

Discount Rate Impacts on Private and Public Sector Capital Investment Valuation

George Bayer, MBA, PMP
Cobec, Inc.



Agenda

- **Introduction**
- **Public vs Private Sector Capital Investment Valuation**
 - Differences – Purpose, Culture, Taxes
 - Cost of Capital Calculation
 - Nominal vs Real Rate Discounting
 - Economic Metrics
- **Discount Rates**
 - Government Discount Rates
 - Inflation
 - Cost of Capital
 - Calculated Discount Rate vs OMB Guidance
- **Recommendations**



Introduction

George Bayer

- Senior Director at Cobec Consulting who leads investment analysis consultant teams developing costs, benefits, sustainability analyses, and business cases for FAA acquisitions
- B.S. in Business Administration (Finance & English majors) from the University of Florida
- MBA in Corporate Finance from The University of Texas at Austin
- Project Management Professional (PMP) Certification (PMI)
- 20 years of Finance experience in capital investment valuation in public and private sectors
 - **Private Sector:** Developed discounted cash flow (DCF) models in Investment Appraisal for major Power Generation capital investments at ConocoPhillips
 - **Public Sector:** Evaluated major capital investments/acquisitions in the Business Case Group of Investment Planning & Analysis at the FAA

Public vs Private Sector Capital Investment Valuation



What is Capital Investment Valuation?

- **Capital investment**¹ – money invested in a business venture with an expectation of income and recovered through earnings generated by the business over several years. It is generally understood to be used for capital expenditure rather than for day-to-day operations (working capital) or other expenses.
- When companies evaluate capital investments, they often use a discounted cash flow (DCF) valuation approach, where the company calculates free cash flow (FCF) and discounts these cash flows by the company's cost of capital to calculate NPV and other valuation metrics.

¹ <http://www.businessdictionary.com>



Purpose of Investments in Public/Private Sectors

Public Sector

- Provide value to agency, industry, or infrastructure investment
- Complying with govt executive or Congressional Order
- Government Efficiency
- Acting in public's best interest (safety, security, hazard avoidance)
- Strategic Initiative

Private Sector

- Organic Business Growth to:
 - Expand existing operations
 - Generate revenue
 - Increase market share
 - Invest in new projects

- **Culture – Public Sector**
 - Provide value to multiple stakeholders, including the public.
 - Philanthropic intent.
 - Mission-based value
- **Culture – Private Sector**
 - Growth-focused
 - Generate growth and revenue for continued business operations

Cultural Distinctions

Public Sector

- Government acquisition **process** well-defined and developed
- **Longer investment decision process**
 - Sunk costs by time of investment decision
- **Compartmentalization**
 - Different operational groups within the agency are tasked with developing new investment ideas, creating alternative solutions to infrastructure problems, and converting new technology programs into business cases
- **Fewer Incentives** – Public sector program managers are not rewarded with financial incentives based on the outcome of their programs.

Private Sector

- **Streamlined Investment Analysis process**
- **Return on Investment (ROI)** – Emphasis on ROI to return cash flow to reinvest in future capital investments

Capital Investment Valuation

- Public and private sectors devoted to development, analysis, and interpretation of business cases.
- Value determined **not just financial analysts** (economists), but also by lawyers, system engineers, developers, project managers, technical experts

Net Present Value (NPV)	Internal Rate of Return (IRR)	Payback	B/C Ratio
<ul style="list-style-type: none">• Discounted cash flow value of project/business case• Revenue and expenses discounted at cost of capital• $NPV > 0$ is a positive project	<ul style="list-style-type: none">• Hurdle rate – minimum percentage return a company requires on investments; exceeds project cost of capital• Calculated as discount rate that makes $NPV = 0$• IRR should exceed the “hurdle rate” or “cost of capital”	<ul style="list-style-type: none">• Number of years before business case pays back original investment• Estimate of economic breakeven point	<ul style="list-style-type: none">• Ratio of discounted benefits divided by discounted costs• Determine if Benefits > Costs• Government metric• $B/C > 1$ is a positive project

Cultural Distinctions

Taxes – biggest distinction between public and private sector cost estimation and business case evaluation

Taxes in Public Sector Investments

- Little or no impact
 - Except where incurred by private sector customers or stakeholders
 - **Example** – Government acquisitions might require companies to purchase equipment in order to realize benefits from public sector capital investment. Tax implications to companies apply.
 - Tax implications to companies for (1) equipment invested and (2) incremental benefits realized.
-

Taxes in Private Sector Investments

- Impact capital investment free cash flow
- Capital structure impacts taxes paid
 - Depreciation Tax Shields | Off-balance sheet financing | Project Finance
- Taxes differ by company and/or by project
 - Project risk, location, financing structures, Accounting strategies

Taxes – Depreciation Tax Shields

Definitions

- **Depreciation**
 - Method of allocating cost of long-term asset over its useful life
 - Assumes asset value will decrease over time, during its use
- **Depreciation Tax Shield**
 - Amount by which income tax payments are reduced by deducting depreciation from taxable income

Tax Shields in Public Sector Investments

- Taxes not applied in Public Sector
- Only indirectly impact private sector customers or stakeholders
 - (1) Incremental Revenue, (2) Required capital (equipage)

Tax Shields in Private Sector Investments

- Capital expenditure (CAPEX) spent on investment treated as depreciable asset
- Depreciation tax shield applies to investment and impacts project Free Cash Flow (FCF)
- Depreciation “shields” project from a portion of incremental taxes it would ordinarily pay

Economic Analysis – Cost of Capital

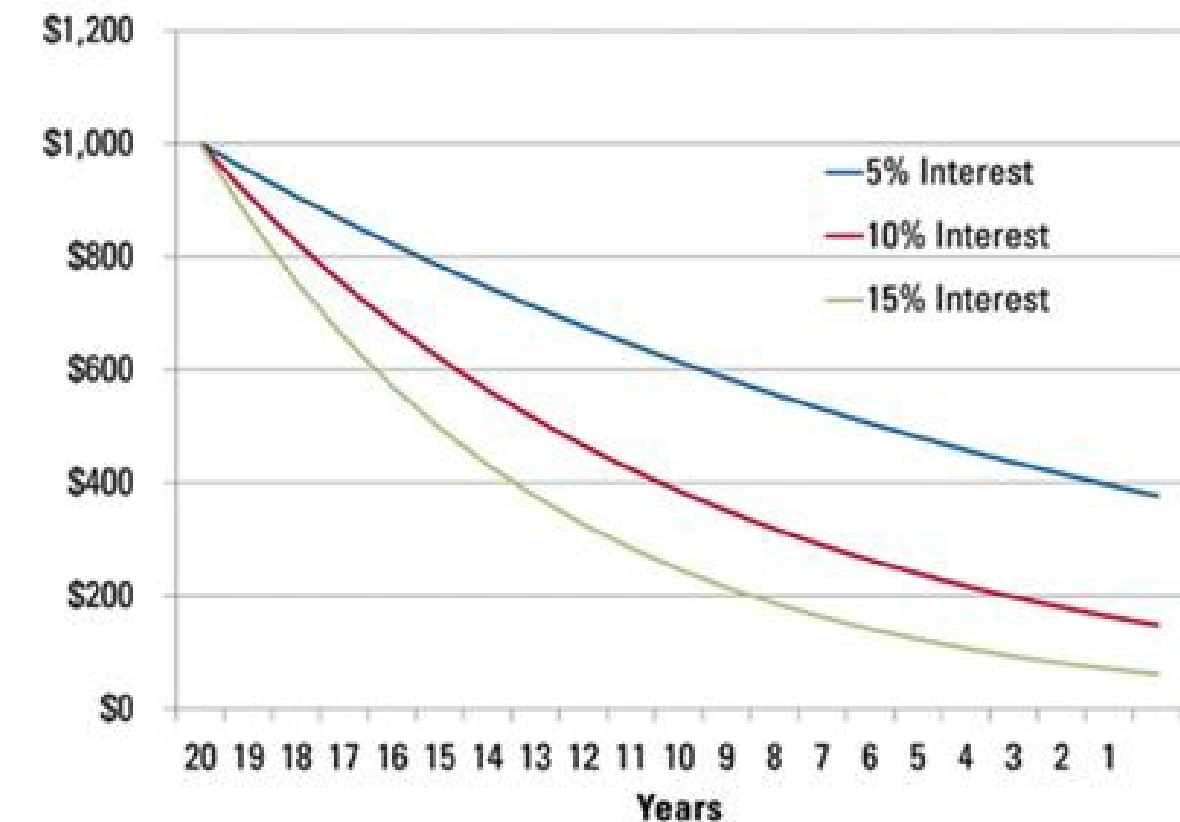
Time Value of Money

- One dollar today is worth more than a dollar tomorrow.
- **Purchasing Power** – A hamburger at a local restaurant should cost more next year than this year. Have greater purchasing power today than tomorrow. (Assumes inflation)
- **Ability to invest** – Ability to invest and earn interest; the sooner invested, the better.

Opportunity Cost of Capital

- At what cost can a company raise capital?
- This should be reflected as the discount rate for company's capital investments (assuming same capital structure for the project)
- A public company can raise capital by (1) issuing debt or (2) issuing equity.

Impact of Discount Rates – Time Value of Money
(20 years) (5%, 10%, 15%).



Economic Analysis – Cost of Capital - WACC

Weighted Average Cost of Capital (WACC)

$$\bullet WACC = \frac{E}{(D+E)} (r_{eL}) + \frac{D}{(D+E)} (1 - t)(r_D)$$

D = market value of debt

E = market value of equity

r_d = discount rate for debt (the average interest rate on long-term debt)

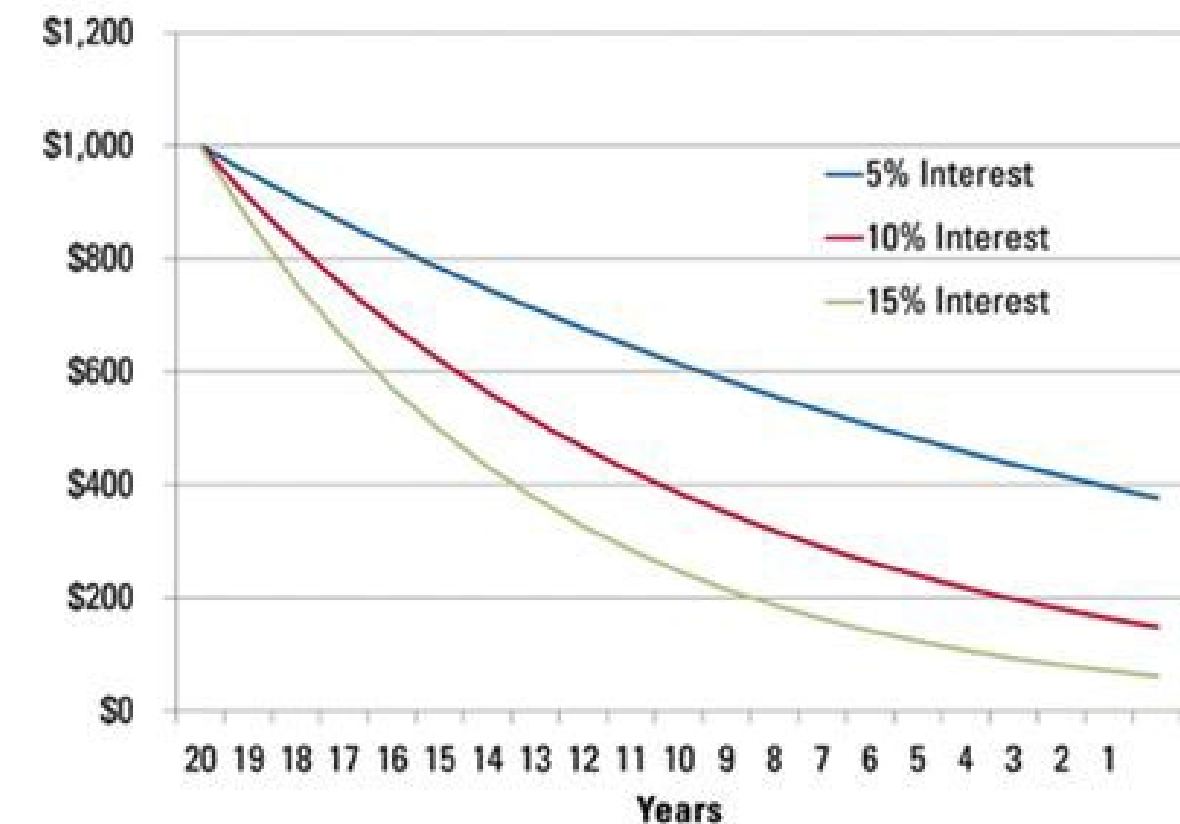
r_{eL} = discount rate for levered equity calculated using the Capital Asset Pricing Method (CAPM)

t = tax rate

- WACC is used as discount rate for nominal dollar cash flows to calculate present value

Impact of Discount Rates – Time Value of Money

(20 years) (5%, 10%, 15%).



Cost of Capital – Private Sector

WACC used as discount rate in private sector

- Most companies use WACC as discount rate for project nominal dollar cash flows to estimate present value (PV).
- Calculate NPV to estimate project value
 - $NPV > 0$ indicates positive value
- Calculate project Internal Rate of Return
 - Where $IRR >$ hurdle rate (WACC), project has positive value to company

Private Sector Discount Rate

- WACC is determined by ability to raise equity and debt capital, company liquidity, and cash flow
- Illiquid companies or companies with low debt rating have higher cost of capital and higher hurdle rate for investments
- Unlike public sector, discount rate used for capital investments differs from company to company

Private Sector Options/ Considerations

- The amount of risk a company is willing to take
- Required return on investment
- Ability to maintain budgets or increase cash flow
- Types of investments – humanitarian or self-serving
- Company financed or project financed



Cost of Capital – Public Sector

Public Sector Discount Rate

- Public sector cost of capital is the Treasury Bill (T-bill), government's yield on short-term debt
- Can either (1) issuing debt or (2) make a capital investment or government acquisition.
- Last 30 years, T-bill rate has been very low.
- Historically, public sector's cost of capital much lower than private sector.



Major Cost of Capital Distinctions between Public and Private Sectors

- Since public sector cost of capital is lower than private sector, government has ability to invest in low-yield projects for common good.
- Public Sector considers value to multiple stakeholders (public, industry, and agency)
- Public Sector has infrastructure responsibility and longer durations between upgrades
- Private sector value is defined by cash flow to the company.
- Private sector cost of capital varies widely by company based on risk, financing mix, and debt rating.



Cost of capital impacts investment behavior:

- The amount of risk a company is willing to take
- Required return on investment
- Ability to maintain budgets or increase cash flow
- Types of investments – humanitarian or self-serving
- Company financed or project financed

Discount Rate Terminology

- **Real Dollars = Base Year \$ (BY\$)**
 - Variables quantified in current year dollars are referred to as “Real Dollars.”
 - Government term is “base-year dollars,” BY\$
 - Variable costs held constant over a time-series
- **Nominal Dollars = Then Year \$ (TY\$)**
 - When inflation is applied to variables and the real rate is escalated each year by variable rate of inflation, it is classified as “Nominal Dollars.”
 - In each subsequent year, variable value is higher than previous year.
 - Government term is “then-year dollars,” TY\$
 - Cost of variable is actual cost in year it is attributed

Private Sector – Nominal Rate Discounting

- **Private Sector – Nominal Rate Discounting**
 - When developing **Discounted Cash Flow (DCF) valuation models for capital investments, private sector applies “cost specific” inflationary rates**
 - Labor may have a different inflationary escalation than hardware
 - For energy company business case valuations, commodity prices (oil, natural gas, and power) will have their own inflationary forecast.
 - Use **nominal rates** in cash flow models
 - Discount nominal cash flows by the company WACC
 - Taking into account multiple factor inflation rates, nominal rates provide most accurate assessment of future project cash flows

Public Sector – Real Rate Discounting

- **Public Sector – Real Rate Discounting**

- In capital investment analysis, government discounts “base-year dollars” or real dollars by the risk-free rate.
- Excludes inflation in discounting benefits and costs
- Without inflation, government discount rate is trivial
 - OMB uses approximately 2% discount rate for investments which only benefit the government
 - OMB previously used 7% discount rate if investment claims any private sector benefits. This has dropped to 3.1%, starting in 2024

- **Why Does Public Sector Use BY\$ and Exclude Inflation?**

- **Constant dollars** – Showing economic variables in “real dollars” allows analyst to show constant dollars across time series, i.e., \$1,000 in 2016, \$1,000 in 2017, \$1,000 in 2018
- **Easy to interpret** – When there is a real change in variable cost, it is more transparent, easier to audit, and easy to interpret for management
- **Not complicated or subjective** – Using nominal rates requires a subjective interpretation of inflation applied to multiple variables.
 - Different investments might use different rates of inflation
 - Difficult to compare projects if different rates of inflation applied
 - Nominal discount rates vary more than real discount rates, so BY\$ discounting has advantage in standardization

Impacts of Discount Rate Conventions

What Are the Drawbacks of Using Real Rates?

- Since real dollars exclude inflation, real rates **do not account for variable rates of inflation**
- BY\$ or real dollar discounting is **less accurate** than nominal dollar discounting
 - Excludes inflation and discounts by a rate that **excludes inflation**
 - If different cost elements escalate at different rates of inflation, **BY\$ treats them all equally**
 - Could **underestimate costs** or revenue
 - Decision-makers may **misinterpret value**
- Discount real rates can be a less accurate reflection of value.

What Are the Drawbacks of Using Nominal Rates?

- Less transparent for changes to cost assumptions
 - Cost assumption changes could be concealed by inflationary escalation
 - More challenging to audit
- Nominal rate discounting is **more challenging** for nonfinancial managers
 - Easier for managers to see constant costs for specific WBS elements over a time series
- Multiple escalation rates could be manipulated by category
 - Program managers could shift costs to WBS elements with a lower inflationary rate

Solution for Discount Rate Conventions

Potential Solution for Discounting

- 1) In order to more accurately discount project benefits and costs in government, analysts could discount cost estimates in **both real and nominal dollar values**
- 2) Could compare results to determine sensitivity of inflationary factors
 - Isolate cost drivers via sensitivity analysis
 - Tornado diagrams
- 3) Can calculate metrics (NPV, B/C, IRR) using both real and nominal discount rates
- 4) In cases where inflation varies widely by cost factor, nominal discounting is preferable

Value Drivers

Value Drivers													
Benefits	<table border="1"> <thead> <tr> <th><u>Public Sector</u></th> <th><u>Private Sector</u></th> </tr> </thead> <tbody> <tr> <td>Public Needs and Interests</td> <td>Corporate Cash Flow</td> </tr> <tr> <td>Public Infrastructure</td> <td>Tax Shields</td> </tr> <tr> <td>Political interests</td> <td>Competitive Advantages</td> </tr> <tr> <td>Private Sector Efficiencies</td> <td>Market Share</td> </tr> <tr> <td>Government Strategic Interests</td> <td></td> </tr> </tbody> </table>	<u>Public Sector</u>	<u>Private Sector</u>	Public Needs and Interests	Corporate Cash Flow	Public Infrastructure	Tax Shields	Political interests	Competitive Advantages	Private Sector Efficiencies	Market Share	Government Strategic Interests	
<u>Public Sector</u>	<u>Private Sector</u>												
Public Needs and Interests	Corporate Cash Flow												
Public Infrastructure	Tax Shields												
Political interests	Competitive Advantages												
Private Sector Efficiencies	Market Share												
Government Strategic Interests													
Costs	<table border="1"> <thead> <tr> <th><u>Public Sector</u></th> <th><u>Private Sector</u></th> </tr> </thead> <tbody> <tr> <td>Acquisition Costs</td> <td>Cost of Capital</td> </tr> <tr> <td>Operations</td> <td>Taxes</td> </tr> <tr> <td>Budget funding allocations</td> <td>Dividends</td> </tr> <tr> <td>Risk-free rate (t-bills)</td> <td>Funding debt</td> </tr> </tbody> </table>	<u>Public Sector</u>	<u>Private Sector</u>	Acquisition Costs	Cost of Capital	Operations	Taxes	Budget funding allocations	Dividends	Risk-free rate (t-bills)	Funding debt		
<u>Public Sector</u>	<u>Private Sector</u>												
Acquisition Costs	Cost of Capital												
Operations	Taxes												
Budget funding allocations	Dividends												
Risk-free rate (t-bills)	Funding debt												

Management’s understanding of value drivers and interests in the public and private sector is critical to make informed investment decisions.

Which Metrics Are Best to Measure Value?

Which Economics Metrics Are Best for Capital Investments?

- Using the wrong metric or the exclusive reliance on one specific metric can lead to the wrong conclusion
- Understanding how best to apply metrics in capital investment valuations helps executives and committees make better informed decisions:
 - Capital Improvements
 - New Opportunities
 - Government Acquisitions

Primary Metrics

- To better understand strengths and weaknesses of valuation metrics, we will compare:
 - **NPV vs. IRR**
 - **NPV vs B/C Ratio**

Mutually Exclusive Projects – NPV vs IRR

• Net Present Value (NPV)

- Most common Finance metric and common between both public and private sectors
- Calculated by discounting capital expenditures (CAPEX) and annual cash flows by the cost of capital

$$NPV = C_0 + \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \dots + \frac{C_T}{(1+r)^T}$$

- C_0 is the initial capital outlay; C_1 , C_2 , C_3 , etc. are annual cash flows, discounted by the cost of capital, r . T is the final year cash flow.
- Capital investment determined to have value (in dollars) if $NPV > 0$

• Internal Rate of Return (IRR)

- Discounted cash flow (DCF) rate of return calculated as the discount rate that makes NPV equal zero

$$NPV = C_0 + \frac{C_1}{(1+IRR)} + \frac{C_2}{(1+IRR)^2} + \dots + \frac{C_T}{(1+IRR)^T} = 0$$

Mutually Exclusive Projects – NPV vs IRR

- **Advantages of IRR**

- Effective measure of determining value where $IRR > \text{Hurdle Rate}$
- Easier for nonfinancial managers to understand as expressed as percentage return

- **Disadvantages of IRR**

- **Lending vs. Borrowing** – metric interpreted differently depending on lending or borrowing
- **Multiple Rates of Return** – If cash flows alternate, more than one IRR can be calculated
- **Mutually Exclusive Projects** – Project with the higher IRR might have a lower NPV. Higher NPV project should be chosen.

- **Conclusion**

- Using IRR exclusively to determine investment value can be misleading and might result in wrong investment decision

Mutually Exclusive Projects – NPV vs B/C Ratio

- **B/C Ratio**

- To simplify investment analysis metrics for decision-makers in public sector, government uses B/C ratio to compare relative value across capital investments.
- Government investments (1) do not include taxes and (2) are not measured by cash flow.

$$\frac{B}{C} \text{ Ratio} = \frac{PV(BY\$ Benefits)}{PV(BY\$ Costs)}$$

- The B/C Ratio divides the present value of real or base year benefits by the present value of base year costs.
- Like IRR, B/C ratio can be misleading when comparing mutually exclusive capital investments

Disadvantages of Using B/C Ratio

• Disadvantages of B/C Ratio

- When evaluating mutually exclusive capital investments, using B/C Ratio exclusively might result in a misinterpretation and a less valuable allocation of capital dollars.

Mutually Exclusive Investment Decisions using B/C and NPV

	PV (Cost)	PV (Benefits)	B/C	NPV
Project A	11,000,000	18,000,000	1.6	7,000,000
Project B	20,000,000	30,000,000	1.5	10,000,000
Project C	25,000,000	36,000,000	1.4	11,000,000

• B/C Ratio Example

- Choice between 3 capital investments
- Maximum constrained budget of \$25M
- If use B/C Ratio exclusively, would choose Project A
- If analyze project with B/C Ratio and NPV, constrained budget choice is Project C with highest NPV within budget.

Discount Rates

Do Government Discount Rates
Provide Accurate Assessment
for Business Case Valuation?



Government Discount Rates & Updates

Discount Rate for CBA

- **Primary Rate for Business Cases**
– Rate for Cost Benefit Analysis for major capital investments, assumes benefits to both government and the private sector or to taxpayers
- **Rate 2** – Capital projects only benefiting the government agency use the 10 or 20-year Treasury rate (risk-free rate) as the cost of capital
- **Real Rates** – Government economics are conducted using real discount rates and real dollars (BY\$).
- **Nominal Rates** – Private sector uses nominal rates and WACC for Discount Cash Flow valuation.

Discount Rates for CBA

OMB direction is to use the 7% real discount rate for Benefit-Cost Analyses. There is an exception in four cases: Cost-Effectiveness, Lease-Purchase, Internal Government Investment, and Asset Sales Analyses. In these cases use the rates below.

Discount Rates for CBA

OMB direction is to use the 3.1% real discount rate for Benefit-Cost Analyses¹. There is an exception in four cases: Cost-Effectiveness, Lease-Purchase, Internal Government Investment, and Asset Sales Analyses. In these cases use the rates below.

1992 – 2022

- Rate used for government business cases for 30-year period from 1992-2022
- Period of inflation, growth, low cost of capital

2023 – Present

- New rate applied at end of 2023.
- Period of inflation volatility and high cost of capital

Historically Low Inflation – 2000 – 2020

Low Inflation

- 20-year period from 2000-2020, inflation at lowest levels in recent history
- **Cheap Capital** – with low interest rates, treasury bonds and cost of capital extremely low
- **20-year Treasury** – 2.0 – 3.6% rates from 2000 – 2020

High Inflation

- **Period of High Inflation** – 2021 - 2024
- Cost of Capital increases
- Treasury rates increase

How Does Inflation Impact Government Discount Rates?



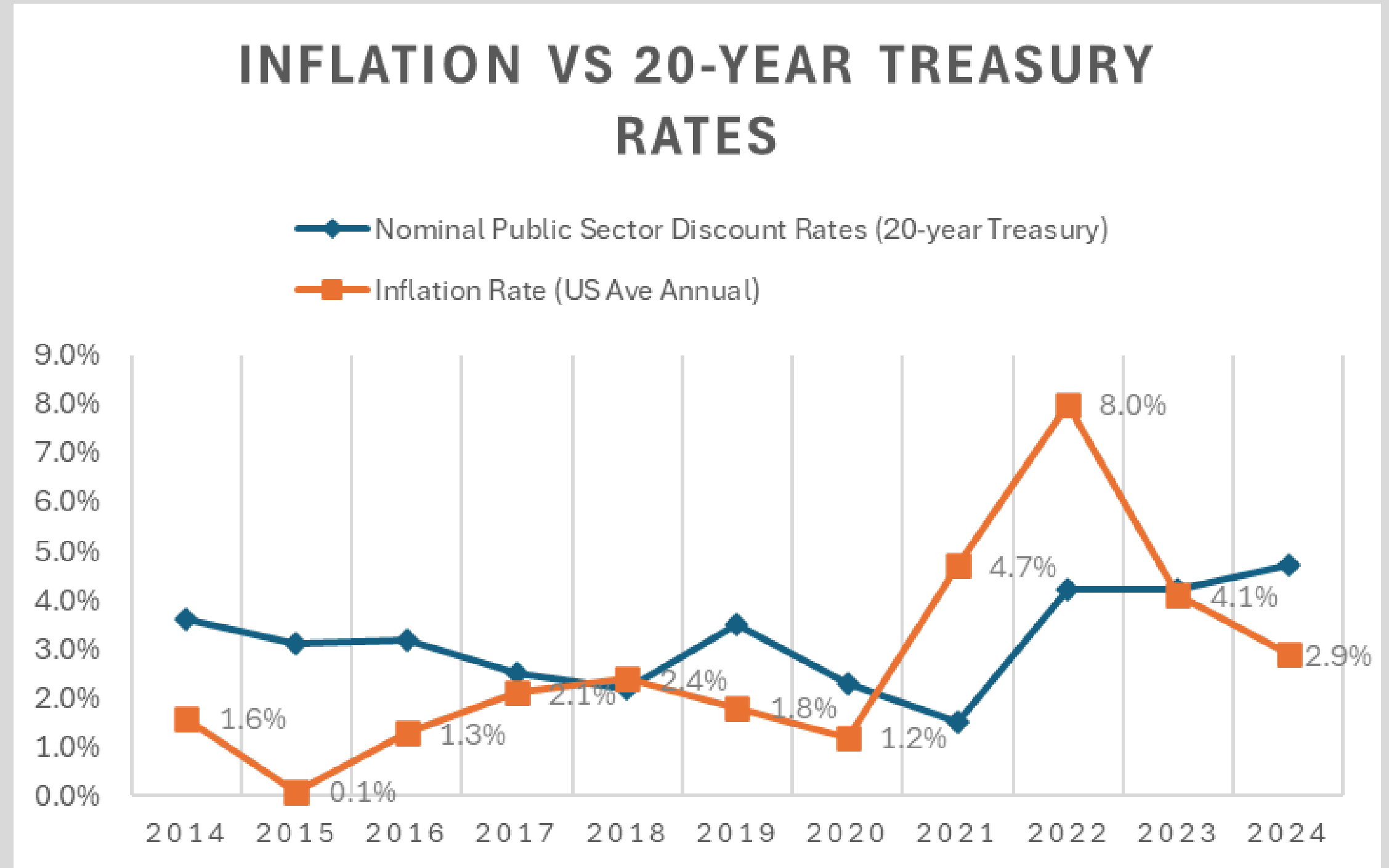
Average Annual Inflation by Year 2000-2024 (Source macrotrends.net inflation-rate-cpi)

Delayed Impact of Inflation on Discount Rates

Rate Changes

- 20-year period from 2000-2020, inflation at lowest levels in recent history
- **Rate Divergence** – 2020 – 2022, Fed slow to react, inflation increases while interest rates are low
- **Rates Exceed Inflation** – 2023 – 2024, interest rates increase to offset inflation, and inflation drops. Treasury rates exceed inflation.

Do We Have the Right Government Discount Rates?



Source: <https://www.usinflationcalculator.com/inflation/current-inflation-rates/> and OMB Circular A-94 Appendix C

Corporate Cost of Capital WACC - Expensive

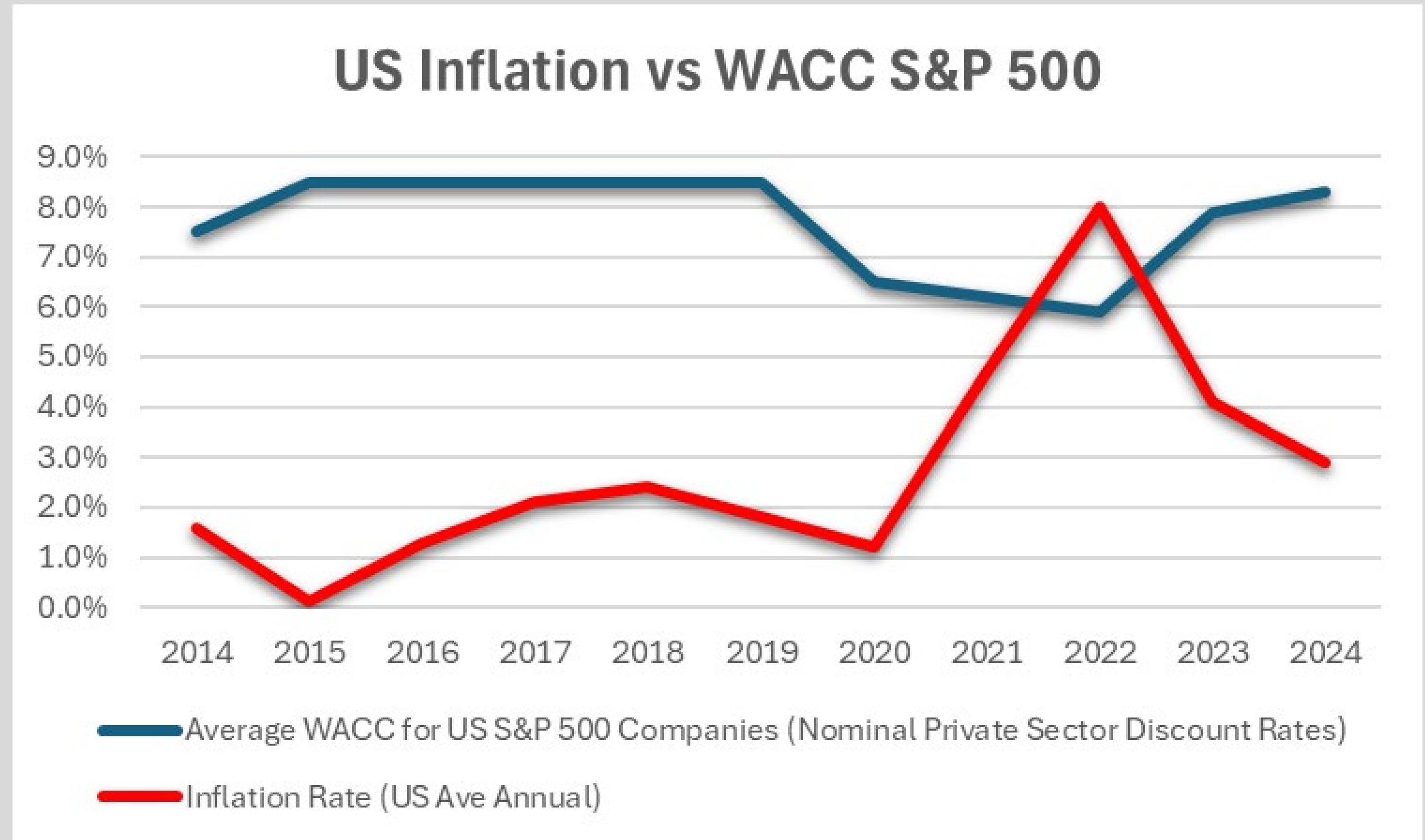
Private Sector Cost of Capital

- WACC for S&P 500 cheap
- 11-year period from 2009-2020, cost of debt was in real terms cost-free
- 2020 – 2022, inflation caused WACC to become expensive again

Capital Investment Gov't Discount Rate

- Should be **blend of public/private sector discount rates**
- **2000 – 2022 – Rate too High**
- **2024/ 2025 – Rate too Low**

What are the Right Government Discount Rates?



Low Inflation vs Gov't Discount Rate Guidance

	Public Sector		Private Sector	
2016 Nominal Discount Rate	3.2%	20-yr Bond	8.5%	WACC
Inflation	1.3%		1.3%	
2016 Real Discount Rate	1.2%	20-yr Bond	7.2%	WACC
2016 Real Calculated Blended Cost of Capital	4.2%			
2016 Real Blended Cost of Capital from OMB Guidance	7.0%			

2016 Example – Low Inflation, Low Cost of Capital

- Inflation = 1.3%
- 20-Year Treasury Bond = 3.2% Nominal, 1.2% Real
- WACC = 8.5% Nominal, 7.2% Real

Capital Investment Gov't Blended Public/Private Discount Rate = 7.0% (1992 – 2022)

- OMB kept blended public/private the same for 30+ years
- Rate used when capital project/ acquisition benefits government and private sector, U.S. citizens

In 2016, 7.0% was too high in period of low inflation and low capital cost!

High Inflation vs Gov't Discount Rate Guidance

	Public Sector		Private Sector	
2024 Nominal Discount Rate	4.7%	20-yr Bond	8.3%	WACC
Inflation (Average Annual)	2.9%		2.9%	
2024 Real Discount Rate	2.5%	20-yr Bond	5.4%	WACC
2024 Real Calculated Blended Cost of Capital	4.0%			
2024 Real Blended Cost of Capital from OMB Guidance	3.1%			

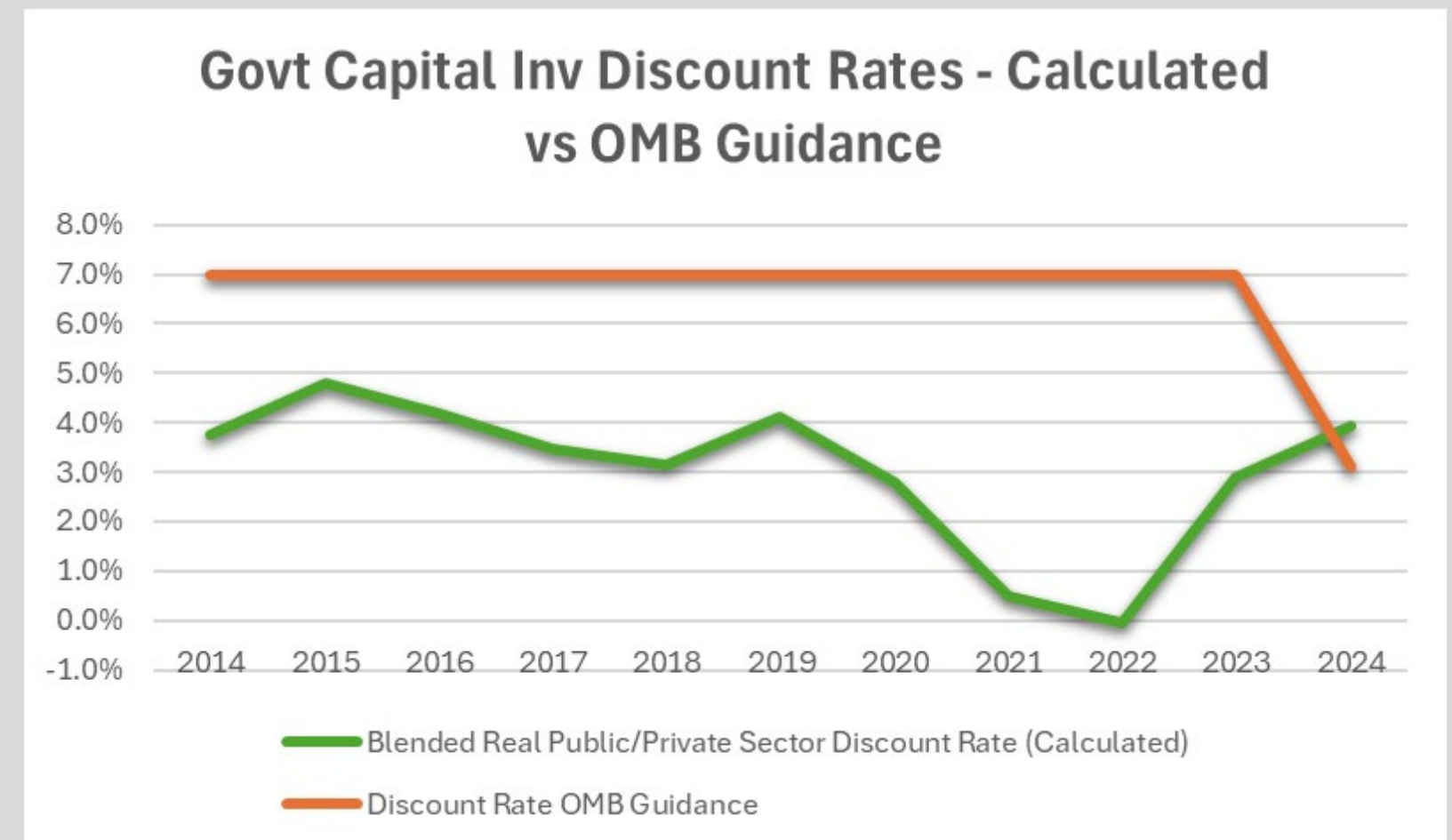
2024 Example – High Inflation, High Cost of Capital

- Inflation = 8% in 2022, 4.1% in 2023, 2.9% in 2024
- 20-Year Treasury Bond = 4.7% Nominal, 2.5% Real
- WACC = 8.3% Nominal, 5.4% Real

Capital Investment Gov't Blended Public/Private Discount Rate = 3.1% (2024 - present) **NEW!**

- OMB lowered blended public/private rate to track risk-free rate
- Not a good reflection of actual project cost of capital and realized risk

In 2024/2025, 3.1% is too low in time of high capital costs, inflationary/ post-inflationary period



Recommendations

- ❑ **Public/ Private Sector Valuation Distinctions** – Capital investments are transformative in the public sector and a primary source of growth in the private sector
 - ✓ Understand public and private sector valuation – risks, cost of capital, and project application
 - ✓ Be informed about drivers of value, leadership/stakeholder motivations, impacts of taxes, inflation, and monetary policy
 - ✓ Conduct “scenario analyses” and sensitivity analyses on all business cases
- ❑ **Valuation metrics** held in isolation can lead to misleading valuation decisions
 - ✓ Best to consider multiple economic metrics when evaluating mutually exclusive acquisitions (NPV, IRR, B/C, payback)
- ❑ **Discount Rates & Project Economics**
 - ✓ Start with discount rate guidance for capital projects
 - ✓ Evaluate impact of inflation and monetary policy on project discount rates
 - ✓ Consider private sector cost of capital project risk
 - ✓ Run secondary scenarios with **calculated blended cost of capital** as “alternative discount rate”
 - ✓ Calculate NPV, IRR, B/C Ratio Range for decision-makers
 - ✓ Get it “just right”

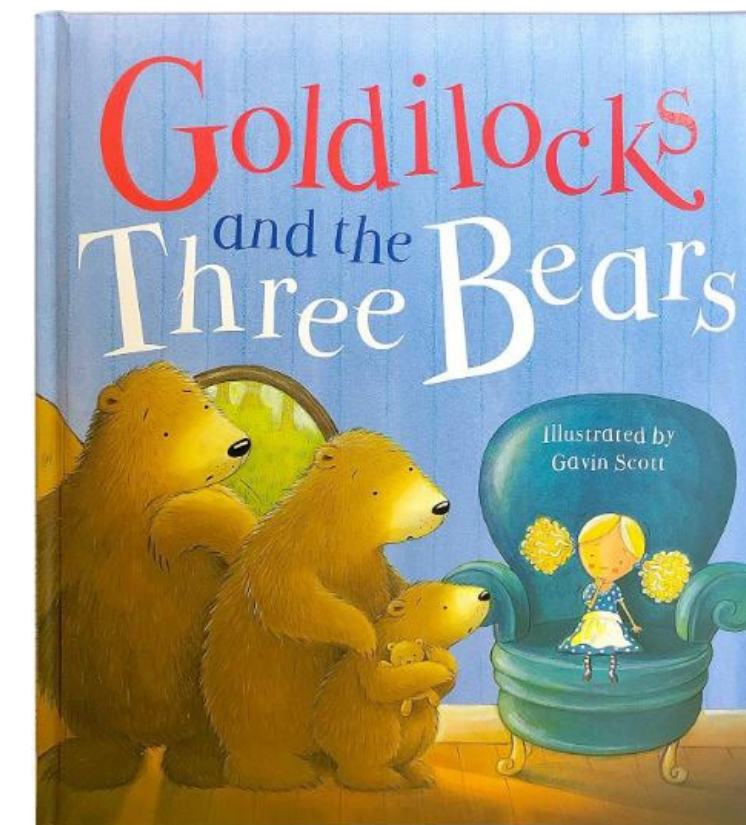


Illustration Gavin Scott