

## Nominal, Real and Net Discount Rates: What's the Difference and Does it Make a Difference?

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(Copies of slides can be found here.)

## What I Plan to Cover

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- The Need to Discount
- The Basic Math
- Does It Make a Difference In the Results or In the Law?
- The Pros and Cons of Nominal, Real and Net Discount Rates
- Valuing Pensions That Are Indexed to Inflation
- Calculating Average Growth Rates **(time permitting)**
- Two Approaches to Real Discount Rates **(time permitting)**

## The Need to Discount

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- The Legal Need to Discount in Missouri
  - No requirement to express damages at present value except in FELA cases and cases involving improper medical care.
  - The defense can only present evidence on present value through a witness.

## The Need to Discount

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- The Legal Need to Discount in Missouri (**something you know better than me**)
  - No requirement to express damages at present value except in FELA cases and cases involving improper medical care.
  - The defense can only present evidence on present value through a witness.
- The Economic Need to Discount (**practically speaking, dominates the legal need - something we all know, including juries**)
  - A dollar today is not the same as a dollar payable one year or several years from now.
  - Suppose you had a mortgage and sold your house . . .

## The Basic Math

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- Nominal interest rate is what you read about in the paper, e.g., a 10-year Treasury note yielding 5 percent. Nominal rate compensates for both expected inflation and a required real return.
- Required real return is the real discount rate and is the nominal rate adjusted for expected inflation.

## The Basic Math

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Example:

Nominal Rate = 5.00 percent

Expected Inflation = 2.50 percent

Real Rate = 2.44 percent

**Why not 2.50%?**

## The Basic Math

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- Example:

Nominal Rate = 5.00 percent

Expected Inflation = 2.50 percent

Real Rate = 2.44 percent

This, minus one, is called the geometric difference.



$$1 + \text{Nominal} = (1 + \text{Inflation}) \times (1 + \text{Real})$$

$$1 + \text{Real} = (1 + \text{Nominal}) / (1 + \text{Inflation}) = 1.0500 / 1.0250$$

$$1 + \text{Real} = 1.0244 \text{ (rounded)}$$

$$\text{Real} = 2.44 \text{ percent}$$

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$$\text{Real} = 2.44 \text{ percent}$$

Why not 2.50%?  
COMPOUNDING:  
 $1.025 \times 1.025 = 1.0506 \rightarrow 5.06\%$

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## The Basic Math

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- Nominal interest rate is what you read about in the paper, e.g., a 10-year Treasury note yielding 5 percent. Nominal rate compensates for both expected inflation and a required real return.
- Required real return is the real discount rate and is the nominal rate adjusted for expected inflation.
- **Net discount rate is the**
  - **Nominal rate adjusted for nominal wage growth or**
  - **Real rate adjusted for real wage growth**

## Present Value: A Simple Example

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- Income today equals \$50,000
- Real Wage Growth equals 0.5 percent
- Expected Inflation equals 3.0 percent
- Nominal interest rate equals 5.0 percent

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- **Net Discount Rate =  $1.05/(1.03 \times 1.005) - 1 = 1.435$  percent**

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- Nominal Wage Growth = 3.515 percent**
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## Present Value: A Simple Example

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  - Real Discount Rate =  $1.05/1.03 - 1 = 1.942$  percent
  - Net Discount Rate =  $1.05/(1.03 \times 1.005) - 1 = 1.435$  percent
  - **One year out:**
    - Real Income = \$50,000 x 1.005 = \$50,250**
    - Nominal Income = \$50,250 x 1.030 = \$51,758**
- Nominal Wage Growth = 3.515 percent**
-

## Present Value: A Simple Example

- Income today equals \$50,000
- Real Wage Growth equals 0.5 percent
- Expected Inflation equals 3.0 percent
- Nominal interest rate equals 5.0 percent
- Real Discount Rate =  $1.05/1.03 - 1 = 1.942$  percent
- Net Discount Rate =  $1.05/(1.03 \times 1.005) - 1 = 1.435$  percent
- One year out:
  - Real Income =  $\$50,000 \times 1.005 = \$50,250$
  - Nominal Income =  $\$50,250 \times 1.030 = \$51,758$
  - Nominal Income =  $\$50,000 \times 1.03515 = \$51,758$**

Nominal Wage Growth  
=**3.515** percent

## Present Value: A Simple Example

- Present Value of Nominal Income  
 $\$51,758/1.050 = \$49,293$   
**1 + Nominal Discount Rate**
- Present Value of Real Income  
 $\$50,250/1.01942 = \$49,293$   
**1 + Real Discount Rate**
- Present Value of the \$50,000  
 $\$50,000/1.01435 = \$49,293$   
**1 + Net Discount Rate**

## Present Value: A Simple Example

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- Present Value of Nominal Income

$$\$51,758/1.050 = \$49,293$$

1 + Nominal Discount Rate

- Present Value of Real Income

$$\$50,250/1.01942 = \$49,293$$

1 + Real Discount Rate

- Present Value of the \$50,000

$$\$50,000/1.01435 = \$49,293$$

1 + Net Discount Rate

The three approaches are mathematically equivalent, so long as the underlying assumptions about the nominal discount rate, the inflation rate and the real growth rate are consistent.

## Nominal, Real and Net Discount Rates

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**No difference in the result if underlying assumptions are consistent, but is there a difference in the law?**

## **Jones & Laughlin Steel Corp. v. Pfeifer**

**462 U.S. 523 (1983)**

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- Nominal market rate of interest if earnings loss is projected in nominal terms
- Below-market rate of interest if earnings loss does not reflect rate of inflation (i.e., is expressed in real terms)
  - Real interest rate if earnings loss incorporates real wage growth
  - Net discount rate if earnings loss does not incorporate real growth
- Total offset method → zero discount rate → no discounting
  - Rests on assumption that market interest rate is equal to nominal wage growth
  - Can be countered by showing that this assumption is not supported by actual experience

## **Nominal Rate – Pros and Cons**

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- Pros
  - Current nominal rates represent what is available to the plaintiff
  - Juries are more familiar with nominal rates
  - Can match nominal rate to the loss (1-year rate for a loss 1 year out; 2-year rate for a loss 2 years out; and so on)

## Nominal Rate – Pros and Cons

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  - Current nominal rates represent what is available to the plaintiff
  - Juries are more familiar with nominal rates
  - Can match nominal rate to the loss (1-year rate for a loss 1 year out; 2-year rate for a loss 2 years out; and so on)
- Cons
  - Explaining forecast of nominal wage growth or of inflation and real wage growth may be difficult
  - Results are dependent on when you read the meter on current rates
  - Changes incentive to settle if rates are moving against you
  - Atypical yield curve (e.g., very steep or inverted) can amplify the last two types of problems

## Real Discount Rate – Pros and Cons

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- Pros
  - Easily explained as difference between nominal interest rates and inflation
  - No need to forecast inflation if average historical difference is used
  - Allows for different real growth rates for different loss components

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- Pros
  - Easily explained as difference between nominal interest rates and inflation
  - No need to forecast inflation if average historical difference is used
  - Allows for different real growth rates for different loss components
- Cons
  - Difference between nominal interest rates and inflation may not be stable through time
  - Results are dependent on time period chosen
  - Some economists use TIPS – solves the stability problem, but depends on when you read the meter

## Net Discount Rate – Pros and Cons

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- Pros
  - Easily explained as difference between nominal interest rates and nominal wage growth
  - No need to forecast inflation or real growth if average historical difference is used

## Net Discount Rate – Pros and Cons

- Pros
  - Easily explained as difference between nominal interest rates and nominal wage growth
  - No need to forecast inflation or real growth if average historical difference is used
- Cons
  - Average difference between nominal interest rates and wage growth may not be stable through time

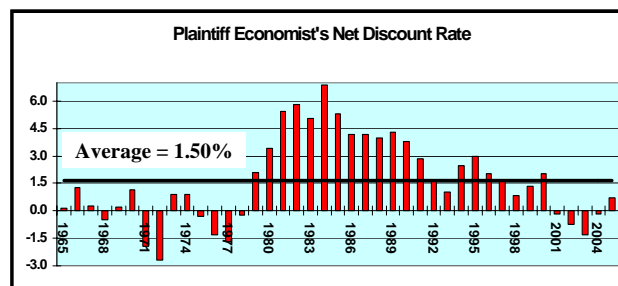
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## Net Discount Rate – Pros and Cons

- Cons
  - Average difference between nominal interest rates and wage growth may not be stable through time **EXAMPLE:**



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## Net Discount Rate – Pros and Cons

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- Pros
  - Easily explained as difference between nominal interest rates and nominal wage growth
  - No need to forecast inflation or real growth if average historical difference is used
- Cons
  - Average difference between nominal interest rates and wage growth may not be stable through time
  - Results are dependent on time period chosen
  - Use of same net discount rate implies same implicit real growth rate for all loss components within a study

## Nominal, Real and Net Discount Rates

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- No difference in the law.
- No difference in the result if underlying assumptions are consistent.
- Question: What should we do?

## Nominal, Real and Net Discount Rates

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- No difference in the result if underlying assumptions are consistent.
- Question: What should we do?
- **Answer:**
  - **Examine the underlying assumptions and**
  - **See if change makes a significant difference in your specific case**

## Examine the Underlying Assumptions

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- Application of net discount rate to loss components with different underlying real growth rates.
  - Lost earnings and lost household services
  - Lost earnings and offsetting earnings
  - Lost earnings and lost pension benefits

## Examine the Underlying Assumptions

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- Application of net discount rate to loss components with different underlying real growth rates.
- **Changed market conditions when a nominal rate is used.**
  - Defense looks for instances in which rates have moved up
  - Plaintiff looks for instances in which rates have moved down

## Examine the Underlying Assumptions

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- Application of net discount rate to loss components with different underlying real growth rates.
- Changed market conditions when a nominal rate is used.
  - Defense looks for instances in which rates have moved up
  - Plaintiff looks for instances in which rates have moved down
    - **Slippery slope:** Why not reevaluate all inputs? Why this case and not another?

## Examine the Underlying Assumptions

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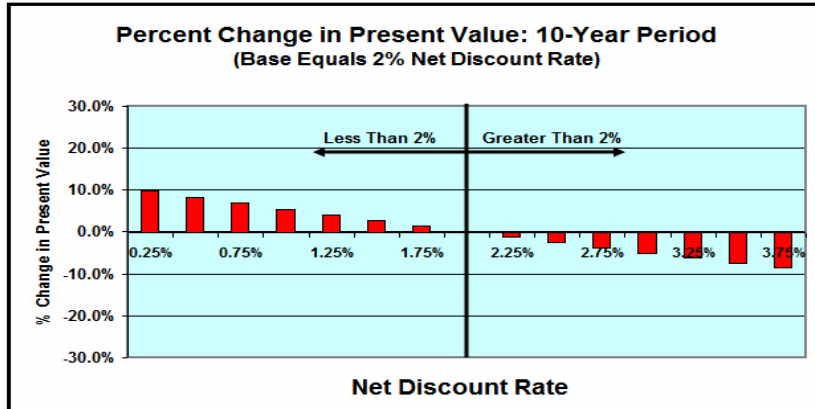
- Application of net discount rate to loss components with different underlying real growth rates.
- Changed market conditions when a nominal rate is used.
- **Validate underlying assumptions concerning nominal wage growth and/or inflation and real wage growth**
  - When historical average is used, look for stability through time
  - Obtain and evaluate claims made about historical growth rates, whether nominal or real
  - Examine source of current inflation forecast and the underlying assumptions

## Does It Make a Significant Difference in the Results?

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- Always look at your specific case
- Answer depends on the change in the discount rate and the time period over which discounting occurs
  - The bigger the change in the discount rate, the bigger the change in the results
  - The longer the time period, the bigger the change in the results
  - Results are asymmetrical
- Also affected by other factors such as survival probabilities, probability of being employed, age-earnings profile, etc.

## Does It Make a Significant Difference in the Results?

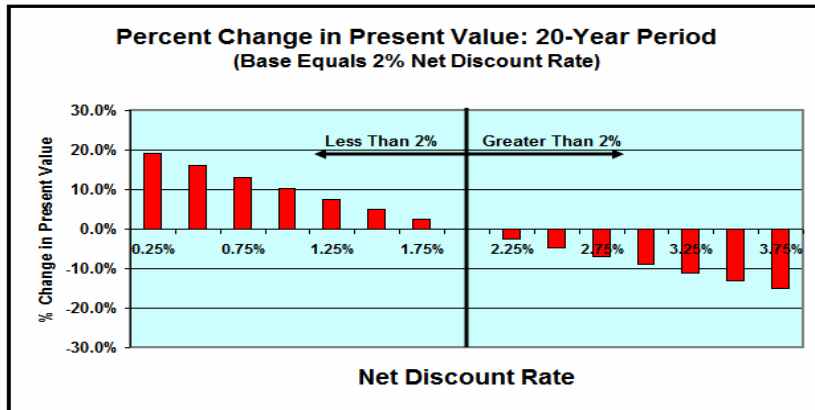


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## Does It Make a Significant Difference in the Results?

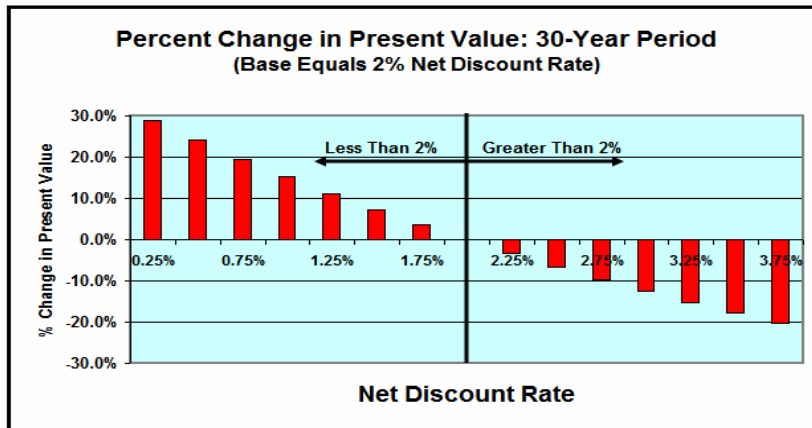


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## Does It Make a Significant Difference in the Results?



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## Does It Make a Significant Difference in the Results?

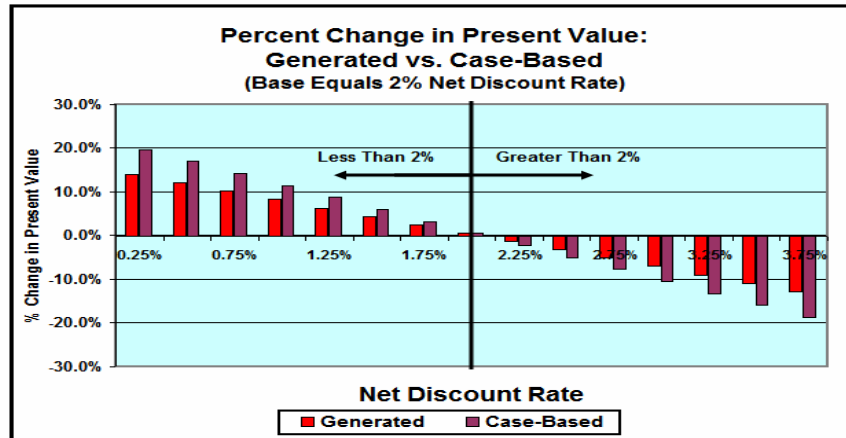
- Previous three graphs based on generated example
- Consistent with analysis of 27 cases I have been involved in
  - Calculated change in damages resulting from increases/decreases of 50 and 100 basis points in whatever discount rate was used
  - Fit a curve expressing the change in damages as a function of the geometric difference in the actual or implied net discount rate
  - Fit the same curve using the generated example of previous three graphs
  - Used the curves to generate similar graphs, ignoring the time dimension

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## Does It Make a Significant Difference in the Results?



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## Let's Use What We've Learned

- Suppose a component of loss is a pension in the form of a \$1,000 per month single-life annuity.
- Suppose the earnings loss was discounted to present value using a 2.5 percent real discount rate and a 0.3 percent real growth rate.
- **Mentally answer the following three questions:**
  - Do we use the 0.3 percent real growth rate to calculate the present value of the pension?
  - Can we use the 2.5 percent real discount rate?
  - Do we have everything we need to calculate the present value of the pension?

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## Let's Use What We've Learned

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- Mentally answer the following three questions:
  - Do we use the 0.3 percent real growth rate to calculate the present value of the pension? **No – the real wage growth has nothing to do with the present value of the pension**
  - Can we use the 2.5 percent real discount rate? **Yes**
  - Do we have everything we need to calculate the present value of the pension? **No**

## Let's Use What We've Learned

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  - Do we have everything we need to calculate the present value of the pension? **No**

**Note that if a Net Discount Rate were used, the real growth rate would be implicitly used to increase the pension.**

## Let's Use What We've Learned

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  - Can we use the 2.5 percent real discount rate? **Yes**
  - Do we have everything we need to calculate the present value of the pension?  
**No**      **What else do we need?**

## Let's Use What We've Learned

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  - Do we use the 0.3 percent real growth rate to calculate the present value of the pension? **No – the real wage growth has nothing to do with the pension**
  - Can we use the 2.5 percent real discount rate? **Yes**
  - Do we have everything we need to calculate the present value of the pension?  
**No**      **What else do we need?**

**A forecast of inflation for as long as the annuity lasts.**

**This inflation rate should be used to decrease the pension payment each year to show decline in real purchasing power.**

## Same Example, but Assume the Pension is Indexed to Inflation

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## Same Example, but Assume the Pension is Indexed to Inflation

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- Mentally answer the following three questions:
  - Do we use the 0.3 percent real growth rate to calculate the present value of the pension? **No – for the same reason**
  - Can we use the 2.5 percent real discount rate? **Yes**
  - Do we have everything we need to calculate the present value of the pension?  
**No – the inflation protection adds value to the annuity that can be measured.**

## Same Example, but Assume the Pension is Indexed to Inflation

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    - Do we use the 0.3 percent real growth rate to calculate the present value of the pension? **No – for the same reason**
    - Can we use the 2.5 percent real discount rate? **Yes**
    - Do we have everything we need to calculate the present value of the pension?  
**No – the inflation protection adds value to the annuity that can be measured.**
- (1) Obtain quote for an inflation-indexed annuity
  - (2) Obtain quote for same annuity that is not inflation-indexed
  - (3) Multiply present value by the ratio of (1) to (2)

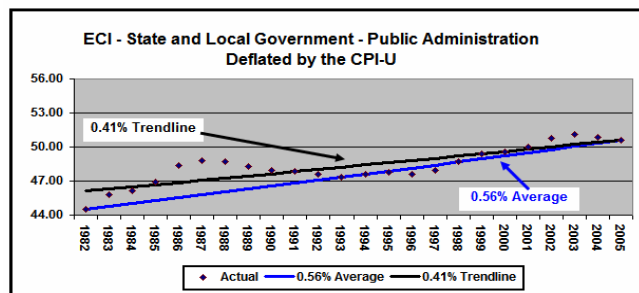
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## Calculating Growth Rates

- Two reasonable approaches
  - Calculate the simple average of annual increases
  - Fit a trendline to the data
- You will generally get comparable results



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## Overstating Growth Rates

- Pick recent quarter as an endpoint – e.g., 2007-Q3
- Calculate compound annual growth from all similar past quarters: 1990-Q3 to 2007-Q3; 1991-Q3 to 2007-Q3; . . .
- Repeat for other recent quarters (2007-Q2, 2007-Q1, 2006-Q4)
- Average all of the resulting annual growth rates
- **Result doesn't describe the data it is based on and overstates the growth rate**

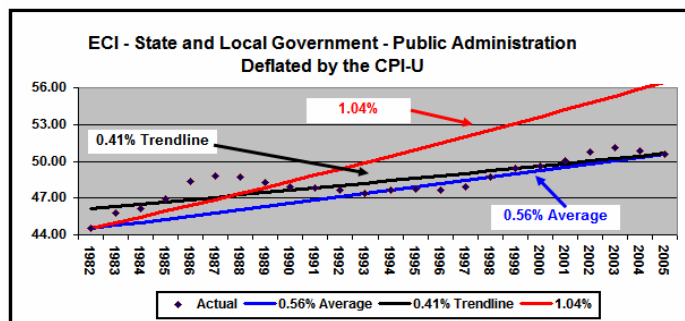
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## Overstating Growth Rates

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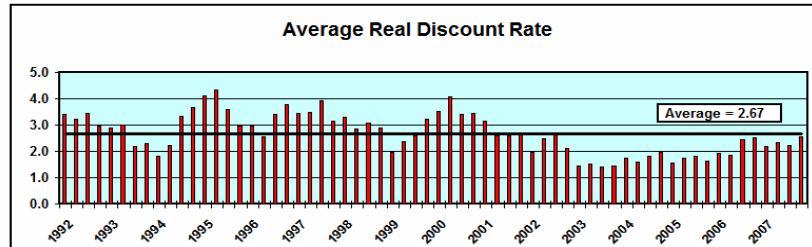
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## Real Discount Rate: What Does Dave Do?

- Historical average of difference between 10-year bond rate and the then-expected 10-year inflation rate



- Still dependent on the time period chosen

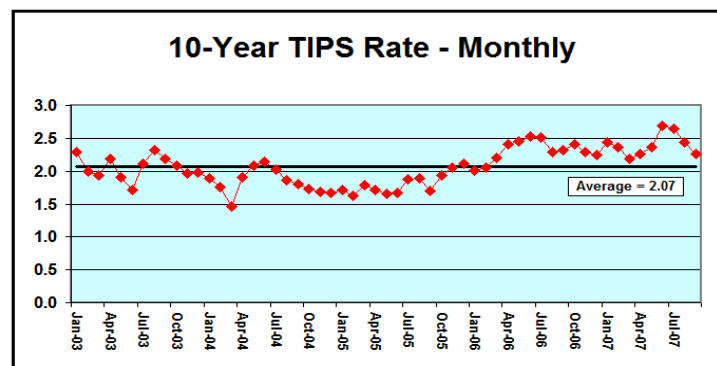
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## Real Discount Rate: What Do Others Do?

- Use yield on TIPS (Treasury Inflation Protected Securities)



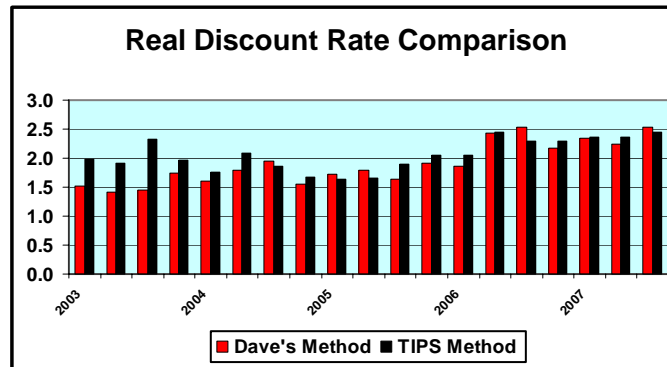
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## Real Discount Rate: What Do Others Do?

**Dave's Average = 1.91%    TIPS Average = 2.06%**  
(Calculated over same time period for the same months.)



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## Last Slide – Everything in a Nutshell

- There is no difference in nominal, real and net discount rates so long as the underlying assumptions about nominal wage growth, inflation and real growth are the same.
- Consider the pros and cons of each method.
- Investigate the impact of a change in the discount rate in your specific case.
- Examine the underlying assumptions.
- In particular, use of the same net discount rate for earnings, lost household services, pensions, etc., should be a red flag.
- Look for implied real growth in a pension when none will occur, and look for proper valuation of inflation-indexed pensions.
- Look for gaming of data in calculating of average growth rates.

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