Learning Objectives

1. Explain how the Consumer Price Index (CPI) is constructed and use it to calculate the inflation rate
2. Show how the CPI is used to eliminate the effects of inflation in economic data
3. Discuss the two most important biases in the CPI
4. Distinguish between inflation and relative price changes to find the true cost of inflation
5. Understand the connections among inflation, nominal interest rates, and real interest rates
Is McDonald’s More Expensive?

Could you retire today if you have a $100 million? Could you retire in thirty years if you accumulate a $100 million by then?

Answer depends on what a $100 million will buy now and 30 years later. And that depends on prices!

A hamburger at McDonald’s, when it opened in 1954, cost 15 cents. It costs about $1.00 today. Are McDonald’s burgers more expensive today?

Compared to other consumer goods it costs slightly less today (Nominal and Real terms).
Can we add up what is happening to supply and demand in each market for goods and services and find out what happens to the overall level of prices? Example: Fuel prices are currently falling due to additional supply from fracking despite increased demand from emerging market consumers.

No. Ss and Dd can only explain why price of Good A is higher or lower relative to the price of other goods and services; not why the price of Good A has risen over time although it may have become cheaper relative to other goods and services.
The aggregate price level (APL) is the overall level of prices in an economy. What causes the APL to rise (inflation) or fall (deflation)?

In the short run, movements in APL are closely related to the overall movements of the economy, called Business Cycles.

In the long run, the APL is mainly determined by changes in Money Supply. Inflation occurs because there is too much money chasing too few goods!
How do we measure the Aggregate Price level and its rate of change, namely inflation/deflation? By calculating a measure called the Consumer Price Index (CPI).

The CPI for any period, measures the cost of a typical consumer’s consumption bundle - *standard basket of goods and services* in that period relative to the cost of the same basket of goods and services in some pre-determined year, called the base year.
Calculating the CPI

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent (two-bedroom apartment)</td>
<td>$500</td>
<td>$630</td>
</tr>
<tr>
<td>Hamburgers (60 at $2 &amp; $2.50, each)</td>
<td>120</td>
<td>150</td>
</tr>
<tr>
<td>Movie tickets (10 at $6 &amp; $7, each)</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Sweaters (4 at $30 &amp; $50, each)</td>
<td>120</td>
<td>200</td>
</tr>
<tr>
<td>Total expenditure</td>
<td>$800</td>
<td>$1050</td>
</tr>
</tbody>
</table>

CPI = \( \frac{\text{Cost of base year basket of goods and services in current year}}{\text{Cost of base year basket of goods and services in base year}} \)

CPI for 2009 = \( \frac{1050}{800} = 1.3125 \)

CPI for 2000 = \( \frac{800}{800} = 1.00 \); CPI for 2009 = \( \frac{1050}{800} = 1.3125 \)
CPI 1913 – 2009; 1982-84=100

Data Source: BLS
CPI 1947 – 2012; 1982-84=100

Consumer Price Index for All Urban Consumers: All Items (CPIAUCSL)

Shaded areas indicate US recessions. 2013 research.stlouisfed.org

Data Source: FRED
CPI 2002 – 2012; 1982-84=100

Data Source: FRED
The CPI reflects spending patterns for each of two population groups - all urban consumers (CPI-U) and for all urban wage earners and clerical workers (CPI-W).

The all urban consumer group represents about 87% of the total U.S. population and includes the expenditures of almost all residents of urban or metropolitan areas, including professionals, self-employed, poor, unemployed, retired, and urban wage earners and clerical workers (32% of the total US population).

Not included in the CPI are the spending patterns of people living in rural nonmetropolitan areas, farm families, people in the Armed Forces, and those in institutions, such as prisons and mental hospitals.
Some details about the CPI from the BLS

- [http://www.bls.gov/cpi/cpifaq.htm](http://www.bls.gov/cpi/cpifaq.htm)

- Consumer inflation for all urban consumers is measured by two indices, namely, the Consumer Price Index for All Urban Consumers (CPI-U) and the Chained Consumer Price Index for All Urban Consumers (C-CPI-U).

- The BLS also calculates the CPI for Urban Wage Earners and Clerical Workers (CPI-W) from a subset of the CPI-U households that earn more than one-half of their income from clerical or wage occupations, and have had at least one employed household earner for at least 37 weeks.

- The C-CPI-U uses different expenditure weights compared to the CPI-U and CPI-W.
How is the CPI Calculated?

First Fix the Basket (base year basket):

Information on the standard basket (also called market basket) for the 2009 CPI was collected by the BLS from *Consumer Expenditure Surveys* for 2005 and 2006. In each of those years, about 7,000 families from around the country provided information each quarter on their spending habits in an interview survey.

For information on frequently purchased items, such as food and personal care products, another 7,000 families in each of these years kept diaries listing everything they bought during a 2-week period.
Over the 2 year period, then, expenditure information that determined the market basket came from approximately 28,000 weekly diaries and 56,000 quarterly interviews.

The market basket is arranged into eight major groups - Food, Housing, Apparel, Transportation, Medical Care, Recreation, Education and Communication and an Other Goods and Services category that includes tobacco and smoking products, haircuts, funeral expenses, etc.
Also included: Government-charged user fees, such as water and sewerage charges, auto registration fees, vehicle tolls; sales and excise taxes.

Not included:

- Income and Social Security taxes as they are not directly associated with the purchase of consumer goods and services;
- Purchase of stocks, bonds, real estate, and life insurance. These items relate to savings and not to day-to-day consumption expenses.
To find out the price of each item, BLS data collectors called economic assistants visit or call thousands of retail stores, service establishments, rental units, and doctors' offices, all over the US and record the prices of about 80,000 items each month, representing a scientifically selected sample of the prices paid by consumers for goods and services purchased.

Next, BLS commodity specialists check the data for accuracy/consistency and make any necessary corrections or adjustments based on changes in size, quantity and even features or quality of a product. Thus, commodity specialists strive to prevent changes in the quality of items from affecting the CPI's measurement of price change.
Although the CPI is frequently used as a Cost of living Index, there are limitations to such usage. A cost-of-living index would measure changes over time in the amount that consumers need to spend to reach a certain utility level or standard of living. However, a person’s standard of living is often determined by non-market factors like political stability, human rights, environmental factors, social, cultural and religious freedoms, etc. – all of which affect consumers' well-being.
Notes regarding the CPI

- Comparisons of area CPIs cannot tell you which area is more expensive. It can only tell you in which area prices have changed more compared to the base year.

- The following illustration shows that although Area B has higher prices than Area A, the price change in Area A has been greater than in Area B.

<table>
<thead>
<tr>
<th></th>
<th>Base Period</th>
<th>Current Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price Index</td>
<td>Price Index</td>
</tr>
<tr>
<td>Area A</td>
<td>$0.30</td>
<td>$0.55</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>183</td>
</tr>
<tr>
<td>Area B</td>
<td>$0.60</td>
<td>$0.90</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>
Two other price measures that are widely used to calculate economy-wide price changes are: the **Producer Price Index** (PPI) and the **GDP deflator**.

The PPI is a Wholesale Price Index and measures the cost of a typical basket of goods and services purchased by producers - raw materials such as steel, electricity, coal, etc. Because commodity producers are quick to change prices in the face of changing supply and demand conditions and because these price changes ultimately get reflected as higher consumer prices, economists often regard trends in the PPI as an early signal predicting changes in the price of manufactured goods.
Other Price Measures: GDP Deflator

-The GDP deflator for year 2009 is:

\[ \text{GDP Deflator in 2009} = \frac{\text{Nominal GDP in 2009}}{\text{Real GDP in 2009}} \times 100 \]

-If the Real GDP is expressed say in 2000 dollars, then the GDP deflator for the year 2000 will be 100.

-The three price measures have significant differences – CPI includes imports and sales/excise taxes, PPI does not, etc.

-Despite the differences, the CPI, PPI and GDP deflator often move closely together although the PPI shows greater variability compared to the other two.
Variations in CPI, PPI and GDP Deflator

Green: CPI; Orange: PPI; Purple: GDP Deflator

Percent change in the CPI, PPI, GDP deflator

Source: Krugman & Wells, Macroeconomics 2ed
### GDP Deflator

Consider a very simple economy that only produces hot dogs and hamburgers. Answer the next two questions. Given that the base year basket is the same as 2009.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>P of Hot Dogs</th>
<th>Q of Hot Dogs</th>
<th>P of Hamburgers</th>
<th>Q of Hamburgers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>$1</td>
<td>100</td>
<td>$2</td>
<td>50</td>
</tr>
<tr>
<td>2009 (base year)</td>
<td>$2</td>
<td>150</td>
<td>$3</td>
<td>100</td>
</tr>
<tr>
<td>2010</td>
<td>$3</td>
<td>200</td>
<td>$4</td>
<td>150</td>
</tr>
</tbody>
</table>

**GDP Deflator in 2010**

\[
\text{GDP Deflator in 2010} = \frac{\text{Nominal GDP in 2010}}{\text{Real GDP in 2010}}
\]

**CPI in 2010**

\[
\text{CPI in 2010} = \frac{?}{?} = ?
\]

\[
\text{GDP Deflator in 2010} = \frac{?}{?} = ?
\]
Consider a very simple economy that only produces hot dogs and hamburgers. Answer the next three questions.

### Table: Yearly Prices and Quantities

<table>
<thead>
<tr>
<th>YEAR</th>
<th>P of Hot Dogs</th>
<th>Q of Hot Dogs</th>
<th>P of Hamburgers</th>
<th>Q of Hamburgers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>$1</td>
<td>100</td>
<td>$2</td>
<td>50</td>
</tr>
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<td>$3</td>
<td>100</td>
</tr>
<tr>
<td>2010</td>
<td>$3</td>
<td>200</td>
<td>$4</td>
<td>150</td>
</tr>
</tbody>
</table>

### GDP Deflator in 2010

\[
\text{GDP Deflator in 2010} = \frac{\text{Nominal GDP in 2010}}{\text{Real GDP in 2010}}
\]

- Nominal GDP in 2010: \(1200\) (base year: \(850\) and \(150\) from \(2008\) and \(2009\) respectively, and \(200\) and \(150\) for \(2010\))
- Real GDP in 2010: \(850\)

\[
\text{GDP Deflator in 2010} = \frac{1200}{850} = 1.41
\]

### CPI in 2010

\[
\text{CPI in 2010} = \frac{850}{600} = 1.42
\]
The CPI measures the average level of prices relative to the prices in the base year.

- **Inflation** is the rate of change in the average price level over time, measured, for example by the rate of change in the CPI over time.
- The **Rate of Inflation** is the annual percentage rate of change in the average price level, measured, for example by the annual rate of change in the CPI.
Calculating Inflation Rates: 2007 – 2011 (82-84=base)

<table>
<thead>
<tr>
<th>Year</th>
<th>CPI</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>207.342</td>
<td>--</td>
</tr>
<tr>
<td>2008</td>
<td>215.303</td>
<td>3.84%</td>
</tr>
<tr>
<td>2009</td>
<td>214.537</td>
<td>-0.36%</td>
</tr>
<tr>
<td>2010</td>
<td>218.056</td>
<td>1.64%</td>
</tr>
<tr>
<td>2011</td>
<td>224.939</td>
<td>3.16%</td>
</tr>
</tbody>
</table>

Inflation rate: 2007 - '08 = \( \frac{215.303 - 207.342}{207.342} \times 100 = 3.84\% \)

Inflation rate: 2008 - '09 = \( \frac{214.537 - 215.303}{215.303} \times 100 = -0.36\% \)
The Inflation Rate 2002-2012 (from CPI data)

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>1.6</td>
</tr>
<tr>
<td>2003</td>
<td>2.3</td>
</tr>
<tr>
<td>2004</td>
<td>2.7</td>
</tr>
<tr>
<td>2005</td>
<td>3.4</td>
</tr>
<tr>
<td>2006</td>
<td>3.2</td>
</tr>
<tr>
<td>2007</td>
<td>2.8</td>
</tr>
<tr>
<td>2008</td>
<td>3.8</td>
</tr>
<tr>
<td>2009</td>
<td>-0.4</td>
</tr>
<tr>
<td>2010</td>
<td>1.6</td>
</tr>
<tr>
<td>2011</td>
<td>3.2</td>
</tr>
<tr>
<td>2012</td>
<td>2.1</td>
</tr>
</tbody>
</table>
The US Inflation Rate: 2002 - 2012
Calculating Inflation Rates: 1972 – 1976 (82-84=base)

<table>
<thead>
<tr>
<th>Year</th>
<th>CPI</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>0.418</td>
<td>--</td>
</tr>
<tr>
<td>1973</td>
<td>0.444</td>
<td>6.2%</td>
</tr>
<tr>
<td>1974</td>
<td>0.493</td>
<td>11.0%</td>
</tr>
<tr>
<td>1975</td>
<td>0.538</td>
<td>9.1%</td>
</tr>
<tr>
<td>1976</td>
<td>0.569</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

Inflation rate : 1972 - '73 = \( \frac{0.444 - 0.418}{0.418} \times 100 = 6.2\% \)

Inflation rate : 1973 - '74 = \( \frac{0.493 - 0.444}{0.444} \times 100 = 11.0\% \)
Calculating Inflation Rates during the Great depression: 1929 – 1933

<table>
<thead>
<tr>
<th>Year</th>
<th>CPI (82-84=100)</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1929</td>
<td>0.171</td>
<td>--</td>
</tr>
<tr>
<td>1930</td>
<td>0.167</td>
<td>-2.3%</td>
</tr>
<tr>
<td>1931</td>
<td>0.152</td>
<td>-9.0%</td>
</tr>
<tr>
<td>1932</td>
<td>0.137</td>
<td>-9.9%</td>
</tr>
<tr>
<td>1933</td>
<td>0.130</td>
<td>-5.1%</td>
</tr>
</tbody>
</table>

- The Great depression was a period of falling output and prices. **Deflation** is when prices of most goods and services are falling – negative inflation.

- Don’t confuse deflation with “deflating” - that’s next!
The US Inflation Rate: 1900 - 2007

[Graph showing the US inflation rate from 1900 to 2007]
The CPI is a useful tool in eliminating the effects of inflation from economic data.

A **nominal quantity** is measured in terms of its current dollar value.

A **real quantity** is measured in physical terms – in terms of goods and services.

CPI can be used to convert current dollar values into real terms – **deflating**; or, to convert real quantities into current dollar terms – **indexing**.
Deflating and Indexing

Deflating a Nominal Quantity
- A process of dividing a nominal quantity by a price index (such as the CPI) to express the quantity in real terms

Indexing
- The practice of increasing a nominal quantity each period by an amount equal to the percentage increase in a specified price index like the CPI – done to prevent erosion of the purchasing power of the nominal quantity
### Deflating: Dividing by a Price Index

<table>
<thead>
<tr>
<th>Year</th>
<th>Nominal family income</th>
<th>CPI 1982-84=1.00</th>
<th>Real family income = Nominal family income/CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>$20,000</td>
<td>1.524</td>
<td>$20,000/1.524 = $13,123.35</td>
</tr>
<tr>
<td>2000</td>
<td>$22,000</td>
<td>1.722</td>
<td>$22,000/1.722 = $12,775.84</td>
</tr>
</tbody>
</table>

The Nominal Income went up by $2000 and yet the real income fell by $347.51.
Deflating

Major League Baseball salaries have increased over time. Babe Ruth made $80,000 in 1930, the average MLB player made $578,930 in 1990 and $3,154,845 in 2008. How do these compare? (Source Associated Press, opening day numbers)

<table>
<thead>
<tr>
<th>Year</th>
<th>Nominal Salary</th>
<th>CPI 1982-84=1.00</th>
<th>Real Salary = Nominal Salary/CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930</td>
<td>$80,000</td>
<td>0.167</td>
<td>$80,000/0.167 = $479,000</td>
</tr>
<tr>
<td>1990</td>
<td>$578,930</td>
<td>1.307</td>
<td>$578,930/1.307 = $442,945</td>
</tr>
<tr>
<td>2008</td>
<td>$3.15 m</td>
<td>2.153</td>
<td>$3.15m/2.153 = $1.46 m</td>
</tr>
</tbody>
</table>

The average MLB player in 2008 makes 3 times more than Babe Ruth
Adjusting Wages for Inflation

- Real Wage is the purchasing power of the workers’ nominal wages.
- Real wage for year X = nominal (dollar) wage in year X divided by the CPI for year X
- Real wages (of US Production workers – non supervisory) were higher in 1970 than in 2007.

<table>
<thead>
<tr>
<th>Year</th>
<th>Nominal Average Wage</th>
<th>CPI 1982-84=1.00</th>
<th>Real Average Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>$3.40</td>
<td>0.388</td>
<td>$3.40/0.388 = $8.76</td>
</tr>
<tr>
<td>2004</td>
<td>$15.68</td>
<td>1.889</td>
<td>$15.68/1.889 = $8.30</td>
</tr>
<tr>
<td>2007</td>
<td>$17.41</td>
<td>2.073</td>
<td>$17.41/2.073 = $8.40</td>
</tr>
</tbody>
</table>
Nominal and Real Wages for Production Workers’ 1960 - 2006

Are US production workers better off today?
Indexing increases a nominal quantity each period by the percentage increase in a specified price index, thereby preventing the erosion of the purchasing power of a nominal quantity.

Some contracts are indexed by law - Social Security payments, some labor contracts, etc.

Some contracts are not automatically indexed – Minimum wages
Adjusting for Inflation: Indexing

- An indexed labor contract
  - First year wage is $12 per hour
    - Real wages to rise by 2% per year for next 2 years
  - Relevant price index is 1.00 in first year, 1.05 in the second, and 1.10 in the third
  - Nominal wage is real wage times the price index

<table>
<thead>
<tr>
<th>Year</th>
<th>Real Wage</th>
<th>Price Index</th>
<th>Nominal Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$12.00</td>
<td>1.00</td>
<td>$12.00</td>
</tr>
<tr>
<td>1</td>
<td>$12.24</td>
<td>1.05</td>
<td>$12.85</td>
</tr>
<tr>
<td>2</td>
<td>$12.48</td>
<td>1.10</td>
<td>$13.73</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Minimum Wage was not indexed to inflation when introduced in 1950. What should the minimum wage have been today had it been indexed?

- Real Minimum Wage in 1950 = $0.75/0.241 = $3.11 in 1982-84 dollars

- To maintain a real value of $3.11, current Minimum Wage should be raised to $3.11 \times 2.34 = \text{approx. } $7.28

The Fed Min Wage is $7.25
Is the CPI Biased?

1996 report by the Boskin Commission concluded that the official CPI inflation rate overstates the true inflation rate by as much as 1 to 2 percentage points a year.

Problems of overstates Inflation

- increase in government spending because of indexed SS contracts
- underestimating living standard improvements

Changes to CPI calculations made since the report has improved the quality of the CPI calculations.
Two Reasons Why the CPI May Overstate the Inflation Rate?

- CPI ignores improvements in the quality of products and introduction of new products - *Quality adjustment bias.*
  - There was no internet and no cell phones in 1985. Innovations widen consumer choices thereby making a given amount of money worth more.
  - Innovation essentially mimics a fall in consumer prices.

- CPI ignores the possibility that the consumer may substitute a cheaper product for a more expensive one - *Substitution bias.*
  - Example: Renting rather than buying a house when house prices rise.
Substitution Bias – An Example

- CPI uses a fixed basket of goods and services
- When the price of a good increases, consumers buy less and substitute other goods
- Failing to account for substitution overstates inflation
- Example: base year cost of market basket

<table>
<thead>
<tr>
<th>Item</th>
<th>2000 price</th>
<th>2000 Spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee (50 cups)</td>
<td>$1.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>Tea (50 cups)</td>
<td>$1.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>Scones (100)</td>
<td>$1.00</td>
<td>$100.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$200.00</td>
</tr>
</tbody>
</table>
Substitution Bias – An Example

In 2005, coffee and scones are more expensive

- Buying exactly the same basket of goods costs $300, compared to $200 in 2000
- CPI = 300 / 200 = 1.50

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<td>$50.00</td>
</tr>
<tr>
<td>Scones (100)</td>
<td>$1.50</td>
<td>$150.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$300.00</strong></td>
</tr>
</tbody>
</table>
Substitution Bias – An Example

- In reality, consumer substitutes tea for coffee
- Assume scones purchased is same as before
- True CPI for consumer is \( \frac{250}{200} = 1.25 \)
- CPI estimate of 1.50 is 20% higher than the consumer's experience

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<tbody>
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<td>$100.00</td>
</tr>
<tr>
<td>Scones (100)</td>
<td>$1.50</td>
<td>$150.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$250.00</td>
</tr>
</tbody>
</table>
If gas prices are high (as they were until recently) it is an increase in the relative price of gasoline – relative to the price of all other goods and services.

The solution maybe to look for alternate sources of energy (supply response), and produce more fuel efficient cars (demand response).

Price level is a measure of the overall level of prices at a particular point in time as measured by the CPI.

Inflation rate is the annual percentage change in the price level.

A change in relative prices may not imply inflation.

A high inflation may not affect relative prices.
CPI data are given below.

Average retail (all US) gasoline prices were $2.533 in 2006; $2.767 in 2007 and $3.213 in 2008.

<table>
<thead>
<tr>
<th>Year</th>
<th>CPI</th>
<th>Inflation</th>
<th>ΔGas P</th>
<th>ΔRel P of Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>201.6</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2007</td>
<td>207.34</td>
<td>2.8%</td>
<td>9.2%</td>
<td>9.2 – 2.8 = 6.4%</td>
</tr>
<tr>
<td>2008</td>
<td>215.30</td>
<td>3.8%</td>
<td>16.1%</td>
<td>16.1 – 3.8 = 12.3%</td>
</tr>
</tbody>
</table>
Recall...

Summary Observations

- To counteract relative price changes, government policy would have to affect the market for specific goods.

- To counteract inflation, the government must use monetary and/or fiscal policy.
The True Costs of Inflation

1. Noise in the Prices System
2. Distortions of the Tax System
3. Shoe Leather Costs
4. Menu Costs
5. Unexpected Redistribution of Wealth
6. Interference with Long Run planning
1. Noise in the Price System

- Prices transmit information about
  - The cost of production, and,
  - The value buyers place on buying an additional unit

- Inflation creates static in the communication

- Buyers and sellers can't easily tell whether
  - The relative price of this good is increasing, or,
  - Inflation is increasing the price of this good and those of all others as well

- Deciding on these issues requires market participants to gather information – at a cost

- Response to changing prices is tentative and slow
2. Distortions in the Tax System

- Some taxes are not indexed to inflation, leading to **Bracket Creep**
  - Bracket creep occurs when a household is moved into a higher tax bracket due to increases in nominal but not real income
    - Higher tax brackets have a higher percentage tax rate

- Income taxes bracket are indexed
  - Suppose the tax rate on $50,000 is 30% in 2000
  - CPI is 1 for 2000, 1.25 for 2005
  - Nominal income of $62,500 will be taxed 30% in 2005
2. Distortions of the Tax System

- Capital depreciation allowances are not indexed
- They are designed to encourage purchase of capital goods
  - Allows firms to deduct a share of the purchase price as a business expense
- Say a machine costs $1,000 and has a life of 10 yrs.
  - Capital depreciation allowance of 10% = $100 per year
  - $100 in year 1 is worth more than $100 in year 10 because of inflation; so investment doesn’t look as lucrative
- In times of high inflation, investment in plant and equipment decreases
2. Distortions of the Tax System

- The US tax code is complex containing hundreds of provisions and tax codes that are not indexed.

- These taxes can seriously distort the incentives for people to work, save, and invest.
  - Lower savings and investment means lower economic growth – a real cost of inflation---Optimal Tax

- Distorted economic incentives lead to lower economic efficiency – a real cost of inflation.
3. Shoe Leather Costs

- Holding cash is convenient because it lubricates economic transactions. If there is no inflation, cash holds its value over time.

- Inflation reduces purchasing power and raises the cost of holding cash to consumers and businesses.

- However, from society’s point of view the above is not a true cost of inflation. Why?
  - Currency is a debt owed by the government to the currency holder. When currency loses value, losses to the holder of currency are offset by corresponding gains to the government – there are no wasted resources.
3. Shoe Leather Costs

The Real costs of inflation arise from actions taken to “economize” on cash holdings:

- More frequent and smaller withdrawals cost consumers and businesses time with OC – a real cost of inflation
- Banks process more transactions, increasing costs – another real cost of inflation
- Costs of managing cash holding are called "shoe leather" costs, referring to the cost of frequent trips to the bank
3. Shoe Leather Costs

- Except for economies with significantly high levels of inflation, shoe leather costs are not considered to be significant.
- During the German Hyperinflation of 1921-23, merchants employed runners to carry their cash to the banks several times a day.
- During Brazil’s hyperinflation in the early 1990s, the Brazilian banking sector accounted for 15% of GDP – more than twice the size of the US banking sector as a share of GDP.
- In the mid 1980s, Israel experienced a “clean” inflation (i.e., not accompanied by war or political instability). Shoe leather costs were commonly incurred.
Menu Costs are the resource or real costs of changing listed prices.

During times of high inflation, like shoe leather costs, menu costs can be significant.

During the Brazilian inflation of the 1990s supermarket workers reportedly spent half their time replacing old price stickers with new ones.

In the mid 1980s the Israeli real estate markets quoted prices in US dollars although the transaction would be done in Israeli shekels.
5. **Unexpected Redistribution of Wealth**

- Unexpected inflation redistributes wealth
- Unexpectedly high inflation hurts workers (with non-indexed contracts) and benefits employers
  - Fixed salaries lose purchasing power
- Unexpectedly high inflation benefits borrowers at the expense of lenders
  - Borrowers repay with dollars worth less than anticipated
- Although redistribution by itself does not destroy wealth, unexpected inflation confuses incentives.
  - A high inflation economy is like a “casino economy “.
6. Interference With Long Run Planning

- Some decisions have a long time horizon
  - Erratic inflation makes planning risky
- Retirement planning requires an estimated cost for your desired lifestyle
  - Save too little and you live less well in the future
  - Save too much and you live less well now
- Given the costs of inflation, most economists agree that low and stable inflation promotes a healthy economy
Hyperinflation is an extremely high inflation rate.

How high? Runaway inflation like 500% or 1000% or more is surely hyperinflation

- Germany in 1923 – 102,000,000 %
- Hungary in 1945 – 3.8 x 10^{27} %
- Israel in 1985 – 400 %
- Nicaragua in 1988 – 33,000 %
- Brazil in 1994 – 2075.8 %
- Zimbabwe in May 2009 (official) – 1,694,000 %
Hyperinflation

Stanley Fischer, Ratna Sahay, and Carlos Vegh examined 133 market economies from 1960 - 96

45 episodes of high inflation (100% +) in 25 countries

- Real GDP/person fell by an average of 1.6%/yr
- Real consumption/person fell by an average of 1.3%/yr
- Real investment/person fell by an average of 3.3%/yr
- During low inflation years these countries enjoyed positive growth in these variables.
There is a close positive relationship between inflation rates and nominal interest rates.

Nominal Interest Rate \((i)\) is the annual percentage increase in the nominal value of a financial asset

Real Interest Rate \((r)\) is the annual percentage increase in the purchasing power of a financial asset

\[ r = i - \pi, \] where \(\pi\) is the rate of inflation.
## Inflation and Interest Rates

<table>
<thead>
<tr>
<th>Year</th>
<th>Real Interest</th>
<th>Nominal Interest</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>0.80</td>
<td>6.5</td>
<td>5.7</td>
</tr>
<tr>
<td>1975</td>
<td>-3.3</td>
<td>5.8</td>
<td>9.1</td>
</tr>
<tr>
<td>1980</td>
<td>-2.0</td>
<td>11.5</td>
<td>13.5</td>
</tr>
<tr>
<td>1985</td>
<td>3.9</td>
<td>7.5</td>
<td>3.6</td>
</tr>
<tr>
<td>1990</td>
<td>2.1</td>
<td>7.5</td>
<td>5.4</td>
</tr>
<tr>
<td>1995</td>
<td>2.7</td>
<td>5.5</td>
<td>2.8</td>
</tr>
<tr>
<td>2000</td>
<td>2.2</td>
<td>4.7</td>
<td>2.5</td>
</tr>
<tr>
<td>2004</td>
<td>-1.4</td>
<td>1.4</td>
<td>2.7</td>
</tr>
<tr>
<td>2005</td>
<td>-0.2</td>
<td>3.2</td>
<td>3.4</td>
</tr>
</tbody>
</table>
The Real Interest Rate in the United States, 1960 - 2006
Fisher-Effect (Irving Fisher)

The tendency for nominal interest rates to be high when inflation is high and low when inflation is low.

Happens because borrowers and lenders keep their eye toward the real interest rates.
End of Chapter

Summary