Chapter 8 Problem Set

1. \( \frac{(X_t - X_{t-1})}{X_{t-1}} = 0.0081-1.83(U_t - U_{t-1}) + \epsilon \) (\( \epsilon \) negligible)

   a. If unemployment is constant, \( U_t - U_{t-1} = 0 \)
   \( \frac{(X_t - X_{t-1})}{X_{t-1}} = 0.0081 \)
   \( X_t - X_{t-1} = 0.0081 X_{t-1} \)
   \( X_t = 1.0081 X_{t-1} \)

   Output must grow by **[0.81%]** each quarter to keep unemployment constant.

   b. If unemployment decreases by 1%, \( U_t - U_{t-1} = -0.01 \)
   \( \frac{(X_t - X_{t-1})}{X_{t-1}} = 0.0081 + 0.0183 \)
   \( X_t - X_{t-1} = 0.0264 X_{t-1} \)
   \( X_t = 1.0264 X_{t-1} \)

   Output would have to grow by **[2.64%]** next quarter.

   c. \( U_{t-1} = 0.097 \), \( U_t = 0.055 \)
   \( X_t = 4,624 \) billion
   \( \frac{(X_t - X_{t-1})}{X_{t-1}} = 0.0081 - 1.83(0.055 - 0.097) \)
   \( \frac{(X_t - 4,624)}{4,624} = 0.08496 \)
   \( X_t - 4,624 = 392.85504 \)
   \( \Delta Y = 393 \) billion

2. a) Monthly inflation = 27.5%.
   Yearly inflation rate = \( (1 + 0.275)^{12} - 1 = 1,745\% \) yearly

   During a period of hyperinflation, prices rise by more than 50% per month, or \( (1.5)^{12} - 1 = 12,875\% \) yearly. Here, prices rise by "only" 27.5% each month and 1,745% each year, so this is not hyperinflation.

   b) \( \hat{i} = \frac{i - \hat{\rho}}{1 + \hat{\rho}} \), \( \hat{\rho} = \) inflation rate, \( i = \) nominal inflation rate

   \( i = 25\% \), \( \hat{\rho} = 1.745\% \)
   \( \hat{i} = \frac{0.25 - 1.745}{1 + 1.745} = \frac{-1.495}{18.45} = -0.0812 \% \)
c) after-tax real interest rate \( r^* = \frac{(1 - t) i - \hat{\pi}}{1 + \hat{\pi}} \)
\[ t = 0.3, \; i = 0.25, \; \hat{\pi} = 17.45 \]
\[ r^* = \frac{0.7(0.25) - 17.45}{18.45} = -17.275 \quad \text{(rounded)} \]
\[ = -93.63\% \]

d) 
\[ 0.05 = \frac{0.7 \times 17.45}{18.45} \]
\[ 0.9225 = 0.7i - 17.45 \]
\[ 0.7i = 18.3725 \]
\[ i = 2.62464\% \]

3. a) real monthly wage = \( \frac{\text{nominal wage}}{\text{CPI}} \) (chart attached)

b) In 1973, privates' real wages were 4$734 in '82-'84 dollars and $1,300 in 2001, both of which were the highest for the given years.

\[ 1973 \]

c) \( P_t = p_0 (1 + \hat{\pi})^t \)
\[ 177.1 = 30.6 (1 + \hat{\pi})^{38} \]
\[ 5.788 = (1 + \hat{\pi})^{38} \]
\[ 1.756 = 38 \ln (1 + \hat{\pi}) \]
\[ 0.0462 = \ln (1 + \hat{\pi}) \]
\[ e^{0.0462} = 1.0473, \; 1 + \hat{\pi} \]
\[ \hat{\pi} = 4.73\% \]

d) doubling time = \( \frac{70}{\hat{\pi}} = \frac{70}{4.73} \approx 14.8 \text{ years} \]

e) ex ante real rate of interest = \( i - \hat{\pi} \), \( \hat{\pi} = \) expected rate of inflation
\[ i = 0.1, \; \hat{\pi} = 0.0473 \]
\[ r^* = 0.1 - 0.0473 = 0.0527 = 5.27\% \]

Honors option

Question 4* is on the next page; a row with the 2006 data has been added to the chart on the last page (source: Statistical Abstract of the United States).
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<tbody>
<tr>
<td>1963</td>
<td>$78</td>
<td>30.6</td>
<td>$255</td>
<td>$451</td>
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<td>1973</td>
<td>$324</td>
<td>44.2</td>
<td>$734</td>
<td>$1,300</td>
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<tr>
<td>1978</td>
<td>$397</td>
<td>65.2</td>
<td>$609</td>
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<td>1987</td>
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<td>1989</td>
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<td>123.9</td>
<td>$564</td>
<td>$999</td>
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<tr>
<td>2001</td>
<td>$964</td>
<td>177.1</td>
<td>$544</td>
<td>$963</td>
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<tr>
<td>2006</td>
<td>$1,274</td>
<td>202.9</td>
<td>$628</td>
<td>$1,112</td>
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</table>

Sources: *Statistical Abstract of the United States* (CPI); goarmy.com (Army pay)
In year 2000, the consumer indifference curve is tangent with the 2000 budget line at point $e^{2000}$. The Laschke budget line goes through $e^{2000}$ allowing customer to purchase the same goods at year 1990 prices. But since Laschke budget line has a different slope as 2000 budget line, it is not tangent to the indifference curve at point $e^{2000}$.

It is clear from the graph that a lower budget for year 1990 would have given the same degree of satisfaction as in year 2000. Thus, the Laschke index, the ratio of year 2000 budget to year 1990 budget tends to underestimate the amount of inflation as the denominator is too large.

Great!