Answer Key for Midterm #1

1. a) 1. \( Y = C + I + G + NX \) or \( Y = C + I + G + (EX - IM) \) \hspace{1em} \text{Product-Expenditure Identity}

2. \( Y - (T - TR) = YD = C + S \) \hspace{1em} \text{Disposable-Income Identity}

3. \( I + G + EX = S + (T - TR) + IM \) \hspace{1em} \text{Inflow-Outflow Identity}

4. \([I - S] + [G - (T - TR)] + [EX - IM] = 0 \) \hspace{1em} \text{Sectoral-Deficits Identity}

private sector deficit + government deficit + foreign deficit = 0.

b) i) By identity #1: \( Y = 7,757 + 1,671 + 2,055 - 495 = 10,988 \)

ii) \text{government deficit} = 253 \equiv G - (T - TR) = 2,055 - T + 1,080; \text{ therefore, } T = 2,882

By identity #2 \( S = Y - (T - TR) - C = 10,988 - 2,882 + 1,080 - 7,757 = 1,429 \)

iii) \( YD = Y - (T - TR) = 10,988 - 2,882 + 1,080 = 9,186 \)

iv) \( NX = -495 \equiv EX - IM = EX - 1,544; \text{ therefore, } EX = 1,049 \)

v) taxes were solved as an intermediate calculation in ii) above: \( T = 2,882 \)

vi) \( I - S = 1,671 - 1,429 = 242 \) [the value of \( S \) taken from ii) above.

c) \$9,090 \cdot \frac{p_{03_t}}{p_{09_{03}}} \cdot \frac{p_{96}}{p_{09}} = 10,988 \cdot \frac{113}{100} = 9,724 \), where the notation \( p_t \) refers to the price index for time \( t \) with a base-year of \( B \).

d) \$9,090 \cdot \frac{p_{03_t}}{p_{09_{03}}} \cdot \frac{p_{96}}{p_{09}} = 9,724 \cdot \frac{76}{0.89} = 12,678 \).

e) \( \bar{p} = \left( \frac{p_{03}}{p_{09}} \right)^{1/7} - 1 = \left[ \left( \frac{113}{100} \right)^{1/7} - 1 \right] = 0.0176 \) or 1.76 percent per year.

2. a) i) \( r = \frac{FV}{PV} - 1 = \frac{10,000}{9,345} - 1 = 0.07 \) or 7 percent.

ii) \( r = \left( \frac{FV}{PV} \right)^{1/0.25} - 1 = \left( \frac{10,000}{9,878} \right)^{1/0.25} - 1 = 0.05 \) or 5 percent.

iii) \( r = \left( \frac{FV}{PV} \right)^{1/3} - 1 = \left( \frac{5,000}{3,969} \right)^{1/3} - 1 = 0.08 \) or 8 percent.

b) i) \( p_t = \frac{FV}{1 + r} = \frac{1,000}{1.035} = $990.10 \).

ii) \( p_t = \frac{FV}{(1 + r)^2} = \frac{10,000}{(1.035)^2} = $9,335.11 \).
iii) \( Cpn = \text{coupon rate} \times FV \div \text{annual coupon frequency} = 9 \times 100,000 \div 2 = $4,500; \) and since the coupons are semiannual, the opportunity cost is the ½-year (or 6-month) yield to maturity = \( r/2 \)

\[
p_a = \frac{Cpn}{(1 + \frac{r}{2})} + \frac{Cpn}{(1 + \frac{r}{2})^2} + \frac{FV}{(1 + \frac{r}{2})^2}
\]

\[
= \frac{4,500}{(1.025)} + \frac{4,500}{1.025^2} + \frac{100,000}{1.025^2} = $103,854.85.
\]

3. a) Laspeyres: \( p_{14}^L = 100 \)

\[
p_{15}^L = \frac{40 \times 2 + 40 \times 1.50}{40 \times 1.50 + 40 \times 1.00} \times 100 = \frac{140}{100} = 140
\]

Paasche: \( p_{14}^P = 100 \)

\[
p_{15}^P = \frac{60 \times 2 + 36 \times 1.50}{60 \times 1.50 + 36 \times 1.00} \times 100 = \frac{174}{126} = 138.09
\]

Chain-weighted: \( p_{14}^C = 100 \)

\[
p_{15}^P = \sqrt{p_{15}^L \times p_{15}^P} = \sqrt{140 \times 138.09} = 139.04
\]

b) Laspeyres

Advantages: (1) easy to compute because the base bundle is fixed; (2) does not suffer from quality bias (quality bias occurs if the index calculation ignores that consumers may be substituting from high-quality goods to low-quality goods, e.g., buying hamburger instead of steak when the price of steak increases (relative to hamburgers)).

Disadvantage: the index allows for substitution bias—overstating the rate of inflation by ignoring that consumers will substitute away from purchasing the goods with the fastest changing prices.

Paasche

Advantages: not subject to substitution bias.

Disadvantage: (1) hard to compute from the shifting current bundle; (2) the index may understate the rate of inflation due to quality bias (failing to incorporate the quality loss from switching from steak to hamburger).

Chain-Weighted

Advantages: compromises between the Paasche and Laspeyres.

Disadvantages: difficult to compute.

c) In constant 2014 dollars:

\[
$14Y_{14} = 40 \times 1.50 + 40 \times 1.00 = 100
\]

\[
$14Y_{15} = \frac{60 \times 2 + 36 \times 1.50}{139.04} \times 100 = 125.14
\]

d) In constant 2015 dollars:

\[
$15Y_{14} = \frac{40 \times 1.50 + 40 \times 1.00}{100} = \frac{139.04}{139.04} = 139.04
\]

\[
$15Y_{15} = 60 \times 2 + 36 \times 1.50 = 174
\]

e) \( \hat{Y} = \left( \frac{125.14}{100} \right) - 1 = \frac{174}{139.04} - 1 = 0.2514 \) or 25.14 percent per year.
f) $\hat{p} = \left(\frac{p_{15}}{p_{14}}\right) - 1 = \left(\frac{140}{100}\right) - 1 = 0.40$ or 40 percent per year

4) a) $\text{ex ante} \quad r_{06.02} = r_{06.02} - \hat{p}^{e}_{06.02} = 4.7 - 3 = 1.7$ percent.

$\text{ex post} \quad r_{06.02} = r_{06.02} - \hat{p}^{e}_{07.02} = 4.7 - 2.4 = 2.3$ percent

[Note: to solve we needed $\hat{p}^{e}_{07.02} = \frac{p_{07.02}}{p_{06.02}} - 1 = \frac{204}{199} .2 - 1 = 0.024$ or 2.4 percent]

b) $\text{ex ante} \quad r_{06.02} = r_{06.12} - \hat{p}^{e}_{06.12} = 4.6 - 2.9 = 1.7$ percent.

$\text{ex post} \quad r_{06.12} = r_{06.02} - \hat{p}^{e}_{07.12} = 4.6 - 4.1 = 0.5$ percent

[Note: to solve we needed $\hat{p}^{e}_{07.12} = \frac{p_{07.12}}{p_{06.12}} - 1 = \frac{211}{203} .4 - 1 = 0.041$ or 4.1 percent]

c) Expected inflation: $\hat{p}^{e}_{06.01} = 3.0$ percent;

compare to actual inflation $\hat{p}^{e}_{06.01} = \frac{p_{07.01}}{p_{06.01}} - 1 = \frac{203}{199} .4 - 1 = 0.021$ or 2.1 percent.

Expectations were not fulfilled: actual inflation was 0.9 percentage points less than expected inflation (0.9 = 3.0 – 2.1).