These two points are plotted as line ND^a in Fig. 3.12. If labour supply = 95, then the equilibrium real wage is 5.

b. $A = 2$. $MPN = 2(100 - N)$.

(1) $W = \$10$. $w = W/P = \$10/\$2 = 5$. Setting $w = MPN$, $5 = 2(100 - N)$, so $2N = 195$, so $N = 97.5$.

(2) $W = \$20$. $w = W/P = \$20 / \$2 = 10$. Setting $w = MPN$, $10 = 2(100 - N)$, so $2N = 190$, so $N = 95$.

These two points are plotted as line ND^b in Fig. 3.12. If labour supply = 95, then the equilibrium real wage is 10.

5. a. If the lump-sum tax is increased, there's an income effect on labor supply, not a substitution effect (since the real wage isn't changed). An increase in the lump sum tax reduces a worker's wealth, so labor supply increases.

b. If $T = 35$, then $NS = 22 + 12w + (2 \times 35) = 92 + 12w$. Labor demand is given by $w = MPN = 309 - 2N$, or $2N = 309 - w$, so $N = 154.5 - w/2$. Setting labor supply equal to labor demand gives $154.5 - w/2 = 92 + 12w$, so $62.5 = 12.5w$, thus $w = 62.5/12.5 = 5$. With $w = 5$, $N = 92 + (12 \times 5) = 152$.

c. Since the equilibrium real wage is below the minimum wage, the minimum wage is binding. With $w = 7$, $N = 154.5 - 7/2 = 151.0$. Note that $NS = 92 + (12 \times 7) = 176$, so $NS > N$ and there is unemployment.

6. Since $w = 4.5\,K^{0.5}\,N^{-0.5}$, $N^{-0.5} = 4.5\,K^{0.5}/w$, so $N = 20.25\,K/w^2$. When $K = 25$, $N = 506.25/w^2$.

a. If $t = 0.0$, then $NS = 100w^2$. Setting labor demand equal to labor supply gives $506.25/w^2 = 100w^2$, so $w^4 = 5.0625$, or $w = 1.5$. Then $NS = 100\,(1.5)^2 = 225$. [Check: $N = 506.25/1.5^2 = 225$.] $Y = 45N^{0.5} = 45(225)^{0.5} = 675$. The total after-tax wage income of workers is $(1\text{-}t)\,w\,NS = 1.5 \times 225 = 337.5$.

b. If $t = 0.6$, then $NS = 100\,[(1 - 0.6)\,w]^2 = 16w^2$. The marginal product of labor is $MPN = 22.5 / N^{0.5}$, so $N = 100\,[(1 - 0.6) \times 22.5 / N^{0.5}]^2$, so $N^2 = 8100$, so $N = 90$. Then $Y = 45\,N^{0.5} = 45(90)^{0.5} = 426.91$. Then $w = 22.5 / 90^{0.5} = 2.37$. The total after-tax wage income of workers is $(1\text{-}t)\,w\,NS = 0.4 \times 2.37 \times 90 = 85.38$. Note that there's a big decline in output and income, although the wage is higher.

c. A minimum wage of 2 is binding if the tax rate is zero. Then $N = 506.25/2^2 = 126.6$, $NS = 100 \times 2^2 = 400$. Unemployment is 273.4. Income of workers is $wN = 2 \times 126.6 = 253.2$, which is lower than without a minimum wage, because employment has declined so much.

7. a. At any date, 25 people are unemployed: 5 who have lost their jobs at the start of the month and 20 who have lost their jobs either on January 1 or July 1. The unemployment rate is 25 / 500 = 5%.

(2) Using Eq. (4.9): $S^d = I^d$

$-480 + 200r + 0.9Y = 120 - 400r$
$0.9Y = 600 - 600r$
When $Y = 600$, $r = 0.10$.
So we can use either Eq. (4.8) or (4.9) to get to the same result.

c. When $G = 144$, desired saving becomes $S^d = Y - C^d - G = Y - (360 - 200r + 0.1Y) - 144 = -504 + 200r + 0.9Y$. S^d is now 24 less for any given r and Y; this shows up as a shift in the S^d line from S^1 to S^2 in Fig. 4.3.

Setting $S^d = I^d$, we get:

$-504 + 200r + 0.9Y = 120 - 400r$

$600r + 0.9Y = 624$

At $Y = 600$, this is $600r = 624 - (0.9 \times 600) = 84$, so $r = 0.14$. The market-clearing real interest rate increases from 10% to 14%.

7. a. $r = 0.10$

$uc/(1 - \tau) = (r + d)p_K / (1 - \tau) = [(.1 + .2) \times 1] / (1 - .5) = 0.6.$

$MPK^f = uc/(1 - \tau)$, so $20 - .02K^f = .6$; solving this gives $K^f = 970$.

Since $K^f - K = I - dK$, $I = K^f - K + dK = 970 - 900 + (.2 \times 900) = 250$.

b. i. Solving for this in general:

$uc/(1 - \tau) = (r + d)p_K / (1 - \tau) = [(r + .2) \times 1] / (1 - .5) = .4 + 2r.$
$MPK^f = uc/(1 - \tau)$, so $20 - .02K = .4 + 2r$; solving this gives $K^f = 980 - 100r$.
$I = K^f - K + dK = 980 - 100r - 900 + (.2 \times 900) = 260 - 100r.$

ii. $Y = C + I + G$

$1000 = [100 + (.5 \times 1000) - 200r] + (260 - 100r) + 200$
$1000 = 1060 - 300r$, so $300r = 60$
$r = 0.2$
$C = 560$; $I = 240 = S$; $uc/(1 - \tau) = .4 + (2 \times .2) = 0.8$; $K^f = 960$

8. a. $PVLR = y + [y^f / (1 + r)] + a$

$= 90 + (110 / 1.10) + 20$

$= 210.$

b. $c + [c^f / (1 + r)] = PVLR.$

$c + (c^f / 1.10) = 210.$

When $c = 0$, $c^f = 231$; this is the vertical intercept of the budget line, shown in Fig. 4.4. When $c^f = 0$, $c = 210$; this is the horizontal intercept of the budget line.

c. $c = c^f$: $c + (c / 1.10) = 210$.

$1.10c + c = 210 \times 1.10$.
$2.1c = 231$.
$c = 110$.
$s = y - c$
$= 90 - 110$
$= -20$.

d. y increases by 11, so new $PVLR = 221$.

$2.1c = 221 \times 1.1 = 243.1$.
$c = 115.76$.
$s = y - c = 101 - 115.76 = -14.76$.

So part of the temporary increase in income is consumed and part is saved.

e. y^f increases by 11, so $PVLR$ rises by $11 / 1.10 = 10$. New $PVLR = 220$.

$2.1c = 220 \times 1.1 = 242$.

$c = 115.24$.

$s = y - c = 90 - 115.24 = -25.24$.

So a rise in future income leads to an increase in current consumption but a decrease in saving.

f. A rise in initial wealth has the same effect on the $PVLR$ and thus on consumption as an increase in current income of the same amount, so $c = 115.76$ as in part (d).

$s = y - c = 90 - 115.76 = -25.76$.

So an increase in wealth increases current consumption and decreases saving.

9. a. PVLR = a + yl + yw + yr = 1500.

(1) No borrowing constraint: $c^l + c^w + c^r = 1500$.

$c^l = c^w = c^r = c = 1500 / 3 = 500$.
$s^l = 200 - 500 = -300$; $s^w = 800 - 500 = 300$; $s^r = 200 - 500 = -300$.

(2) A borrowing constraint is nonbinding, since $a + y^l = 500 = c^l$, and $c^w = 500 < 800 = y^w$. So consumption and saving are the same in each period as in part (1) above.

5. When there is a temporary increase in government spending, consumers foresee future taxes. As a result, consumption declines, both currently and in the future. Thus current consumption does not fall by as much as the increase in G, so national saving (Sd = Y – Cd – G) declines at the initial real interest rate, and the saving curve shifts to the left from S1 to S2, as shown in Fig. 4.14. Thus the real interest rate increases and consumption and investment both fall.

When there is a permanent increase in government spending, consumers foresee future taxes as well, with both current and future consumption declining. But if there is an equal increase in current and future government spending, and consumers try to smooth consumption, they will reduce their current and future consumption by about the same amount, and that amount will be about the same amount as the increase in government spending. So the saving curve in the saving-investment diagram does not shift, and there is no change in the real interest rate.

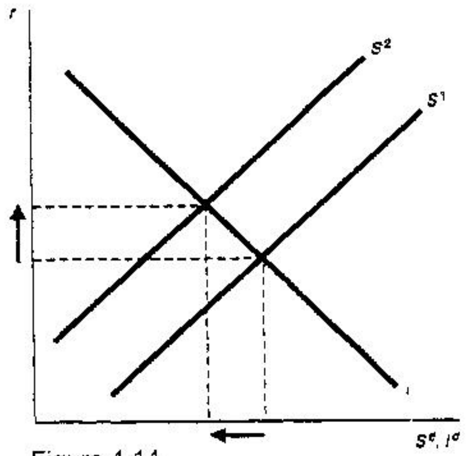

Figure 4.14

Since the saving curve shifts upward more in the case of a temporary increase in government spending, the real interest rate is higher, so investment declines by more. However, consumption fails by more in the case of a permanent increase in government spending.

6. See Fig. 4.15. The consumer is originally on budget line BL^1, with consumption at point *D*. An increase in the real interest rate shifts the budget line to BL^2, with consumption at point *Q*. The change can be broken down into two steps. First, the substitution effect shifts the budget line from BL^1 to BL^{int}, and the consumption point changes from point *D* to point *P*. The substitution effect results in higher future consumption and lower current consumption. The income effect shifts the budget line from BL^{int} to BL^2, with the consumption point changing from point *P* to point *Q*. The income effect results in lower current and future consumption. Thus the income and substitution effects work in the same direction, reducing current consumption and increasing saving.

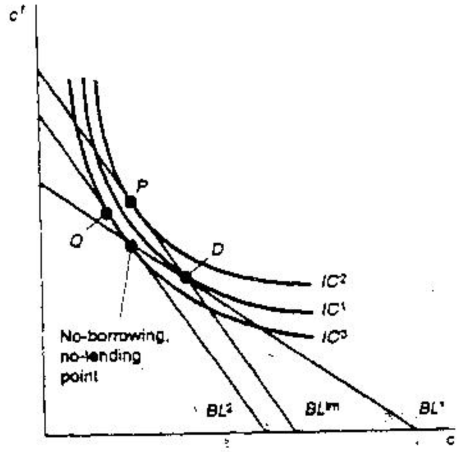

Figure 4.15