

The answers to the homework problems are highlighted in red boxes in this document. The chapter and problem numbers from your homework are also indicated.

amount the value added she sells the baker is \$3:

she sells the bread to the engineer for \$6 but paid the miller \$3 for the flour. GDP is the total value added, or  $\$1 + \$2 + \$3 = \$6$ . Note that GDP equals the value of the final good (the bread).

3. When a woman marries her butler, GDP falls by the amount of the butler's salary. This happens because measured total income, and therefore measured GDP, falls by the amount of the butler's loss in salary. If GDP truly measured the value of all goods and services, then the marriage would not affect GDP since the total amount of economic activity is unchanged. Actual GDP, however, is an imperfect measure of economic activity because the value of some goods and services is left out. Once the butler's work becomes part of his household chores, his services are no longer counted in GDP. As this example illustrates, GDP does not include the value of any output produced in the home. Similarly, GDP does not include other goods and services, such as the imputed rent on durable goods (e.g., cars and refrigerators) and any illegal trade.

4. a. government purchases      Chapter 2, Problem 4  
 b. investment  
 c. net exports  
 d. consumption  
 e. investment

5. Data on parts (a) to (g) can be downloaded from the Bureau of Economic Analysis ([www.bea.doc.gov](http://www.bea.doc.gov)—follow the links to GDP and related data). Most of the data (not necessarily the earliest year) can also be found in the *Economic Report of the President*. By dividing each component (a) to (g) by nominal GDP and multiplying by 100, we obtain the following percentages:

	1950	1975	2000
a. Personal consumption expenditures	65.5%	63.0%	68.2%
b. Gross private domestic investment	18.4%	14.1%	17.9%
c. Government consumption purchases	15.9%	22.1%	17.6%
d. Net exports	0.2%	0.8%	-3.7%
e. National defense purchases	6.7%	6.6%	3.8%
f. State and local purchases	7.1%	12.8%	11.7%
g. Imports	3.9%	7.5%	14.9%

(Note: These data were downloaded February 5, 2002 from the BEA web site.)

Among other things, we observe the following trends in the economy over the period 1950–2000:

- (a) Personal consumption expenditures have been around two-thirds of GDP, although the share increased about 5 percentage points between 1975 and 2000.  
 (b) The share of GDP going to gross private domestic investment fell from 1950 to 1975 but then rebounded.  
 (c) The share going to government consumption purchases rose more than 6 percentage points from 1950 to 1975 but has receded somewhat since then.  
 (d) Net exports, which were positive in 1950 and 1975, were substantially negative in 2000.  
 (e) The share going to national defense purchases fell from 1975 to 2000.  
 (f) The share going to state and local purchases rose from 1950 to 1975.  
 (g) Imports have grown rapidly relative to GDP.

This calculation shows that the price of goods purchased in 2010 increased by 60 percent compared to the prices these goods would have sold for in 2000. The CPI for 2000, the base year, equals 1.0.

- b. The implicit price deflator is a Paasche index because it is computed with a changing basket of goods; the CPI is a Laspeyres index because it is computed with a fixed basket of goods. From (5.a.iii), the implicit price deflator for the year 2010 is 1.52, which indicates that prices rose by 52 percent from what they were in the year 2000. From (5.a.iv.), the CPI for the year 2010 is 1.6, which indicates that prices rose by 60 percent from what they were in the year 2000.

If prices of all goods rose by, say, 50 percent, then one could say unambiguously that the price level rose by 50 percent. Yet, in our example, relative prices have changed. The price of cars rose by 20 percent; the price of bread rose by 100 percent, making bread relatively more expensive.

As the discrepancy between the CPI and the implicit price deflator illustrates, the change in the price level depends on how the goods' prices are weighted. The CPI weights the price of goods by the quantities purchased in the year 2000. The implicit price deflator weights the price of goods by the quantities purchased in the year 2010. The quantity of bread consumed was higher in 2000 than in 2010, so the CPI places a higher weight on bread. Since the price of bread increased relatively more than the price of cars, the CPI shows a larger increase in the price level.

- c. There is no clear-cut answer to this question. Ideally, one wants a measure of the price level that accurately captures the cost of living. As a good becomes relatively more expensive, people buy less of it and more of other goods. In this example, consumers bought less bread and more cars. An index with fixed weights, such as the CPI, overestimates the change in the cost of living because it does not take into account that people can substitute less expensive goods for the ones that become more expensive. On the other hand, an index with changing weights, such as the GDP deflator, underestimates the change in the cost of living because it does not take into account that these induced substitutions make people less well off.

7. a. The consumer price index uses the consumption bundle in year 1 to figure out how much weight to put on the price of a given good:

$$\begin{aligned} \text{CPI}^2 &= \frac{(P_{\text{red}}^2 \times Q_{\text{red}}^1) + (P_{\text{green}}^2 \times Q_{\text{green}}^1)}{(P_{\text{red}}^1 \times Q_{\text{red}}^1) + (P_{\text{green}}^1 \times Q_{\text{green}}^1)} \\ &= \frac{(\$2 \times 10) + (\$1 \times 0)}{(\$1 \times 10) + (\$2 \times 0)} \\ &= 2. \end{aligned}$$

Chapter 2, Prob 7

According to the CPI, prices have doubled.

- b. Nominal spending is the total value of output produced in each year. In year 1 and year 2, Abby buys 10 apples for \$1 each, so her nominal spending remains constant at \$10. For example,

$$\begin{aligned} \text{Nominal Spending}_2 &= (P_{\text{red}}^2 \times Q_{\text{red}}^2) + (P_{\text{green}}^2 \times Q_{\text{green}}^2) \\ &= (\$2 \times 0) + (\$1 \times 10) \\ &= \$10. \end{aligned}$$

- c. Real spending is the total value of output produced in each year valued at the prices prevailing in year 1. In year 1, the base year, her real spending equals her nominal spending of \$10. In year 2, she consumes 10 green apples that are each valued at their year 1 price of \$2, so her real spending is \$20. That is,

$$\begin{aligned}\text{Real Spending}_2 &= (P_{\text{red}}^1 \times Q_{\text{red}}^2) + (P_{\text{green}}^1 \times Q_{\text{green}}^2) \\ &= (\$1 \times 0) + (\$2 \times 10) \\ &= \$20.\end{aligned}$$

Chapter 2, Prob 7, continued

Hence, Abby's real spending rises from \$10 to \$20.

- d. The implicit price deflator is calculated by dividing Abby's nominal spending in year 2 by her real spending that year:

$$\begin{aligned}\text{Implicit Price Deflator}_2 &= \frac{\text{Nominal Spending}_2}{\text{Real Spending}_2} \\ &= \frac{\$10}{\$20} \\ &= 0.5.\end{aligned}$$

Thus, the implicit price deflator suggests that prices have fallen by half. The reason for this is that the deflator estimates how much Abby values her apples using prices prevailing in year 1. From this perspective green apples appear very valuable. In year 2, when Abby consumes 10 green apples, it appears that her consumption has increased because the deflator values green apples more highly than red apples. The only way she could still be spending \$10 on a higher consumption bundle is if the price of the good she was consuming fell.

- e. If Abby thinks of red apples and green apples as perfect substitutes, then the cost of living in this economy has not changed—in either year it costs \$10 to consume 10 apples. According to the CPI, however, the cost of living has doubled. This is because the CPI only takes into account the fact that the red apple price has doubled; the CPI ignores the fall in the price of green apples because they were not in the consumption bundle in year 1. In contrast to the CPI, the implicit price deflator estimates the cost of living has halved. Thus, the CPI, a Laspeyres index, overstates the increase in the cost of living and the deflator, a Paasche index, understates it. This chapter of the text discusses the difference between Laspeyres and Paasche indices in more detail.

Don't worry about this Laspeyres and Paasche stuff

8. a. Real GDP falls because Disney does not produce any goods. This corresponds to a decrease in economic well-being because the income of owners and shareholders of Disney falls (the income side of the national accounts), and people's consumption of Disney falls (the expenditure side of the national accounts).
- b. Real GDP rises because the original capital and labor in farm production now produce more wheat. This corresponds to an increase in the economic well-being of society, since people can now consume more wheat. (If people do not want to consume more wheat, then farmers and farmland can be shifted to producing other goods that society values.)
- c. Real GDP falls because with fewer workers on the job, firms produce less. This accurately reflects a fall in economic well-being.
- d. Real GDP falls because the firms that lay off workers produce less. This decreases economic well-being because workers' incomes fall (the income side), and there are fewer goods for people to buy (the expenditure side).
- e. Real GDP is likely to fall, as firms shift toward production methods that produce fewer goods but emit less pollution. Economic well-being, however, may rise. The economy now produces less measured output but more clean air; clean air is not

- c. If the marginal productivity of barbers is unchanged, then their real wage is unchanged.
  - d. The real wage in (c) is measured in terms of haircuts. That is, if the nominal wage is in dollars, then the real wage is  $W/PH$ , where  $PH$  is the dollar price of a haircut.
  - e. If workers can move freely between being farmers and being barbers, then they must be paid the same wage  $W$  in each sector.
  - f. If the nominal wage  $W$  is the same in both sectors, but the real wage in terms of farm goods is greater than the real wage in terms of haircuts, then the price of haircuts must have risen relative to the price of farm goods.
  - g. Both groups benefit from technological progress in farming.
4. The effect of a government tax increase of \$100 billion on (a) public saving, (b) private saving, and (c) national saving can be analyzed by using the following relationships:

$$\begin{aligned}\text{National Saving} &= [\text{Private Saving}] + [\text{Public Saving}] \\ &= [Y - T - C(Y - T)] + [T - G] \\ &= Y - C(Y - T) - G.\end{aligned}$$

Chapter 3, problem 7

- a. **Public Saving**—The tax increase causes a 1-for-1 increase in public saving.  $T$  increases by \$100 billion and, therefore, public saving increases by \$100 billion.
- b. **Private Saving**—The increase in taxes decreases disposable income,  $Y - T$ , by \$100 billion. Since the marginal propensity to consume ( $MPC$ ) is 0.6, consumption falls by  $0.6 \times \$100$  billion, or \$60 billion. Hence,

$$\Delta \text{Private Saving} = -\$100b - 0.6(-\$100b) = -\$40b.$$

Private saving falls \$40 billion.

- c. **National Saving**—Because national saving is the sum of private and public saving, we can conclude that the \$100 billion tax increase leads to a \$60 billion increase in national saving.

Another way to see this is by using the third equation for national saving expressed above, that national saving equals  $Y - C(Y - T) - G$ . The \$100 billion tax increase reduces disposable income and causes consumption to fall by \$60 billion. Since neither  $G$  nor  $Y$  changes, national saving thus rises by \$60 billion.

- d. **Investment**—To determine the effect of the tax increase on investment, recall the national accounts identity:

$$Y = C(Y - T) + I(r) + G.$$

Rearranging, we find

$$Y - C(Y - T) - G = I(r).$$

The left-hand side of this equation is national saving, so the equation just says the national saving equals investment. Since national saving increases by \$60 billion, investment must also increase by \$60 billion.

6. a. Private saving is the amount of disposable income,  $Y - T$ , that is not consumed:

$$\begin{aligned} S^{\text{private}} &= Y - T - C \\ &= 5,000 - 1,000 - (250 + 0.75(5,000 - 1,000)) \\ &= 750. \end{aligned}$$

Public saving is the amount of taxes the government has left over after it makes its purchases:

$$\begin{aligned} S^{\text{public}} &= T - G \\ &= 1,000 - 1,000 \\ &= 0. \end{aligned}$$

Total saving is the sum of private saving and public saving:

$$\begin{aligned} S &= S^{\text{private}} + S^{\text{public}} \\ &= 750 + 0 \\ &= 750. \end{aligned}$$

- b. The equilibrium interest rate is the value of  $r$  that clears the market for loanable funds. We already know that national saving is 750, so we just need to set it equal to investment:

$$\begin{aligned} S &= I \\ 750 &= 1,000 - 50r \end{aligned}$$

Solving this equation for  $r$ , we find:

$$r = 5\%.$$

- c. When the government increases its spending, private saving remains the same as before (notice that  $G$  does not appear in the  $S^{\text{private}}$  above) while government saving decreases. Putting the new  $G$  into the equations above:

$$\begin{aligned} S^{\text{private}} &= 750 \\ S^{\text{public}} &= T - G \\ &= 1,000 - 1,250 \\ &= -250. \end{aligned}$$

Thus,

$$\begin{aligned} S &= S^{\text{private}} + S^{\text{public}} \\ &= 750 + (-250) \\ &= 500. \end{aligned}$$

- d. Once again the equilibrium interest rate clears the market for loanable funds:

$$\begin{aligned} S &= I \\ 500 &= 1,000 - 50r \end{aligned}$$

Solving this equation for  $r$ , we find:

$$r = 10\%.$$

7. To determine the effect on investment of an equal increase in both taxes and government spending, consider the national income accounts identity for national saving:

Chapter 3, problem 10

$$\begin{aligned} \text{National Saving} &= [\text{Private Saving}] + [\text{Public Saving}] \\ &= [Y - T - C(Y - T)] + [T - G]. \end{aligned}$$

We know that  $Y$  is fixed by the factors of production. We also know that the change in consumption equals the marginal propensity to consume ( $MPC$ ) times the change in disposable income. This tells us that

$$\begin{aligned} \Delta \text{National Saving} &= [-\Delta T - (MPC \times (-\Delta T))] + [\Delta T - \Delta G] \\ &= [-\Delta T + (MPC \times \Delta T)] + 0 \\ &= (MPC - 1) \Delta T. \end{aligned}$$

The above expression tells us that the impact on saving of an equal increase in  $T$  and  $G$  depends on the size of the marginal propensity to consume. The closer the  $MPC$  is to 1, the smaller is the fall in saving. For example, if the  $MPC$  equals 1, then the fall in consumption equals the rise in government purchases, so national saving  $[Y - C(Y - T) - G]$  is unchanged. The closer the  $MPC$  is to 0 (and therefore the larger is the amount saved rather than spent for a one-dollar change in disposable income), the greater is the impact on saving. Because we assume that the  $MPC$  is less than 1, we expect that national saving falls in response to an equal increase in taxes and government spending.

The reduction in saving means that the supply of loanable funds curve shifts to the left in Figure 3-3. The real interest rate rises, and investment falls.

Chapter 3, problem 10  
continued

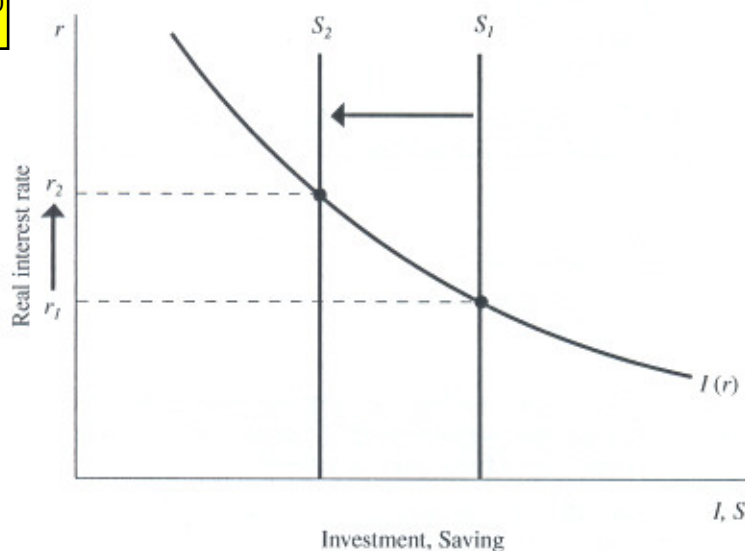


Figure 3-3

8. a. The demand curve for business investment shifts out because the subsidy increases the number of profitable investment opportunities for any given interest rate. The demand curve for residential investment remains unchanged.
- b. The total demand curve for investment in the economy shifts out since it represents the sum of business investment, which shifts out, and residential investment, which is unchanged. As a result the real interest rate rises as in Figure 3-4.

## Chapter 5, problem 2

2. a. National saving is the amount of output that is not purchased for current consumption by households or the government. We know output and government spending, and the consumption function allows us to solve for consumption. Hence, national saving is given by:

$$\begin{aligned} S &= Y - C - G \\ &= 5,000 - (250 + 0.75(5,000 - 1,000)) - 1,000 \\ &= 750. \end{aligned}$$

Investment depends negatively on the interest rate, which equals the world rate  $r^*$  of 5. Thus,

$$\begin{aligned} I &= 1,000 - 50 \times 5 \\ &= 750. \end{aligned}$$

Net exports equals the difference between saving and investment. Thus,

$$\begin{aligned} NX &= S - I \\ &= 750 - 750 \\ &= 0. \end{aligned}$$

Having solved for net exports, we can now find the exchange rate that clears the foreign-exchange market:

$$\begin{aligned} NX &= 500 - 500 \times \epsilon \\ 0 &= 500 - 500 \times \epsilon \\ \epsilon &= 1. \end{aligned}$$

- b. Doing the same analysis with the new value of government spending we find:

$$\begin{aligned} S &= Y - C - G \\ &= 5,000 - (250 + 0.75(5,000 - 1,000)) - 1,250 \\ &= 500 \\ I &= 1,000 - 50 \times 5 \\ &= 750 \\ NX &= S - I \\ &= 500 - 750 \\ &= -250 \\ NX &= 500 - 500 \times \epsilon \\ -250 &= 500 - 500 \times \epsilon \\ \epsilon &= 1.5. \end{aligned}$$

The increase in government spending reduces national saving, but with an unchanged world real interest rate, investment remains the same. Therefore, domestic investment now exceeds domestic saving, so some of this investment must be financed by borrowing from abroad. This capital inflow is accomplished by reducing net exports, which requires that the currency appreciate.

c. Repeating the same steps with the new interest rate,

$$\begin{aligned} S &= Y - C - G \\ &= 5,000 - (250 + 0.75(5,000 - 1,000)) - 1,000 \\ &= 750 \end{aligned}$$

$$\begin{aligned} I &= 1,000 - 50 \times 10 \\ &= 500 \end{aligned}$$

$$\begin{aligned} NX &= S - I \\ &= 750 - 500 \\ &= 250 \end{aligned}$$

$$NX = 500 - 500 \times \epsilon$$

$$250 = 500 - 500 \times \epsilon$$

$$\epsilon = 0.5.$$

Saving is unchanged from part (a), but the higher world interest rate lowers investment. This capital outflow is accomplished by running a trade surplus, which requires that the currency depreciate.

3. a. When Leverett's exports become less popular, its domestic saving  $Y - C - G$  does not change. This is because we assume that  $Y$  is determined by the amount of capital and labor, consumption depends only on disposable income, and government spending is a fixed exogenous variable. Investment also does not change, since investment depends on the interest rate, and Leverett is a small open economy that takes the world interest rate as given. Because neither saving nor investment changes, net exports, which equal  $S - I$ , do not change either. This is shown in Figure 5-6 as the unmoving  $S - I$  curve.

The decreased popularity of Leverett's exports leads to a shift inward of the net exports curve, as shown in Figure 5-6. At the new equilibrium, net exports are unchanged but the currency has depreciated.

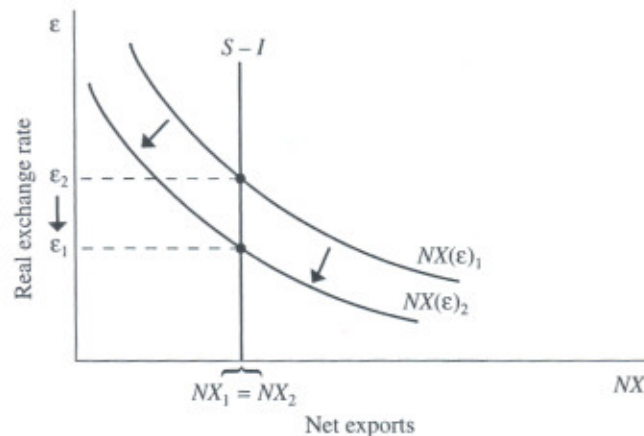


Figure 5-6

Even though Leverett's exports are less popular, its trade balance has remained the same. The reason for this is that the depreciated currency provides a stimulus to net exports, which overcomes the unpopularity of its exports by making them cheaper.