Simple versus compound interest

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Below are some examples which demonstrate the impact of simple and compound interest on debt, followed by comments.

Equation for calculating simple interest:

$$A = P(1 + rt)$$

A = amount

P = principal

r = rate of interest (in decimal form)

t = length of the loan in years

Equation for calculating compound interest:

$$A = P(1 + r/n)^{nt}$$

A = amount

P = principal

r = rate of interest (in decimal form)

n = number of times interest compounds within one year

t = length of the loan in years

^ = exponential symbol

Examples:

1. Principal = $1,000 Interest (r) = .05 t = 5 years

Simple

A = $1,000 (1 + .05 x 5) = $1,000 (1.25) = $1,250

A = $1,250

Simple interest increases the debt by $250.

Compounded (quarterly):

A = $1,000 (1 + .05/4)^20 = $1,000 (1 + .0125)^20 = $1,000 (1.0125)^20 = $1,000 (1.262) = 1,262

Compounding the interest increases the debt by an additional $12.

2. P = $10,000, other variables unchanged.

Simple

A = $10,000 (1.25) = $12,500

A = $12,500

Compound

A = $10,000 (1.262) = $12,620

Compounding the interest increases the debt by an additional $120.

3. P = $1,000,000,000, other variables unchanged.

Simple

A = $1,000,000,000 (1.25) = $1,250,000,000

A = $1,250,000,000

Compound

A = $1,000,000,000 (1.262) = 1,262,000,000

Compounding the interest increases the debt by an additional $12,000,000.

4. P same as in item 3. Interest rate is increased to 20 percent. Length of loan is still 5 years.

Simple

A = S1,000,000,000 (1 + .2x5) = $1,000,000,000 (2) = $2,000,000,000

A = $2,000,000,000

Compound

A = $1,000,000,000 (1 + .2/4)^20 = $1,000,000,000 (1.05)^20 = $1,000,000,000 (2.653)

A = $2,653,000,000

Compounding the interest increases the debt by an additional $653,000,000.

5. P and r are the same as in item 4; length of loan changed to 25 years.

Simple

A = $1,000,000,000 (1 + .2x25) = $1,000,000,000 (5)

A = $5,000,000,000

Compound

A = $1,000,000,000 (1 + .2/4)^100 = $1,000,000,000 (1 + .05)^100 = $1,000,000,000 (1.05)^100 = $1,000,000,000 (131.501)

A = $13,150,100,000

Compounding the interest increases the debt by an additional $8,150,100,000.

6. An international financial organization representing financial institutions from the five wealthiest nations (based on GDP) loans country A, for whatever reason, $50 billion @ 10 percent interest compounded monthly. Length of the loan is 50 years.

Simple

A = $50,000,000,000 (1 + .1x50)

A = $50,000,000,000 (1 + 5)

A = $300,000,000,000

Compound

A = $50,000,000,000 (1 + .1/12)^600

A = $50,000,000,000 (1 + .0083)^600

A = $50,000,000,000 (1.0083)^600

A = $50,000,000,000 (142.515)

A = $7,125,750,000,000

Compounding the interest increases the debt by an additional $6,825,750,000,000.

7. Conditions are the same as in 6, except that the interest rate now is to 2 percent compounded monthly.

Simple:

A = $50,000,000,000 (1 + .02x50)

A = $50,000,000,000 (1 + 1)

A = $100,000,000,000

Compound

A = $50,000,000,000 (1 + .02/12)^600

A = $50,000,000,000 (1 + 0.0016)^600

A = $50,000,000,000 (2.6096)

A = $130,480,000,000

Even at a 2 percent interest rate, compounding the interest increases the debt by an additional $30,480,000,000.

Comments:

As the mathematics shows, even if the interest is simple, paying off a debt is a difficult challenge. The debt quickly escalates in size. No wonder countries default and have to re-finance their debts. This produces havoc in local economies and political destabilization, as currencies are de-valued, services cut, benefits slashed, and wages depressed. If default occurs, creditors may initiate actions to foreclose. This may entail seizing assets. The purpose of such actions is to force the borrower to agree to terms that will ensure continued payments.

Compound interest is insidious. Its effect is not immediately felt. It sneaks up over time. When the sums involved are relatively small and the interest rate moderate the difference in impact between simple and compound interest is relatively small. But as the above examples show, compound interest on debt can become crushing. This can have dire social and political consequences. Massive lending places both the creditor and debtor nations at risk. Default is always possible. No one benefits from a default. Hence, the goal is to prevent default. Remember, according to the rules of accounting, a debt is an ASSET, which like any other asset has value - as long as the borrower is making payments. The debt

becomes a liability if it is uncollectable. Hence, at the international level creditors will arrange for bail outs, no matter how financially strapped a borrower country, the intent of which is to keep the debt alive so as to protect the creditors from ruin. As of April 2013, the International Monetary Fund had bailed out 41 countries. These countries include Mexico, Poland and Greece. In 2012, the European Union acted to bail out Italy and Spain. In 2006, Great Britain finally paid off its post-war debt to the United States, 61 years after the end of World War Two. In 2006, the Soviet Union and then Russia repaid in full the Soviet Union Lend Lease debt owed to the United States. Some countries have chronic payment problems. Argentina has defaulted on its external debt seven times and on its domestic debt five times since becoming independent. In 2014, the year of Argentina's most recent default, American creditors tried to impound an Argentine warship and the presidential airplane.

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