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Selecting Discount Rates for Budgetary Purposes

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I. Current Discount Rate Policies

A. Overview

The purpose of this briefing paper is to describe the discount rate policy used by the federal government and federal agencies and consider the problems of current discount rate policies.

Accrual budgeting and accrual accounting generally depends on the present-value method.[1] The estimation of the present value of future benefits/costs is highly sensitive to the choice of a discount rate.[2] Thus it is important to decide on an appropriate discount rate for accrual budgeting/accounting.

Part [I] describe the discount rate policies used by the federal government and its agencies. Part [I.B.] shows discount rate policy in the *budget* process -- especially the tax expenditure budget for tax deferrals and the Federal Credit Reform Act.. Par [I.C.] illustrate discount rate policies used in the *accounting* process. Part [I.D.], [I.E.], and [I.F.] describe the discount rate policies of the Office of Management of Budget (OMB), the Government Accountability Office (GAO), and the Congressional Budget Office (CBO) in *cost-benefit*

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[1] 【 Present-Value 】 Today's one dollar is not equal to tomorrow's one dollar. If you have $100 and put it in your savings account today [Year1] (suppose annual risk-free interest rate is 10%), it would become $110 in the next year [Year2]. In this sense, $110 in Year2 is equivalent to $100 in Year1. In other words, the present value (current value/ discounted value) of $110 in Year 2 is $100. We can calculate the present value of $110 (Y2) as following. PV = 110 / (1 + 0.1) = 100. So, the present value of $100 in Year 2 is $90.9.

We can calculate the present value (discounted value) of future cash flows in Year *n* by using:

$$PV = C_n / (1 + r_n)^n$$

The present value (value in Y1) of $100 in Year 3 is $82.64.

More generally, the present value of future cash flows arising a project can be calculated by:

$$PV = \sum_{t=1}^{n} \frac{C_t}{(1 + r_t)^t}$$

C_t is expected-cash flow in year *t*, r_t is an interest rate (risk-adjusted interest rate)

[2] 【Discount Rate】The discount rate is the rate that is used to calculate the present value. In above example, the discount rate is denoted by *r*. In private sector, the *opportunity cost* is used as discount rate.

When we discount the *nominal (real)* cash flows, we need to use *nominal (real)* discount rate. Also when we discount a risky future cash flow, it would be appropriate to use a *risk-adjusted discount rate*. In private sector, the *opportunity cost* is used as discount rate.

analysis (net-present value analysis) and *cost-effective analysis*.[3]

Part [II.] considers the problem of these discount rate policies. Part [II.B.] analyzes the current discount rate policy in the Tax Expenditure and Federal Credit. Part [II.C.] refers to the discussions of social discount rates.

B. Budgeting

1. No Discounting (discounting with zero rate)

The cash-based federal budget does not discount in most fields. In calculating the baseline and scoring (the impact of policy changes), the usual practice is to compute the score as the *cumulative* budgetary change over a full period covered by the baseline.[4] In other words, there is no discounting.

2. Discounting by a risk-free rate

a) Tax Expenditure Budget of Tax Deferrals

The Congressional Budget Act of 1974 requires that a list of tax expenditures be included in the budget.[5] Under that law, tax expenditures are defined as "revenue losses attributable to provisions of the Federal tax law which allow special exclusion, exemption, or deduction from gross income or which provide a special credit, a preferential rate of tax, or a deferral liability".[6]

In general, the US government annually calculates the value of tax expenditure on a cash basis. But in calculating the value of tax expenditure of *tax deferrals* (ex. 401(k) plan[7], IRA[8]),

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[3] Cost-effective analysis is a systematic quantitative method for comparing the costs of alternative means of achieving the same stream of benefits or given objects. *See*. Office of Management of Budget, *Circular A-94*, at 3-4. (revised 1992) [thereafter OMB] *available at*, http://www.whitehouse.gov/omb/circulars/a094/a094.pdf

[4] ALLEN SCHINK, THE FEDERAL BUDGER: POLITICS, POLICY, PROCESS 57 (revised ed. 2000)

[5] OMB, ANALYTICAL PERSPECTIVE: FISCAL YEAR2006, at 315 (2005)

[6] *Id.*

[7] Pursuant to Internal Revenue Code §401(k) [26 U.S.C. 401(k)], individual taxpayers can make tax-preferred

cash-based estimates do not reflect the true economic cost of tax deferrals.[9]

According to OMB (2006), "[c]ash-based estimates reflect the difference between taxes deferred in the current year and incoming revenues that are received due to deferrals of taxes from prior year".[10] This method can measure annual cash-inflows into the government. However, the problem is that "for a provision where activity levels have changed, so that incoming tax receipts from past deferrals are greater than deferred receipts from new activity, the cash-basis tax expenditure estimate can be negative, despite the fact that in present-value terms current deferrals do not have a real cost to the Government."[11] And "in the case of a newly enacted deferral provision, a cash-based estimate can overstate the real effect on receipts to the Government because the newly deferred taxes will ultimately be received."[12]

Thus, as a complement to the cash-basis method, since 1995 OMB has provided the present value estimates of revenue effects for certain provisions that provide tax deferrals and accelerated depreciation. The US government estimates the present value of tax expenditures from tax deferrals as follows:[13]

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contributions to certain types of employer-provided 401(k) plan. An employee can exclude up to $15,000 (in 2005) of wages from AGI under a qualified agreement with employer's 401(k) plan. The tax on the investment income earned by 401(k) plan is deferred until withdrawn. (so-called "EET" scheme.) Also employee can make after-tax contribution to 401(k) plans. In this case, investment income on after-tax contribution is exempt from taxation and there is no tax at the time of withdrawal.(so-called "TEE" scheme)

[8] Under I.R.C. §219 [26 U.S.C. 219], individual taxpayers can contribute up to $4,000 (rising to $5,000 after 2008) of their annual earnings (e.g. salary) to an IRA (Individual Retirement Accounts) and can *deduct* such contributions from gross income. IRA investment gains are tax-exempt until the taxpayer withdraws the IRA account. When withdrawn, the entire amount in the IRA account (annual contribution plus investment earnings) is included in his gross income. In a word, taxpayers can *defer* tax on their salary and gain from its investment until he withdraws. This is called as a *traditional IRA(deductible IRA)*. Traditional IRA is EET scheme. Roth IRA is another type of IRA (TEE scheme).

[9] OMB, ANALYTICAL PERSPECTIVE: FISCAL YEAR 2006, *supra note* 5, at 316 (2005)

[10] *Id.*

[11] *Id.*

[12] *Id.*

[13] *Id.* "The present-value estimates represent *the revenue effects*, net of future tax payments, that follow from activities undertaken during calendar year 2004 which cause the deferrals or other long-term revenue effects. For instance, a pension contribution in 2004 would cause a deferral of tax payments on wages in 2004 and on pension earnings on this contribution (e.g., interest) in later years. In some future year, however, the 2004 pension contribution and accrued earnings will be paid out and taxes will be due; these receipts are included in

PV of tax expenditure = [Initial loss in revenue] + [PV of the taxes forgone as the earnings accrue] – [PV of the taxes when the contribution and earnings are taxed]

In estimating the present value, the US government uses the *government borrowing rate* as the discount rate.[14] The following table shows the present value of several tax expenditures.

Table 19–4. PRESENT VALUE OF SELECTED TAX EXPENDITURES FOR ACTIVITY IN CALENDAR YEAR 2005

(in millions of dollars)

	Provision	2005 Present Value of Revenue Loss
1	Deferral of income from controlled foreign corporations (normal tax method)	10,020
2	Deferred taxes for financial firms on income earned overseas	2,270
3	Expensing of research and experimentation expenditures (normal tax method)	2,390
4	Expensing of exploration and development costs—fuels	180
5	Expensing of exploration and development costs—nonfuels	10
6	Expensing of multiperiod timber growing costs	200
7	Expensing of certain multiperiod production costs—agriculture	140
8	Expensing of certain capital outlays—agriculture	180
9	Deferral of income on life insurance and annuity contracts	19,640
10	Accelerated depreciation on rental housing	16,088
11	Accelerated depreciation of buildings other than rental	15,980
12	Accelerated depreciation of machinery and equipment	64,330
13	Expensing of certain small investments (normal tax method)	1,100
14	Deferral of tax on shipping companies	20
15	Credit for holders of zone academy bonds	210
16	Credit for low-income housing investments	3,970
17	Deferral for state prepaid tuition plans	1,190
18	Exclusion of pension contributions—employer plans	81,160
19	Exclusion of 401(k) contributions	102,640
20	Exclusion of IRA contributions and earnings	4,460
21	Exclusion of contributions and earnings for Keogh plans	3,190
22	Exclusion of interest on public-purpose bonds	19,830
23	Exclusion of interest on non-public purpose bonds	6,700
24	Deferral of interest on U.S. savings bonds	410
25	Exclusion of Roth earnings and distributions	8,170
26	Exclusion of non-deductible IRA earnings	370

Source: OMB, ANALYTICAL PERSPECTIVE: FISCAL YEAR 2007, at 299 (2006)

the present-value estimate." *Id.*

[14] Emil Sunley, *Tax Expenditures in the United States: Experience and Practice*, *in* TAX EXPENDITURES: SHEDDING LIGHT ON GOVERNMENT SPENDING THROUGH THE TAX SYSTEM 155, 164 (Hana Polackvoa Brixi, Christain M.A. Valenduc & Zhicheng Li Swift ed., 2004)

b) Federal Credit Reform Act (FCRA)[15]

The federal government has two types of loan programs. One is a direct loan to borrowers. The other is a guarantee of a loan made by other lenders. Those programs provide subsidies – in the form of more attractive loan terms than borrowers could otherwise obtain – for borrowers at a cost to the government.[16]

Before 1990, under the cash-flow based federal budget, a direct loan was disbursed immediately and recorded as an outlay. "Immediate disbursement of a full loan has the effect of overstating the costs of such loan in the year it is made since the government cost for the loan is not the full value of the loan".[17] On the other hand, the liability incurred by a loan guarantee was not generally recorded at all because there was no cash-out-flows at the time of guarantees. The costs of loan guarantees were underestimated. So a cash-based budget mechanism created the bias favor for loan guarantees.[18]

The Federal Credit Reform Act of 1990 requires that the federal government recognize the cost of federal direct loans and loan guarantees on an accrual basis instead of a cash basis. This requires that the federal government recognize its expected losses from such loans – the subsidy cost of loans — in the budget when the credit is extended.[19] FCAR defines the subsidy cost as "the estimated long-term cost to the government of a direct loan or a loan guarantee,

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[15] This paper focuses on the methods of estimation of subsidiary costs – especially on discount rates. *See.* e.g. The Federal Credit Reform Act of 1990, 2 U.S.C. 661, 104 Stat 1388-1610; CBO, *Estimating the Costs of One-Sided Bets: How CBO Analyzes Proposals with Asymmetric Uncertanities* (1999); Schick, *supra note* 4, at 42-44; CBO, *Estimating the Value of Subsidies for Federal Loans and Loan Guarantees* (2004); CENTER ON FEDERAL FINANCIAL INSTITUTIONS, *Budgeting for Credit Programs: A Primer* 1, 3 (2004) *available at* http://www.coffi.org/pubs/Budgeting%20Primer.pdf ; Neill Perry & Puja Seam, *Accrual Accounting for Federal Credit Programs: The Federal Credit Reform Act of 1990*, Federal Budget Seminar Briefing Paper Vol.1 No.6 (2005), *available at* http://lawweb.usc.edu/cslp/conferences/fiscal%20challenges/documents/6-AccrualAccounting.pdf

[16] CBO (2004) *supra note* 15, at 1.

[17] Perry & Seam, *supra note* 15, at 2.

[18] CENTER ON FEDERAL FINANCIAL INSTITUTIONS, *supra note* 15, at 5.

[19] Schick, *supra note* 4, at 43.

calculated on a net present value basis, excluding administrative costs".[20] The FCRA instructs the government to discount expected future cash flows (disbursements by the government and repayments to it) by using "the average interest rate on marketable Treasury securities of similar maturity to the cash flows".[21] The following table shows the estimated future cost (subsidies) of outstanding federal credit programs.

Table 7–1. ESTIMATED FUTURE COST OF OUTSTANDING FEDERAL CREDIT PROGRAMS

(In billions of dollars)

Program	Outstanding 2004	Estimated Future Costs of 2004 Outstanding [1]	Outstanding 2005	Estimated Future Costs of 2005 Outstanding [1]
Direct Loans: [2]				
Federal Student Loans	107	8	113	11
Farm Service Agency (excl. CCC), Rural Development, Rural Housing	43	10	43	9
Rural Utilities Service and Rural Telephone Bank	32	3	34	2
Housing and Urban Development	13	2	12	2
Export-Import Bank	12	5	10	5
Public Law 480	9	5	9	4
Agency for International Development	8	3	8	3
Commodity Credit Corporation	7	3	3	1
Federal Communications Commission	4	4	*	*
Disaster Assistance	3	1	4	1
VA Mortgage	2	*	1	*
Other Direct Loan Programs	13	2	11	3
Total Direct Loans	251	46	247	41
Guaranteed Loans: [2]				
FHA Mutual Mortgage Insurance Fund	384	1	336	2
VA Mortgage	351	4	206	3
Federal Family Education Loan Program	245	23	289	31
FHA General/Special Risk Insurance Fund	91	4	90	3
Small Business	57	2	73	2
Export-Import Bank	36	2	36	2
International Assistance	21	2	22	2
Farm Service Agency (excl. CCC), Rural Development, Rural Housing	29	1	30	1
Commodity Credit Corporation	4	*	2	*
Maritime Administration	3	*	3	*
Air Transportation Stabilization Program	2	1	1	1
Government National Mortgage Association (GNMA) [3]	.....	*	.....	*
Other Guaranteed Loan Programs	8	3	8	1
Total Guaranteed Loans	1,231	43	1,096	48
Total Federal Credit	**1,482**	**89**	**1,343**	**89**

*$500 million or less.

[1] Direct loan future costs are the financing account allowance for subsidy cost and the liquidating account allowance for estimated uncollectible principal and interest. Loan guarantee future costs are estimated liabilities for loan guarantees.

[2] Excludes loans and guarantees by deposit insurance agencies and programs not included under credit reform, such as CCC commodity price supports. Defaulted guaranteed loans which become loans receivable are accounted for as direct loans.

[3] GNMA data are excluded from the totals because they are secondary guarantees on loans guaranteed by FHA, VA and RHS.

Source: OMB, ANALYTICAL PERSPECTIVE: FISCAL YEAR 2007, at. 86 (2006)

[20] 2 U.S.C.§661a(5)(A)

[21] 2 U.S.C.§661a(5)(E)

C. Accounting

1. FASAB standards and Financial Report of the U.S. Governments: <Retirement Benefits for Federal Employees>

The Federal Accounting Standards Advisory Board (FASAB) establishes accounting standards and principles for the federal government.[22] *SFFAS-No.5* developed by FASAB requires the federal government to recognize the liability and associated expense for pensions and other retirement benefits (i.e. health care benefits) for federal employees on accrual basis — when the employee's services are provided.[23] Under this standard, the *Financial Report of the U.S. Government* recognizes and discloses those costs on accrual basis.

Most important retirement benefits for federal workers are pension benefits (defined benefits) and health care.[24] In calculating the present value of pension obligations, *SFFAS-No.5* requires the government to use *the long-term expected return on plan assets*.[25] For other retirement benefits (i.e. health insurance), *SFFAS No.5* distinguishes funded plans from unfunded plans. It says "[t]he rate used to discount projected benefits should be equal to the *long-term expected return on plan assets* if the plan being *funded* or on other long-term assumptions (for

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[22] THE FEDERAL ACCOUNTING STANDARDS ADVISORY BOARD [thereafter FASAB], STATEMENTS OF FEDERAL FINANCIAL ACCOUNTING STANDARDS, VOLUME II, CURRENT TEXT, iii, (June 2004), *available online at* http://www.fasab.gov/pdffiles/voliiv4.pdf
Also see. Allison Quick & Hiroyuki Kohyama, *Retirement Benefits for Federal Employees: Differences between the accrual accounting and the current budgeting,* Harvard Law School Federal Budget Seminar Briefing Paper *No.* (2006)

[23] SFFAS-No.5 ¶ 57

[24] There are three pension systems for federal workers: (i) Civil Service Retirement System (CSRS), (ii) Federal Employee Retirement System (FERS), and (iii) Military Retirement System (MRS). CSRS is an old pension system for federal employees hired before 1984 and contains defined pension plan and defined contribution plan (Thrift Savings Plan). FERS is a new pension system for employees hired after 1983 and contains defined pension plan, defined contribution plan (Thrift Savings Plan) and Social Security.

[25] FASAB, *supra note* 22, at 436. As to pension liability, *SFFAS-No.5* says "[t]he rate used to discount the *pension obligation* should be equal to the long-term expected return on plan assets." *Also see.* SFFSA-No.5¶66

example, *the long-term federal government borrowing rate*) for *unfunded* plans".[26]

FASAB uses an *opportunity costs approach* for pension plans and other funded retirement benefit plans, and uses a *borrowing costs approach* for unfunded retirement benefit plans. The following table summarizes FASAB's policies for discount rates for government liabilities (retirement benefits).

Table-1

		Discount Rate	**Approach**
Pension Benefits (defined benefit plan)		the long-term expected return on plan assets	Opportunity cost approach
Other Retirement Benefits (i.e. Health care)	Funded plan	the long-term expected return on plan assets	Opportunity cost approach
	Unfunded plan	the long-term federal government borrowing rate	Borrowing cost approach

2. Trustees Report of OASIDI

Under Social Security Act, the Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds (OASIDI) reports annually to Congress on the financial and actuarial status of the OASI and DI Trust Funds.[27] This documents reports the "actuarial balance" of the trust fund.[28] "[T]he actuarial balance is the difference between the present value of tax income for the period, and the present value of the cost for the period, each divided by the present value of taxable payroll for all years in the period" [29] The method of calculation the actuarial balance is based on the present-values.

The report says "[f]or the purpose of present-value calculations for this report, values are discounted by *the effective yield on trust fund assets*."[30] The effective yield on trust fund assets is

[26] SFFAS No.5 ¶ 83
[27] THE BOARD OF TRUSTEE, THE 2005 ANNUAL REPORT OF THE BOARD OF TRUSTEES OF THE FEDERAL OLD-AGE AND SURVIVORS INSURANCE AND DISABILITY INSURANCE TRUST FUNDS, (2005)
[28] The present value of the Social Security imbalance over the next 75 years was estimated to be $5.7 trillion as of January 1, 2005.
[29] THE BOARD OF TRUSTEE, *supra note* 27, at 137
[30] THE BOARD OF TRUSTEE, *supra note* 27, at 201, [*emphasis* added]

a measure of the overall average interest earnings on the fund's portfolio of assets. The report explains the effective interest rates (yields) as follows:

> Interest rates on new public-debt obligations issuable to Federal trust funds (see "Special public-debt obligation") are determined monthly. Such rates are set equal to the average market yield on all outstanding marketable U.S. securities not due or callable until after 4 years from the date the rate is determined….. The effective interest rate for a trust fund is the ratio of the interest earned by the fund over a given period of time to the average level of assets held by the fund during the period. The effective rate of interest thus represents a measure of the overall average interest earnings on the fund's portfolio of assets.[31]

3. Trustees Report of HI & SMI

Under Social Security Act, the Medicare Board of Trustees is required to report annually to the Congress on the financial and actuarial status of the HI (Hospital Insurance) and SMI (Supplementary Medical Insurance) trust funds.[32] "The actuarial balance of the HI trust fund is defined as the difference between the summarized income rate for the valuation period and the summarized cost rate for the same period."[33] "The summarized income rates, cost rates, and actuarial balance are based upon the present values of future income, costs, and taxable payroll. The present values are calculated, as of the beginning of the valuation period, by discounting the future annual amounts of income and outgo *at the assumed rates of interest credited to the HI trust fund*."[34]

Because the actuarial balance based on a present-value method is highly sensitive to the interest rates used as a discount rate, the Trustees Report provides sensitivity analysis with various assumptions about annual real-interest rate for special public debt issuable to the trust

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[31] THE BOARD OF TRUSTEE, *supra note* 27, at 197-198

[32] THE MEDICARE BOARD OF TRUSTEE, THE 2005 ANNUAL REPORT OF THE BOARDS OF TRUSTEES OF THE FEDERAL HOSPITAL INSURANCE AND FEDERAL SUPPLEMENTARY MEDICAL INSURANCE TRUST FUNDS, (2005) The present value of the Medicare imbalance over the next 75 years was estimated to be $29.9 trillion as of January 1, 2005.

[33] *Id.* at 57.

[34] *Id.* [*emphasis* added]

fund.[35] "These assumptions are that the ultimate annual real-interest rate will be 2.2 percent (as assumed for the high cost alternative), 3.0 percent (as assumed for the intermediate assumptions), and 3.7 percent (as assumed for the low cost alternative)."[36] The following table illustrates the actuarial balance under these assumptions.

Table III.B15.—Estimated HI Income Rates, Cost Rates, and Actuarial Balances, Based on Intermediate Estimates with Various Real-Interest Assumptions
[As a percentage of taxable payroll]

Valuation period	Ultimate annual real-interest rate		
	2.2 percent	3.0 percent	3.7 percent
Summarized income rate:			
25-year: 2005-2029	3.40	3.40	3.41
50-year: 2005-2054	3.38	3.39	3.40
75-year: 2005-2079	3.39	3.39	3.40
Summarized cost rate:			
25-year: 2005-2029	4.15	4.10	4.05
50-year: 2005-2054	5.54	5.35	5.17
75-year: 2005-2079	6.89	6.48	6.09
Actuarial balance:			
25-year: 2005-2029	–0.75	–0.69	–0.64
50-year: 2005-2054	–2.16	–1.96	–1.78
75-year: 2005-2079	–3.51	–3.09	–2.69

Source, THE MEDICARE BOARD OF TRUSTEE, *supra note* 32, at 70.

D. OMB's discount rate policy for cost-benefit/cost-effectiveness analysis

1. Discounting with market-determined rates

a) *Cost-Benefit* analysis

Federal agencies are required to perform *cost-benefit* analysis (net present value method) for proposed public investments and regulatory programs that provide benefits and costs to the general public. In *Circular A-94*, OMB instructs federal agencies to use a real discount rate of 7% in their base-case analysis.[37] "This rate approximates the *marginal pretax rate of return* on

[35] *Id.* at 70

[36] *Id.*. "In each case, the ultimate annual increase in the CPI is assumed to be 2.8 percent (as assumed for the intermediate assumptions), resulting in ultimate annual yields of 5.0, 5.8, and 6.5 percent under the three illustrations."

[37] From 1972 to 1992, OMB used a real discount rate of 10%. *See.* OMB, *Circular A-94* (first version 1972); *Also See.* HM TREASURY, THE GREEN BOOK, (2003), 97, The U.K. government uses real rate of 3.5% as a discount rate for cost-benefit analysis.

an average investment in the private sector in recent years." [38]

Moreover, OMB indicates the alternatives to this rate:

> Analyses should show the sensitivity of the discounted net present value and other outcomes to variations in the discount rate. The importance of these alternative calculations will depend on the specific economic characteristics of the program under analysis. For example, in analyzing a regulatory proposal whose main cost is to reduce business investment, net present value should also be calculated using *a higher discount rate than 7percent*.
>
> Analyses may include among the reported outcomes the *internal rate of return* implied by the stream of benefits and costs. The internal rate of return is the discount rate that sets the net present value of the program or project to zero. While the internal rate of return does not generally provide an acceptable decision criterion, it does provide useful information, particularly when budgets are constrained or there is uncertainty about the appropriate discount rate.[39] [*emphasis* added]

On the other hand, GAO uses the Treasury borrowing rates as a base discount rate in their cost-benefit analysis. [*See.* I.E.]

2. Discounting with the Treasury borrowing rates

In *Circular A-94*, OMB indicates that the Treasury borrowing rates should be used as discount rates in (1) *cost-effective* analysis, (2) lease-purchase analysis, (3) internal government investments, and (4) asset sale analysis. In addition to this, under the Water Resources Development Act of 1974, cost-benefit analyses for water-resources projects are required to use a discount rate based on the Treasury borrowing rate.

a) *Cost-Effectiveness* analysis

Cost-effectiveness analysis is used to determine "the least expensive" way to achieve a given policy goal.[40] So cost-effective analysis would be appropriate when the benefits from competing alternatives are the same or where a policy decision has been made that the benefit

[38] OMB, *supra note* 3, at 8. (revised 1992), [*emphasis* added]
[39] *Id.*
[40] Coleman Bazelon & Kent Smetters, *Discounting Inside the Washington D.C. Beltway*, 13(4) JOURNAL OF ECONOMIC PERSPECTIVES, 213, 220 (1999)

must be provided.[41] "A program is cost-effective if, on the basis of life cycle cost analysis of competing alternatives, it is determined to have the lowest costs expressed in present value terms for a given amount of benefits."[42]

b) Lease-purchase analysis

The current cash-based budget system biases the federal government in favor of leasing (against purchasing) long-lived assets (ex. building).[43] "Because a long-term lease commits the government to spending money outside the budget window, it was feared that innovative politicians might lease rather than purchase."[44] To correct this bias, OMB "instructs agencies to choose the least expensive of the two options – lease or purchase – by performing a net present value analysis of the two options".[45]

In calculating a net present value of leases, OMB requires agencies to use *the Treasury borrowing rate on marketable securities of comparable maturity* to the period of analysis.[46]

c) Internal Government Investments

In the case of federal investments that provide "internal" benefits for the government, but no external benefits for society as a whole, OMB (1992) concludes that a comparable-maturity Treasury rate is an appropriate discount rate to calculate such a project's net present value. [47] One example is an investment in an energy-efficient building system that reduces federal operating costs. [48]

Where federal projects provide a mix of both internal and external social benefit, OMB request to use the 7% real discount rate to evaluate the net present value of such investments –

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41 OMB (1992),*supra note* 3, at 4.
42 *Id.*
43 Bazelon & Smetters, *supra note* 40, at 220.
44 *Id.*
45 *Id.*
46 OMB (1992), *supra note* 3, at 8.
47 OMB(1992), *supra note* 3, at 9.
48 *Id.*

unless the analysis is able to allocate the investment's costs between provision of federal cost savings and external social benefits.[49] As an example, OMB mentions federal investments in information technology that can produce federal savings in the form of lower administrative costs and external social benefits in the form of faster claims processing.[50]

Where the allocation of investment costs is possible, OMB indicates that federal cost savings may be discounted at the Treasury rate, while the external social benefit should be discounted at the 7% real rate.[51]

d) Asset Sale Analysis

As to the analysis of possible asset sales, *Circular-A94* requires to use the Treasury borrowing rate as a discount rate in calculating the net present value to the federal government. And interestingly it indicates that "even though a governmental asset may be used more efficiently in the private sector, potential private sector purchasers will generally discount such an asset's earnings at a rate in excess of the Treasury rate, in part, due to the cost of bearing risk."[52] And when there is evidence that government assets can be used more efficiently in the private sector, OMB requires analysts to do sensitivity analysis that discount the returns from such assets with the rate of interest earned by assets of similar riskiness (*risk-adjusted* discount rate) in the private sector.[53]

e) Water-resources projects

Under the Water Resources Development Act of 1974, the U.S. government started to use a different lower discount rate for capital-intensive water-resources projects with long time

[49] *Id.*
[50] *Id.*
[51] *Id.*
[52] *Id.*
[53] *Id.* at 9-10

horizons (ex. dams and channels) than the rate of return for private investment.[54] Every year, "the U.S. Water Resources Council estimates the federal government's average long-term borrowing costs, to determine the discount rate to be used by federal agencies during the coming fiscal year for analyzing water-related projects."[55]

E. GAO's discount rate policy for cost-benefit analysis

In 1991, GAO released their revised discount rate policy guidelines. Until then, GAO had used "a rate based on the Treasury borrowing rate for all type of discounting problems, including those related to public investment, regulatory, lease-purchase, and asset divestiture decisions".[56] "While the revised policy leaves the prior approach largely intact, it also includes increased guidance on sensitivity analysis and certain procedural modification."[57] In deciding on a discount rate, GAO considers the two other factors as important: (1) consistency with basic economic principles, and (2) feasibility of implementation.

1. Nominal rate v. Real rate

As a base case discount rate, GAO's revised policy uses "the interest rate for marketable Treasury debt with maturity comparable to the program being evaluated" for cost-benefit analysis.[58] The previous GAO's policy assumed that all quantities would be measured in nominal terms.[59] Under the revised policy, GAO distinguishes nominal terms from real terms: nominal rates may be used to discount nominal benefits and costs, and real rates (= [nominal

[54] DIANA FUGUITT & SHANTON J. WILCOX, COST-BENEFT ANALYSIS FOR PUBLIC SECTOR DECISION MAKERS 116 (1999), *See also* Water Resources Development Act of 1974, Pub. L. No. 93-251, 83 Stat .12 (1974) *See also* Clark Row, H. Fred Kaiser & John Sessions, *Discount Rate for Long-Term Forest Service Investments*, 79(6) JOURNAL OF FORESTRY 367, 367-369 (1981)

[55] *Id.* "The special discount rate for federal water project recognized the penalty imposed by a high discount rate on large capital start-up costs and long-term future annual benefits." Id.

[56] GAO, *Discount Rate Policy*, 6 (revised 1991) [thereafter GAO(1991)]; *Also see.* GAO, *Discount Rate Policy*, 17-18 (1983).[thereafter GAO (1983)]

[57] *Id.*

[58] *Id.* at 7.

[59] *Id.* at 18.

rates] – [expected inflation]) may be used to discount real quantities.[60]

2. Matching the maturity (Term-structure of interests)

The former GAO's discount rate policy involved *averaging* the yield of public traded Treasury issues with maturities between one year and the length of the project.[61] But "[t]his averaging approach used the published yields in the Wall Street Journal without carefully adjusting for the number of issues with maturities in different years or for the specific time streams of project benefits and costs".[62] Thus the revised policy is to match bond maturity to project length.

3. Sensitivity Analysis

Also GAO requires analyst to use sensitivity analysis to address "issues such as differing expectations about inflation and interest rates, private sector opportunity cost, and intergenerational effects of policy on human life."[63]

GAO permits considering alternative inflation or interest rate forecasts, where nominal or real interest rates are sensitive to difference between credible economic forecasts.[64]

In the case of asset divestures, *private sector discount rates (interest rates in private sector)* must be considered.[65] Since Treasury interest rates are below interest rates in the private sector, the use of Treasury interest rates generally will yield a greater present value of future return from an asset than would a higher private sector rate.[66] As a consequence, analyses (with

[60] To calculate expected inflation, GAO instructs analysts to use the leading independent forecasters (e.g. DRI, McGraw-Hill, or WEFA) instead of using OMB or CBO forecasts. GAO thinks that this approach has the benefit of using forecasts that are more frequent and of longer duration than OMB or CBO forecasts. Also GAO attempts to avoid political influences that could affect forecasts from government sources. *See*. GAO (1991), *supra note* 56, at 19.
[61] GAO (1983), *supra note* 56, at 14-17.
[62] GAO (1991), *supra note* 56, at 19.
[63] *Id.* at 7.
[64] *Id*. at 8.
[65] As mentioned in [I.D.2.d], OMB uses a Treasury interest rate of appropriate maturity in the analysis of the sales of government assets.
[66] GAO (1991), *supra note* 56, at 8.

Treasury interest rates) could result that government ownership is preferable to private ownership even when there are no real efficiency gains from government ownership.[67] Thus in sensitivity test, GAO estimate the present value of the asset value under continued government ownership using an appropriate private sector discount rate.[68]

In evaluating public investments and regulations, GAO requires the estimations of both private sector opportunity costs and the rate of time preference.[69] When analyzing policies with large intergenerational effects involving human life, GAO recommends the use of a *very low discount rate* (effective real discount rate close to zero)[70].

F. CBO's Discount Rate Policy

The Congressional Budget Office (CBO) generally uses a *social rate of time preference* and certainty equivalents (CE) in its social welfare analysis.[71] All costs and benefits are first converted into consumption units, uncertainty is eliminated by using certainty equivalents, and then the social rate of time preference is applied to discount certainty equivalents.[72]

However, Bazelon & Smetters points out that in practice CBO often uses *expected values* of costs and benefits.[73] "The CBO does not distinguish between internal and external rates of time preference and so the social rate of time preference was taken as the time preference of consumption. After analysis of real government Treasury bill rates, this rate was determined in 1990 to be 2 percent real. Analysts are also directed to perform sensitivity analysis of plus

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[67] *Id.*
[68] Also GAO instructs analysts to note that consideration other than government's financial position – such as view bout the proper roles for the public and private sectors. *See.* GAO (1991), *supra note* 56, at 8-9.
[69] *Id.*
[70] GAO (1991), *supra note* 56, at 9
[71] Bazelon & Smetters, *supra note* 40, at 222
[72] *Id.*
[73] *Id.*

and minus 2 percent around this rate"[74]

Furthermore, "[e]xceptions to CBO's official social rate of time preference are permitted, if the net benefits of a proposed policy are highly correlated with GDP. If the correlation is positive, than the discount rate is raised correspondingly; if negative, the discount rate is lower because the policy serves as a form of insurance. Exceptions to the policy can also be made of a well-established and accepted alternative discount rate exists."[75]

II. Theoretical Analysis and Critiques

A. Overview

Part II analyzes existing critiques and theoretical possibilities of discount rates for budgetary purposes. In Part [II.B.], tax expenditure budget and Federal Credit Reform Act are discussed. In Part [II.C.], discussion about social discount rate are referred for further discussion. Part [II.D.] considers when the government can justify no-discounting.

B. Specific topics

1. Tax Expenditure for Tax Deferrals

a) Several Present-Value Methods

"The present-value method considers the net revenue foregone in today's dollars because of contribution made in a year. That is, it adds together the cost of the deduction incurred today for those contributions and the discounted cost of the non-taxation of the accrued investment income earned on those contributions, and then it subtracts the discounted revenue stream received when the contributions and the investment income are withdrawn."[76]

To calculate the present value of tax expenditures for tax deferrals (e.g. IRAs), there are

[74] *Id.* at 222-223.
[75] *Id.*
[76] Department of Finance Canada, *Tax Expenditures and Evaluations, Appendix: Alternative Approach to estimating the present-value tax expenditure* 42, (2001) [thereafter Canada]

some methods. The Canadian government, which also has a tax expenditure budget, considers how it can estimate the present-value of tax expenditures.[77]

(i) Tax-Cost Method

This method considers the tax cost to the government over time ("the tax-cost method").[78] Suppose that a contribution is made at age *M* and withdrawn at age *N*. Denote the present value of the tax expenditure (i.e. IRA) as P_{TCM}, the amount of contribution as *C*, marginal tax rate as *t*, the nominal rate of return as *i*, and the discount rate as *d*. *P* can be calculated using the following formula:[79]

$$P_{TCM} = Ct_M + C[1-t_M]\sum_{j=M+1}^{N} \frac{\left(\prod_{k=M+1}^{j-1}[1+i(1-t_K)]\right)it_j}{(1+d)^{j-M}} - \frac{C(1+i)^{N-M}t_N}{(1+d)^{N-M}} \qquad [1]$$

The first term is the tax foregone on the contribution, the second term is the revenue that would have been collected on the investment income, and the third term represents the revenue that is collected when the contribution and all investment income are withdrawn.

If the discount rate is equal to the rate of return on the investment, the revenue received from the future withdrawal exactly compensates for the tax lost on the contribution today.[80] If the discount rate were less than the rate of return on the investment, the tax on the withdrawal would have a higher present value, leading to a *lower* tax expenditure.[81]

(ii) Benefit-method

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[77] *Id.* at 59

[78] *See.* Canada, *supra note* 76, at 42-45; Kwang-Yeol Yoo & Alain de Serres, *Tax Treatment of Private Pension Savings in OECD countries*, 82, OECD Economic Studies No.39, 2004/2 (2004), *available at*, https://www.oecd.org/dataoecd/19/0/35663569.pdf

[79] The formula [1] is a modification of Canada, *supra note* 76, at 43. *Also see.* Yoo & Serres, *supra note* 78. they use the same formula to calculate the present value of tax expenditure (EET).

[80] Canada, *supra note* 78, at 44.

[81] *Id.*

Another method is the "benefit-method".[82] This method approaches the problem from the view point of the individual. It assumes that the present value of the net present value of the net proceeds to the individual is equal to the present value of the costs to the government.[83] This is only true when the discount rate is equal to the rate of return on capital.[84]

The net (after-tax) proceeds of saving a dollar in a tax-deferred account (e.g. IRA) from age *M* to age *N* can be calculated by the following formula. NP_{TD} is the net (after-tax) proceeds of tax deferral savings:

$$NP_{TD} = C(1+i)^{N-M}(1-t_N) \qquad [2]$$

On the other hand, the net proceeds in a future year of saving the after-tax amount from one dollar or pre-tax income in a non-tax-deferral investment are estimated by NP_{NTD} - the net proceeds of non-tax-deferral saving.

$$NP_{NTD} = C(1-t_M)\prod_{j=M+1}^{N}[1+i(1-t_j)] \qquad [3]$$

The future net benefit to the contributor of saving in a tax-deferral plan is given by the difference between NP_{TD} and NP_{NTD}.

$$\boxed{\text{Net Benefit to Individual } (P_{BM}) = NP_{TD} - NP_{NTD} = \text{Loss in tax revenue (?)}} \qquad [4]$$

To calculate the present value of the tax expenditure, the future loss in tax revenue need to be discounted by the discount rate *d*. From [2], [3], and [4]:

$$P_{BM} = \frac{C(1+i)^{N-M}(1-t_N) - C(1-t_M)\prod_{j=M+1}^{N}[1+i(1-t_j)]}{(1+d)^{N-M}} \qquad [5]$$

P_{BM} is the present value tax expenditure in this approach. Only when the discount rate

[82] *See*. Brianna Dusseault & Jonathan Skinner, *Did Individual Retirement Account Actually Raise Revenue?*, 86 TAX NOTES 851,852 (2000); Canada, *supra note* 78, at 59-61.; It considers this method as an alternative. In this briefing paper, the model is based on Canada (2001).

[83] Canada, *supra note* 78, at 59.

[84] *Id.*

d and rate of return *i* are equal, P_{BM} become equivalent to P_{TCM}.[85]

b) Discount Rates

There are two perspectives as to discount rates in tax expenditure budgets.[86] The first is the *financial approach*. The second is the *social approach*.

(ii) Financial Approach

This perspective considers how much it costs the government, in terms of lost revenue, to provide tax deferrals (ex. IRA).[87] This approach considers the costs from the viewpoint of the government (revenue loss), rather than the viewpoint of society. In this approach, the discount rate would be the government's borrowing cost[88] There can be several issues regarding what should be the appropriate proxy of the cost to the government.

◆ **Pre-tax v. After-tax**

One issue is whether we should use *pre-tax* government bond rates or *after-tax* bond rates.[89] Canada (2001) argues that the government should use the *pre-tax* long-term government bond rate in calculating the costs of tax deferrals.[90]

On the other hand, Dusseault & Skinner (2000) adjust the discount rate to the *after-tax* government bond rate in calculating the costs of Individual Retirement Accounts (IRAs) to the government.[91] The government pays interest on its debt but at the same time it collects taxes on that interest, so the net cost of deficit financing to the government can be the *after-tax* return.[92]

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[85] For the mathematical proof, *see* Canada, *supra note* 78, at 61.
[86] *Id.* at 55.
[87] *Id.*
[88] *Id.*
[89] From the view point of taxpayers, after-tax cash flows need to be discounted by *after-tax* rate of return. *See.* Jerrild J. Stern, *How to Assess the Value of Deferral,* 67 Taxes 384, 385 (1989)
[90] Canada, *supra note* 78, at 55.
[91] Dusseault & Skinner, *supra note* 82, at 852.
[92] *Id.*

Moreover, they adjust the marginal tax rate on government debt by taking into account the fraction of Treasuries held by nontaxable entities.[93]

◆ **Marginal cost v. Average cost**

A second issue is whether we should use the *marginal* borrowing cost or the *average* borrowing cost. Dusseault & Skinner (2000) uses the weighted average of returns on 6-month bills, 3-year notes, and 30-years bonds with weights respective of the proportion of each instrument held by the public in each year.[94]

◆ **Risk-adjustment? Government's borrowing cost v. Rate of return**

A third issue is whether we need to adjust the discount rate to reflect risks. Yoo & Serres (2004) choose the *nominal rate of return* as a primary discount rate in order to calculate the cost of tax-favored pension plans under the present-value method.[95] *Rate of return* seems high because the government can usually borrow at the risk-free interest rate.[96][97] Yoo & Serres (2004) try to justify a higher discount rate than the risk-free rate on the basis that governments partly bear the risks of private pension arrangements.[98]

(ii) Social Approach

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[93] *Id.* In their calculation, they use the same percentage as the estimation by King & Fullerton (1984). King & Fullerton (1984) estimated at most 31% of corporate debt was held by nontaxable institutions. *See* MERVYN KING & DON FULLERTON ed, THE TAXTATION INCOME FROM CAPITAL: A COMPARATIVE STUDY OF UNITED STATES, THE UNITED KINGDOM, SWEDEN, AND WEST GERMANY (1984).

[94] *Id.*

[95] Yoo & Serres , *supra note* 78, at 82.; In this article, they report results on a lower discount rate than rate of return

[96] Here "risk-free" means only default-free. Government bonds are free from the risk of default, but are not free from inflation risk, the risk of changing real interest rate, and other risks. Even inflation indexed bonds (i.e. Treasury Inflation Protected Securities: TIPS) are not free from inflation-risk because the U.S. tax system reintroduces the inflation-risk into inflation indexed bonds. *See* Pu Shen, *Benefits and limitations of inflation indexed Treasury bonds*, Federal Reserve Bank of Kansas City Economic Review 3rd quarter. (1995); MARK DEACON, ANDREW DERRY & DARIUSH MIRFENDERESKI, INFLATION-INDEXED SECURITIES: BONDS, SWAPS AND OTHER DERIVATIVES, 31-34 (2nd ed. 2004).

[97] Whether nominal or real rate does not matter because it depends on whether cash flow is expected in nominal term or real term.

[98] Yoo & Serres , *supra note* 78, at 104, n.17; Moreover, they mention that governments risk losing tax revenues in the case of under-funded pension plans. In some countries, employment-based pension plans are guaranteed by government-backed agencies (i.e. Pension Benefit Guarantee Corporation: PBGC). *Id.* at 106.

The social approach attempts to take into account the impact of tax expenditures such as deferrals of tax payment (ex. IRAs) on social welfare.[99] Tax expenditures can be viewed as alternatives to government spending programs that have no spending limitations. So the discussion of the cost-benefit analysis of public spending would provide some insight into appropriate discount rate.[100] This approach is discussed in a latter section [*See* II.C.].

2. FCRA

In calculating the subsidy costs, the FCRA requires discounting estimated future cash flows by using average interest rates on marketable Treasury securities with similar maturities. If loans were risk free, the current method results in an estimate of the market value of the loans.

The CBO (2004) argues that in the case of a risky loan (uncertain future cash flows), (1) the current method "overestimates" the market value of promised cash flows (expected cash inflows) and (2) "underestimates" the cost of loan guarantees by discounting at a rate that is too low.[101]

The main justifications for using the Treasury borrowing rate as a discount rate are that the government can borrow money at the Treasury rate, and that the government can spread financial risk more widely than other institutions (effectively making the risk diversifiable and thus without cost to stakeholders/taxpayers).[102]

But these arguments are not appropriate for federal credit programs. The first argument (that the government can borrow at a risk-free rate) ignores the role of stakeholders in enhancing the government's credit quality.[103] Lower rates on Treasury bonds partly result from the

[99] Canada, *supra note* 78, at 55.
[100] *Id.*
[101] CBO (2004), *supra note* 15, at 3.
[102] *Id.* at 4-5
[103] *Id.*

government's power to tax. However, "the authority to draw on the resources of others to ensure repayment of debt obligations does not reduce the risk that the government assumed by extending risky loans and quarantines."[104] The second argument (that the government can reduce the cost of risk by spreading risk more widely) is relevant to diversifiable risk (firm-specific risk, unique risk) but not to market risk (systematic risk), which can not be diversified.[105]

Thus the CBO (2004) suggests using the market price of loans and guarantees.[106] When market prices are unavailable or unreliable, CBO recommends using the risk-adjusted discount rates, or option-pricing methods.[107] It argues that the market price reflects the fact that risky future cash flows are discounted by investors at risk-adjusted rates.[108]

As for the risk-adjusted discount rate, in the market many investors use the capital asset pricing model (CAPM) to adjust discount rates for risk when valuing capital investments. [109] For a loan guarantee, the correct CAPM rate and the value of the guarantee change with time and with assets and liabilities of the borrower and so are difficult to estimate. [110]

As the CBO recognized, "[b]ecause option-pricing methods account for the changing risk of loan guarantees over time, they are likely to be more accurate at estimating the market value of subsidies—but only when the necessary data and models are available."[111] Thus option-pricing methods would be more suitable for credit to commercial enterprises than credit to individuals.[112]

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[104] *Id.* "[I]t is he means by which such risk is shifted to taxpayers and beneficiaries of government programs, who are, in essence, equity holders in the government's financial services."
[105] *Id.* *Cf.* Merton (1977), (1998)
[106] *Id.* at 4-9.
[107] *Id.* at 8-9.
[108] *Id.*
[109] *Cf.* ZVI BODIE, ALEX KANE & ALAN J. MARCUS, INVESTMENTS, ch.9 (6th ed., 2005)
[110] CBO (2004), *supra note*15, at 8.
[111] *Id.*
[112] *Id.*

C. Social Approach

1. Introduction

There is a lot of literature about social discount rates for cost-benefit analysis.[113][114] The primary objective of seeking a social discount rate is to promote decision making.

The social approach can be categorized into two perspectives: a *normative* perspective and a *descriptive* (or *positive*) perspective.[115] The normative perspective considers how impacts on future generations should be valued.[116] On the other hand, the descriptive approach considers to what extent investments for public investments will displace investments elsewhere.[117] This paper mainly deals with the latter.

Lind (1982) states there are five central concepts in choosing social discount rates. "These concepts are (1) the *social* rate of time preference, which is the rate at which society is

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[113] *See. e.g.*, William J. Baumol, *On the Social Rate of Discount*, 58(4) AMERICAN ECONOMIC REVIEW 788-802 (1968); Arnold C. Harberger, *On Measuring the Social Opportunity Cost of the Public Funds*, *in* THE DISCOUNT RATE IN PUBLIC INVESTMENT EVALUATION 1-24 (Conference Proceedings of the Committee on the Economics of Water Resources Development, Western Agricultural Economics Research Council, Report No. 17, 1968); Kenneth J. Arrow & Robert C. Lind, *Uncertainty and the Evaluation of Public Investment Decision*, 60(3) AMERICAN ECONOMIC REVIEW 364 (1970); ARNOLD C. HARBERGER, PROJECT EVALUATION: COLLECTED PAPERS (1974); David F. Bradford, *Constraints on Government Investment Opportunities and the Choice of Discount Rate*, 65(5) AMERICAN ECONOMIC REVIEW 887 (1975); Alan J. Auerbach, *Tax Neutrality and the Social Discount Rate*, 17 JOURNAL OF PUBLIC ECONOMICS 355 (1982); Robert C. Lind, *A Primer on the Major Issues Relating to the Discount Rate for Evaluating National Energy Options*, *in* DISCOUNTING FOR TIME AND RISK IN ENERGY POLICY, 21-94 (LIND ed., 1982); Kenneth J. Arrow, W.R.Cline, K-G.Maler, M. Munasinghe, R. Squitieri, & J.E. Stiglitz, *Intertemporal Equity, Discounting, and Economic Efficiency*, *in* CLIMATE CHANGE 1995: ECONOMIC AND SOCIAL DIMENSIONS OF CLIMATE CHANGE, 127, 136 (INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 1996); DIANA FUGUITT & SHANTON J. WILCOX, *supra note* 54, at 95-117; PAUL R. PORTNEY & JOHN P. WEYANT ed., DISCOUNTING AND INTERGENERATIONAL EQUITY (1999); RICHARD W. TRESCH, PUBLIC FINANCE: A NORMATIVE THEORY, 731-757 (2 nd ed. 2002),

[114] The difference between the private sector investment analysis (NPV analysis) and the public sector cost-benefit analysis is that the latter needs to take into account marginal "social value" of the (public) investment, which can be ignored in the private sector investment analysis. In the private sector analysis, *profitability* is the criterion for alternatives investments but it would not be for the public investments. Cost-benefit analysis (present-value formula) is useful only when its elements can be peculiarly quantified. And cost-benefit analysis is good for determines the efficient decision but not for distributional matter. *See.* Tresch (2002) *supra note* 113, at 722.

[115] *See* Arrow, et al.(1996), *supra note* 113, at 130-133.

[116] Id. Normative perspective tends to argue that the government should use zero or lower discountrates to discount future generation's costs and benefits. *See.* Frank P. Ramsey, *A Mathematical Theory of Saving* 138(152) ECONOMIC JOURNAL 543-559 (1928)

[117] *Id.*

willing to exchange consumption no for consumption in the future; (2) the consumption rate of interest [*individual* rate of time preference], which is the rate at which individual consumers are willing to exchange consumption now for consumption in the future; (3) the marginal rate of return on investment in the private sector; (4) the opportunity cost of a public investment, that is, the value of the private consumption and investment forgone as a result of that investment; and (5) risk, which is related to the degree to which variation in the outcome of a public project will affect variation I the payoff from the nation's total assets." [118]

In a "first-best" world (i.e. no market distortion, no tax and no risk), (2) the consumption rate of interest for individuals [individual rate of time preference] and (3) the marginal rate of return on investment in the economy, would be equal to the market interest rate.[119]

However, once we take into account taxation, the corporate income tax and the personal income tax create a significant difference between (3) the pre-tax rate of return that can be earned on the marginal investment in the economy and (2) the after-tax rate of return that individuals can earn on their savings, which equals their consumption rate of interest.[120] Suppose that tax rate of corporate income tax is 50% and that of individual income tax is 40% (flat rate). If individual time preference is 6%, the pre-rate of return on capital must be 20%.[121]

2. Policy Options

We can distinguish literature on social discount rates into the following 6 approaches.[122]

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[118] Lind (1982), *supra note* 113, at 21-22. [*emphasis* added]
[119] *Id* .at 25.
[120] *Id.* at 29.
[121] Suppose that the firm invest $100 into project that will provide 20% return in Year 1. In Year 2, the firm receives $120 and pay tax of $10 (taxable income is $20 and tax rate is 50%). Then firm pay dividends of $10 to an individual shareholder and he pays tax of $4 (taxable income is $10 and tax rate is 40%). As a result, after-tax yield for individual is 6%.
[122] This categorization based on GAO(1991) *supra note* 56, ch2. *See.* Bazelon & Smetters, supra note 40, 213 (1999); RICHARDH W. TRESCH, PUBLIC FINANCE A NORMATIVE THEORY, (2002)

(a) Rate of time preference
(b) Opportunity cost
(c) Weighted average of the rate of time preference and the opportunity cost
(d) Shadow price of capital
(e) Rate based on Treasury borrowing cost
(f) Combining Certainty-Equivalent Values and Risk-Free Discount Rates (Option-pricing model)

Tresch (2002) mentions that despite fundamental conceptual disagreement over discount rates, all public economists agree that the present value of government projects depends crucially upon three factors: (i) the opportunity cost of public funds, (ii) the degree to which the net benefits of government projects are reinvested or consumed, and (iii) the social rate of time preference.[123] The disagreement results from the emphasis on each of these factors and their precise roles in the present value formula.[124]

(a) Rate of time preference

A rate of time preference is equal to the marginal rate of substitution (MRS) between consumption in one period and the next period. Economists believe that the *social* rate of time preference is more appropriate for a cost-benefit analysis of public investment than that of the *individual*.[125] The social rate of time preference could be lower or higher than that of individuals.[126]

As a practical matter, social rate of time preferences are not observable in the market. However, in theory, the most used formula of social time preference rate (STPR) consists of two components: (1) the rate of pure time preference [ρ], and (2) the product of the annual growth in

[123] Tresch (2002), *supra note* 113, at 732-733
[124] *Id.*
[125] *See.e.g.* FUGUITT & WILCOX, *supra note* 54, at 102.; Arrow et al. (1996), *supra note* 113, at 130.; HM Treasury, *supra note* 37; Louise Young, *Determining the Discount Rate for Government Projects*, New Zealand Treasury Working Paper 02/21, at 7-8 (2002), *available at* http://www.treasury.govt.nz/workingpapers/2002/twp02-21.pdf
[126] *See.* Arrow et al. (1996), *supra note* 113, at 130-133, 136-137.; FUGUITT & WILCOX, *supra note* 54, at 101-104.

per capita consumption [g] and the elasticity of marginal utility of consumption [μ].[127] STPR is represented as follows:

$$STPR = \rho + \mu g$$

The second term reflects the assumption that if per capita consumption is expected to grow over time, future consumption will be plentiful relative to the current position and thus have lower marginal utility.[128]

(b) Opportunity Cost

When we consider the opportunity cost of public funds, we need to take into account at least three factors; [1] a rate of return that reflects the opportunity cost of consumption (rate of time preference), [2] a rate of return that reflects the opportunity cost of private investment[129] (rate of return on private investment), and [3] the proportions by which an extra dollar of government investment comes at the expense of consumption and private investment.[130] Tresch (2002) says "[w]hat public sector economists cannot agree on is how the present value formula should account for these opportunity costs"[131]

The CBO (1991) says that the opportunity cost reflects the value of funds to the private sector. So this rate is based on the marginal pre-tax rate of return on private investment. As mentioned in [I.D.1.], OMB uses a real discount rate of 7% (marginal pre-tax rate of return on an

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[127] *See. e.g.* Arrow et al. (1996), *supra note* 113, at 130; FUGUITT & WILCOX, *supra note* 54, at 103; Young, *supra note 125*, at 7-8 (2002); *Also see*. HM Treasury (UK), *supra note* 37, at 97 Annex6; The UK government also takes into account "catastrophe risk" to estimate [ρ]. It estimates g =2%, ρ = 1.5%, and μ = 1.0, then SRTP = 3.5%. This rate is used as the basic discount rate for cost-benefit analysis by the UK government.

[128] HM Treasury (UK), *supra note* 37, at 106. *See.* DIANA FUGUITT & SHANTON J. WILCOX, *supra note* 54, at 103.

[129] To calculate a rate of return that reflects the opportunity cost of private investment, there are several different models: the Capital Asset Pricing Model (CAPM), the Arbitrage Pricing Theory (APT), and Fama and French's multi-factor model. The results from these models are then used in the standard weighted average cost of capital (WACC) formula to get a discount rate. *See.* Young (2002) at 8-11

[130] Tresch, *supra note* 113, at 733. "An extra dollar of government spending (in this case, government investment) implies either a dollar decrease in consumption spending or a dollar decrease in private investment spending, or some combination of the two adding to one dollar".

[131] Tresch, *supra note* 113, at 733.

average private investment) in its cost-benefit analysis for public investment and regulations.[132] So both CBO and OMB would assume that each dollar of government investment comes only at the expense of private investment. In other words, they assume that the fraction of consumption is zero.

The rationale for opportunity cost is that "by investing in a particular policy, society foregoes earning a future return on an alternative investment."[133] But the problem with this approach is that "while funds used for the public policy could, in principle, have been invested at the private sector rate, it is not clear that they would have been so used in the absence of the public activity."[134]

Another issue with the opportunity cost approach is whether the government should use a single discount rate. Using a single discount rate for cost-benefit analysis provides the advantage of consistency among government cost-benefit analyses.[135] This is the method used by the CBO and the OMB. Before 1972, each agency submitted cost-benefit analysis using widely different discount rates between agencies.[136] This practice may have prevented decision makers from accurately comparing the relative efficiency of different policy proposals.[137]

However, there are several critiques of using a single discount rate. "There is no reason to believe that either 10% or 7% real rate always reflects the foregone alternative return on private investment; thus, the analysis do not necessary identify the efficient policy decision."[138]

Bazelon & Smetters (1999) critique using a "single" higher discount rate such as a

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[132] As mentioned earlier, in cost-benefit analyses for capital-intensive water-resource projects with long time frames, the agency is required to use a lower discount rate.
[133] FUGUITT & WILCOX, *supra note* 54, at 99
[134] GAO (1991), *supra note* 56, at 13. *See*. Feldstein, *The Inadequacy of Weighted Average Discount Rates*, 319, *in* COST-BENEFIT ANALYSIS: SELECTED REASINGS (RICHARD LAYARD ed.,1972).
[135] FUGUITT & WILCOX, *supra note* 54, at 116.
[136] *Id.*
[137] *Id.*
[138] *Id.*

risk-adjusted discount rate. One problem with using a single pre-prescribed discount rate for all projects is that it will not reflect the varying degree of risk in all projects.[139] Another problem with a single discount rate is that it considers each government program in isolation and independent of the taxpayer's wage fluctuations.[140] Even if the returns to each government project are technically uncorrelated, a few large risks (e.g. Social Security and Medicare) that cannot be adequately pooled with many smaller risks put the government effectively in possession of a portfolio of highly correlated risks.[141]

(c) Weighted average of the rate of time preference and the opportunity cost

This approach attempts to address the actual use of funds in the absence of public policy. In other words, this approach weighs the share of costs drawn from private consumption at a rate of time preference and the share drawn from private investment at an opportunity cost rate.[142] One of the critiques of the weighted average approach is that it does not distinguish between whether benefits are consumed or reinvested.[143] Such critiques believe that the shadow price of capital approach is an appropriate one.[144]

(d)Shadow price of capital

The shadow price of capital approach "involves an adjustment in benefits and costs, not the discount rate, to reflect a policy's effects on consumption and investment flows".[145] The shadow price of capital is "the present value of the stream of consumption resulting from $1 of private investment. With this adjustment, the benefit and cost streams are expressed in

139 Bazelon & Smetters, *supra note* 40, at 216
140 *Id.*
141 *Id.*
142 *See*. Harberger (1976); GAO (1991), *supra note* 56, at 13.
143 DIANA FUGUITT & SHANTON J. WILCOX, *supra note* 54, at 104
144 *Id.*
145 *Id.* For detailed explanations, *See. e.g.* Stephan A. Marglin, *Opportunity Costs of Public Investment*, 77 Quartely Journal of Economics 274-289 (1963) ; Bradford, *supra note* 113; Lind (1982), *supra note* 113, at 39-55; Tresch, *supra note* 113, at 748-750

consumption units."[146] Then these are discounted by the social rate of time preference.[147]

Many economists, such as Feldstein (1972), Bradford (1975), Lind (1982) and Scheraga (1990), suggest that the shadow price approach is a superior method.[148] One advantage is that it can resolve the dilemma resulting from unequal rates of opportunity cost (rate of return to private investments) and rate of time preference.[149]

However, Mendelsohn (1981) and Lyon (1990) argue that the shadow price approach is extremely sensitive to the technical assumptions made about the incidence of costs, the propensities to save and reinvest, and the opportunity cost of private investment and time preference rates.[150] Also OMB (1992) says that in order to accurately use the shadow price method, the government must be able to compute how the benefits and costs of a program affect the allocation of private consumption and investment.[151]

(e) Rate based on Treasury borrowing cost

GAO (1991) thinks that the Treasury rate has the following strengths: (i) it is easy to implement because the information needs are much lower than those required for the shadow price or weighted average approaches, (ii) it is intuitively meaningful to decision makers and non-specialists as one measure of the cost of programs and society's tradeoffs between present and future monetary values, (iii) if marginal investments are funded by federal debt and capital markets are open, additional government borrowing does not raise interest rates or displace private investments (no crowding-out)[152], (iv) once guidelines are determined, they cannot be

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146 *Id. at 105*
147 *Id.*
148 GAO (1991), *supra note* 56 at 14. *See.* Feldstein, *supra note* 134; Bradford, *supra note* 113; Lind (1982), *supra note* 113; Joel D. Scheraga, *Perspectives on Government Discounting Policies*, 18 JOURNAL OF ENVIRONMENTAL ECONOMICS AND MANAGEMENT 65-71 (1990)
149 GAO (1991), *supra note* 56 at 41, Appendix IV
150 *See* GAO (1991), supra note 56 at 14.
151 OMB (1992), *supra note* 3, at 8.
152 *See.* Sebastian Edwards, *Country Risk, Foreign Borrowing and the Social Discount Rate in an Open Developing Economy*, National Bureau of Economic Reasearch, Working Paper No.1615 (1985); Robert Lind,

manipulated by analysts, and (v) the Treasury rate can be close (within 100 or 200 basis points) to a weighted average discount rate given the fraction of funding drawn from consumption of 60% to 90%.[153]

But there are also several limitations.[154] First, the Treasury rate does not equal the pre-tax return to domestic capital nor the after-tax return to domestic lenders. Second, the Treasury rate (and weighted average) can differ significantly from the discount rate under the shadow price approach.[155] Third, this approach can lead to a bias toward federal ownership of capital, loans, and guarantees because it implies a lower rate of return than the private sector requires. This is because the treasury rate does not reflect risk premium (default-risk), or corporate taxation. Finally, as the shadow price approach points out, project-specific discount rates are appropriate.[156] The treasury rate approach does not reflect the project-specific factors that yield different rates.

(f) Certainty Equivalence and risk-free rate (Option Pricing Model)

A general consensus among economists is that consideration of risk can be treated by converting outcomes into "certainty equivalents", amounts that reflect the degree of risk in an investment, and then discount these certainty equivalents by the risk-free rate.[157] Merton (1998) considers how option pricing has been used to value risks associated with many government programs.[158]

This approach would be attractive in a principle. But some government programs do

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[153] GAO (1991), *supra note* 56 at 14-18.

[154] *Id.*

[155] *Cf.* Macdonald, *The Use of Weighted Discount Rates in Cost-Benefit Analysis: A Future Analysis*, 17 WATER RESOURCES RESEARCH 478 (1981)

[156] *Cf.* Lind (1982) *supra note* 113.

[157] Lind (1982) *supra note* 113, Arrow et al.(1996) *supra note* 113.

[158] Bazelon & Smetters, *supra note* 40 at 217-218; *See.* Robert C. Merton, *Applications of Option-Pricing Theory: Twenty-Five Years Later*, 88(3) AMERICAN ECONOMIC REVIEW 323 (1998)

not have close private market substitutes, nor do they have long histories. [159] As a practical matter, estimating the relevant parameters for the option pricing formula becomes difficult.[160]

D. Can no-discounting be justified?

1. Arguments for no-discounting

GAO recommends the use of a very low discount rate (effective real discount rate close to zero) when analyzing policies with large intergenerational effects involving human life.

Ramsey argued that discounting future utility was unethical and lack of imagination.[161] Ramsey's argument is based on "the ethical presumption that all individuals, including those living in different generations, should be valued the same."[162] This argument is a normative perspective of social approach.

As the President's Advisory Panel (2005) mentions, under standard conventions, the revenue effect of a tax reform proposal is simply the sum of nominal (undiscounted) predicted revenues over the budget window.

> The Treasury Department's ten-year revenue target is based on the nominal sum of annual revenues. In other words, Treasury first estimates the amount of revenue for each year, and then adds those numbers together to arrive at a total amount of revenue for the period. *There is no discount for the time value of money*. This approach differs from standard business practice – which does use present value discounting. The reason for discounting future revenues is simple: A dollar received at a future date is worth less than a dollar today because a dollar today can be invested to earn interest and deliver more than a dollar in the future.
>
> The use of the convention of summing annual revenues without discounting future cash flows has implications for the Panel's proposals. Here is why: Under the Treasury baseline, the annual revenue generated by the AMT rises during the ten-year budget window. The Panel's proposals, on the other hand, generally have a much more stable flow of revenue. If one were to picture the revenue flow over the budget window it would be an upward sloping line; the Panel's proposals would flatten out

[159] *Id.* at 218.
[160] *Id.*
[161] *See*. Ramsey (1928), *supra note* 116
[162] Arrow et al.(1996), *supra note* 113, at 136

> that line. For both the baseline and the Panel's proposals, there will be the same total nominal flow of revenues over the relevant period; however, a tax reform proposal that generates a more stable flow of revenues over the budget window, rather than a more rapidly rising flow, will raise more revenue than the baseline if the future revenue flows are discounted. Thus, revenue-neutral tax reforms that repeal the AMT would require lower tax rates if the baseline were calculated using present discounted values instead of nominal values.[163] [*emphasize added*]

2. Critique against no-discounting

The Congressional cash-based budget does not discount the future. Under PAY-GO-RULE (direct spending), a lack of discounting creates an incentive to propose funding new current programs with cuts in some other program much further down the road.[164] Changes in spending or revenue beyond the budget window (five or ten years) are not taken into account for calculation. These changes are essentially discounted at an "infinite rate".[165]

III. In Lieu of Conclusion

The first part of this paper describes what discount rates are being used by the U.S. government. In general, there are two major alternatives: the borrowing rate of the Treasury and the rate of return on private investment. Then, this paper refers to some theoretical analyses. There are disagreements about the criteria of choosing discount rate. At the very least, one can conclude that there is no "single" discount rate that is appropriate for all budgetary processes. In theory, it might be appropriate to choose a different discount rate that reflects the risk of the specific project and the maturity of the project. However, as a pragmatic matter, one needs to take into account the simplicity of implementation and the minimization of arbitrariness by agencies.

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[163] The President's Advisory Panel on Federal Tax Reform, *Simple, Fair, and Pro-Growth: Proposals to Fix America's Tax System*, 46 (2005)
[164] Bazelon & Smetters, *supra note* 40, at 219.
[165] *Id.*

Selecting a discount rate for budgetary purposes is not an easy task. There are two different approaches. The first is a *financial approach*, which considers only the revenue effects to the government. This view treats the government as a separate entity from society. The second is a *social approach*, which tries to take into account the effect of public policies on society. Furthermore, the social approach can be categorized into two perspectives: the normative perspective and the positive (or descriptive) perspective. For cost-benefit analysis, as most economist imply, the social approach should be taken.

However, if the main purpose of the federal budget process is to disclose the financial position of the government for the coming fiscal year, the financial approach might be more appropriate. In order to choose an appropriate discount rate, one needs to reconsider the purpose and the roles of the federal budget process itself. More research will be required to consider what the differences are, if any, between a discount rate for a specific budget process and that for cost-benefit analysis in general.

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