplus, as shown in Figure 1 of -(C+D). There is a gain of producer surplus of (C+D+E). The net change in producer and consumer surplus is (E). The government expenditure, which is a loss, is shown by (D + E + G + J + H + K). The financial cost is then the government expenditure. The economic cost is the same but minus area E. Notice that the economic cost, (D+G+J+H+K) is the cost of incremental supply, (H+K), plus the foregone benefit of displaced demand, (D+G+J). (This area plus

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area E can also be derived directly from applying equation (1), where area E is treated as a gain but not factored into the discount rate.)

The economic cost is slightly different from the financial cost due to the gain to producers from assuming an upward sloping supply curve. With a flat supply curve, or a small project the economic and financial cost are the same. Note that the cost to intermediaries is captured in the supply curve. The relevant comparisons for the private sector are the equilibriums of the supply function with tax and the two demand curves. (Some may wonder why area X is not part of a gain in consumer surplus. Area X is already accounted for; it is not a gain in consumer surplus because nothing has made credit more valuable to consumers or lowered its price.[1])

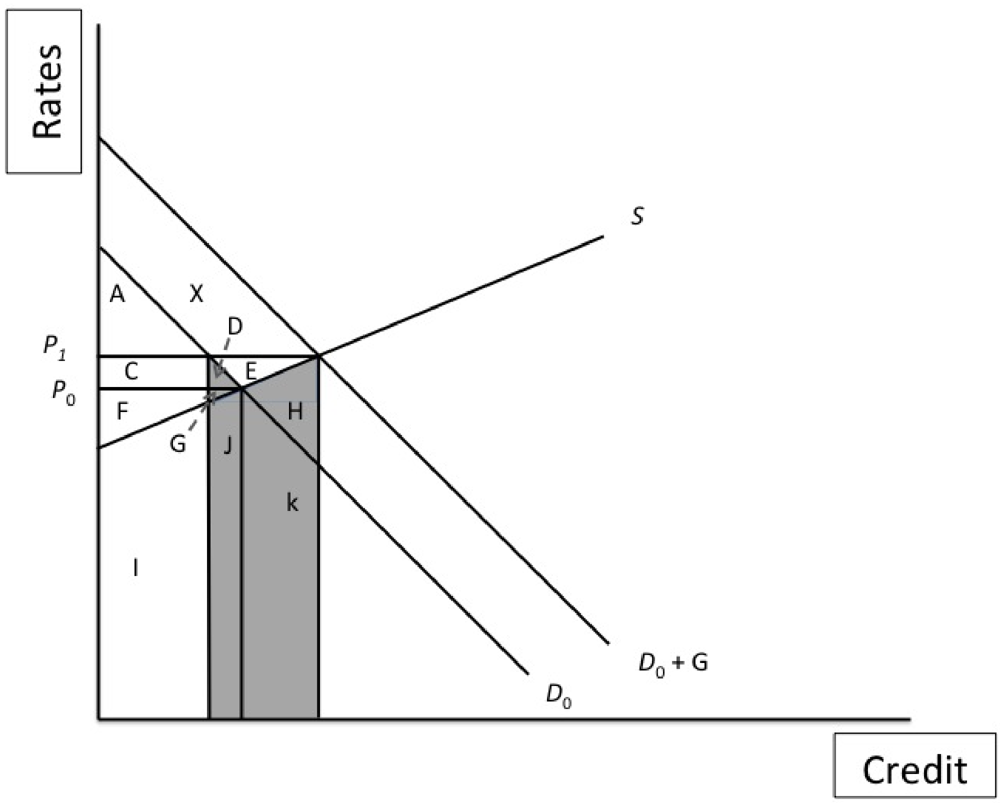

Figure 1: Case of No Distortions in Credit Market

[1] For an expanded intuitive explanation see Zerbe and Dively (1994).

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The cost to the government is equal to the shaded area in Figure 1, which is just the market interest rate cost except for area E. In this instance, the market rate is about equal to the discount rate, and would be exactly equal if the supply curve is perfectly elastic and we would be in agreement with the second comments were this in fact the situation. However, this is not the case.

Consider also the simple case of a small open economy in which the supply of funds is perfectly elastic, and there is no taxation and no monopoly. An increase in government borrowing to finance project spending will neither crowd out consumption nor private investment. Instead it will increase the financial deficit and crowd out net exports dollar for dollar. The government discount rate nevertheless would not equal the cost of borrowing unless there was no risk. The default risk would be borne by U.S. economy in terms of higher future borrowing costs, or absent default, U.S. taxpayers would bear the risk of higher taxes in the future to service the increased debt. Thus even if the government could borrow from the Chinese at 4%, the economic cost of borrowing exceeds the 4% rate. In our opinion the best way to calculate the economic cost of borrowing when the supply of funds is perfectly elastic is to calculate the annual rate of return foreign investors have received in the U.S. net of U.S. taxes. Thus if the pre-tax rate of return is 8.5% and the corporate tax rate is 35% with no withholding taxes, the net return would be 5.5% and this would be the SOC. This calculation is uninfluenced by the loan rate offered by banks, monopoly or otherwise.

Figure 2 below shows a stylized case in which there is a tax on borrowing such as a tax on interest income. The initial private demand is D_0 and the demand plus government financing is $D_0 + G$. The economic cost of the funds needed to finance the project will be the value of the foregone private financing opportunities represented by areas (C, F, H, L, P) plus the necessary compensation to induce incremental supply, represented by areas (Q, R, N). The financial cost of the funds will be the net of tax cost, consisting of the rectangle with height equal to P_1 minus tax and width equal to the horizontal distance between D_0 and D_0 +G, as drawn this will equal (K, O, L, P, M, Q, and R). The two areas are not the same. For a small project there will be no material impact on the prevailing interest rate so the financial cost of funds will understate the economic cost.

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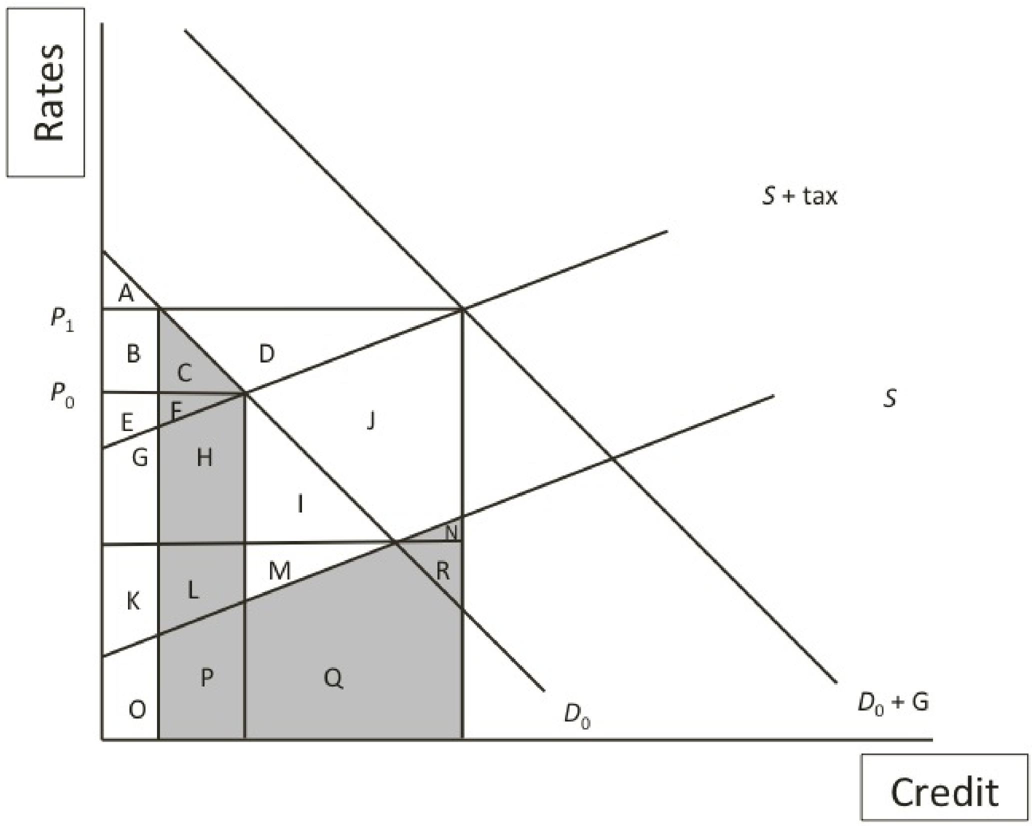

Figure 2: Credit Market with Taxation

The "Comments Paper," confusingly, agrees with our theoretical approach but disagrees with our calculations. The appendix of the Comments Paper claims that financial rates of return should be used to calculate the discount rate whereas we focus on opportunity costs. To provide a concrete illustration of why the financial cost of funds provides an inappropriate social discount rate, consider the simple case of a risk-free closed economy in which capital is taxed at both the corporate and personal level. The pre-tax rate of return is 8% and the after tax rate of return is 3%, consistent with an effective corporate tax rate of 40% and a personal income tax rate of 37.5%. Assume that an increase in government borrowing displaces private investment and consumption in proportions .9 and .1 respectively. We argue that the economic opportunity cost of borrowed funds is 7.5%, whereas the author maintains that the government's borrowing rate is the appropriate measure. But the government's borrowing rate would be 3% if bond

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interest payments were tax exempt and 4.8% if they were taxed at the personal rate. Yet the act of government borrowing has the same real economic effects in either case, i.e. the same effect on private investment and consumption, no matter what the tax treatment of government bond interest payments happens to be.

The Comments Paper Appendix Calculations

The appendix of the Comments Paper provides an example of a project that costs $100 and yields benefits of $9 in each of the next 20 years. Assuming that the pre-tax rate of return is 8% and the after tax rate of return is 3%, with 90% of the funding displacing private investment and 10% displacing consumption, the SOC rate (economic opportunity cost of borrowed funds) is 7.5%. We would reject this project because its internal rate of return is below the economic opportunity cost of borrowed funds, but the author maintains that the project should be accepted. We want to show that if the project is accepted the economy will be worse off.[2]

To understand why, let us accept the author's financing method in which a 20-year bond is issued that pays interest at 3%. This is the net of tax cost of government borrowing. However, when the government borrows $100 for 20 years at 3%, it displaces private investment worth $90, resulting in a loss of capital income tax revenue of $4.50 each year for 20 years. Meanwhile, the project yields benefits for which the private sector is willing to pay $9 per year. Assuming that the benefits are appropriated by the government they will show up as additional government revenue each year. Thus in years 1 through 20 the government collects additional revenue from the project of $9 which it uses to pay bond interest of $3 and sets aside $4.50 to offset for the loss in capital income tax revenue (required each year to fund pre-existing entitlements). This leaves it with just $1.50 each year to invest for the purpose of repaying the principal of $100 that is owed to bondholders in year 20. When the government invests funds it simply lends at 3%, but each dollar that it lends at 3% results in .9 dollars of increased private investment and additional capital income tax revenue of .045 dollars, so the rate of return on each dollar of government lending is 7.5%. In order for the government to accumulate a sum of $100 by year 20 to redeem the

[2] The author inadvertently switches the assumed rates for the SOC and MOC so that the text reads incorrectly. The correct rates are 7.5% and 3% for the SOC and MOC respectively.

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outstanding debt from the project it must invest $2.31 each year.[3] But there is only $1.50 available to fund the redemption of principal once the annual revenue from the project is used to pay bond interest plus offset the loss in capital income tax revenue. If the project is undertaken the economy will end up in year 20 with insufficient funds to redeem the outstanding debt; the economy will be made worse off if it undertakes the project.

The Separation of Benefits and Costs

Some comments we have received since our article was published suggest, without clear reason, that our recommended rates are too high. Here we take the opportunity to address two sources of confusion that we believe account for these criticisms.

The Current Low Rates on Government Bonds

The current low rates on government bonds apparently lead some to believe that the social cost of funds is now quite low. This is not the case. What is true is that in the current economic climate with substantial unemployment in the United States the benefits from government stimulus could be great. Various infrastructure and environmental or other projects could be profitable at the discount rates we recommend.

Untangling Growth Rates and Discount Rates

Often, the discount rate incorporates estimated future values such that the rate used is lower than might otherwise be expected (i.e. One might assign a uniform valuation for a given benefit across all generations but lower the discount rate, which in essence serves to increase the estimated value to future generations). For example, Summers and Zeckhauser (2008), echoing the recommendations of many environmental economists and environmental lawyers, give a low discount rate to amenity goods on the grounds that such goods will become especially valuable in the future. Benefit cost analysis is compatible with arguments that

[3] Let x be the dollar amount of funding required at the end of periods 1, 2, …20, invested at interest rate w, to generate a sum of $100 by the end of year 20. Then $x\,[(1+w)^{19} + (1+w)^{18} + \ldots + 1\,] = 100$. If $w = .075$, then $x = \$2.31$.

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attempt to take account future values through adjustment to the discount rate, but this is not the preferred method as it conflates two different values.

For example, if the real value of amenity goods increases at 2.5% per year and the discount rate for income is 6%, one could use a discount rate for amenity goods of 6% minus 2.5%, or 3.5%. This approach is reasonable as long as one is clear about the assumption for the growth rate of the real value of equity goods. Thus we could have benefits that grow at the rate g and are discounted by r: the present value would be:

$$PV = A + A(1+g)/(1+r) + A(1+g)^2/(1+r)^2 \ldots A(1+g)^n/(1+r)^n \tag{2}$$

where A the current value of the amenity good. Equation (1) may be expressed as:

$$PV = A + A/(1+k) + A/(1+k)^2 + \ldots A(1+k)^n, \tag{3}$$

Where ($k = (1+r)/(1+g)-1$), which is approximately ($r-g$), Summers and Zeckhauser would reduce the discount rate by the rate of population growth for the future, say 1%, on similar grounds that the population growth rate will result in greater future values. If we assume the 2.5% growth in amenity values is due to their increasing scarcity and that an additional value of 1% per year is gained from population growth, then the amenity discount rate is reduced from 3.5% to 2.5%. That is, g is now 3.5%. The reduction in the effective discount rate to account for population growth, however, seems problematic. Increased population will likely reduce the quantity of amenity goods so it is not clear that increased population will increase total values. In any event, this process of accounting for the growth (or diminution) of values applies to any goods and not just to amenity goods. This is obviously equivalent to a two step process in which the future values are estimated and then discounted by the normal discount rate. Thus we can talk about k as the amenity discount rate or about future values of amenity goods and the discount rate remains at 6% or 7%. Obviously, the difficulty here is the estimation of future values but this difficulty exists under any approach to discount rates.

What is most relevant and readily apparent from this discussion is that major differences about the proper discount rate arise because some are using estimates of future values to reduce the rate and others separate the two calculations, estimating future values independent of the discount rate. In so far

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as the equity rate is simply accounting for future values, it does not differ from the usual procedure. However, accounting for estimated changes in future valuation using the discount rate is not ideal for BCA because it muddles the assumptions and choices made in the analysis.

Separating future value estimates from the discount rate is more transparent and interpretable for policy makers, as it better highlights the implications and choices made regarding each aspect. Thus, this is the most appropriate method for BCA.[4]

Conclusion

There is urgent need for agreement on the correct conceptual and empirical basis for discount rates. As long as wildly different rates are used, studies are difficult to compare and investment decisions will be inefficient. We do not think that the two comments we address here are correct, as indeed our comments have shown, and we hope that this exchange advances the subject by reducing confusion.

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[4] Parts of this last section are taken with some slight language changes from Zerbe et. al, "Principles and Standards for Benefit-Cost Analysis" (2011).

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