# Real and nominal prices

- Changing money value is like a shrinking meter stick
  - What if two meters today was was the same length as 1.5m twenty years ago?
  - We care about what *really* happened to lengths over time
- When we compare prices over time, we should adjust for inflation: convert nominal price changes to real price changes

# How to adjust for inflation

- Find a price index "P" that indicates how prices in general have changed
  - Estimate the price of a standard "basket" of goods and services
  - Example: consumer price index
  - The CPI index is set to 100 for a chosen base year.
  - With inflation, P values are < 100 for prior years
  - P values are > 100 for subsequent years

# Example bus fares in 1954 and 2012

- $P_{2012}$ = 100; $P_{1954}$ = 11.8
  - Things that cost $11.80 in 1954 cost, on average, $100 in 2012, an increase of (100-11.8)/11.8 = 747%
  - Some items rose more than 747%, some less
- Bus fare, $B_{1954}$ = $0.20; $B_{2012}$ = $2.00
  - In nominal terms, bus fare is up (2.00-0.20)/0.20 = 900%
  - Did the real bus fare rise that much? Did it rise at all?

# Converting nominal to real bus fare

- First approach
  - Express 1954 fare in terms of 2012 dollars: $1.00 in 1954 equals $11.80 in 2012
  - $0.20 x 11.80 = $2.36 in 2012 dollars
  - The real bus fare of 1954 was higher than in 2012 by (2.36-2.00)/2.00 = 18%
- Second approach
  - Express 2012 fare in terms of 1954 dollars: 2.00/11.8 = $0.169 in 1954 dollars
  - The real bus fare of 1954 was higher by (0.20-0.169)/0.169 = 18%

# Converting nominal to real bus fare

- Third approach
  - Compare price level rise to bus fare rise
  - Price level rise was (100-11.8)/11.8 = 747%
  - Bus fare rise was (2.00-0.20)/0.20 = 900%
  - Bus fare increased more than the price level increased
  - The real bus fare has risen

# But buses have changed!

- Bus rides cost more in real terms than in 1954 but have the bus rides changed?
- Buses in 1954:
  - No air conditioning
  - No wheelchair ramps
  - Noisier
  - Lower engine efficiency
  - No Clipper Card

# Two kinds of exchange rate parity

1. Purchasing power parity: currencies have the same purchasing power as measured by
   - Price levels in two countries (p.329)
   - Big Mac prices
2. Interest rate parity: interest rate differences should reflect expected changes in exchange rates

# 1. Purchasing power parity

- Purchasing power parity holds true between two countries if the price level P (or the Big Mac price if you prefer) is the same in both countries, after currency conversion
- US purchasing power: $P_{US}$ = price of a basket of goods/services in US ($/basket)
- US purchasing power: $P_{UK}$ = price of the same basket of goods/services in UK (£/basket)
- XR = nominal exchange rate ($/£)
- RXR = real exchange rate = XR x $P_{UK}/P_{US}$

# Example RXR calculation

- Assume
  - XR is \$1.25/£
  - US price level is $P_{US}$ = \$50/basket
  - UK price level is $P_{UK}$ = £40/basket
- RXR is 1.25\$/£ x £40/\$50 = 1 (no units)
- This means the \$ and £ are at PPP
- Now assume XR changes to 1.50\$/£ while price levels are unchanged
- RXR = 1.50x40/50 = 1.2: £ has depreciated but price levels have not changed

# RXR meaning

- The real exchange rate shows the deviation of an exchange rate from purchasing power parity (PPP)
  - RXR = 1: PPP holds true
  - RXR < 1: under-valued currency
  - RXR > 1: over-valued currency
- Note: Fig. 14.2 curve marked "real exchange rate" is actually the ratio of price levels

# Example RXR calculation

- Now assume
  - XR unchanged at $1.25/£
  - US price level rises $P_{US}$ = $60/basket
  - UK price level is still $P_{UK}$ = £40/basket
- RXR is 1.25$/£ x £40/$60 = 0.83 (no units)
- The £ is under-valued. XR should have increased because of US inflation, to maintain PPP
- If the £ is under-valued, the $ is over-valued. It should have decreased because of inflation
- Historical record in Fig. 14.12. Note: the curve marked "real exchange rate" is actually the ratio of price levels

# Real and nominal interest rates

- Inflation can wipe out most or all of the interest earned on an investment
- Lenders care about the purchasing power of the interest they get: the real interest rate
- Real interest definition: $r = i - \boldsymbol{\pi}$
- Example:
  – Nominal interest rate i = 3% per annum
  – Inflation rate = 4% per annum
  – Real interest rate r = 3-4 = -1% per annum: a loss in purchasing power

# 2. Real interest rate parity

- A differences interest rates in two countries should reflect changes in real exchange rate ("interest rate parity")
- $r_{UK} - r_{US} = E[\%\Delta RXR]$
  - $r_{UK}$ is the interest rate in UK (%)
  - $r_{US}$ is the comparable interest rate in US (%)
  - $\%\Delta RXR$ is the percent change in real exchange rate
  - $E[\%\Delta RXR]$ is the *expected* percent change in RXR during the next year

# Why is this?

- If US bond buyers expect the £ to depreciate by 2% over the coming year, they will want 2% more interest on UK bonds to compensate for declining $ value of their investment
- Example: if interest rate parity holds true and we observe $r_{US}$ = 3% and the £ is expected to depreciate by 2% next year, then we should see $r_{UK}$ = 5% so that $r_{UK} – r_{US}$ = E[%ΔRXR] = 5%-3% = 2%

# How do we find E[%ΔRXR] ?

- Answer: the one-year forward market ($/£) XR relative to the spot XR tells us
- Example:
  - spot $1.25/£
  - one-year forward $1.28/£, a 2.4% rise
  - UK interest rate should be 2.4% higher than US for interest rate parity to hold true
- This is approximate because of carrying costs and fees