Chapter 19 Returns, Index Numbers, and Inflation

Solutions

1. The total interest you paid is , which corresponds to an annual interest payment of .



* 1. The income yield is



* 1. The capital gains yield is



* 1. The total return on the investment is the sum of the income and capital gains yields, that is, .



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* 1. The nominal return for year 2 is = 0.0630, or 6.30%. The nominal rate of return for year 3 is ―7.18%.



* 1. For year 2, the real return is , or 3.40%. For year 3, the real return is , or ―8.64%.



* 1. The total rate of return is .



* 1. The real rate of return is .



* 1. The total market value of the 1,000 shares at end of the year is and total dividend is . Bill’s total return on the investment is .



* 1. The dollar *gain* from the investment is of $17,100, that is, $17,100 ×0.8129 = $13,901.



* 1. We use the Fisher equation to derive the implied inflation rate as = .



* 1. Given the implied inflation rate of 2.35%, the nominal return of the conventional CD will equal the expected nominal return of the Inflation Plus CD. Therefore, each CD will have an expected dollar value of , for a total of $10,460 × 2 = $20,920.



* 1. The real return of the Inflation Plus CD is the promised 2.2% whereas the real return of the conventional CD will be Therefore, the conventional CD turns out to be a better investment. This happens since the inflation rate of 2.2% is below the implied inflation rate of 2.35%, shown in part a.



1. We use the adjusted close prices to compute the monthly return as



|  |  |  |
| --- | --- | --- |
| Date | Adjusted Close Price | Monthly return |
| Dec-10 | $21.48 | 0.0238 |
| Nov-10 | $20.98 | 0.0634 |
| Oct-10 | $19.73 | - |

The monthly returns for November and December 2010 are 6.34% and 2.38%, respectively.

1. We use the adjusted close prices to compute the monthly return as



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | J&J | Return J&J | Caterpillar | Return Cat. |
| Mar-11 | 60.70 | -1.20% | 99.86 | -2.98% |
| Feb-11 | 61.44 | 3.73% | 102.93 | 6.10% |
| Jan-11 | 59.23 | -3.38% | 97.01 | 4.07% |
| Dec-10 | 61.30 | 0.49% | 93.22 | 10.71% |
| Nov-10 | 61.00 | -2.60% | 84.20 | 7.63% |
| Oct-10 | 62.63 | - | 78.23 | - |

The monthly returns for Johnson and Johnson and Caterpillar are in their respective columns. For instance, the monthly returns for January 2011 are -3.38% for Johnson and Johnson and 4.07% for Caterpillar. In general Caterpillar has provided a much better return than Johnson and Johnson in the above period.

* 1. The simple price index for period *t* is calculated as where represents the price in the base year 1994. For 1995, we derive the price index as . Others are derived similarly.



|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
| Price | 62 | 60 | 64 | 67 | 66 | 70 | 74 | 72 | 70 |
| Price Index | 100.00 | 96.77 | 103.23 | 108.06 | 106.45 | 112.90 | 119.35 | 116.13 | 112.90 |

* 1. With a base year of 1994, the price index for 1998 is 106.45. It implies that prices rose by 6.45% from 1994 to 1998.
  2. The updated price index is calculated as . For 2004, we update the price index as . Others are updated similarly.



|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
| Old Price Index (Base = 2004) | 100 | 102.2 | 106.3 | 110.8 | 109.4 | 107.2 | 108.9 | 110.5 | 114.7 |
| Updated Index  (Base 2008) | 91.41 | 93.42 | 97.17 | 101.28 | 100.00 | 97.99 | 99.54 | 101.01 | 104.84 |

* 1. The old index value of 114.7 in 2012, with a base of 2004, suggests that prices increased by 14.7% from 2004 to 2012.
  2. The updated index value of 104.84 in 2012, with a base of 2008, suggests that prices increased by 4.84% from 2008 to 2012.
  3. The simple price index for each product in period *t* is calculated as where represents the price in the base year 2008. For Product 1 in 2009, we derive the price index as . Others are derived similarly.



|  |  |  |  |
| --- | --- | --- | --- |
|  | Simple Price Index | | |
| Year | Product 1 | Product 2 | Product 3 |
| 2008 | 100.00 | 100.00 | 100.00 |
| 2009 | 104.20 | 98.56 | 102.21 |
| 2010 | 108.39 | 99.28 | 98.90 |

* 1. Relative to 2008, the price of Product 1 increased by 4.20% and 8.39% respectively in 2009 and 2010, whereas the price of Product 2 decreased by 1.44% and 0.72% for the same years. Relative to 2008, the price of Product 3 increased by 2.21% in 2009 and decreased by 1.10% in 2010.
  2. The unweighted aggregate price index for period *t* is calculated as , where represents the prices in the base year 2008. For 2009, we derive the unweighted price index as . Others are derived similarly.



|  |  |  |
| --- | --- | --- |
| Year |  | Unweighted aggregate  price index |
| 2008 | $46.30 | 100.00 |
| 2009 | $47.10 | 101.73 |
| 2010 | $47.20 | 101.94 |

As compared with 2008, the prices of the three products, increased by 1.73% and 1.94% in 2009 and 2010, respectively.

* 1. The Laspeyres price index for period *t* is calculated as where represents the quantities in the base period 2008.



|  |  |  |
| --- | --- | --- |
| Year |  | Laspeyres price index |
| 2008 | 44,094.60 | 100.00 |
| 2009 | 44,787.80 | 101.57 |
| 2010 | 45,014.00 | 102.09 |

The Laspeyres price index indicates that relative to 2008, the prices of the three products increased by 1.57% in 2009 and increased by 2.09% in 2010.

* 1. The Paasche price index for period *t* is calculated as , where represents the quantities in the current period 2010.



|  |  |  |
| --- | --- | --- |
| Year |  | Paasche price index |
| 2008 | 34594.00 | 100.00 |
| 2009 | 34744.00 | 100.43 |
| 2010 | 34471.00 | 99.64 |

The Paasche price index indicates that relative to 2008, the prices of the three products increased by 0.43% in 2009 and decreased by 0.36 in 2010.

* 1. The simple price index for period *t* is calculated as where represents the price in the base month January.



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Jan | Feb | Mar | Apr | May | Jun |
| Price | 3.25 | 3.18 | 3.56 | 3.82 | 3.97 | 4.48 |
| Simple Price index | 100.00 | 97.85 | 109.54 | 117.54 | 122.15 | 137.85 |
|  |  |  |  |  |  |  |
| Month | Jul | Aug | Sep | Oct | Nov | Dec |
| Price | 4.46 | 4.16 | 3.79 | 3.39 | 2.46 | 1.82 |
| Simple Price index | 137.23 | 128.00 | 116.62 | 104.31 | 75.69 | 56.00 |

Relative to January, the price of regular gasoline in California peaked in June with a price increase of 37.85%, whereas it decreased by 44% in December of the same year.

* 1. As mentioned above, given the price index of 137.85 in June, the percentage change in price, from January to June 2008 is 37.85%.
  2. The simple price index for period *t* is calculated as where represents the price in the base month January.



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Jan | Feb | Mar | Apr | May | Jun |
| Price | 16.6 | 15.8 | 18 | 19.8 | 20.6 | 23.4 |
| Simple Price index | 100.00 | 95.18 | 108.43 | 119.28 | 124.10 | 140.96 |
|  |  |  |  |  |  |  |
| Month | Jul | Aug | Sep | Oct | Nov | Dec |
| Price | 23.2 | 24.4 | 25.5 | 27.5 | 29.2 | 30.3 |
| Simple Price index | 139.76 | 146.99 | 153.61 | 165.66 | 175.90 | 182.53 |

* 1. Given the price index of 139.76 in July, the percentage change in price, from January to July is 39.76%.
  2. Given the price index of 182.53 in December, the percentage change in price, from January to December is 82.53%.
  3. The simple price index for period *t* is calculated as where represents the price in the base year 2004.



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Tuition | $36,850 | $39,844 | $42,634 | $44,556 | $46,784 | $48,650 |
| Simple Price index (Base = 2004) | 100.00 | 108.12 | 115.70 | 120.91 | 126.96 | 132.02 |

* 1. The updated price index is calculated as ×100.



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Simple Price index (Base = 2004) | 100.00 | 108.12 | 115.70 | 120.91 | 126.96 | 132.02 |
| Updated Price Index (Base = 2007) | 82.70 | 89.42 | 95.69 | 100.00 | 105.00 |  |

* 1. Relative to 2004 tuition rate, the 2007 tuition rate increased by 20.91%.

Relative to 2007 tuition rate, the 2009 tuition rate increased by 9.19% (or 32.02% relative to 2004 tuition rate).

* 1. Monthly quantities of each fund is obtained by dividing $250 by the monthly price of the asset. For example, for EqInc in January, we calculate the quantity as $250/$14.77 = 16.93. Others are calculated similarly.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | EqInc | | Bond | |
| Month | Price | Quantity | Price | Quantity |
| January | 14.77 | 16.93 | 4.47 | 55.93 |
| February | 12.93 | 19.33 | 4.49 | 55.68 |
| March | 14.14 | 17.68 | 4.53 | 55.19 |
| April | 16.04 | 15.59 | 4.58 | 54.59 |
| May | 16.87 | 14.82 | 4.64 | 53.88 |
| June | 16.89 | 14.80 | 4.66 | 53.65 |
| July | 18.4 | 13.59 | 4.72 | 52.97 |
| August | 19.45 | 12.85 | 4.75 | 52.63 |
| September | 19.92 | 12.55 | 4.78 | 52.30 |
| October | 19.53 | 12.80 | 4.8 | 52.08 |
| November | 20.6 | 12.14 | 4.85 | 51.55 |
| December | 20.99 | 11.91 | 4.82 | 51.87 |

The Laspeyres price index for period *t* is calculated as where represents the quantities in the base month January.



|  |  |  |
| --- | --- | --- |
| Month |  | Laspeyres price index |
| January | 500.06 | 100.00 |
| February | 470.03 | 93.99 |
| March | 492.75 | 98.54 |
| April | 527.72 | 105.53 |
| May | 545.12 | 109.01 |
| June | 546.58 | 109.30 |
| July | 575.50 | 115.09 |
| August | 594.96 | 118.98 |
| September | 604.59 | 120.90 |
| October | 599.11 | 119.81 |
| November | 620.02 | 123.99 |
| December | 624.94 | 124.97 |

The Laspeyres price index suggests that the prices of the mutual funds in December were 24.97% higher than what they were in January.

* 1. The Paasche price index for period *t* is calculated as , where represents the quantities in the current period December.



|  |  |  |
| --- | --- | --- |
| Month |  | Paasche price index |
| January | 407.77 | 100.00 |
| February | 386.89 | 94.88 |
| March | 403.38 | 98.92 |
| April | 428.60 | 105.11 |
| May | 441.60 | 108.30 |
| June | 442.87 | 108.61 |
| July | 463.97 | 113.78 |
| August | 478.03 | 117.23 |
| September | 485.19 | 118.99 |
| October | 481.58 | 118.10 |
| November | 496.92 | 121.86 |
| December | 500.00 | 122.62 |

The Paasche price index suggests that the prices of the mutual funds in December were 22.62% higher than what they were in January.

* 1. The results of the two indices are different because the Laspeyres price index uses the base year quantities where as the Paasche price index uses the current year quantities. The base year quantities (16.93 and 55.93) are higher than the current year quantities (11.91 and 51.87), perhaps due to price increases, resulting in the higher value of the Laspeyres price index as compared to the Paasche price index.
  2. The simple price index for period *t* is calculated as where represents the price in the base year 2007.



|  |  |  |  |
| --- | --- | --- | --- |
|  | Simple Price Index | | |
| Year | Omelet | Pancakes | Cereal |
| 2007 | 100.00 | 100.00 | 100.00 |
| 2008 | 110.53 | 121.43 | 114.29 |
| 2009 | 105.26 | 128.57 | 121.43 |

Relative to 2007, the price of omelet, pancake, and cereal increased by 5.26%, 28.57%, and 21.43%, respectively in 2009.

* 1. The unweighted aggregate price index for period *t* is calculated as , where represents the prices in the base year 2007.



|  |  |  |
| --- | --- | --- |
| Year |  | Unweighted Aggregate Price Index |
| 2007 | 11.75 | 100.00 |
| 2008 | 13.5 | 114.89 |
| 2009 | 13.75 | 117.02 |

Relative to 2007, the prices of the three breakfast items increased by 14.89% and 17.02% in 2008 and 2009, respectively.

* 1. The Laspeyres price index for period *t* is calculated as where represents the quantities in the base period 2007.



|  |  |  |
| --- | --- | --- |
| Year |  | Laspeyres Price Index |
| 2007 | 80.455 | 100.00 |
| 2008 | 92.29 | 114.71 |
| 2009 | 92.58 | 115.07 |

Relative to 2007, the prices of the three breakfast items increased by 14.71% and 15.07% in 2008 and 2009, respectively.

* 1. The Paasche price index for period *t* is calculated as , where represents the quantities in the current period 2007.



|  |  |  |
| --- | --- | --- |
| Year |  | Paasche Price Index |
| 2007 | 86.95 | 100.00 |
| 2008 | 99.625 | 114.58 |
| 2009 | 99.66 | 114.62 |

Relative to 2007, the prices of the three breakfast items increased by 14.58% and 14.62% in 2008 and 2009, respectively.

* 1. The simple price index for period *t* is calculated as where , for each region, represents the price in the base year2007 .



|  |  |  |  |
| --- | --- | --- | --- |
|  | Simple Price Index | | |
| Region | 2007 | 2008 | 2009 |
| Northeast | 100.00 | 94.24 | 83.55 |
| Midwest | 100.00 | 93.25 | 88.29 |
| South | 100.00 | 94.74 | 86.47 |
| West | 100.00 | 80.61 | 65.46 |

* 1. The most severe drop is in the West where home prices in 2009 are 65.46% of what they were in 2007. The least severe drop is in the Midwest, where home prices in 2009 are 88.29% of what they were in 2007.

* 1. The Laspeyres price index for period *t* is calculated as where represents the quantities in the base period 2007.



|  |  |  |
| --- | --- | --- |
| Year |  | Laspeyres price index |
| 2007 | 1274894.40 | 100.00 |
| 2008 | 1150743.90 | 90.26 |
| 2009 | 1019805.50 | 79.99 |

According to the Laspeyres price index, home prices in the US are 90.26% and 79.99% in 2008 and 2009, respectively, of what they were in 2007.

* 1. The Paasche price index for period *t* is calculated as , where represents the quantities in the current period 2009.



|  |  |  |
| --- | --- | --- |
| Year |  | Paasche price index |
| 2007 | 1194571.20 | 100.00 |
| 2008 | 1069137.70 | 89.50 |
| 2009 | 941971.90 | 78.85 |

According to the Paasche price index, home prices in the US are 89.50. and 78.85% in 2008 and 2009, respectively, of what they were in 2007.

* 1. The results of the two indices are different because the Laspeyres price index uses the base year (2007) quantities where as the Paasche price index uses the current year (2009) quantities. The base year quantities are higher than the current year quantities, perhaps due to price increases, resulting in the higher value of the Laspeyres price index as compared to the Paasche price index.

1. The real value is calculated as .



|  |  |  |
| --- | --- | --- |
| Nominal Value | Price Index | Real Value |
| 32 | 100 | 32.00 |
| 37 | 102 | 36.27 |
| 39 | 103 | 37.86 |
| 42 | 108 | 38.89 |

The real value is lower than the nominal value whenever the price index exceeds 100.

1. The percentage change in return *R*, is . We use the Fisher equation to find the return in real terms as



1. The nominal revenue equals the real revenue in the initial period since the relevant price index is 100. In the next period, the real revenue increases to , resulting in an increase of



* 1. The inflation rate for 2008 is



* 1. The real value is calculated as: .



|  |  |  |  |
| --- | --- | --- | --- |
| Year | Nominal Value | Price Index | Real Value |
| 2007 | 38 | 112 | 33.93 |
| 2008 | 40 | 120 | 33.33 |

The percentage change, using the real values, is .



1. The real value is calculated as: . The nominal and real values are shown in the table below.



|  |  |  |  |
| --- | --- | --- | --- |
| Year | Nominal Value | Price Index | Real values |
| 2009 | 38 | 100 | 38.00 |
| 2010 | 40 | 103 | 38.83 |
| 2011 | 42 | 112 | 37.50 |

The percentage change in nominal values from 2009 to 2010 is . The corresponding percentage change in real values is . The percentage increase in the nominal value is higher since it does not incorporate the change in prices which reduces the value in real terms.



* 1. The percentage change in nominal terms from 2010 to 2011 is . The corresponding percentage change in real values is . Again, the percentage increase in the nominal value is higher since it does not incorporate the change in prices which reduces the value in real terms.



* 1. The inflation rate for 2010 is .



The inflation rate for 2011 is .



* 1. The number of times sales were below that of the previous month is five. These were in months March, April, July, September, and December.
  2. The real value is calculated as: . The nominal and real values are shown in the table below.



|  |  |  |  |
| --- | --- | --- | --- |
| Month | Sales | PPI | Real Sales |
| January | 340,439 | 171.2 | 198,854.56 |
| February | 342,356 | 170.9 | 200,325.34 |
| March | 339,228 | 169.6 | 200,016.51 |
| April | 338,344 | 170.6 | 198,325.91 |
| May | 339,873 | 170.6 | 199,222.16 |
| June | 342,912 | 173.7 | 197,416.23 |
| July | 342,489 | 171.6 | 199,585.66 |
| August | 350,800 | 174.1 | 201,493.39 |
| September | 343,687 | 173.3 | 198,319.10 |
| October | 347,641 | 174 | 199,793.68 |
| November | 354,467 | 176.6 | 200,717.44 |
| December | 353,817 | 177.3 | 199,558.38 |

The number of times real sales were below that of the previous month is still five but in March, April, June, September, and December.

* 1. The total percentage change in 2009, using the nominal sales in January and December, is .



The total percentage change in 2009, using the real sales in January and December, is .



The percentage increase is higher in the nominal values since it does not incorporate the change in prices which reduces the value in real terms.

* 1. Economists may feel some optimism because the sales have increased in real terms, even though the increase has been rather small.

1. We calculate the inflation rate (%) as .



|  |  |  |
| --- | --- | --- |
| Year | CPI | Inflation Rate (%) |
| 2001 | 120.1 | - |
| 2002 | 119 | ―0.92 |
| 2003 | 118.7 | ―0.25 |
| 2004 | 118.7 | 0.00 |
| 2005 | 118.3 | ―0.34 |
| 2006 | 118.7 | 0.34 |
| 2007 | 118.7 | 0.00 |
| 2008 | 120.3 | 1.35 |
| 2009 | 118.7 | ―1.33 |

Inflation in Japan has been negative four times, which supports the deflation claim.

* 1. The real earnings are in the last column of the following table. They are calculated as: .



|  |  |  |  |
| --- | --- | --- | --- |
| Month | Earnings | CPI | Real Earnings |
| January | 21.25 | 173.3 | 12.26 |
| February | 21.29 | 173.9 | 12.24 |
| March | 21.43 | 175.8 | 12.19 |
| April | 21.43 | 176.5 | 12.14 |
| May | 21.52 | 178.8 | 12.04 |
| June | 21.6 | 181.5 | 11.90 |
| July | 21.66 | 183.7 | 11.79 |
| August | 21.74 | 181.9 | 11.95 |
| September | 21.8 | 182 | 11.98 |
| October | 21.84 | 177.3 | 12.32 |
| November | 21.93 | 172.3 | 12.73 |
| December | 21.96 | 169.4 | 12.96 |

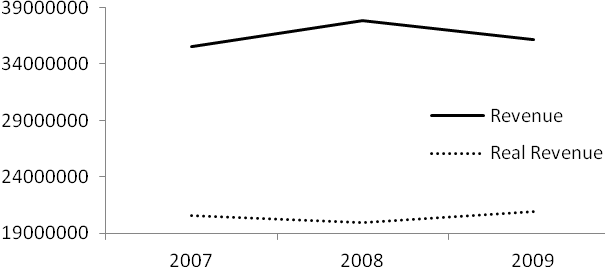
|  |  |  |
| --- | --- | --- |
| Month | Nominal % Change | Real % Change |
| January | - | - |
| February | 0.19 | -0.16 |
| March | 0.66 | -0.43 |
| April | 0.00 | -0.40 |
| May | 0.42 | -0.87 |
| June | 0.37 | -1.12 |
| July | 0.28 | -0.92 |
| August | 0.37 | 1.36 |
| September | 0.28 | 0.22 |
| October | 0.18 | 2.84 |
| November | 0.41 | 3.33 |
| December | 0.14 | 1.85 |

* 1. As expected, given the increase in the price index, the change in the real values is smaller than the change in the nominal values. The nominal percentage change is mostly positive, indicating that the consumers were better off throughout 2008 in $ terms. However, the negative values of the real percentage change suggests that the purchasing power of the consumers was reduced.

* 1. The real revenue is shown in the last column of the following below. It is calculated as .



|  |  |  |  |
| --- | --- | --- | --- |
| Year | Revenue | PPI  (1982 = 100) | Real Revenue |
| 2007 | $35,510,000 | 172.7 | $20,561,667.63 |
| 2008 | $37,843,000 | 189.6 | $19,959,388.19 |
| 2009 | $36,149,000 | 172.9 | $20,907,460.96 |



As shown in the graph, the nominal revenue increased and the real revenue decreased in 2008. In 2009, the trend was reversed.

1. The average teachers salary in real terms is shown in the last column of the following table. It is calculated as .



|  |  |  |  |
| --- | --- | --- | --- |
| Year | Salary | CPI (1982-84 =100) | Real Salary |
| 2006 | $46,797 | 201.59 | $23,213.95 |
| 2007 | $48,310 | 207.34 | $23,299.89 |
| 2008 | $46,797 | 215.3 | $21,735.72 |

The percentage change in the dollar value (nominal) as well as the purchasing power (real) of salaries is shown below.

|  |  |  |
| --- | --- | --- |
| Year | % Nominal Salary | % Real Salary |
| 2006 | - | - |
| 2007 | 3.23 | 0.37 |
| 2008 | -3.13 | -6.71 |

As expected, given the increase in the price index, the change in the real values is smaller than the change in the nominal values. In 2008, the average teachers salary decreased both in nominal and real terms.

1. The inflation rate in 2009 is. The negative inflation rate implies that the prices in 2009 were 99.65% of what they were in 2008. The starting salary in 2009 must decrease in order to adjust for a reduced cost of living. Therefore, the 2009 starting salary must be reduced to .



* 1. Kim's investment return on each bond is



* 1. Kim invested a total of $20,000 on 20 bonds of $ 1000 each. Her total dollar gain is . So her initial investment of $20,000 is now worth $21,200, ignoring the impact of inflation.



* 1. The simple price index for period *t* is calculated as where represents the price in the base month October, 2009.



|  |  |  |
| --- | --- | --- |
| Date | Adjusted Close Price | Simple price index (Base = Oct 09) |
| Oct-09 | 78.89 | 100.00 |
| Nov-09 | 78.54 | 99.56 |
| Dec-09 | 84.16 | 106.68 |
| Jan-10 | 77.00 | 97.60 |
| Feb-10 | 74.83 | 94.85 |
| Mar-10 | 79.56 | 100.85 |

* 1. The updated price index is calculated as .



|  |  |  |
| --- | --- | --- |
| Date | Adjusted Close Price | Updated index (Base = Jan 2010) |
| Oct-09 | 78.89 | 102.46 |
| Nov-09 | 78.54 | 102.00 |
| Dec-09 | 84.16 | 109.30 |
| Jan-10 | 77.00 | 100.00 |
| Feb-10 | 74.83 | 97.19 |
| Mar-10 | 79.56 | 103.33 |

* 1. Given the index value of 106.68 in December 09(Base = Oct 09), the percentage price increase from October 2009 to December 2009 is 6.68%.
  2. Given the index value of 103.33 in March 10 (Base = Jan 10), the percentage price increase from January 2010 to March 3.33%.
  3. The simple price index for period *t* is calculated as where represents the price in the base year 2002.

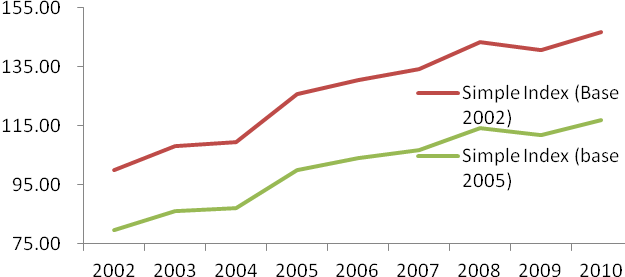


|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Price | 3.2 | 3.46 | 3.51 | 4.02 | 4.18 | 4.3 | 4.59 | 4.5 | 4.7 |
| Price Index | 100 | 108.13 | 109.69 | 125.63 | 130.63 | 134.38 | 101 | 140.63 | 146.88 |

* 1. The updated price index is calculated as .



|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Price Index | 100 | 108.13 | 109.69 | 125.63 | 130.63 | 134.38 | 101 | 140.63 | 146.88 |
| Updated Index | 79.60 | 86.07 | 87.31 | 100.00 | 103.98 | 106.97 | 80.40 | 111.94 | 116.92 |



While the units of the two graphs are different, the basic shape is similar. This shows that the main purpose of index numbers is to provide an easy interpretation of the changes of the series over time.

* 1. The simple price index for period *t* is calculated as where represents the price in the base year 2009.



|  |  |  |  |
| --- | --- | --- | --- |
|  | Simple Price Index (Base = 2009) | | |
| Year | Product 1 | Product 2 | Product 3 |
| 2009 | 100.00 | 100.00 | 100.00 |
| 2010 | 105.26 | 97.87 | 106.67 |
| 2011 | 110.53 | 104.26 | 124.44 |

Relative to 2009, the price of Product 1 increased by 5.26% in 2010 and by 10.53% in 2011. For Product 2, relative to 2009, it decreased by 2.13% in 2010 and increased by 4.26% in 2011. Relative to 2009, the price index of Product 3 also shows the highest increases of 6.67% in 2010 and 24.44% in 2011.

* 1. The unweighted aggregate price index for period *t* is calculated as , where represents the prices in the base year 2009.



|  |  |  |
| --- | --- | --- |
| Year |  | Unweighted aggregate  price index |
| 2009 | 177 | 100.00 |
| 2010 | 180 | 101.69 |
| 2011 | 196 | 110.73 |

Relative to 2009, the prices of the three products, increased by 1.69% in 2010 and by 10.73% in 2011.

* 1. The Laspeyres price index for period *t* is calculated as where represents the quantities in the base period 2009.



|  |  |  |
| --- | --- | --- |
| Year |  | Laspeyres price index |
| 2009 | 8588 | 100.00 |
| 2010 | 8848 | 103.03 |
| 2011 | 9604 | 111.83 |

* 1. The Paasche price index for period *t* is calculated as , where represents the quantities in the current period 2011.



|  |  |  |
| --- | --- | --- |
| Year |  | Paasche price index |
| 2009 | 7328 | 100.00 |
| 2010 | 7528 | 102.73 |
| 2011 | 8148 | 111.19 |

* 1. The results of the two indices are different because the Laspeyres price index uses the base year (2009) quantities where as the Paasche price index uses the current year (2011) quantities. The base year quantities are higher than the current year quantities, perhaps due to price increases, resulting in the higher value of the Laspeyres price index as compared to the Paasche price index.
  2. The unweighted aggregate price index for period *t* is calculated as , where represents the prices in the base year 2005.



|  |  |  |
| --- | --- | --- |
| Year |  | Unweighted aggregate  price index |
| 2005 | 233.09 | 100.00 |
| 2006 | 475.34 | 203.93 |
| 2007 | 553.66 | 237.53 |

The unweighted aggregate price index shows that relative to 2005, Lindsay’s investment increased by 103.93% in 2006 and 137.53% in 2007.

* 1. The Laspeyres price index for period *t* is calculated as where represents the quantities in the base period 2005.



|  |  |  |
| --- | --- | --- |
| Year |  | Laspeyres price index |
| 2005 | 33475 | 100.00 |
| 2006 | 59378 | 177.38 |
| 2007 | 69064 | 206.32 |

The Laspeyres price index shows that relative to 2005, Lindsay’s portfolio increased by 77.38% in 2006 and by 106.32% in 2007.

* 1. The unweighted price index gave equal weights to the prices of Google, Microsoft, and Nokia even though Lindsay owned 100 shares of Google, 300 shares of Microsoft, and 500 shares of Nokia. The unweighted price index values are high due the spectacular price appreciation of Google. The Laspeyres price index values are lower since it used quantities in its calculation.

1. The simple price index for period *t* is calculated as where represents the price in the base year 2006.



|  |  |  |
| --- | --- | --- |
|  | Simple price index(Base = 2006) | |
| Year | Net Revenue | Net Income |
| 2006 | 100.00 | 100.00 |
| 2007 | 108.59 | 16.98 |
| 2008 | 72.17 | -130.66 |
| 2009 | 75.72 | -7.55 |

1. Relative to 2006, Net Revenue increased by 8.59% in 2007, decreased by 27.83% in 2008, and decreased by 24.28% in 2009.
2. Relative to 2006, Net Income decreased by 83.02% in 2007, decreased by 230.66% in 2008, and decreased by 107.55% in 2009.
   1. We use PPI to deflate the net revenue as



|  |  |  |  |
| --- | --- | --- | --- |
| Year | Net Revenue | PPI  (1982 = 100) | Real Net Revenue |
| 2006 | 146.6 | 164.8 | 88.96 |
| 2007 | 159.2 | 172.7 | 92.18 |
| 2008 | 105.8 | 189.6 | 55.80 |
| 2009 | 111.0 | 172.9 | 64.20 |

* 1. We use CPI to deflate the net income as



|  |  |  |  |
| --- | --- | --- | --- |
| Year | Net Income | CPI  (1982-84 =100) | Real Net Income |
| 2006 | 21.2 | 201.59 | 10.52 |
| 2007 | 3.6 | 207.34 | 1.74 |
| 2008 | -27.7 | 215.3 | -12.87 |
| 2009 | -1.6 | 214.54 | -0.75 |

* 1. The rate of return is



* 1. We use CPI to compute the inflation rate for 2009 as



* 1. We use the Fisher's equation to compute the real return rate as = The real interest is higher than the nominal return because of the deflation.



* 1. We find real adjusted price as The percentage change in the real adjusted price is computed as usual. Note: We did not round the real adjusted price in computing the real return.



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | Adjusted Price | CPI (Base 1982-1984) | Real Adjusted Price | Real Return |
| January, 2008 | 8.94 | 212.23 | 4.21 | - |
| February, 2008 | 8.29 | 212.70 | 3.90 | ―0.0748 |
| March, 2008 | 6.01 | 213.54 | 2.81 | ―0.2779 |

The real rate of return is negative in February and in March.

* 1. We first compute the nominal return *R* and the inflation rate *i*. We then use the Fisher equation to compute the real return as ; the results are presented in the table below.



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date | Adjusted Price | Nominal Return | CPI (Base 1982-1984) | Inflation | Real Interest with Fisher (%) |
| January, 2008 | 8.94 | - | 212.23 | - | - |
| February, 2008 | 8.29 | ―0.0727 | 212.70 | 0.0023 | ―0.0748 |
| March, 2008 | 6.01 | ―0.2750 | 213.54 | 0.0039 | ―0.2779 |

Both approaches yield the same real rate of return of ―7.48% in February and ―27.79% in March, 2008.

**Case Study 1**

1. We use the adjusted close prices to compute the monthly return as



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Month | AMZN | EBAY | Coke | JNJ |
| January, 1999 | - | - | - | - |
| February, 1999 | 9.56% | 20.31% | ―0.45% | 0.59% |
| March, 1999 | 34.39% | 23.28% | ―1.32% | 9.52% |
| April, 1999 | ―0.07% | 51.63% | ―0.46% | 4.28% |
| May, 1999 | ―30.98% | ―14.87% | ―0.21% | ―4.75% |
| June, 1999 | 5.36% | ―14.58% | 2.98% | 5.82% |
| July, 1999 | ―20.03% | ―35.47% | 4.80% | ―7.08% |
| August, 1999 | 24.31% | 28.50% | ―0.95% | 12.63% |
| September, 1999 | 28.54% | 12.36% | ―2.66% | ―10.17% |
| October, 1999 | ―11.65% | ―4.20% | ―6.18% | 14.02% |
| November, 1999 | 20.43% | 22.14% | ―1.62% | ―0.69% |
| December, 1999 | ―10.51% | ―24.14% | ―7.57% | ―10.11% |
| January, 2000 | ―15.19% | 19.87% | 7.14% | ―7.71% |
| February, 2000 | 6.68% | ―4.48% | 0.44% | ―16.02% |
| March, 2000 | ―2.72% | 22.77% | 4.90% | ―2.44% |
| April, 2000 | ―17.63% | ―9.55% | ―3.65% | 17.41% |
| May, 2000 | ―12.47% | ―21.41% | ―3.93% | 8.90% |
| June, 2000 | ―24.84% | ―13.17% | ―6.68% | 13.81% |
| July, 2000 | ―17.05% | ―7.95% | ―3.28% | ―8.65% |
| August, 2000 | 37.78% | 24.00% | ―8.38% | ―0.85% |
| September, 2000 | ―7.37% | 10.77% | 4.68% | 2.16% |
| October, 2000 | ―4.73% | ―24.99% | ―14.16% | ―1.93% |
| November, 2000 | ―32.58% | ―33.39% | ―4.53% | 8.92% |
| December, 2000 | ―36.98% | ―3.85% | 9.17% | 2.37% |



Summary Measures:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | AMZN | EBAY | Coke | JNJ |
| Average | ―3.38% | 1.03% | ―1.39% | 1.31% |
| Minimum | 37.78% | 51.63% | 9.17% | 17.41% |
| Maximum | ―36.98% | ―35.47% | ―14.16% | ―16.02% |
| Range | 74.76% | 87.10% | 23.33% | 33.43% |
| Standard Deviation | 21.38% | 22.87% | 5.44% | 9.05% |

The stock performance of the internet-based companies is high in the earlier part of 1999, turning negative later. The most noteworthy aspect of stock performance pertains to the higher risk of the internet-based companies, as measured by the standard deviation. The standard deviation of AMZN and EBAY are 21.38% and 22.87, respectively. The corresponding standard deviation for Coke and JNJ are only 5.44% and 9.05%, respectively.

**Case Study 2**

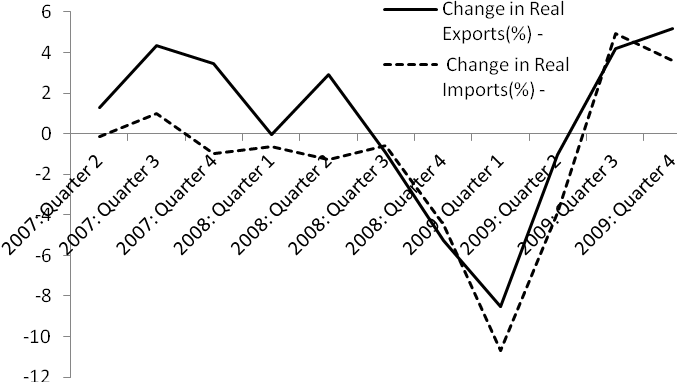
1. The simple price index for period *t* is calculated as where represents the real exports and real imports in 2007: Quarter 1.



|  |  |  |
| --- | --- | --- |
| Period | Exports Simple index | Imports Simple index |
| 2007: Quarter 1 | 100.00 | 100.00 |
| 2007: Quarter 2 | 101.27 | 99.88 |
| 2007: Quarter 3 | 105.65 | 100.84 |
| 2007: Quarter 4 | 109.29 | 99.87 |
| 2008: Quarter 1 | 109.25 | 99.25 |
| 2008: Quarter 2 | 112.42 | 97.98 |
| 2008: Quarter 3 | 111.39 | 97.43 |
| 2008: Quarter 4 | 105.53 | 93.07 |
| 2009: Quarter 1 | 96.54 | 83.12 |
| 2009: Quarter 2 | 95.53 | 79.87 |
| 2009: Quarter 3 | 99.52 | 83.81 |
| 2009: Quarter 4 | 104.68 | 86.85 |

Compared to the first quarter of 2007, the U.S. real exports were mostly higher through 2008 (some attribute this to a weak US dollar that makes U.S. exports more price-competitive). The U.S. real imports for the same period were mostly below the first quarter of 2007 level (again, a weak US dollar may have contributed to making foreign–made goods and services less price attractive to U.S. consumers). Both real exports and real imports exhibited a decline, starting towards the end of 2008 before rebounding a bit towards the end of 2009. These dates coincide with the global financial crisis.

|  |  |  |
| --- | --- | --- |
| Period | % Change in Real Exports | % Change in Real Imports |
| 2007: Quarter 1 | - | - |
| 2007: Quarter 2 | 1.27 | -0.12 |
| 2007: Quarter 3 | 4.33 | 0.97 |
| 2007: Quarter 4 | 3.45 | -0.96 |
| 2008: Quarter 1 | -0.04 | -0.63 |
| 2008: Quarter 2 | 2.90 | -1.28 |
| 2008: Quarter 3 | -0.91 | -0.56 |
| 2008: Quarter 4 | -5.27 | -4.48 |
| 2009: Quarter 1 | -8.51 | -10.69 |
| 2009: Quarter 2 | -1.05 | -3.91 |
| 2009: Quarter 3 | 4.18 | 4.94 |
| 2009: Quarter 4 | 5.19 | 3.62 |



As mentioned earlier, the percentage change in the U.S. real exports took a big hit after the second quarter of 2008, before rebounding in the third quarter 2009. The percentage change in the U.S. real imports has been mostly negative until the third quarter of 2009. The overall trend of the graphs is somewhat similar.

**Case Study 3**

1. For each variety of meat, the simple price index for period *t* is calculated as where represents the price in the base month of January.



|  |  |  |  |
| --- | --- | --- | --- |
|  | Simple Price Index | | |
| Month | Regular Beef | Ground Chuck | Lean Ground Beef |
| January | 100.00 | 100.00 | 100.00 |
| February | 103.35 | 101.96 | 100.41 |
| March | 96.27 | 100.51 | 97.93 |
| April | 95.50 | 101.11 | 97.26 |
| May | 95.76 | 97.13 | 100.03 |
| June | 94.78 | 97.03 | 101.26 |
| July | 91.09 | 94.56 | 96.44 |
| August | 90.54 | 96.01 | 100.76 |
| September | 90.71 | 93.95 | 99.15 |
| October | 92.36 | 94.06 | 98.60 |
| November | 87.48 | 94.46 | 99.68 |
| December | 92.75 | 95.51 | 98.98 |

Relative to January, price levels for all three varieties of meat have declined. The price of regular beef in December is 92.75% of what it was in January. The corresponding prices in of ground chuck and lean ground beef in December are 95.51% and 98.98%, respectively, of what they were in January.

1. In this application, there is no difference between the Laspeyres price index and the Paasche price index as the restaurant always purchases the same quantities of ground beef each month, implying that the base period and the current period quantities are the same. We calculate the weighted (Laspeyres or Paasche) price index for period *t* as where represents 1,400 pounds of regular beef, 800 pounds of ground chuck, and 500 pounds of lean ground beef.



|  |  |  |
| --- | --- | --- |
| Year |  | Laspeyres price index |
| January | 7381.60 | 100.00 |
| February | 7545.60 | 102.22 |
| March | 7234.90 | 98.01 |
| April | 7212.60 | 97.71 |
| May | 7174.10 | 97.19 |
| June | 7160.50 | 97.00 |
| July | 6897.80 | 93.45 |
| August | 6988.00 | 94.67 |
| September | 6917.30 | 93.71 |
| October | 6964.80 | 94.35 |
| November | 6831.90 | 92.55 |
| December | 7018.30 | 95.08 |

The weighted price index shows that relative to January, the meat prices have generally declined over the year; the only time it rose relative to January was in February when it was 2.22% higher.

1. We plot the above price indices in the following figure. Whereas the simple price index calculates the index of each item, the Laspeyres price index is an aggregate price index. Although these indices cannot be compared directly, it is noteworthy that the indices for both methods follow the same general downward trend. Also note that in general, the price of regular beef is more volatile than the price of ground chuck and lean ground beef.

