

# ITRN 501 Class 4

Indexes, comparing prices,  
adjusting data for inflation,  
working in multiple currencies,  
interest and annuities

# Homework review

- Where did you find data?
- What data did you find?
- How did you set up the table(s)
  - Did you follow rules from Gaske and Economist?
- What problems did you encounter and how did you resolve them?

# Re-introduction to Excel

- Navigation
- Formulas
- Loading Analysis Toolpak

# Simple indexes

- A way to show change
  1. Select base
  2. Divide other years by base year and multiply by 100.
    - $(\text{Year Value} / \text{Base Year Value}) * 100$
- Can also do geographic indexes
  - $(\text{subpopulation value} / \text{Population value}) * 100$

# Composite indexes

- Industrial production or price indexes
  - Most famous is the Consumer Price Index
- Index all components, i.e. prices of different goods
- Select weights of components, i.e. proportion of consumption.
- Multiply indexed component by its weight
  - $(\text{Index1} * \text{weight1}) + (\text{Index2} * \text{weight2}) \dots + (\text{IndexN} * \text{WeightN})$

# The wine and cheese example

## Prices and quantities

- 1995
  - wine:  $\$9 \times 5 = \$45$
  - cheese  $\$5 \times 2 = \$10$
- 2000
  - wine  $\$10.50 \times 6 = \$63$
  - Cheese  $\$8 \times 3 = \$24$

## A base weighted index

- Weights from base year are used in subsequent years
- $1995 = 55$  (i.e.  $45 + 10$ )
- $2000 = 68.50$  [i.e.  $(10.50 \times 5) + (8 \times 2)$ ]

## A current weighted index

- Weights from current year are used for past years
- $1995 = 69$  [i.e.  $(6 \times 9) + (3 \times 5)$ ]
- $2005 = 87$  (i.e.  $63 + 24$ )

# Prices inflation

- Nominal value vs. Real value
  - Nominal is “current,” i.e. the value the day it was measured
  - Real is “constant,” i.e. adjusted for inflation over time.
- Price Inflation
  - Consumer price indexes/weighted basket approach
  - Producer price indexes
  - Gold/Commodity prices indexes
  - Export/Import price indexes

# Wage inflation

- Wages and Incomes
  1. Nominal wage
    - Wage/time
  2. Real wage
    - Wage/prices/time
  3. Productivity
    - Wage and costs/output

# Income deflators

- Private expenditure deflator
  - Based on actual expenditures rather than a predetermined basket of goods
    - Good because actual consumption
    - Bad because changing composition affects level
- GDP (national income) deflator
  - Used for broad national comparisons of inflation or comparisons of broad budget or economy numbers.

# Adjusting for inflation

- Use “deflators” to translate nominal values into real values.
- Series of Interest/Re-based deflator series
  1. Essentially turn the deflator (inflation index) into a new index: the initial year of the series of interest becomes the base year.
  2. Divide by the deflator.

**Exercise: Do Excel exercise on page 37-38**

# Deflating nominal values

Year	Manufacturing Wages	CPI (1980= <u>100</u> )	CPI (1970=1)	Real wages
1970	3.35	38.80	1.00	3.35
1980	7.27	82.40	2.12	3.42
1990	10.83	130.70	3.37	3.22
1998	13.49	163.00	4.20	3.21

Note: If deflator does not use 100 as its base you do not need to multiply by 100.

Source: Gaske (2000) page 37

# Exchange rates

- Exchange rate
  - The price of one currency in terms of another, reflecting the demand and supply of currency
- Nominal exchange rates
  - Price of one currency in terms of another
- Effective exchange rates
  - Average exchange rate against a basket of currencies.
- Real exchange rates
  - One of a number of indexes comparing local to foreign competitors' prices
- Terms of trade
  - Export price to import prices (index)
- Purchase Power Parity
  - Relative to local prices for a basket of goods/inflation

# Converting foreign currency values to US dollars

- IF EXR is in local currency unit (LCU) per unit of target currency (\$) e.g. ¥119.4/\$1
  - Local currency units/EXR=target currency
  - Yen/EXR=\$
  - $400Y/119.4Y=\$3.35$
- If EXR is expressed as target currency (\$) per LCU (Yen) i.e. \$0.008/¥1
  - $400Y*.008=\$3.35$

Note:  $1/119.4=.008$

– Do Excel exercise on page 45-46

# Computing cross exchange rates

- Comparing more than one local currency (Yen, Euro) to each other in terms of the target currency (\$).
  - $\text{EXR}^{\text{Yen}/\$} / \text{EXR}^{\text{Euro}/\$}$
  - So  $119.40 / 1.6630 = 71.79$  Yen per Euro
- This is necessary when data are all in dollar (or another currency) and can be useful when comparing a number of currencies to each other or when currencies are linked as in the “ERM” and “ERM2.”

# Exchange rates and time

Date	Amount in mill \$	EXR	Amount in mill Euro
Actual	44	1.01	44.5
Q1 start	44	0.81	35.64
Q1 end	44	1.19	52.36
Annual average	44	1.15	50.60

# Interest

- Simple Interest
  - Interest paid solely on the principal in all periods.
- Compound Interest
  - Interest which itself earns interest, i.e. interest is added to the principal in future periods.
- Interest “in disguise”
  - Lease and rental charges, fees
  - Discount for immediate payment (cash)

# Terminology

- “Gross” and “Net” return – Total return (Gross); Gross return minus initial investment (Net).
- Return on investment – A ratio of net return to total outlay (divide).
- Conversion period – Length of time between interest payments, Frequency of compounding.
- Payback period – Time to recover original outlay
- Effective rate – a rate for a standardized period for comparison
- Discounting – Interest paid in advance
- Future value – The amount that a sum will grow to when invested
- Present value – The sum that would have to be placed on deposit today at a given compound interest rate to generate a given “future value.”

# Terminology: Basis points

- 1 basis point =  $1/100^{\text{th}}$  of a percentage point
- 10 basis points = .10 percentage point
- 25 basis points = .25 percentage point
- 100 basis points = 1.0 percentage point

# Remember

- There are two sides to every deal
- You can look at interest problems as either a borrower or a lender.
  - Sometimes looking at it differently can make it clearer.
    - View a loan as your bank account.
    - View an investment as you car loan.

# Simple interest calculation

1. Principal (PV) = \$1000
  2. Interest rate (r): 12.5%,  $i = 0.125$  (r as a proportion)
  3. Period: annual for five years
- Interest *factor*  $0.125 * 5 = 0.625 = f$
  - Interest *accumulation* factor is  $1 +$  interest factor
    - $(1+f) = 1.625$  for 5 years.
  - $\$1000 * 1.625 = \$1625 =$  Future Value (FV)
  - Simple interest = \$625 (PV\*i or FV-PV)
  - Note if the five year interest rate is 62.5% than annual is 12.5%.

# Compound interest calculation

1.  $PV = \$1000$
  2.  $r = 12.5\%$  annually,  $i = 0.125$  (r as a proportion)
  3. Period quarterly interest for two years
    - $k = \text{no of conversions a year} = 4$
    - $n = \text{total conversion periods} = 8$
- $FV = PV * [1 + (i/k)]^n$
  - $FV = 1000 * [1 + (0.125/4)]^8 = \$1279.12$
  - Amount of compound interest is  $FV - PV = \$279.12$

# Effective interest rate

What annual interest rate would you have to earn to achieve similar returns?

- $r_e$  = Effective interest rate

- $r_e = [1 + (i/k)]^k$

- $[1 + (0.125/4)]^4 = 13.10\%$

12.5% compounded quarterly generates the same return as 13.10% compounded annually

# Note: There are limits to compounding

Conversion Period	Number per year	Value of \$1 after a year \$	$r_e$
Annually	1	1.10	10.00
6 monthly	2	1.1025	10.25
3 Monthly	4	1.1038	10.38
Daily	365	1.1052	10.52
At every moment in time	Infinite	1.1052	10.52

# Discounting

- FV=Full, redemption or payment value
- n=time period (in years)]
- $i=0.075$  ( $r=7.5\%$ )]
- $PV=FV*[1-(i*n)]$ 
  - $\$981.25=1000*[1-(0.075*0.25)]$ 
    - n=a quarter of the year
- Discount  $D=FV-PV$ 
  - $D=18.75$
- $r_e=(D/PV)/n$ 

(note: The formula given on page 41 is in error)]

  - $r_e=(\$18.75/981.25)/0.25=0.0764$  or 7.64%

# Calculating real interest rates

- Two methods

1. Quick and dirty

A 9.32 interest rate minus 5.4 Inflation rate is roughly a 3.92 real interest rate.

2. More accurately

Step 1  $9.32/100+1=1.0932$

Step 2  $5.4/100+1=1.054$

Step 3  $1.0932/1.054=3.72$

**Do Exercise on page 39-40**

# Assignment

- Available at the class website
- Be sure to follow directions.
- You can work with other students and ask me questions.

Bonus reading: For those interested in the financial calculations read chap 12 Money and Financial Markets in the Guide to Economic Indicators