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Macroeconomics

Theory, Models & Policy

an Open Text
by Douglas Curtis and Ian Irvine



SOLUTIONS TO EXERCISES
VERSION 2017 – REVISION A

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Version 2017 — Revision A

Version 2017 – Revision A: Updates include new cover and back pages, new front matter.

Version 2015 – Revision A: The content of this edition has been revised in several respects. Chapter 5 has been modified to provide a more concise AD/AS model and a framework for the material covered in later chapters. The development of the $AD\pi/AS\pi$ model in Chapter 12 is now presented using diagrams comparable to those used in the development of the AD/AS in Chapter 11. Empirical examples and illustrations of economic performance have been updated in all chapters along with some additional discussions of economic performance and policy.

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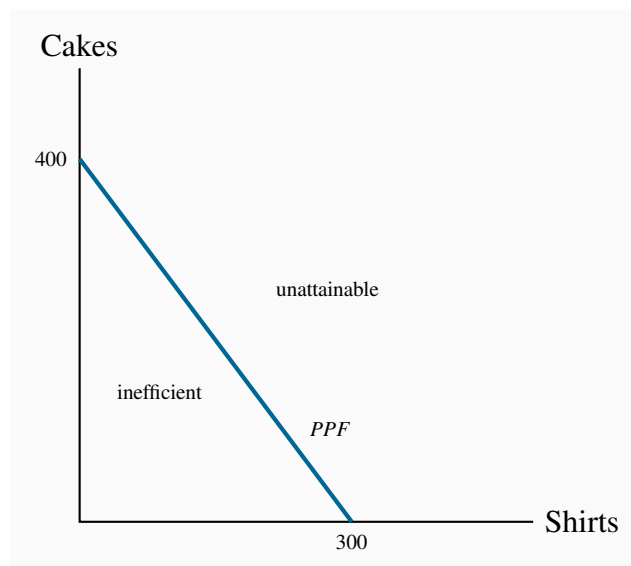
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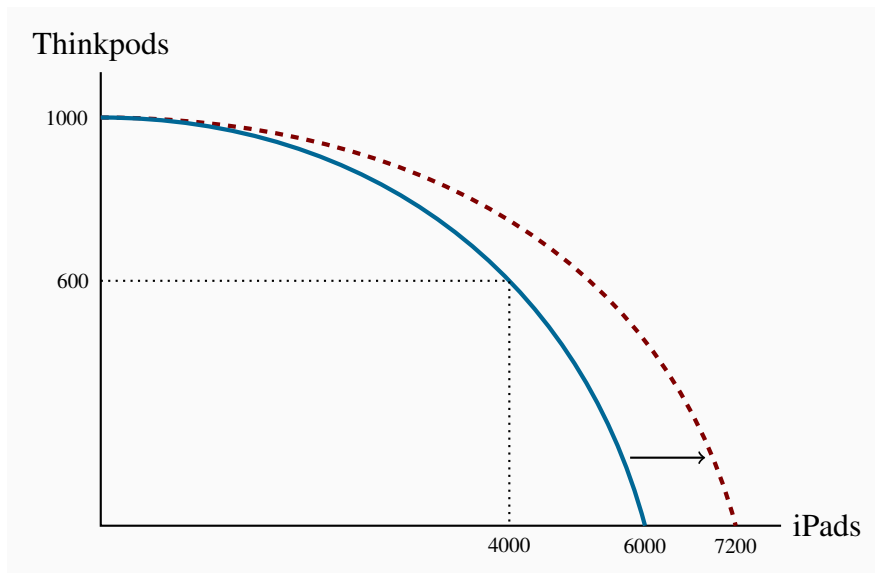
SOLUTIONS TO EXERCISES FOR CHAPTER 1

- 1.1**
1. If all 100 workers make cakes their output is $100 \times 4 = 400$.
 2. If all workers make shirts their output is $100 \times 3 = 300$.
 3. The diagram shows the *PPF* for this economy.
 4. As illustrated in the diagram.



- 1.2**
1. The *PPF* is curved outwards with intercepts of 1000 on the Thinkpod axis and 6000 on the iPad axis. Each point on the *PPF* shows one combination of outputs.
 2. Different.
 3. 400 X.
 4. The new *PPF* in the diagram has the same Thinkpod intercept, 1000, but a new iPad intercept of 7200.

2 ■ Solutions to exercises for Chapter 1



1.3 By examining the opportunity cost in the region where the combinations are defined, and by assuming a linear trade-off between each set of combinations, it can be seen that the first combination in the table is feasible, but not the second combination.

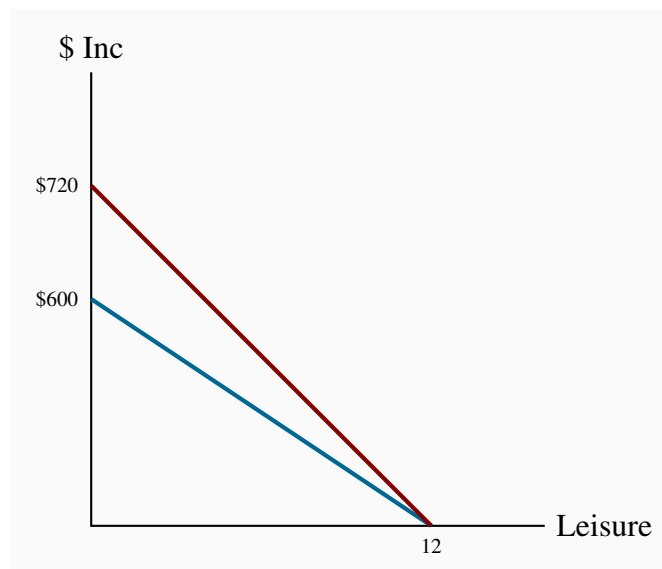
1.4 1. \$50.

2. \$60.

3. See diagram.

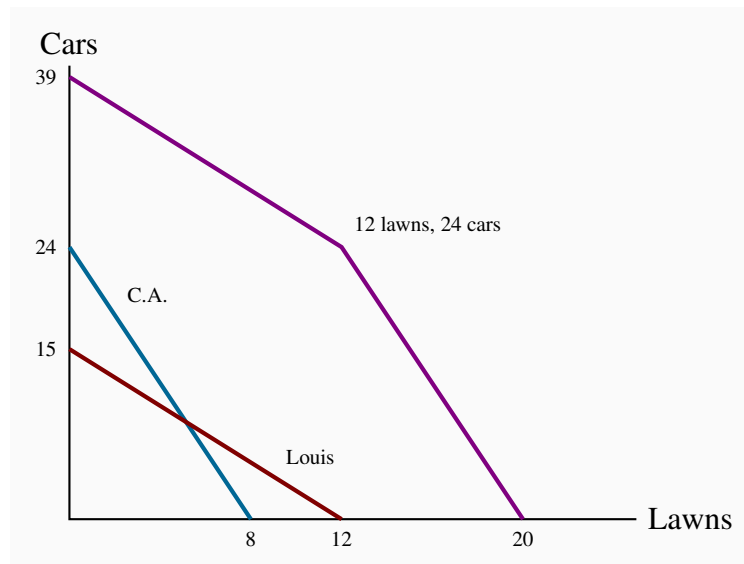
4. See diagram.

5. The person with the lower wage.



- 1.5**
1. Louis has an advantage in cutting the grass while Carrie Anne should wash cars.
 2. If they each work a twelve-hour day, between them they can cut 12 lawns and wash 24 cars.

1.6 Following the method described in the text:



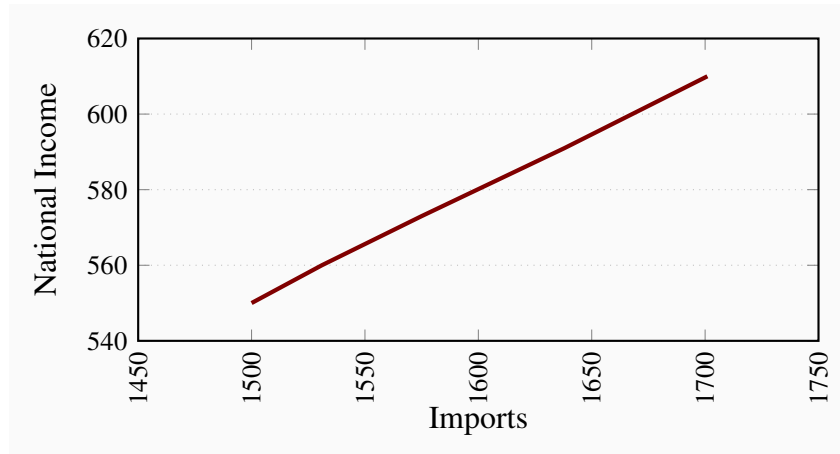
- 1.7**
1. Carrie Anne's lawn intercept is now 12 rather than 8.
 2. Yes, specialization still matters because C.A. is more efficient at cars.
 3. The new coordinates will be 39 on the vertical axis, 24 on the horizontal axis and the kink point is the same.

1.8 C.A.'s intercepts are now 30 cars and 15 lawns; Louis' intercepts are 18.75 cars and 15 lawns; the economy-wide *PPF* car coordinate is thus 48.75, the lawn coordinate is 30, and the kink point is 15 lawns and 30 cars.

- 1.9**
1. 220 cakes requires 55 workers, the remaining 45 workers can produce 135 shirts. Hence this combination lies inside the *PPF* described in Exercise 1.1.
 2. 98 workers.
 3. 2%.

SOLUTIONS TO EXERCISES FOR CHAPTER 2

2.1 These variables are positively related.



2.2 For (b) the answer is 32%, and for (c) the answer is 5.26%.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Index	0.95	1.00	1.04	1.09	1.14	1.14	1.21	1.23	1.32	1.35

2.3 To find the national unemployment rate for each year you take a weighted average of the unemployment rate in the big cities and that in other areas. The weights used are the shares of population living in each area. In 2007, for example, the national unemployment rate would be: Big city rate \times 0.67 + other rate \times 0.33 = $5 \times 0.67 + 7 \times 0.33 = 5.67$. Hence:

Year	2007	2008	2009	2010	2011
Index	5.67	7.99	8.33	10.67	9.67

2.4 For years 1 through 5 the index values for transport, rent and food are:

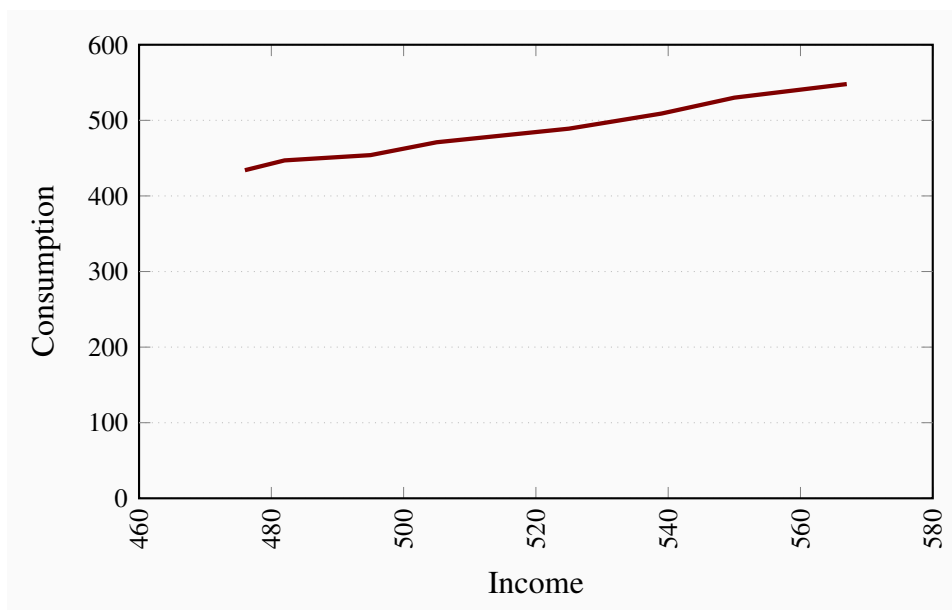
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Weight in total expenditure
Transport	100	100	107	107	107	10%
Rent	100	100	110	112	115	55%
Food	100	103	102	107	110	35%

The aggregate price index is the weighted average of the component price indexes with weights equal to shares in total expenditure. For Year 1 the aggregate index is $(100 \times 0.10 + 100 \times 0.55 + 100 \times 0.35) = 100$. For years 2 through 5 this methodology gives aggregate price indexes of 101, 108, 110, 114.

2.5

	2000	2002	2004	2006	2008	2010
Nominal	100	111.54	126.92	126.92	119.23	115.38
Carrot price \$	2.6	2.9	3.3	3.3	3.1	3
CPI	110	112	115	117	120	124
CPI new base	100	101.82	104.55	106.36	109.09	112.73
Real carrot index	100	109.55	121.40	119.33	109.29	102.36

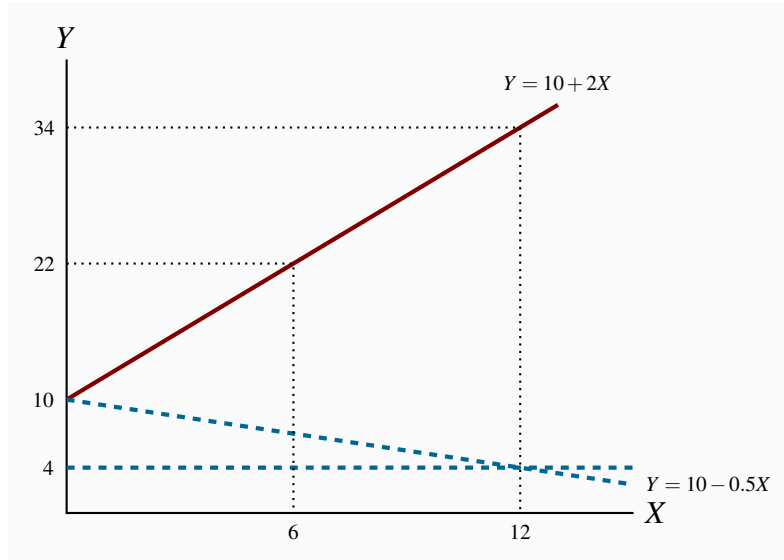
2.6 The scatter diagram plots observed combinations of income and consumption as follows. For parts (c) and (d): the variables are positively related and the causation runs from income to consumption.



2.7 The percentage changes in income are:

Pct Inc	1.3	2.7	2.0	4.0	2.7	2.0	3.1
Pct Con	3.0	1.6	3.7	3.8	4.1	4.1	3.4

2.8 The relationship given by the equation $Y = 10 + 2X$ when plotted has an intercept on the vertical (Y) axis of 10 and the slope of the line is 2. The maximum value of Y (where X is 12) is 34.



X	0	1	2	3	4	5	6	7	8	9	10	11	12
Y	10	12	14	16	18	20	22	24	26	28	30	32	34

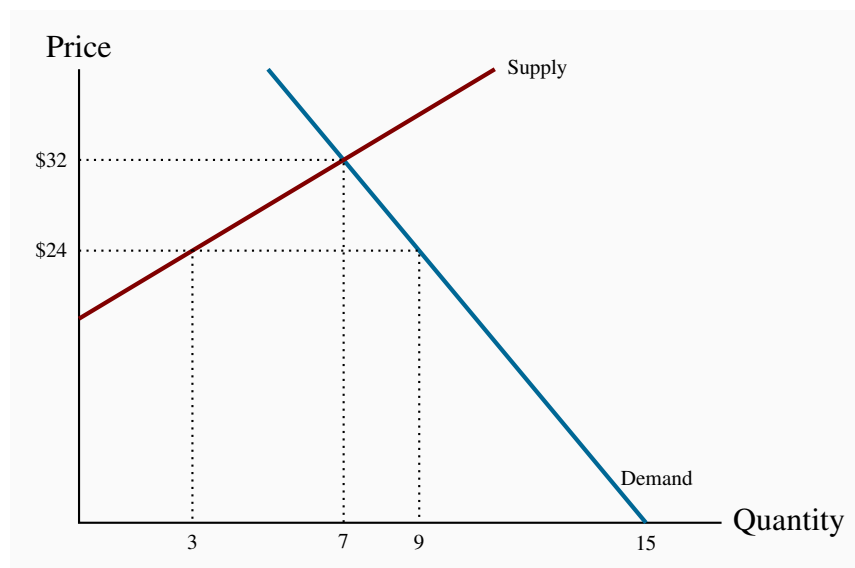
2.9 The relationship $Y = 10 - 0.5X$ has a Y intercept of 10 but there is now a negative slope equal to one half (-0.5). When X has a value of 12, Y has a value of 4. If you plot this in the diagram for Exercise 2.8 it is the dashed line sloping downward from 10 to 4 at $X = 12$.

2.10 1. The relationship is negative.

2. The relationship is non-linear.

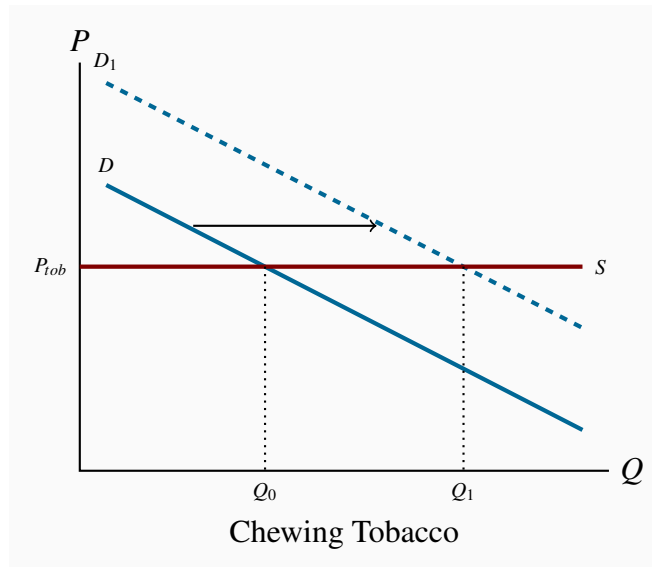
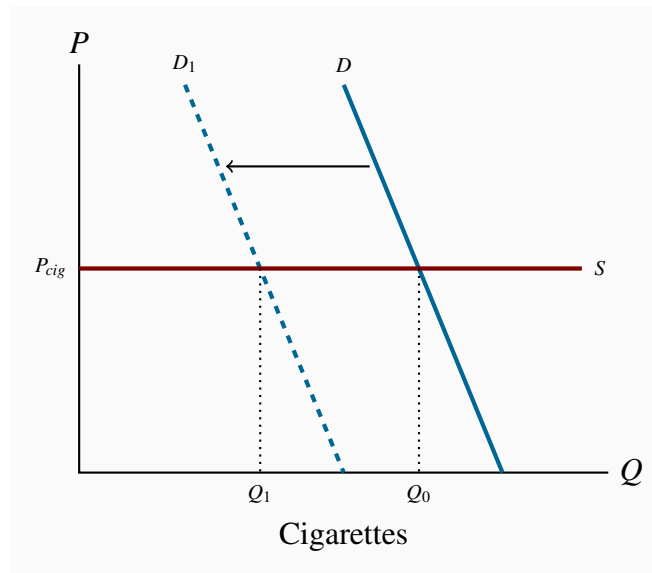
SOLUTIONS TO EXERCISES FOR CHAPTER 3

- 3.1**
1. The diagram shows the supply and demand curves from the data in the table. These curves intersect at the equilibrium price \$32 and the equilibrium quantity 7.
 2. Excess demand is 6 and excess supply is 3.
 3. With excess demand the price is bid up, with excess supply the price is pushed down.
 4. Equate supply P to demand: $18 + 2Q = 60 - 4Q$, implying $6Q = 42$, which is $Q = 7$. Hence $P = 32$.



- 3.2**
1. Demand curve facing *Air Canada* shifts left and down. The price of the substitute *Via Rail* has fallen and reduced the quantity of air transport services demanded at any price.
 2. Demand curve facing *Air Canada* shifts left and down. The substitute car travel has improved in quality and perhaps declined in cost.
 3. Demand curve facing *Air Canada* shifts left and down. A new budget air carrier is another substitute for *Air Canada* that will divide the market for air transport.

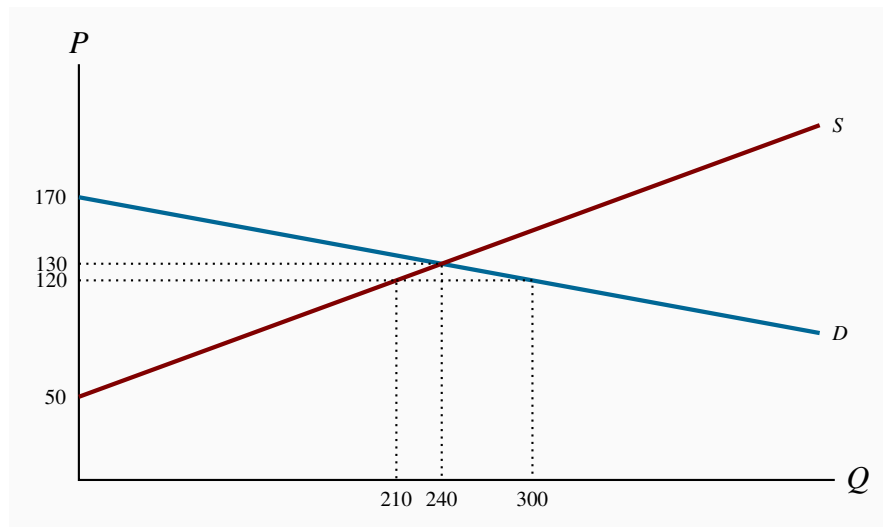
3.3 The market diagrams are drawn on the assumption that each product can be purchased for a given price, the supply curve in each market segment is horizontal. A downward sloping demand should characterize each market. If the cigarette market is 'quashed' the demand in the market for chewing tobacco, a substitute, should shift outward, leading to higher consumption at the same price.



3.4 The supply curve shifts down and parallel, the demand curve shifts up and parallel.

1. Setting the new supply equal to the new demand: $10 + 2Q = 76 - 4Q$ implies $6Q = 66$ and therefore $Q = 11$, $P = 32$.

3.5 The diagram shows that equilibrium quantity is 240, equilibrium price is \$130, which are the values obtained from equating supply and demand. At a price of \$120 the quantity demanded is 300 and the quantity supplied is 210. Excess demand is therefore 90.



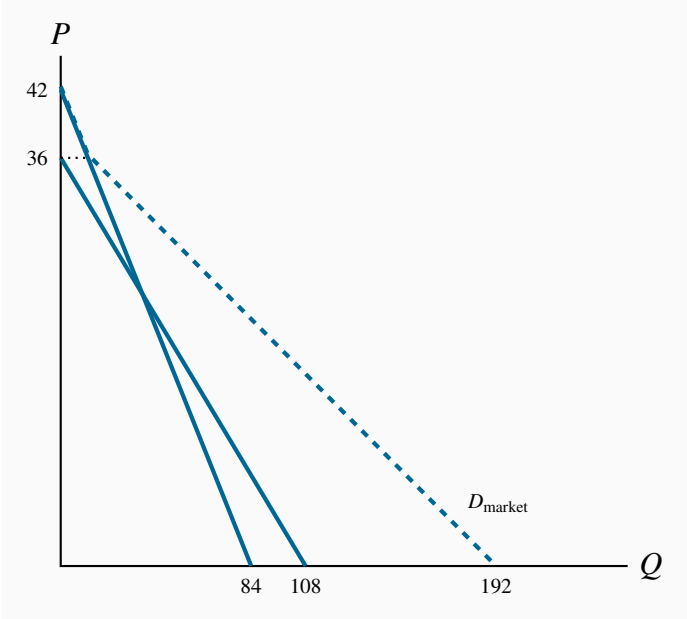
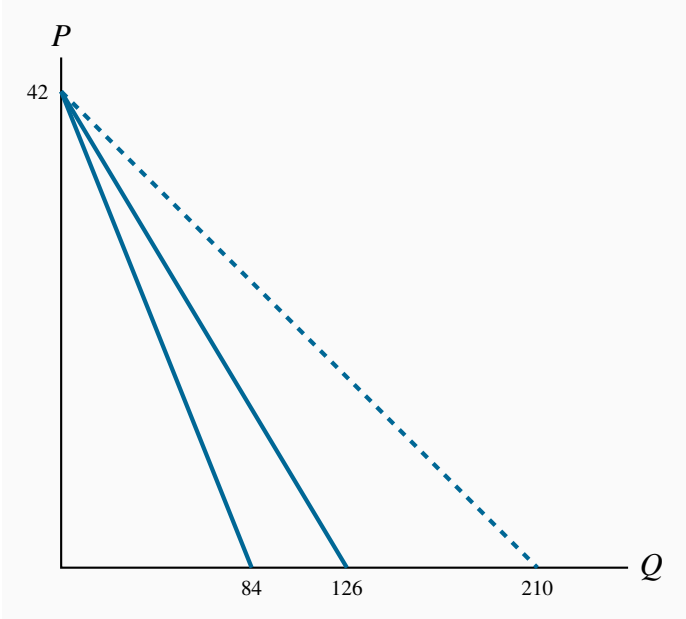
3.6 1. At a price of \$140 quantity demanded is 180 and quantity supplied is 270; excess supply is therefore 90.

2. Total quotas of 180 will maintain a price of \$140. This is obtained by substituting the price of \$140 into the demand curve and solving for Q .

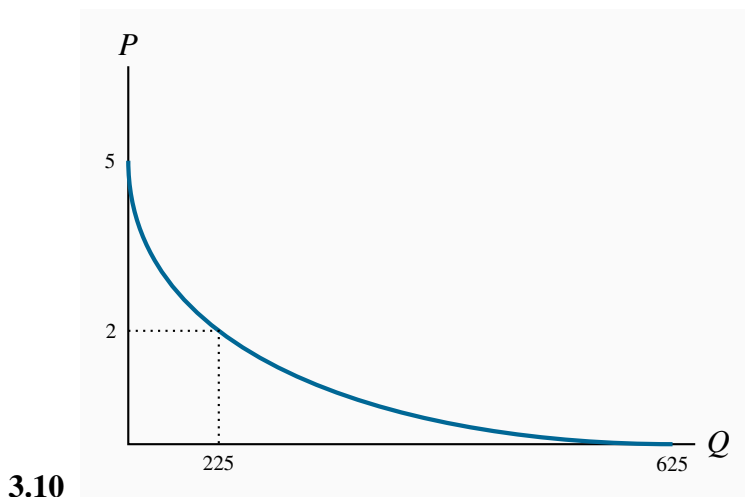
3.7 It must buy 90 units at a cost of \$140 each. Hence it incurs a loss on each unit of \$60, making for a total loss of \$5,400.

3.8 1. The quantity axis intercepts are 84 and 126.

2. The quantities demanded are 160, 110 and 60 respectively, on the market demand curve in the diagram. These values are obtained by solving the quantity demanded in each demand equation for a given price and summing the quantities.



3.9

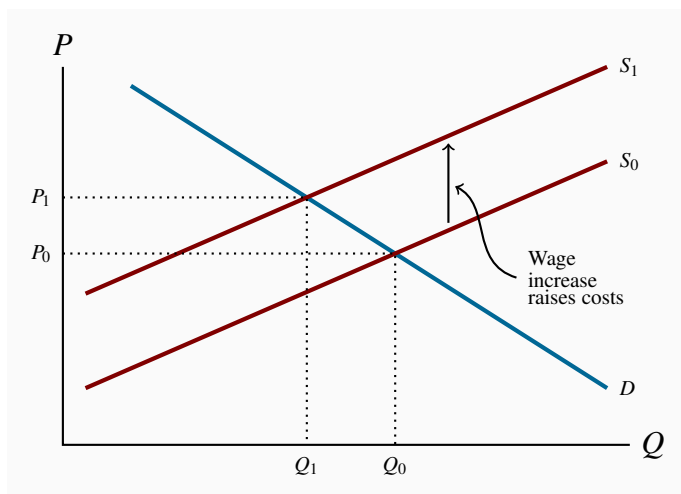


3.11 1. The equilibrium admission price is $P = \$21$, $TR = \$630$.

2. The equilibrium price would now become $\$18$ and $TR = \$648$. Yes.

3. The answer is no, because total revenue falls.

3.12 Wages are a cost of bringing lettuce to market. In the market diagram the supply curve for lettuce shifts upwards to reflect the increased costs. If demand is unchanged the price of lettuce rises from P_0 to P_1 and the quantity demanded falls from Q_0 to Q_1 .



SOLUTIONS TO EXERCISES FOR CHAPTER 4

4.1 1. Rates of growth of real GDP:

$$2010-11: \left(\frac{1307}{1282} - 1 \right) \times 100\% = 1.95\%, \quad 2011-12: -1.45\%$$

2. Rates of inflation:

$$2011: \left(\frac{111.9}{109.1} - 1 \right) \times 100\% = 2.7\%, \quad 2012: 24.1\%$$

3. Rates of growth of labour force and employment:

2010-2011:

$$\text{Labour: } \left(\frac{17.857}{17.593} - 1 \right) \times 100\% = 1.5\%, \quad \text{Employ: } \left(\frac{16.696}{16.573} - 1 \right) \times 100\% = 0.95\%$$

2011-2012:

Labour: 1.5%, Employ: 0.96%

4. Unemployment rates 2010-2012:

$$2010: \left(\frac{17.593 - 16.537}{17.593} \right) \times 100\% = 6.0\%$$

2011: 6.5%

2012: 7.0%

Unemployment increased in 2011 and 2012 because the growth in employment was less than the growth in the labour force.

4.2 1. The participation and employment rates in 2012 were:

$$\left(\frac{18.125}{27.885} \right) \times 100\% = 65\% \quad \text{and} \quad \left(\frac{16.856}{27.885} \right) \times 100\% = 60.4\%$$

2. The labour force would decline to $(0.645 \times 27.885) = 17.986$ without any change in employment. As a result the unemployment rate in 2012 would fall to 6.3% but the employment rate would be unchanged. The fall in the participation rate lowers the size of the labour force. The population and employment, and the employment rate are unchanged.

4.3 Value added is the difference between the market value of final output and the costs of intermediate inputs to production. In this case the market value of final output is \$1,000, the cost of inputs is \$625, i.e. $(\$350 + \$125 + \$150)$, and value added is \$375 $(\$1,000 - \$625)$. If brewers wholesale some of their output it is an intermediate input to the service provided by pubs and is not counted in GDP.

4.4 Nominal GDP is the market value of final goods and services produced in the economy. The value of final goods produced by the goods industry is \$4,000, \$5,000 – \$1,000 sold as intermediate inputs to the service industries. The value of final services produced by the service industries is \$9,000, \$10,000 – \$1,000 sold as intermediate inputs to the goods producing industries. Nominal GDP is \$13,000, i.e. \$4,000 + \$9,000.

The value of output is the sum of value added in the goods and service industries, namely

- i. Value added in services = \$10,000 – \$1,000 intermediate inputs of computers, paper etc. = \$9,000.
- ii. Value added in goods = \$5,000 – \$1,000 intermediate financial and other services = \$4,000.
- iii. Value of aggregate output = \$13,000.

4.5 1. Nominal GDP by expenditures = $C + I + G + X - IM = 4,000$.

2. Net domestic income = Employ income + Business income + invest income = 3650.

3. Nominal GDP by income = Net domestic income + capital consumption allowance + net indirect taxes = 4,000.

4.6 1. Investment expenditure is $Y - (C + G + NX) = 2,000 - (\$1,700 + \$50 + \$40) = \$210$.

2. If exports are \$350 and net exports are \$40 imports are \$310.

3. Net domestic income is $GDP - (CCA + T_{in}) = \$1,770$.

4. Yes. Net exports would be negative if imports exceed exports.

4.7 1. Growth in nominal GDP from 2012 to 2013 is 10%.

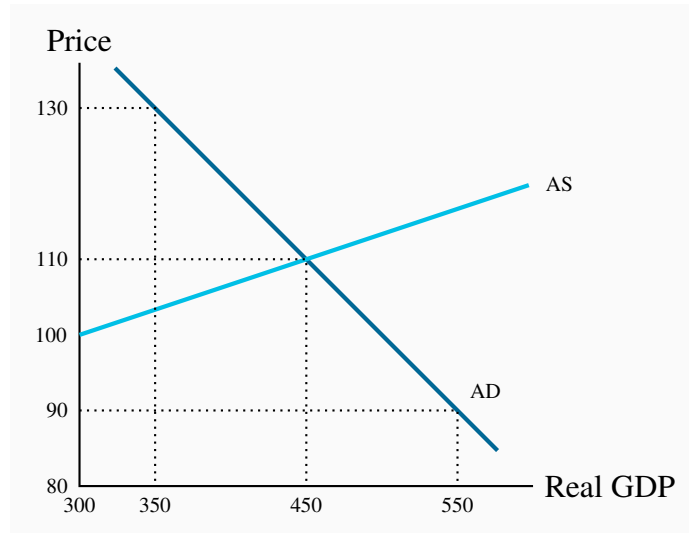
2. Real GDP in 2012 was \$721.15. Real GDP in 2013 was \$736.60. Real GDP grew by 2.14%.

3. Per capita real GDP was \$28.8 thousand in 2012 and \$24.5 thousand in 2013.

4. The standard of living declined because population grew faster than real GDP.

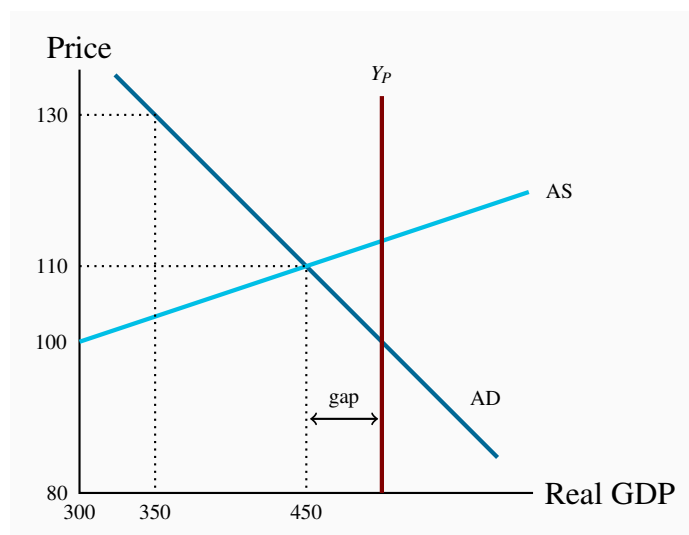
SOLUTIONS TO EXERCISES FOR CHAPTER 5

5.1 1. The AD and AS curves are as shown below.



2. The short run equilibrium values are $P = 110$, $Y = 450$, where the AD and AS curves intersect.

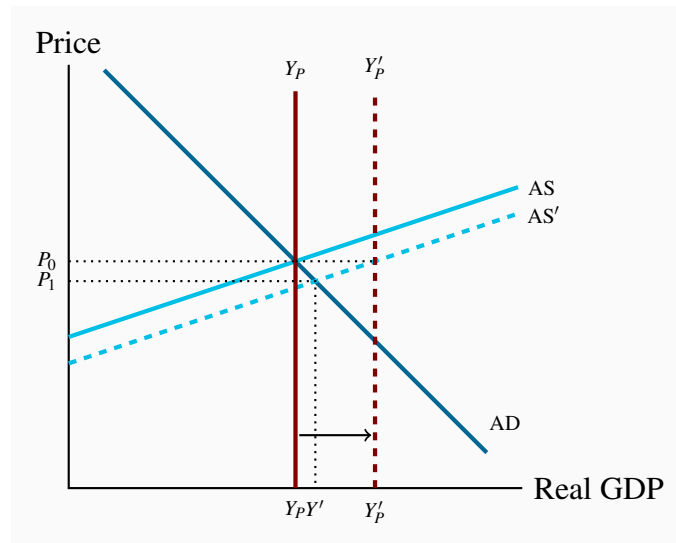
5.2 1. The diagram shows potential output of $Y_P = 500$ added to the diagram.



2. The diagram shows an output gap. Equilibrium $Y \neq Y_P$.

3. The output gap is $Y - Y_P = (450 - 500) = -50$.

5.3 Growth in labour force, or the stock of capital, or improvements in technology that increased the productivity of labour and capital would increase the economy's capacity to produce goods and services and increase potential GDP. As shown in the diagram below, the vertical line measuring potential output would shift to the right. Without an increase in AD a recessionary gap opens. The economy could produce more output at any price level without putting upward pressure on the price level beyond the initial level P_0 .

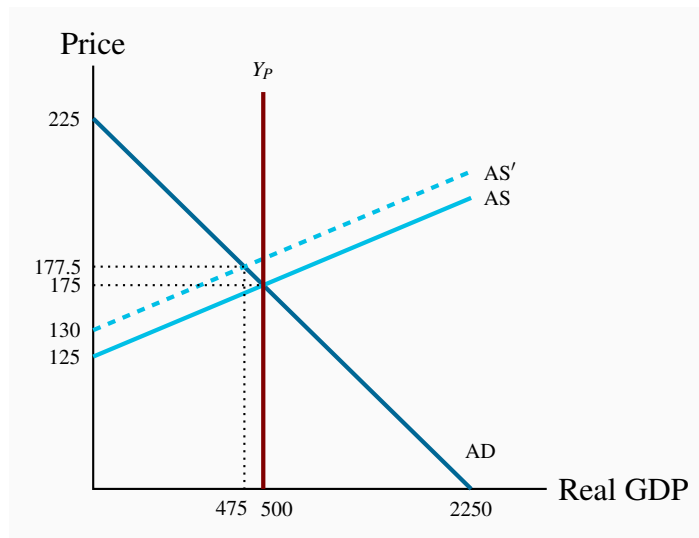


5.4 1. Short run equilibrium means $AD=AS$. For the aggregate demand and supply functions given:

$$\begin{aligned} Y &= 2250 - 10 \times (125 + 0.1Y) \\ 2Y &= 2250 - 1250 \\ Y &= 500 \end{aligned}$$

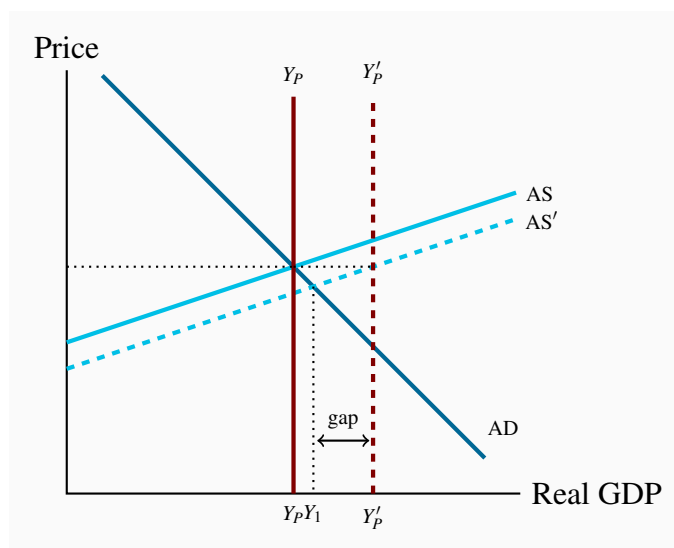
When $Y = 500$, AS gives $P = 125 + 0.1 \times 500 = 175$.

2. In the diagram, the intercepts of the AD curve are $Y = 2250$, $P = 225$. The vertical intercept of the AS curve is $P = 125$.
3. The new AS' curve as shown by the dotted line would be $P = 130 + 0.1Y$, and the AD curve would be $Y = 2250 - 10P$. The new equilibrium value of Y would be lower and P would be higher, namely $Y' = 475$ and $P = 177.5$.



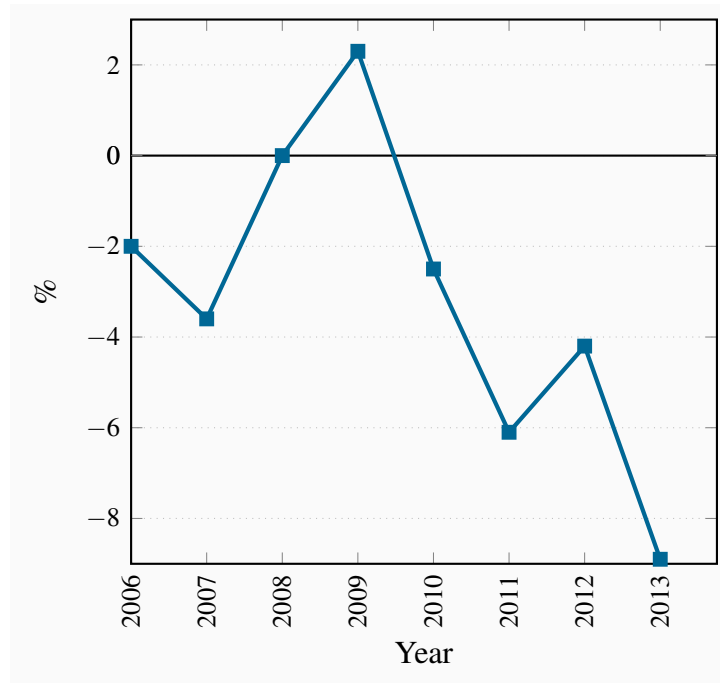
4. The new AS' curve is shown as a dotted line in the diagram. There is a recessionary gap of 25.

- 5.5** 1. A simple approximation of the annual growth in potential output is the sum of the growth in labour force and labour productivity, namely $1.5\% + 1.0\% = 2.5\%$. However it is more accurate to recognize the compounding effect and multiply $1.015 \times 1.01 = 1.0252$, which gives an annual rate of growth of potential output as 2.52% .
2. The growth in potential output is illustrated by a rightward shift in the Y_p and AS curves as shown below.



- 5.6** Output gaps in a growing economy are calculated as: $\frac{Y - Y_p}{Y_p} \times 100\%$. The data give the following annual gaps:

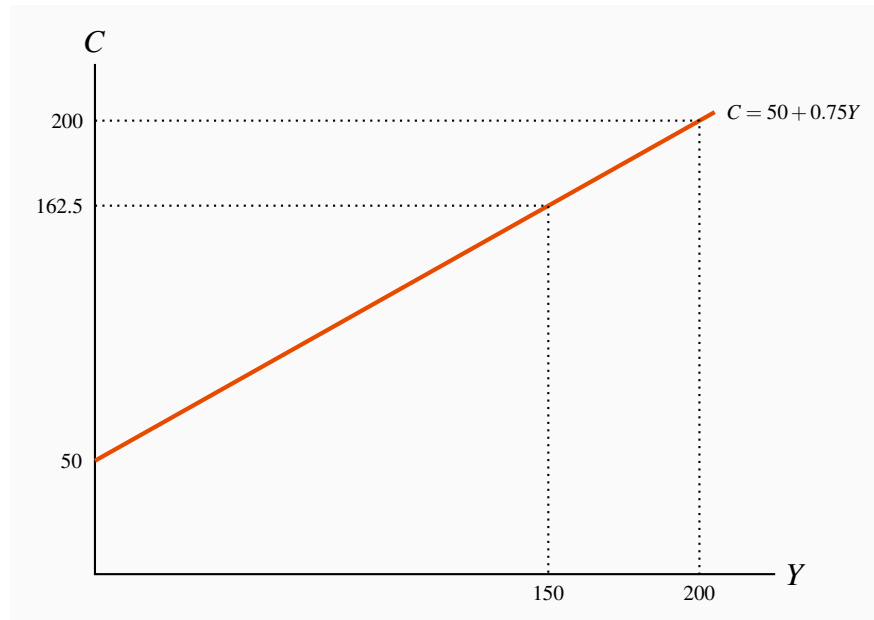
Year	2006	2007	2008	2009	2010	2011	2012	2013
Gap	-2.0	-3.6	0	+2.3	-2.5	-6.1	-4.2	-8.9



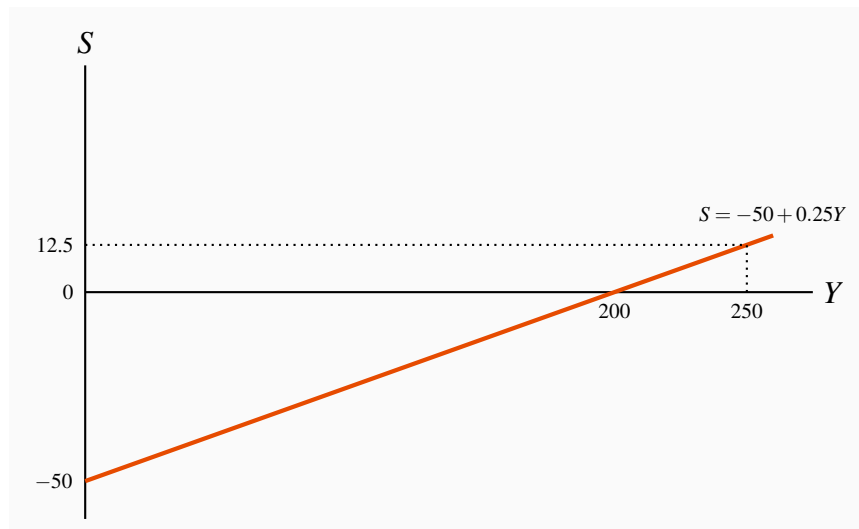
The plot of the output gaps shows the economy in recession in 2006-07, followed by recovery and boom from 2008-09, followed by recession starting in 2010, running into 2011 and then moderating in 2012 before deepening in 2013.

5.7 With the output function $Y = 100N$, employment is proportional to output. A 1.0 percent reduction in output (Y) would reduce employment by 1.0 percent.

SOLUTIONS TO EXERCISES FOR CHAPTER 6

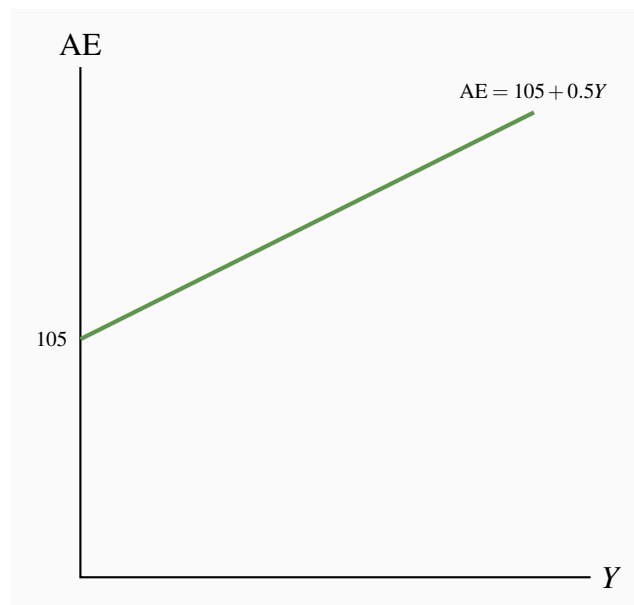


1. When $Y = 150$, $C = 50 + 0.75 \times 150 = 162.5$.
2. When $Y = 200$, $C = 50 + 0.75 \times 200 = 200$. The change in consumption caused by the change in income of 50 is $\Delta C = 0.75 \times \Delta Y = 37.5$.
3. If $C = 50 + 0.75Y$, then $S = Y - C = -50 + 0.25Y$.

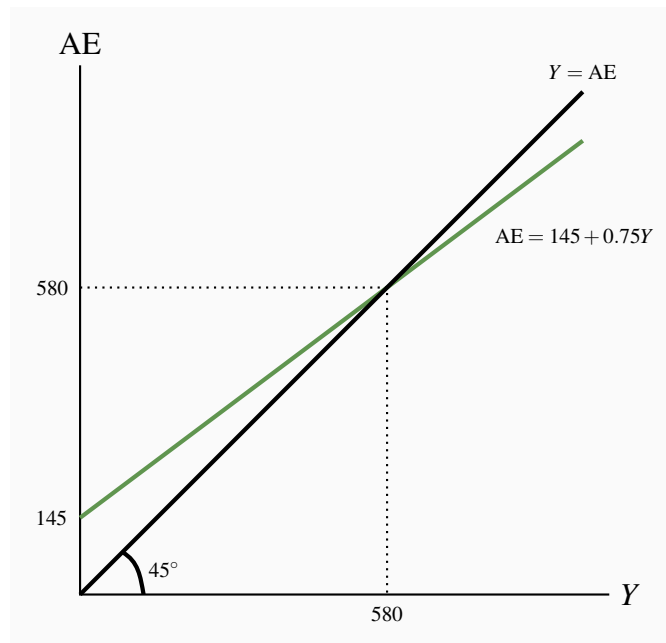


4. In the diagram in part (c), $S = 0$ when $Y = 200$. If Y increased to 250, saving would increase by: $\Delta S = 0.25 \times 50 = 12.5$.

- 6.2** 1. A reduction in autonomous expenditure from 50 to 30 would cause a parallel downward shift in the consumption function, and a parallel upward shift in the savings function. The new intercepts with the vertical axes would be 30 and -30 respectively. The slopes are not changed.
2. The marginal propensity to consume would be lower and the marginal propensity to save higher. The slope of the consumption function would be reduced and that of the saving function increased.
- 6.3** 1. The AE function is $AE = 105 + 0.5Y$. In the diagram the intercept on the vertical axis is 105 and the slope of AE is 0.5.
2. The aggregate expenditure function $AE = 105 + 0.5Y$ has an intercept on the vertical axis of 105. This measures autonomous expenditure.



3. The slope of the AE function is 0.5. It measures the change in AE caused by a change in national income.
- 6.4** 1. The aggregate expenditure function is $AE = C + I + X - IM$. In this example:



2. The 45° line is shown in the diagram.
3. Algebraically, in equilibrium:

$$\begin{aligned}
 Y &= AE \\
 Y &= 145 + 0.75Y \\
 Y - 0.75Y &= 145 \\
 0.25Y &= 145 \\
 Y &= 580
 \end{aligned}$$

- 6.5**
1. If output is OG, planned expenditure would be OB. Planned expenditure would be greater than current output.
 2. At output OG the *unplanned decrease* in inventories is AB.
 3. Business firms will respond by increasing output to meet the strong demand for output.
 4. The equilibrium level of output and expenditure is OH=OD.
 5. If output were at OJ, there would be an *unplanned increase* in inventories in the amount EF.
- 6.6**
1. The initial equilibrium would be at $Y = OG$.
 2. If the marginal propensity to import, m , were to increase the slope of the AE function, which is MPC minus the marginal propensity to import ($c - m$), would decrease by a corresponding amount and the new AE function would be AJ.

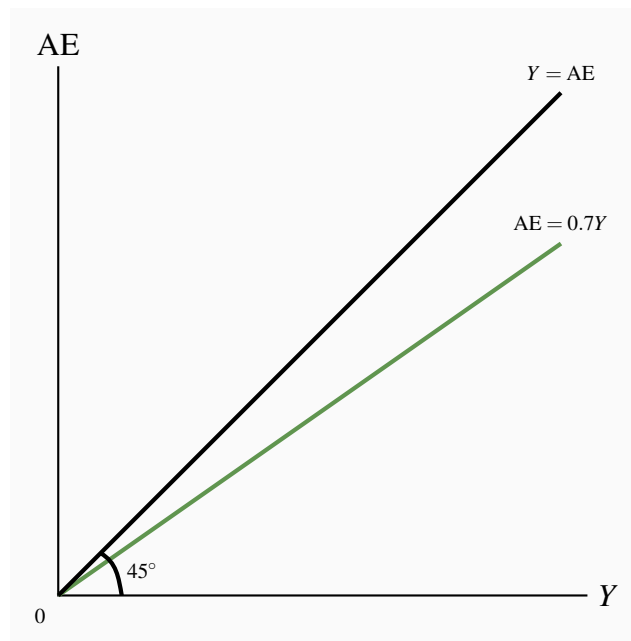
3. The new equilibrium, based on the AE function AJ, would be $Y = OF$.
4. If the MPC increased the new AE function would be AL and the new equilibrium would be $Y = OH$.

- 6.7** 1. When autonomous expenditure $A = 0$, $MPC = 0.8$ and $MPM = 0.1$. The AE function is:

$$AE = (MPC - MPM)Y$$

$$AE = 0.7Y$$

2. A diagram to illustrate this AE.

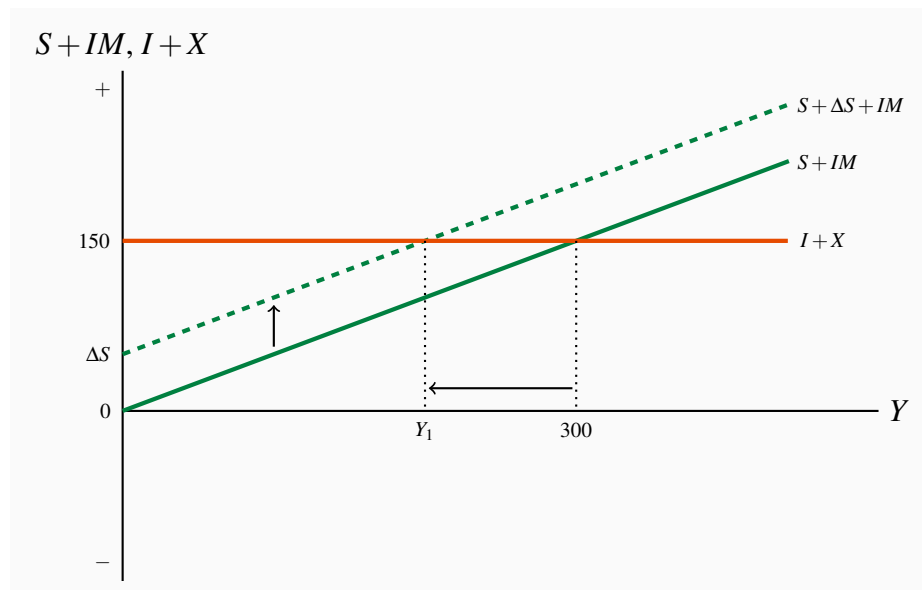


3. The equilibrium level of real GDP is $Y = 0$.
 4. The equilibrium $Y = 0$ because expenditure is not sufficient to cover the costs of production at any positive level of real GDP.
- 6.8** 1. The $AE = 105 + 0.5Y$ with $MPC = 0.75$ and $MPM = 0.25$. An increase in investment by 10 with a slope of $AE = 0.5$, increases equilibrium real GDP by: $\Delta I \times \text{multiplier} = 20$.
2. An increase in real GDP by 20 means consumption has increased by 15 and imports have increased by 5 for a net change in induced expenditure by 10.
 3. If the MPC was 0.85 the slope of AE would be ($MPC - MPM = 0.85 - 0.25 = 0.6$) the increase in investment by 10 would increase equilibrium real GDP by 25, consumption by 21.25 and imports by 6.25 for a net change in induced expenditure of 15. The higher MPC gives a higher slope to AE and a larger multiplier.

- 6.9**
1. Equilibrium real GDP would be 1,000.
 2. The marginal propensity to consume is $\Delta C/\Delta Y = 0.9$, to import $\Delta IM/\Delta Y = 0.15$.
 3. The multiplier = $1/(1 - \text{slope of AE})$, the slope of AE is the $MPC - MPM = 0.75$, the multiplier is $1/(1 - 0.75) = 4$.
 4. If actual real GDP were 900, AE would be $250 + 0.75(900) = 925$. If AE is greater than Y inventories are reduced to fill the gap. Planned investment, including planned inventory investment is 100 but the unplanned reduction in inventories reduces actual investment to 75.
 5. An increase in planned investment by 50 with a multiplier of 4 increases equilibrium income and real GDP by 200 to 1,200.

6.10 In equilibrium $S + IM = I + X$, which in this case gives: $0.5Y = 150$.

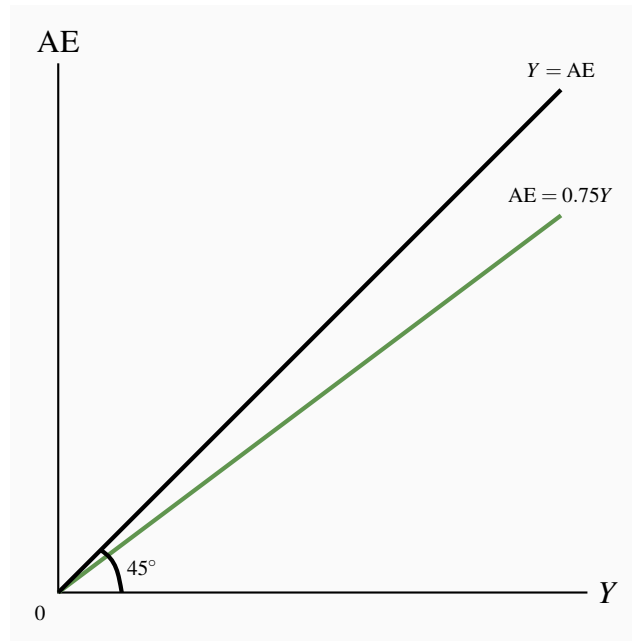
1. The diagram shows equilibrium income $Y = 300$.



2. Higher autonomous household saving, which means equally lower autonomous consumption expenditure would lower equilibrium real GDP and income by the increase in saving multiplied by the multiplier.

In the diagram the $S + IM$ line shifts up as shown by the amount of the increase in autonomous saving. Equilibrium real GDP is reduced, but the sums of saving plus imports and investment plus exports are unchanged.

6.11 1. The AE function $AE = 0.75Y$ is shown in the diagram.



2. The equilibrium real GDP is $Y = 0$.

$$\begin{aligned}
 Y &= AE \\
 Y &= 0.75Y \\
 0.25Y &= 0 \\
 Y &= 0
 \end{aligned}$$

3. Equilibrium $Y = 0$ because AE is never sufficient to give producers the revenue they need to cover their costs of production.

SOLUTIONS TO EXERCISES FOR CHAPTER 7

7.1 Before government is established $G = 0$, $C_0 + I_0 + NX_0 = 200$ and an $MPC = 0.75$ and $MPM = 0.15$ the aggregate expenditure function is:

$$AE = 200 + 0.6Y$$

Then for equilibrium:

$$\begin{aligned} Y &= AE \\ Y &= 200 + 0.6Y \\ Y_0 &= \frac{200}{1 - 0.6} = 500 \end{aligned}$$

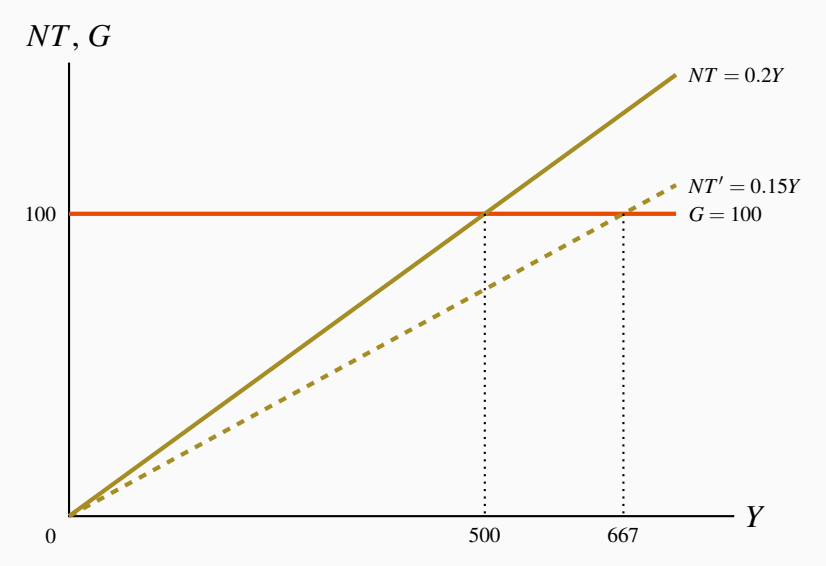
After government is established and $G = 100$: $AE = 300 + 0.6Y$. Equilibrium $Y = Y_1 = 750$.

- 7.2**
1. The slope of AE in Exercise 7.1 is 0.6. The slope of AE in Exercise 7.2 is 0.525.
 2. The multiplier in Exercise 7.1 is 2.5. The multiplier in Exercise 7.2 is 2.11.
 3. With a tax rate $t = 0.1$ disposable income would be $Y_d = 0.9Y$ giving $AE = 300 + 0.525Y$ and equilibrium $Y = 632$, compared to the equilibrium of 750 in Exercise 7.1.

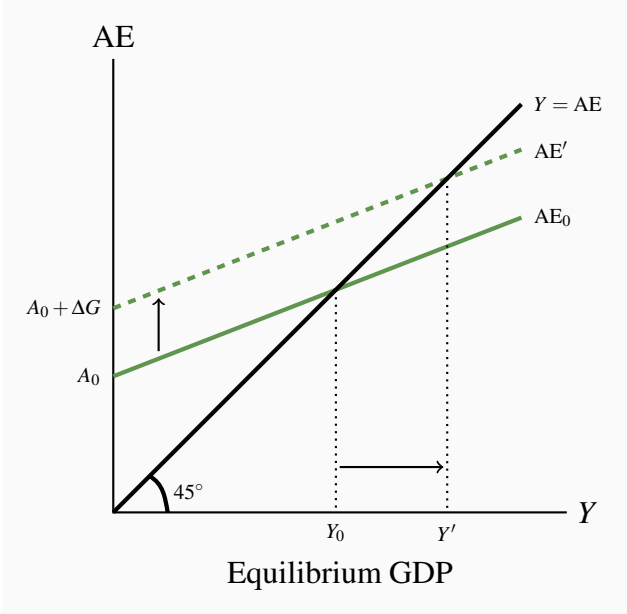
- 7.3**
1. The table values are as follows:

Y	$NT = tY$	G	$BB = NT - G$
100	20	100	-80
200	40	100	-60
300	60	100	-40
400	80	100	-20
500	100	100	0
600	120	100	+20
700	140	100	+40

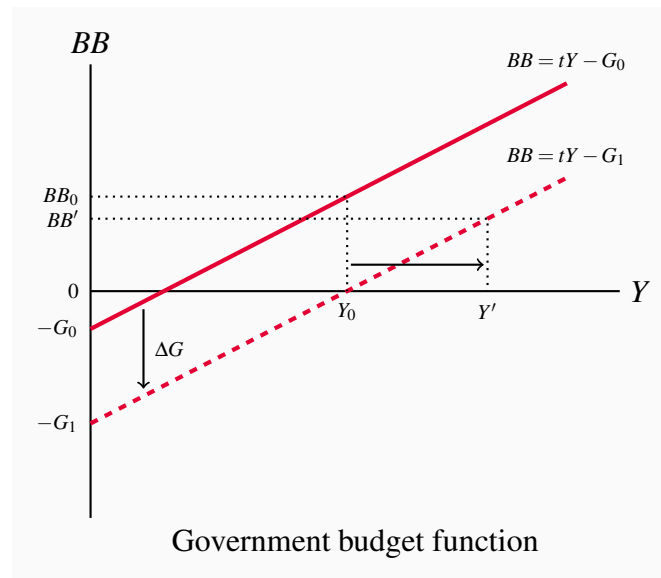
2. The NT function has an intercept of 0 because there is no autonomous tax revenue, and a slope of 0.2. The G function has a vertical intercept at 100 and zero slope because G is autonomous.



3. A cut in the net tax rate from $t = 0.20$ to $t = 0.15$ reduces tax revenue proportionately at every level of Y as shown by the lower slope on the tax function NT' in the diagram. The budget balance $NT - G$ is correspondingly lower at every Y .



7.4



Before the increase in G , equilibrium is $Y = Y_0$ and the government's budget balance is BB_0 . The increase in G shifts AE up and the BB function down. The increase in Y combined with the new budget function $BB = tY - G_1$ give a new budget balance BB' , smaller than the initial balance, but not reduced by the full amount of the increase in G because the expansionary effect of increased G raised Y and tax revenue.

7.5 1. The slope of AE is the change in C minus the change in IM caused by a change in real income Y .

$$AE/\Delta Y = MPC \times (1 - t) - m = (0.8 \times 0.75) - 0.15 = 0.45$$

and the multiplier $\Delta Y/\Delta A = [1/(1 - 0.45)] = 1.82$.

2. Autonomous expenditure is $300 + 400 = 700$. Equilibrium real GDP is autonomous expenditure times the multiplier:

$$Y = 700 \times 1.82 = 1,274$$

With equilibrium income 1,274 the government budget balance, BB , is:

$$\begin{aligned} BB &= tY - G \\ &= 0.25 \times 1,274 - 400 \\ &= 318.5 - 400 \\ &= -81.5 \end{aligned}$$

3. An increase in G by 100 will increase equilibrium Y by 182 and raise tax revenue by 45.5 increasing the government budget deficit to $BB = -136$.

7.6 1. With $Y = 750$ and $Y_P = 850$ there is a recessionary gap $= Y - Y_P = -100$.

2. If the $MPC = 0.75$, $MPM = 0.10$ and $t = 0.20$ the slope of $AE = 0.75(1 - 0.20) - 0.1 = 0.5$, and the multiplier is:

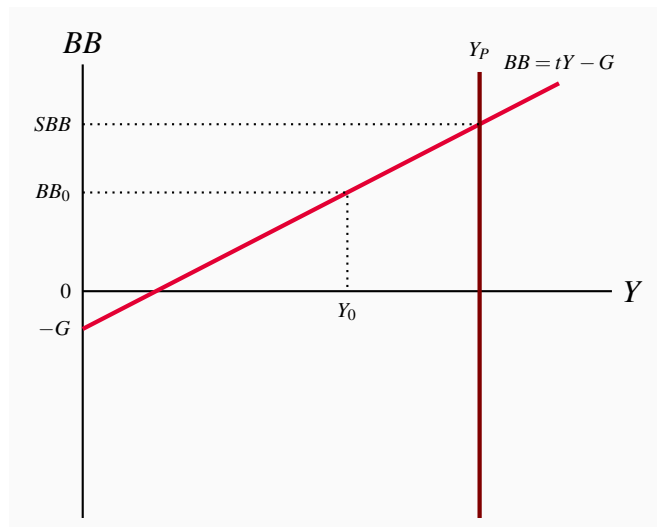
$$\frac{1}{1 - 0.5} = 2.0$$

To increase equilibrium income by 100 requires an increase in G by $100/2 = 50$.

3. With the initial tax rate $t = 0.20$, the $MPC = 0.75$ and $MPM = 0.10$ and $Y = 750$, total autonomous was $750/2 = 375$. The new tax rate needed for equilibrium $Y = 850$ and $A_0 = 375$ must give a multiplier of $850/375 = 2.267$.

Then $\frac{1}{1 - 0.75(1 - t_1) + 0.10} = 2.267$, and solving for t_1 gives $t_1 = 0.121$. As an alternative to increasing G by 50 to eliminate the GDP gap, the government could cut the net tax rate by $0.20 - 0.121 = 0.079$ or close to 40%.

- 7.7** 1. The vertical intercept of BB is $-G$ and the slope of BB is the net tax rate t .



2. The structural budget balance is shown at SBB , the budget balance at Y_P . If the economy has a recessionary gap as at Y_0 the actual budget balance is BB_0 .
3. Automatic stabilization comes from the slope of the budget function. Changes in Y move the economy along the budget function, causing pro-cyclical changes in the actual budget balance but do not change the structural balance. Discretionary fiscal policy changes t , or G or both t and G . The result is a new budget function and a new structural budget balance.

- 7.8** 1. With $Y = 2000$ and a public debt of 1000 the debt/GDP ratio is 0.5 or 50%.

2. After an increase in government expenditure $\Delta G = 10$, equilibrium $Y = 2020$ and the change in the government's budget balance is $\Delta T - \Delta G = 2 - 10 = -8$.
3. Financing this budget deficit results in a national debt of 1008. The new debt/GDP ratio is $1008/2020 = 49.9\%$.

SOLUTIONS TO EXERCISES FOR CHAPTER 8

8.1 Money is anything generally accepted as a means of payment, a store of wealth and a unit of account.

In Canada today, Bank of Canada notes, coins and bank deposits are money.

The money supply is the sum of notes and coin in circulation outside the banking system, and bank deposits.

A debit card is money because, like a cheque, it transfers bank deposits from the bank account of the payer to the bank account of the payee. There is no payment further financial obligation. Using a credit card to make a payment creates a credit card debt for the payer that must be settled by a money payment – notes or bank deposits.

8.2 A central bank, like the Bank of Canada works to control money and financial conditions in the economy using its position as monopoly supplier of monetary base – bank reserve assets. It is not profit oriented. It does not attempt to make a profit.

A commercial bank works to earn a profit for its owners (shareholders) by providing banking services to the non-bank public on terms that generate net interest income. It is profit oriented.

8.3 Banks create money by issuing their own deposit liabilities (IOUs) in payment for the assets they buy, such as financial securities and customer loan contracts.

Suppose banks operate to a 5% reserve ratio. $rr = 0.05$.

The following balance sheets show the initial new deposit and the deposit creation that follows.

1. The new deposit provides the banks with a 100 increase in cash (reserve asset) in exchange for 100 in new deposit liabilities.

All banks			
Assets		Liabilities	
Cash	+100	Deposits	+100

(excess reserves +95)

2. In part (a) banks hold \$95 excess reserves based on the reserve ratio of 5%. In part (b) they make loans equal to their excess reserves \$95, and pay for those loans by creating new deposit liabilities, \$95.

Assets		Liabilities	
Loans	+95	Deposits	+95

3. Assuming the public uses bank deposits as money and does not withdraw cash from the banking system, the banks expand their lending and create new deposits to a total of +1,900, based on the initial increase in cash reserves and the reserve ratio of 5%. The deposit multiplier is: $\Delta D = \Delta R / rr = 100 / 0.05 = 2,000$.

Assets		Liabilities	
Cash	+100	Deposits	+2,000
Loans	<u>+1,900</u>		
	+2,000		

8.4 If banks have a reserve ratio of $rr = 10\%$ and the public has a currency ratio of $cr = 10\%$ a new cash deposit of \$1,000 to the banking system would allow an expansion of bank deposits by:

$$\begin{aligned}\Delta D &= \Delta MB \times [1 / (rr + cr)] \\ \Delta D &= 1,000 \times [1 / (0.10 + 0.10)] \\ \Delta D &= 1,000 \times (1 / 0.2) \\ \Delta D &= 5,000\end{aligned}$$

Deposit expansion beyond the initial \$1,000 would be the result of a \$4,000 increase in bank lending.

With an expansion of bank deposits by \$5,000 the public would increase cash holdings by \$500 (i.e. 10%).

Yes. If the banks could encourage a lower currency ratio a larger share of the monetary base would be available to the banks as reserves to support bank lending and deposit creation. A lower currency ratio increases the deposit and money supply multipliers that and bank lending.

8.5 Confidence in the banking system is based partly on the established reputations of banks in converting deposits into cash and the general acceptability of bank deposits as means of payment. This confidence is reinforced by the insurance coverage on deposits up to \$100,000 provided by CDIC.

8.6 The money multiplier determines the change in the money supply that results from a change in the monetary base. It would be useful to a central bank wishing to control the money supply using its control and management of the monetary base.

- 8.7** 1. With a monetary base of $MB = 1,000$ a reserve ratio of $rr = 0.10$ and a currency ratio of $cr = 0.15$ the money supply function is:

$$M_S = \frac{1 + cr}{rr + cr} \times MB = \frac{1.15}{0.25} \times 100 = 4,600$$

2. If the monetary base decreased by 100, money supply would decrease by:

$$\Delta M_S = \frac{1 + cr}{rr + cr} \times \Delta MB = \frac{1.15}{0.25} \times (-\$100) = -\$460$$

8.8 The financial crisis made both banks and the non-bank public more concerned about the risks attached to making loans and to holding bank deposits. The banks responded by increasing their reserve ratios and by being more selective about the quality of loans and other assets they bought. Even if total bank assets were not reduced overall some forms of bank credit did dry up and some potential borrowers are denied credit.

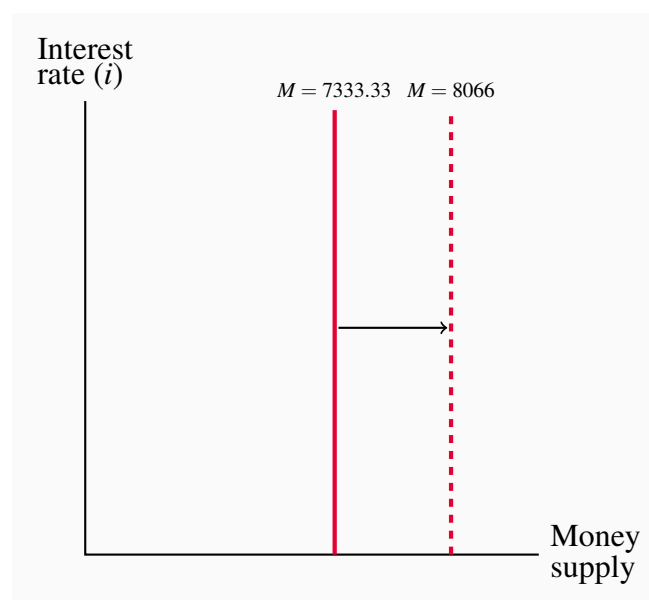
Concerns about the stability of banks and other financial institutions led the non-bank public to hold more of their money in cash rather than deposits. If the currency ratio is increased and the banking system's lending capacity is reduced.

The effects of increased reserve ratios and currency ratios are smaller deposit multipliers, reduced bank lending and reduced money supply in the absence of an offsetting increase in the monetary base.

- 8.9** With monetary base $H = \$1,000$, $rr = 0.05$ and $cr = 0.10$ the money supply would be:

$$M = 1,000 \times \left(\frac{1 + 0.10}{0.05 + 0.10} \right) = 1,000 \times 7.33 = 7,333.33$$

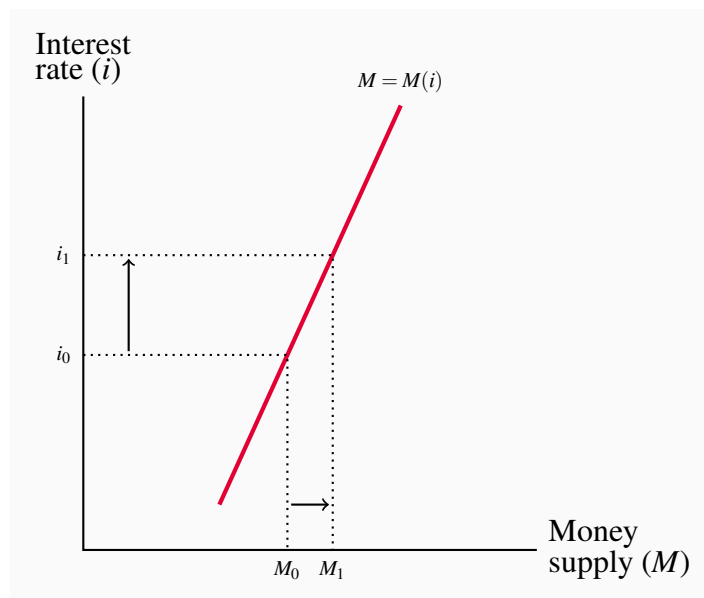
This money supply is shown by the vertical line M in the diagram.



If high powered money were to increase by 10 percent to 1,100 the money supply would be increased by 733 to 8,066. The money supply function in the diagram is shifted to the right to show this effect.

8.10 If the cr falls as interest rates rise the money multiplier would increase as interest rates increased giving a positive relationship between the interest rate and the money supply.

The diagram shows a money supply function with $\Delta M/\Delta i > 0$.



SOLUTIONS TO EXERCISES FOR CHAPTER 9

9.1 A perpetual bond with a 3% coupon would have a market price of \$100 if the current market rate were 3%. (Yield=coupon/price. Price=coupon/yield= \$3.00/0.03 = \$100).

9.2 1. The market price of the bond is the present value of the future stream of payments it provides. A two-year 5% bond, when market rates are 4% has a present value of:

$$P_B = PV = \frac{\$5}{1.04} + \frac{\$105}{(1.04)^2} = \$4.81 + \$97.08 = \$101.89$$

2. If market rates rise to 6%, then the market price of the two-year 5% bond will be:

$$P_B = PV = \frac{\$5}{1.06} + \frac{\$105}{(1.06)^2} = \$4.72 + \$93.45 = \$98.17$$

3. The market risk in holding bonds is that bond prices and interest rates vary inversely. A rise in market interest rates means a fall in bond prices and capital losses for bondholders, at least on paper.

9.3 The price of \$1,000 three year 6% bond that yields 5.5%, the current market rate, for three year bonds is:

$$P_B = PV = \frac{\$60}{1.055} + \frac{\$60}{(1.055)^2} + \frac{\$1,060}{(1.055)^3} = \$56.87 + \$53.91 + \$902.71 = \$1,013.49$$

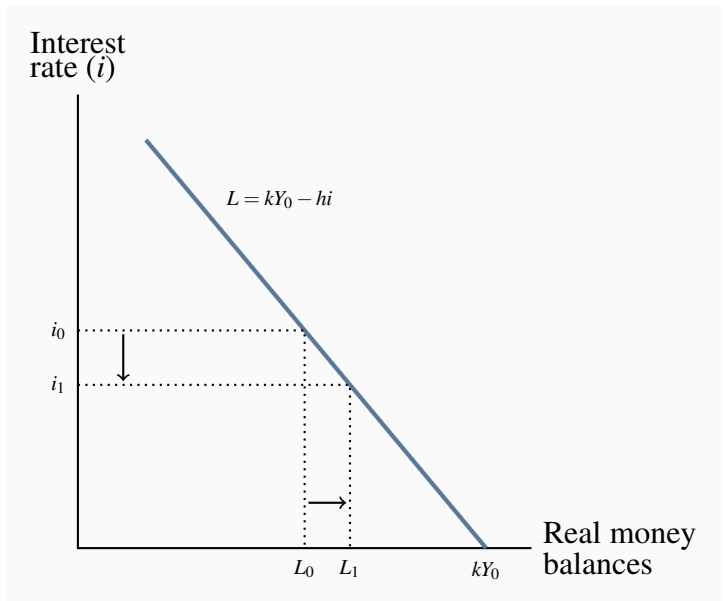
Therefore paying \$1,015 for the \$1,000 bond would be too high a price in terms of current market yields.

9.4 1. The horizontal intercept in the diagram (below) shows the money balances people would want to hold, based on their income (Y_0) if the interest rate, and thus the opportunity cost of holding money were zero. The slope of the line shows how portfolio managers would adjust their holdings of money (vs bonds) if interest rates were to change.

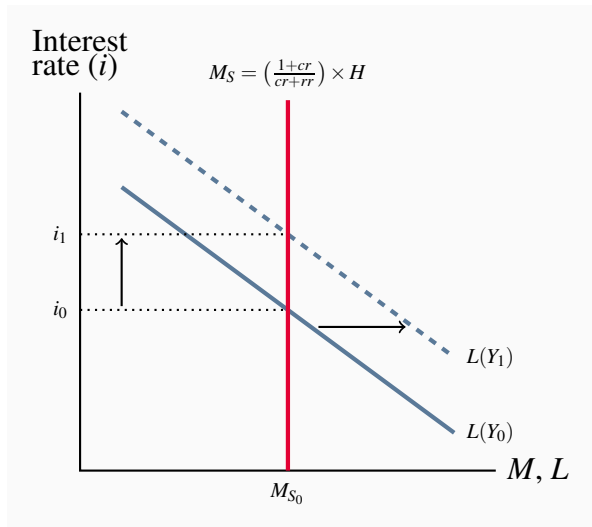
2. At the interest rate i_0 the demand for money balances is L_0 . Some money balances are held to make regular payments, some to provide for uncertainty in the timing of receipts and payments, and some to lower the risks in portfolios of bonds and money.

3. If interest rates dropped from i_0 to i_1 in the diagram, the people demand for money balances would increase from L_0 to L_1 . Lower interest rates mean lower opportunity costs to holding money balances.

A fall in interest rates increases the demand for money balances and reduces the demand for bonds. Portfolios shift from bonds to money.



4. An increase in real GDP ($\Delta Y > 0$) would shift the demand for money function to the right by the amount $k\Delta Y$. Higher Y means higher income and expenditure levels and a need for larger transaction balances to make payments.



9.5

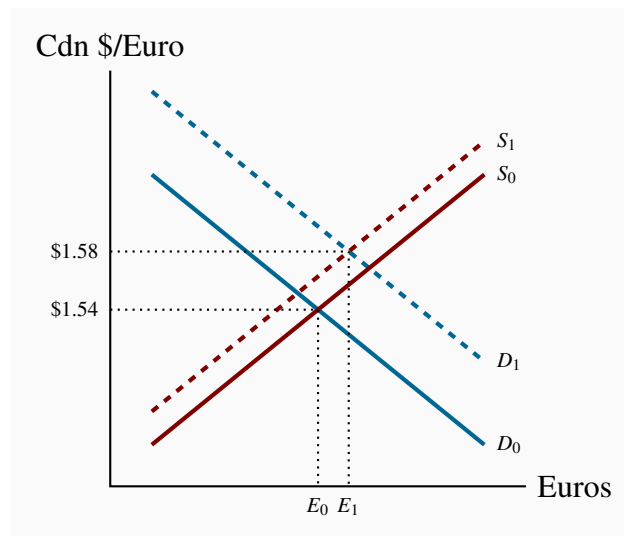
In the diagram the M_S line is vertical. M_S is not affected by interest rates. The monetary base and the money multiplier determine the position of the M_S line. The position of the demand for money function L is determined by the level of real income Y_0 , and the transactions demand kY_0 . The slope of the L function illustrates the reaction of portfolio managers, changing the mix of money and bonds in portfolios in response to changes in interest rates. Higher interest rates reduce the demand for money balances and increase the demand for bonds.

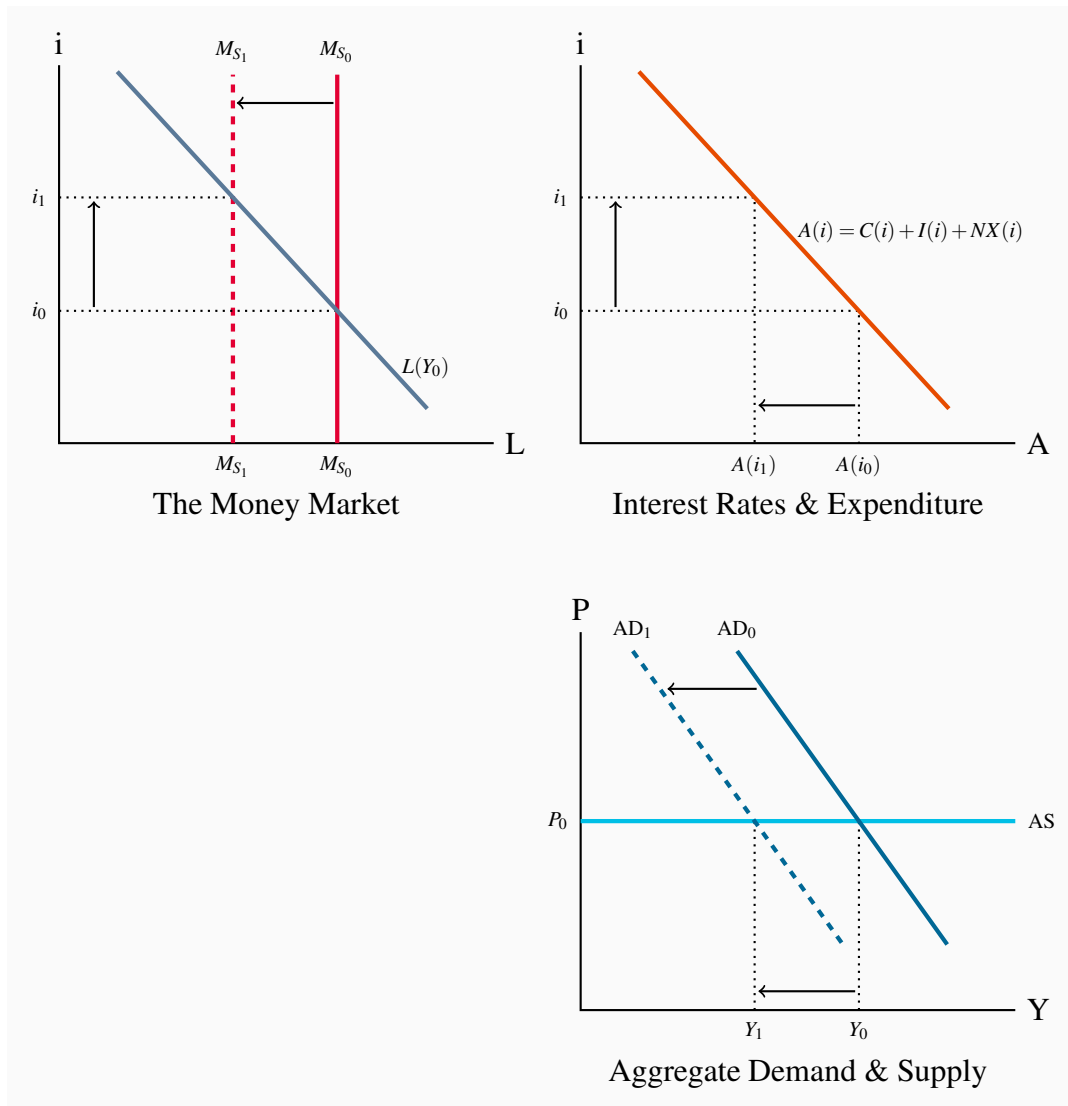
1. An increase in income to Y_1 shifts the demand for money function L to the right to $L(Y_1)$. The

excess demand for money balances at the initial interest rate i_0 results in the sale of bonds, bond prices fall and yields increase until interest rates rise to i_1 .

2. With higher Y and higher demand for money the new equilibrium interest rate is higher but money holdings are unchanged because the money supply is fixed.

9.6 A fall in Canadian interest rates relative to euro rates makes euro bonds more attractive to portfolio managers than Canadian bonds. Reduced demand for Canadian bonds by foreign bondholders reduces the supply of euros on the market while increased demand for euro bonds by Canadian bondholders increases the demand for euros. The diagram shows these changes in supply and demand and the rise in the exchange rate that result.





9.7

1. A reduction in M_S shifts the M_S line to the left, raising interest rates and lowering expenditure to $A(i_1)$. AD shifts to the left by the change in A times the multiplier to AD_1 and Y is reduced to Y_1 .
2. Alternatively, an increase in precautionary demand for money would shift the demand for money (L) to the right, raising interest rates and lowering expenditure and aggregate demand and equilibrium Y .
3. Alternatively, any increase in autonomous expenditure would shift the expenditure function to the right, the AD function to the right and higher Y would increase the demand for money balances L . as a result interest rates would rise offsetting some of the increase in investment expenditure (moving along the $A(r)$ function) and shifting AD back to the left. The net result would be a increase in investment, interest rates and equilibrium Y .

SOLUTIONS TO EXERCISES FOR CHAPTER 10

10.1 A central bank that operated to make maximum profits would cause financial market instability by expanding the monetary base through its purchase of interest bearing government bonds until the yields on those bonds were driven to (approximately) zero.

A commercial bank pursues profits as long as the costs of raising funds through deposit expansion are less than the interest revenue earned by expanding its lending. The bank's shareholders expect a positive return on their equity in the business. Competition among banks and the public's concern about the solvency of a bank means the costs of funds rises as the bank expands, thereby eliminating the profitability of further expansion.

Currently, the central bank's operating objective is to control the rate of inflation based on an agreed target inflation rate of 2%.

The central bank's unique position as monopoly supplier of the monetary base, cash and central bank deposits, gives it the power to pursue its monetary policy objectives.

10.2 Monetary base, central bank notes (cash) and deposits, are the ultimate means of payment in the economy. Commercial banks issue deposits that are convertible into cash on demand. This convertibility together with the public's demand for cash balances creates a demand for monetary base that limits the size of commercial bank deposit liabilities. The central bank's control of the monetary base gives it control of the money supply and interest rates.

10.3 A change in monetary base is by itself a direct change in the money supply. But the profit seeking behaviour of the commercial banks causes a larger change in the money supply as a result of ΔMB . If $\Delta MB > 0$, for example, and the public deposits these new funds in the banks, the banks find they are holding excess reserves. These reserves support an increase in bank lending and the deposit creation that goes with it. The money supply increases based on the money supply multiplier provided the currency and reserve ratios are constant.

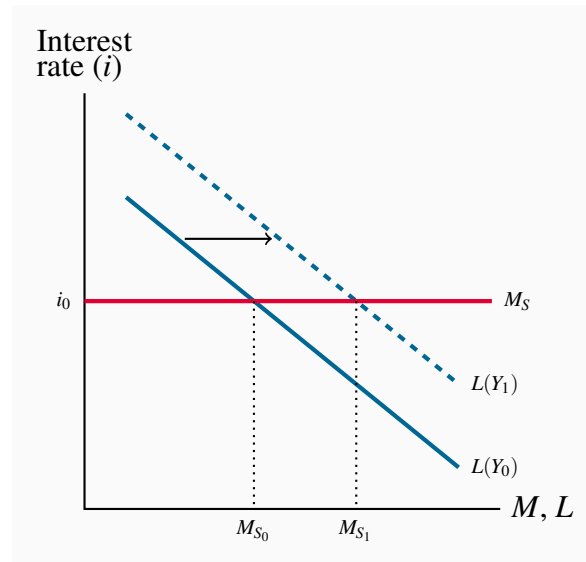
10.4 1. The purchase of \$10 million in the open market by the central bank creates \$10 million in monetary base, which increase the reserves of the commercial banks, provided it is not held as cash by the non-bank public.

2. With a reserve ratio $rr = 0.025$ and a cash ratio $cr = 0.075$ a \$10 million increase in monetary base results in:

- i. An increase in money supply of \$107.5 million.
- ii. An increase in public cash holdings of \$7.5 million.
- iii. An increase in bank reserve balances of \$2.5 million.

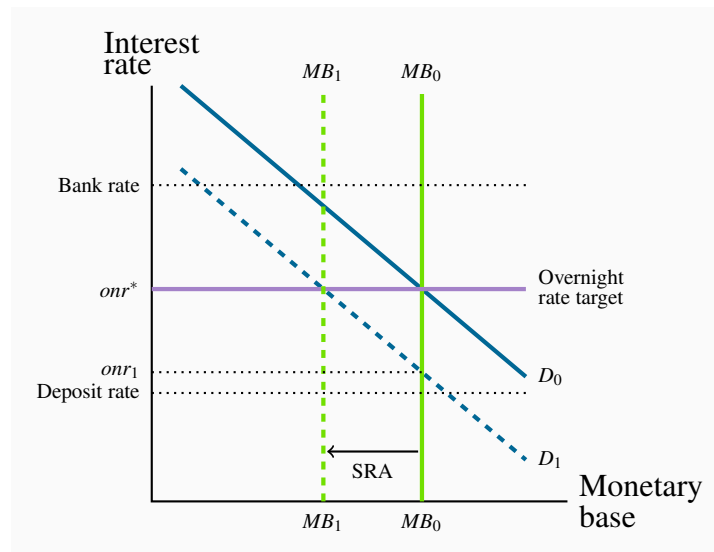
10.5 To set and maintain interest rate at i_0 in the diagram the central bank provides whatever money supply is demanded at that interest rate. This is shown in the diagram by the horizontal M_S line at i_0 .

An increase in real output from Y_0 to Y_1 would increase the demand for money, shifting the $L(Y)$ line in the diagram to the right to $L(Y_1)$. The money supply would increase to M_{S1} to meet the increased demand for money at the interest rate i_0 .



- 10.6**
1. The Bank of Canada's monetary policy target is an inflation control target of 2% in the CPI within a range of 1%-3%. The Bank aims at a 2% inflation rate over six to eight quarters.
 2. The Bank uses the overnight interest rate as its monetary policy instrument to influence short-term interest rates by raising or lowering the target and operating band it sets for the overnight rate.
 3. Implementing monetary policy by setting the interest rate means the Bank gives up its short-term control of the money supply.

10.7 The market for overnight funds:

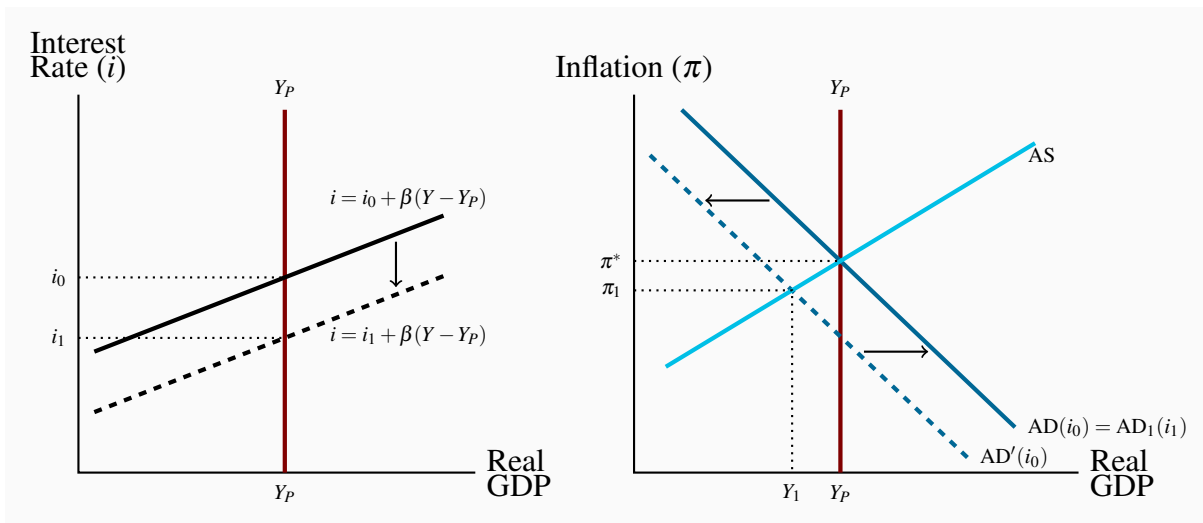


The Bank has set its target for the overnight rate at ONR^* consistent with a demand for monetary base D_0 . If it happens that the demand for monetary base is less than D_0 , for example D_1 , the ONR will fall below the Bank's target. To prevent this the Bank can remove some monetary base from the overnight market by selling short term securities to the banks on the agreement that it will buy those securities back the next day. This is a 'sale and repurchase agreement', and SRA . Its effect is to reduce the monetary base, as illustrated by the shift to MB_1 , and maintain ONR^* as shown by the intersection of D_1 and MB_1 .

The Bank uses an SRA rather than an open market operation because an SRA makes an immediate change in the clearing balance position of the banks that last for one day. It is a very short-term adjustment. An open market operation takes time to affect the clearing balance position of the banks as it works its way through bond markets and bank customer accounts to clearing balances. It is better suited to longer term management of the monetary base rather than very short term and likely temporary adjustments to bank clearing balances.

- 10.8**
1. The central bank chooses and sets the interest rate it thinks will be consistent with equilibrium at potential output at its target rate of inflation.
 2. A rise in the unemployment rate would indicate a fall in aggregate demand and call for a decrease in the Bank's interest rate from its basic setting.
 3. An inflation rate above the Bank's target would indicate stronger than expected aggregate demand and call for a rise in the Bank's interest rate from its basic setting.
 4. A persistent change in either unemployment or inflation would lead the Bank to change its basic interest rate setting.

10.9 The Bank's setting of the interest rate i_0 in the left hand diagram gives the AD curve $AD(i_0)$ in the right hand diagram and equilibrium at π^* , Y_P .



A persistent change in expenditure such as a decrease in investment or net exports would shift the $AD(i_0)$ to $AD'(i_0)$. The inflation rate would fall and output would fall to $Y_1 < Y_P$ in the diagram.

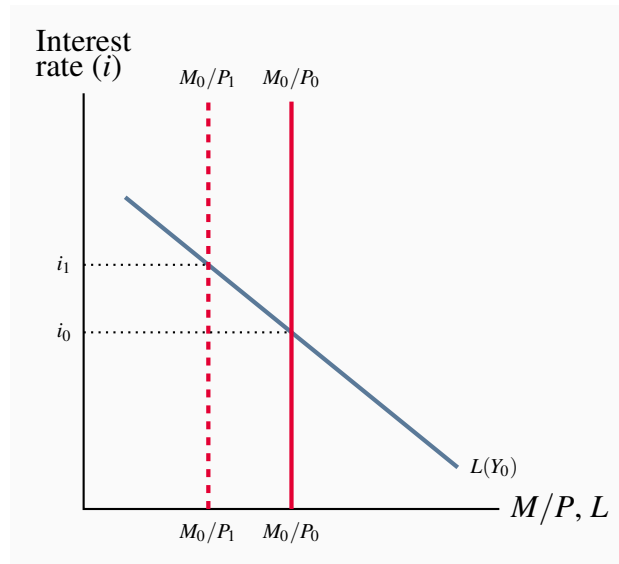
The Bank responds by lowering its interest rate setting to i_1 in the left-hand diagram lowering the monetary policy function. The lower setting for the interest rate shifts $AD'(i_0)$ to $AD'(i_1)$, which coincides with $AD(i_0)$.

The central bank's reaction to the change in AD has stabilized Y at Y_P .

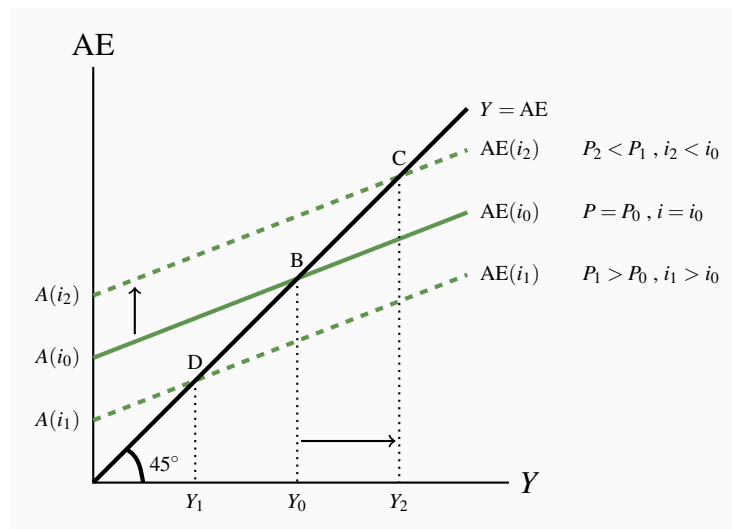
SOLUTIONS TO EXERCISES FOR CHAPTER 11

11.1 1. The money market diagram illustrates the determination of the equilibrium interest rate i_0 by the real money supply (M_0/P_0) and the demand for real money balances at the income level Y_0 , $L(Y_0)$.

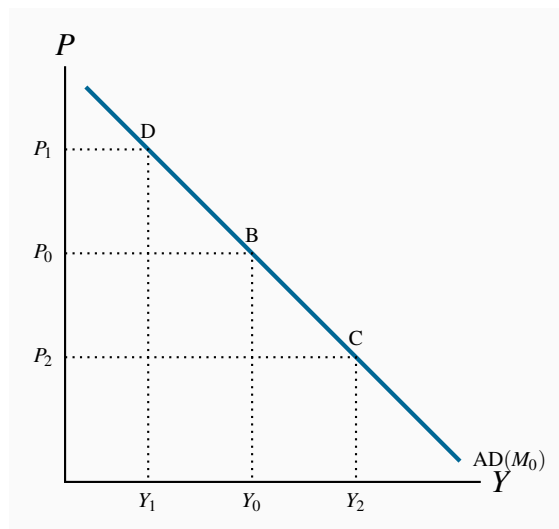
An increase in the general price level from P_0 to P_1 reduces the real money supply to M_0/P_1 , shifting the money supply function in the diagram to the left and raising the interest rate to i_1 . A fall in P would have the opposite effect.



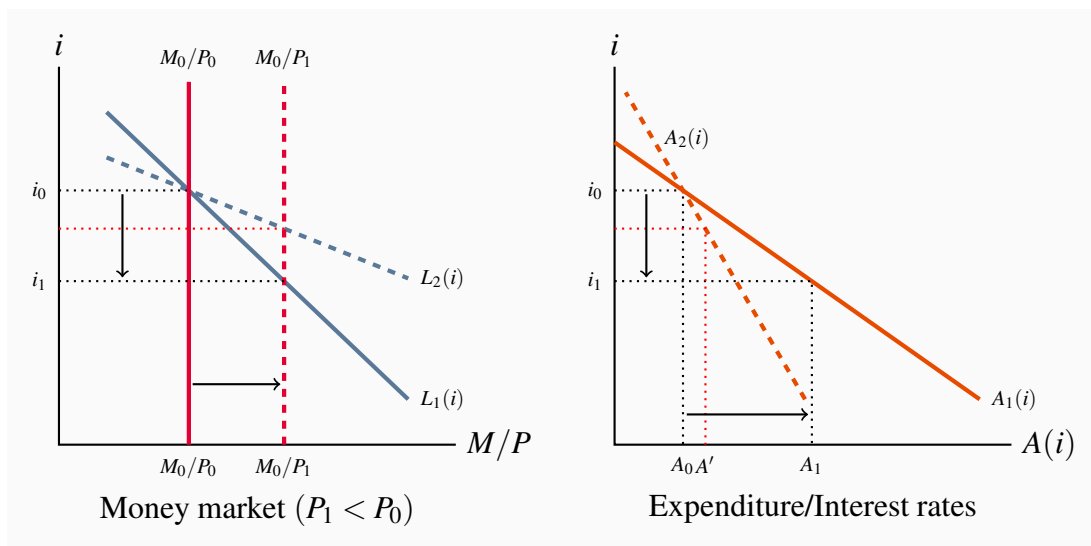
2. Changes in interest rates shift the AE function. If the initial AE function is $AE(i_0)$, a lower interest rate shifts AE up to $AE(i_2)$. A higher interest rate shifts AE down. Equilibrium real GDP changes as a result of the changes in AE caused by changes in interest rates.



3. The AD curve is the locus of equilibrium combinations of real GDP (Y) and the general price level (P). Points B, C and D in the above diagram are three such combinations. These combinations plotted in P, Y space give the AD curve for the money supply M_0 .



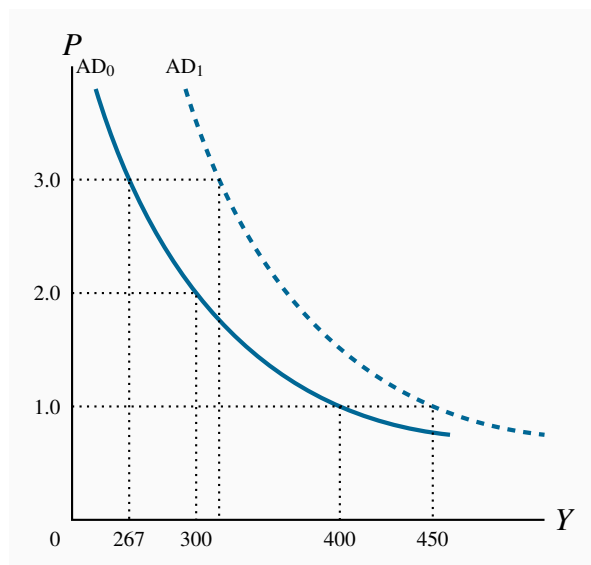
11.2 A demand for money that is not very sensitive to interest rate changes (a steep L function) and expenditures that are very sensitive to interest rates (a flat $A(i)$ function) would result in large changes in AE and equilibrium real GDP as a result of changes in P . The following diagrams illustrate.



With the demand for money $L_1(i)$, not very sensitive to interest rates, a fall in price from P_0 to P_1 lowers the interest rate to i_1 and with $A_1(i)$, very sensitive to interest rates, autonomous expenditure increases from A_0 to A_1 . The effect on AE and equilibrium Y is large compared to the effects of the same fall in prices when the opposite conditions prevail, as illustrated by the money demand $L_2(i)$ and the $A_2(i)$ expenditure function.

11.3 A flatter AE curve means a smaller multiplier and smaller changes in real GDP as a result of a change in P that changes interest rates and interest sensitive autonomous expenditure. The slope of the AD curve $-\Delta P/\Delta Y$ is determined by the change in autonomous expenditure $A(i)$ when $\Delta P = \Delta i$ and the change in equilibrium real GDP caused by a change in A , $(\Delta Y/\Delta A)$. $\Delta Y/\Delta A$ is the multiplier, which is $1/(1 - \text{slope AE})$. A flatter AE curve gives a smaller multiplier and thus a smaller ΔY as a result of ΔP . The AD curve is steeper when the slope of the AE curve is lower.

- 11.4**
1. When $P = 1$, $AE = 200 + 0.5Y$. When $P = 2$, $AE = 150 + 0.5Y$. When $P = 3$, $AE = 133.3 + 0.5Y$.
 2. A rise in P reduced the real money supply, causing a rise in interest rates, lower interest-sensitive expenditure and lower AE at every level of real GDP.
 3. The equilibrium levels of expenditure and real GDP are: $P = 1$, $Y = 400$; $P = 2$, $Y = 300$; $P = 3$, $Y = 267$.

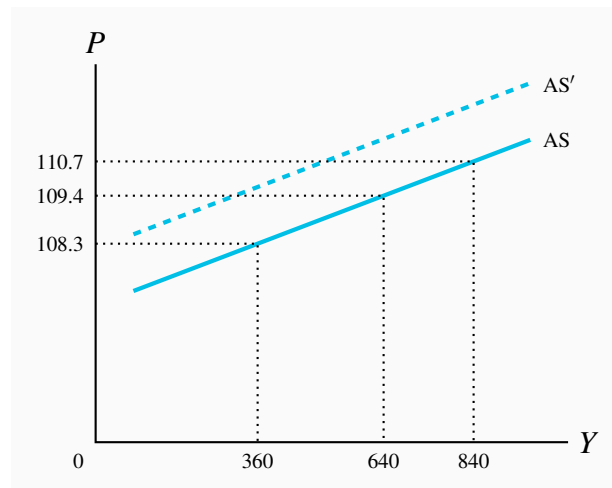


4. The AD curve would lie everywhere to the right of AD_0 at: $P = 1$, $Y = 450$; $P = 2$, $Y = 350$; and $P = 3$, $Y = 317$, giving AD_1 in the diagram for part (c).

- 11.5**
1. The price level when real GDP is $Y = 360$ is:

$$P = 100 + 1.5(1,000/180) = 100 + 1.5(5.56) = 108.3$$

Similarly when $Y = 640$, $P = 109.4$ and when $Y = 840$, $P = 110.7$. These values give the AS curve plotted as:



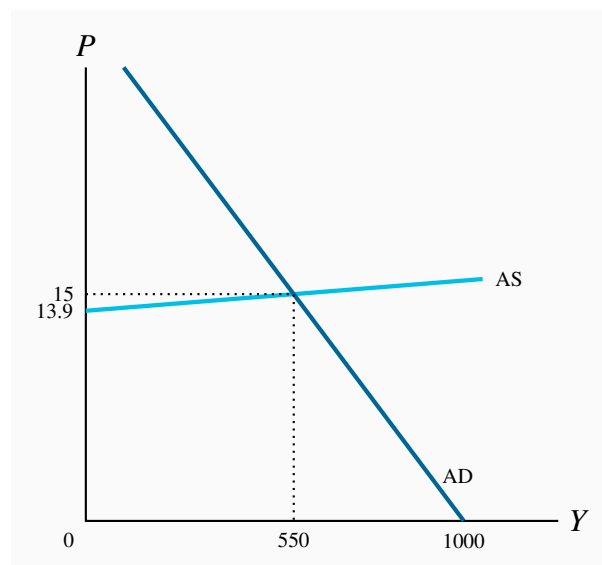
2. Labour productivity (Y/N) decreases as output increases and, with a fixed money wage rate, raises labour cost per unit of output. Producers need higher prices to cover these higher costs if they are going to supply more output. Therefore the AS curve is upward sloping. An increase in Y involves increased costs and increased prices.

3. When $W = 1,100$ and $Y = 360$, $P = 100 + 1.5(1,100/180) = 109.2$. Similarly with $Y = 640$, $P = 110.3$ and with $Y = 840$, $P = 111.8$.

The dotted AS' curve illustrates the effect of an increase in the wage rate on AS.

4. The higher money wage rate raises labour costs per unit at every level of output. Producers needed a higher price to cover this increase in costs if they are going to continue to supply the same level of output.

11.6 1. The AD and AS functions are plotted as:

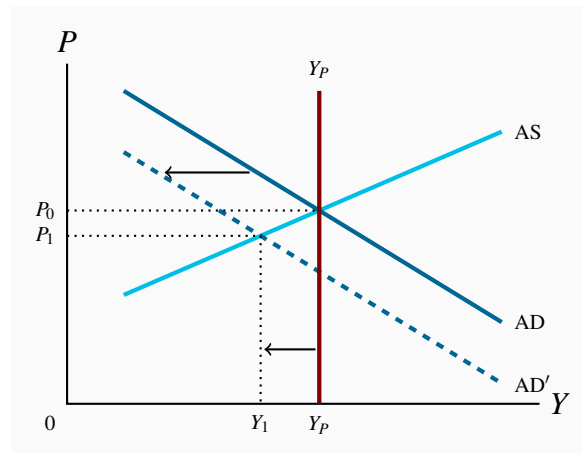


2. Equilibrium values from $AD = AS$ are $P = 15$, $Y = 550$.
3. If $Y_P = 650$ there is a recessionary gap of 100.
4. From $AD = AS$, equilibrium $Y = 583/1.06 = 550$. Note that the denominator of 1.06 captures the effect of the change in price along AS when any change in AE that shifts the AD curve (i.e. a change in the number 583 in this case). Closing the recessionary gap of 100 so $Y = 650$ with an increase in G , when the simple expenditure multiplier with constant prices is 2.0, calls for:

$$650 = (583 + 2\Delta G)/1.06$$

$$\Delta G = 53$$

An increase in government expenditure of 53 is required to close the gap, recognizing that the positively sloped AS curve means prices rise and offset some of the increase in expenditure as Y increases.



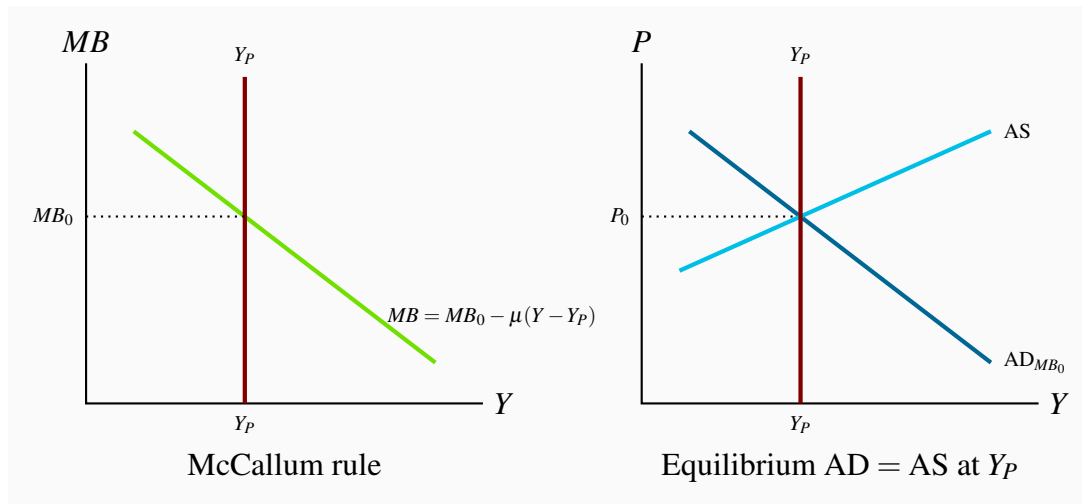
11.7

A fall in exports reduces AD by $\Delta X/(1 - \text{slope of AE})$ at every level of Y . Equilibrium Y falls from Y_P to Y_1 and lowers P from P_0 to P_1 . The result is a recessionary gap equal to $Y_1 - Y_P$.

11.8 A fall in the money wage rate will only work to reduce or eliminate a recessionary gap if lowers the AS curve without disturbing the AD curve. However, if debt contracts like loans, lines of credit, mortgages and bonds are defined in money terms, a fall in money wage rates reduces the flow of money income needed to service those contracts. Expenditures on goods and services would be reduced and some households and businesses would face insolvencies. In these circumstances the fall in wage rates reduces AD as AS falls and the equilibrium Y falls, increasing the recessionary gap.

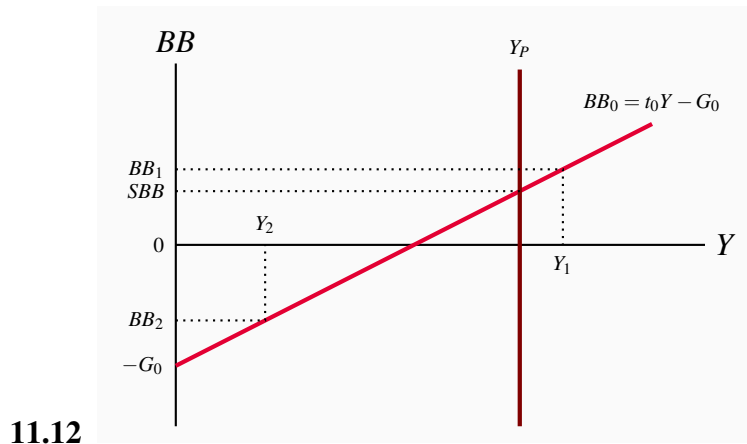
11.9 A rise in money wage rates would work to reduce an inflationary gap by raising production costs, shifting AS and prices upwards, raising interest rates and reducing expenditures along the AD curve until $AD = AS$ at Y_P .

11.10 In the diagram on the left the central bank sets the monetary base at MB_0 which, given current fundamental conditions, supports $AD_{(MB_0)}$ needed for equilibrium at Y_P .



11.11 Based on a McCallum rule, the central bank would react to transitory changes in economic conditions that shifted AD, and caused temporary departures from Y_P by changing MB as shown by movements along the MB rule. For example, the reaction to a transitory increase in AD would be a cut in MB , moving to the right and down the MB function. That would tighten credit conditions and reduce expenditure.

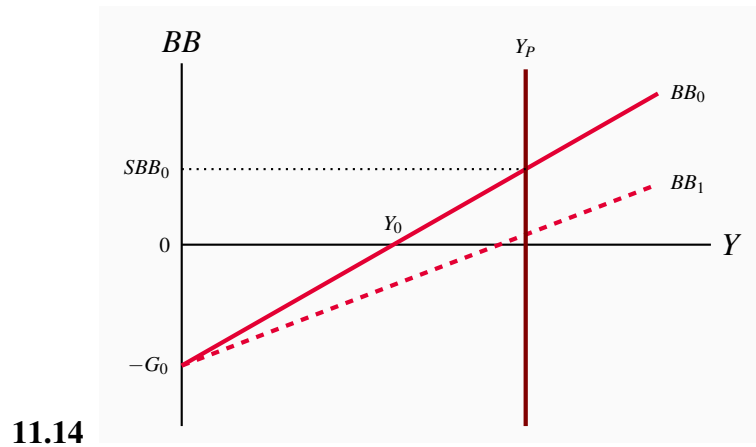
The central bank would react to a change in *fundamental economic conditions* by resetting its MB_0 target, which would shift the MB function and the AD curve.



The budget function BB_0 is defined by the tax rate t_0 and expenditure G_0 set in the government's budget plan. It would produce a structural budget surplus SBB at Y_P .

If economic conditions caused either inflationary or recessionary gaps actual budget balances would be either BB_1 , a larger surplus, or BB_2 , a budget deficit, respectively.

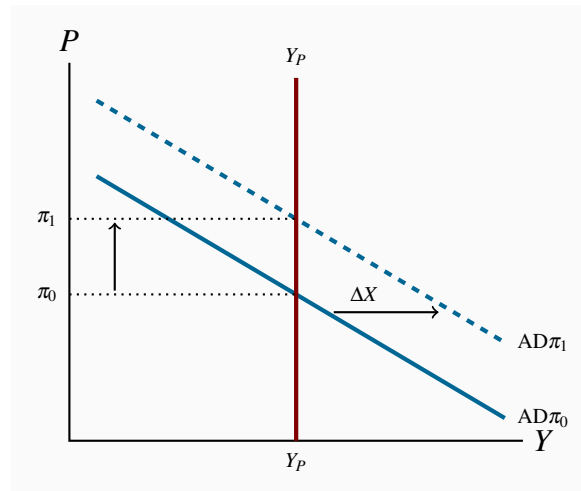
11.13 In the diagram above, the actual budget balance with an inflationary gap, $Y > Y_P$, is higher than the structural budget balance SBB .



The economy is initially at Y_0 with a recessionary gap and a balanced budget $BB = 0$. Fiscal stimulus, as cut in the tax rate, shifts BB_0 to BB_1 . The recessionary gap is eliminated. The structural and actual budget balances are equal with a small budget deficit.

SOLUTIONS TO EXERCISES FOR CHAPTER 12

12.1 The equilibrium inflation rate is determined by AD and Y_P at the expected inflation π^e . An increase in export demand would shift AD to the right and raise the equilibrium inflation rate.



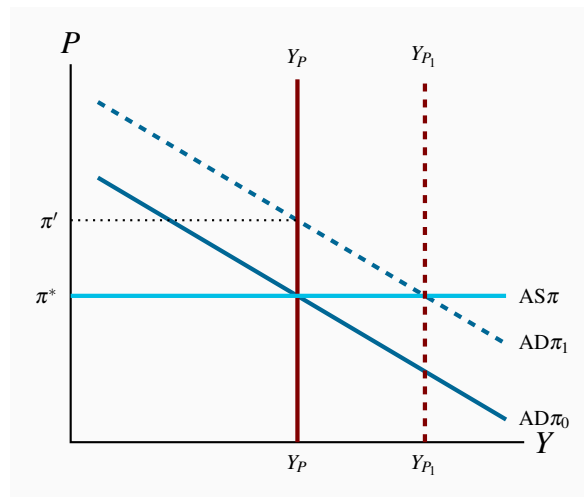
If the central bank reacted to defend its inflation target as π_0 , it would raise its interest rate and money supply growth would decrease to shift AD back from AD_1 to AD_0 .

12.2 With AD: $Y = 1,150 - 25\pi$ and $Y_P = 1,000$ the equilibrium inflation rate is:

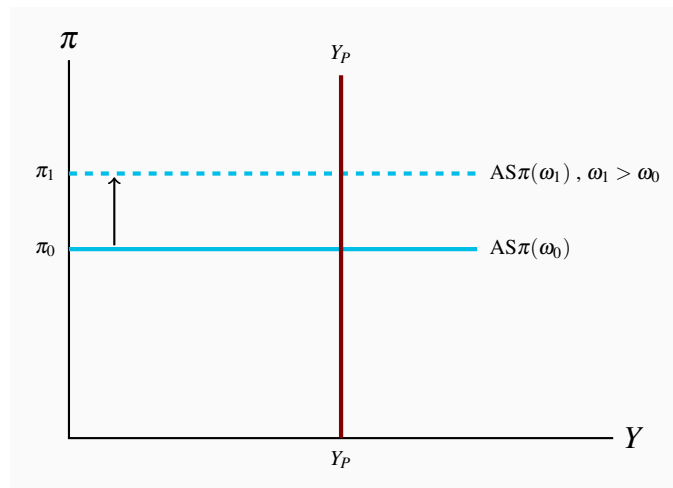
$$\begin{aligned} 1,000 &= 1,150 - 25\pi \\ 25\pi &= 150 \\ \pi &= 6.0 \end{aligned}$$

This inflation rate is above the central bank's $\pi^* = 4.0$ target. The bank would have to raise its interest rate to reduce AD and lower the inflation rate to 4.0%.

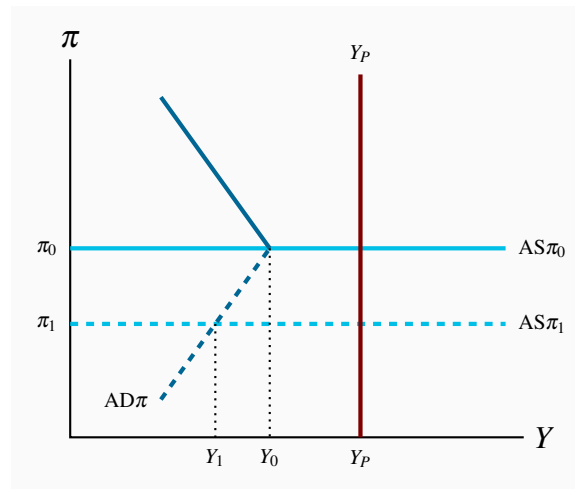
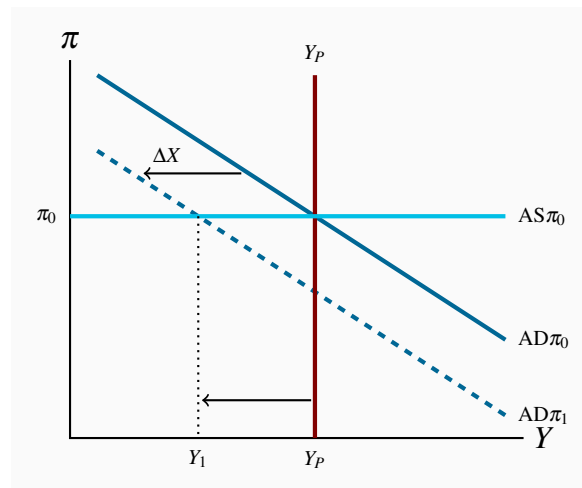
12.3 Increased investment shifts $AD\pi$ to $AD\pi_1$, increase real GDP and will put upward pressure on the inflation rate. However, as the new capital stock and technology comes on stream Y_P grows to Y_{P1} , offsetting the initial inflationary gap. The final result is a higher level of real GDP at Y_{P1} with inflation at the initial level π^* , the central bank's target.



12.4 A higher rate of increase in wages shifts AS up as the rate of increase in real costs of production rises at each level of output.

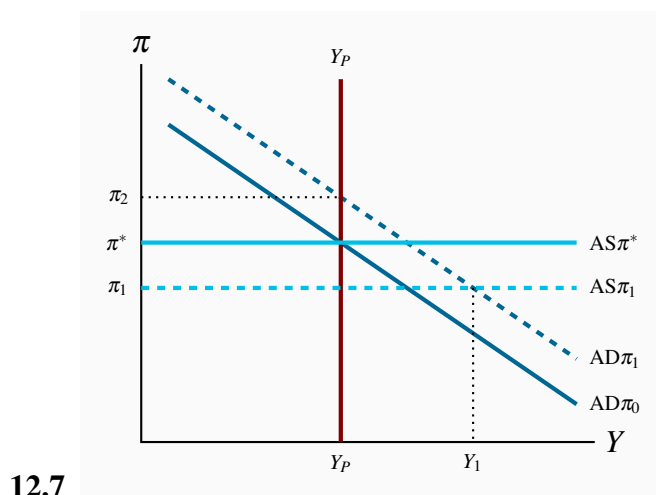


12.5 The economy is initially in equilibrium at Y_P and π_0 . A fall in exports shift $AD\pi$ left to $AD\pi_1$, opening a recessionary gap $Y_1 - Y_P$. The inflation rate is not changed in the short run but will decline over time if the recessionary gap persists.

**12.6**

With the economy at Y_0 and the central bank having reduced its policy rate to the lower bound to fight the persistent recessionary gap, the $AD\pi$ curve has a positive slope at any inflation rate less than π_0 . Any fall in the inflation rate from π_0 raises the real interest rate ($i - \pi$) because the bank cannot counter with a lower nominal interest rate. Higher real rates reduce expenditures and output.

Furthermore, cuts in the rate of increase in money wage rates or any other cost reductions that lower the inflation rate that shift $AS\pi$ down, will increase rather than reduce the recessionary gap: e.g. $Y_1 - Y_P$ in the diagram.



In the diagram the economy is at π^*Y_P before the tax cut. Cutting the GST lowers $AS\pi$ to $AS\pi_1$ and shifts AD to $AD\pi_1$. The result is an initial fall in the inflation rate and an inflationary gap $Y_1 - Y_P$. However, $AD\pi_1$ is too strong for long run equilibrium at the Bank's target inflation rate π^* . The Bank reacts by raising its policy interest rate to reduce $AD\pi$ to its initial value. When equilibrium is restored at π^*, Y_P households and businesses enjoy lower rates of GST on expenditures but higher interest rates on debt.

12.8 1. Given that $\Delta pd = -spbb + (i - n)pd$, and the both i and n are not policy instruments, the $spbb$ required for $\Delta pd = 0$ is:

$$0 = -spbb + (i - n)pd$$

$$spbb = (i - n)pd$$

If the interest rate on the public debt is greater than the rate of growth in nominal GDP a $spbb > 0$ is required to stabilize the debt ratio. Alternatively, $n > i$ permits a primary budget deficit without increasing the debt ratio.

2. If the rate of growth of Y falls a fiscal policy that increases in the $spbb$ is required to maintain public debt ratio.
3. An increase in the $spbb$ reduces $AD\pi$ and reduces n , which at least partially offsets the attempt to maintain pd .
4. A lower interest rate would increase $AD\pi$ and n and lower future i costs of carrying the public debt. The result would be a smaller $(i - n)$ in the Δpd function, supporting the government's $\Delta pd = 0$ target.

SOLUTIONS TO EXERCISES FOR CHAPTER 13

13.1 1. Growth in potential GDP is growth in the capacity of the economy to produce goods and services. Growth in per capita real GDP is growth in the economy's output of goods and services per person.

2. Growth in per capita real output is a measure of growth in the standard of living. Growth in per capita real output depends on both the growth in total real output and the growth in population.

3. If population is growing, growth in per capita real GDP will be less than growth in potential GDP.

13.2 1. Ten years in the future the country with a growth rate of 3.5% will have potential GDP of \$141 billion, while the country with a growth rate of 3.25% will have potential GDP of \$138 billion, a difference of 2.2 percent.

2. Twenty years in the future the potential GDPs will be \$200 billion and \$190 billion respectively, a difference of 5.3 percent.

13.3 By growth accounting the contributions to annual growth in potential output are:

1. Labour force growth 1.4%.
2. Capita stock growth 1.0%.
3. Improved productivity 1.1%.

13.4 By growth accounting the growth in real GDP = $0.7(\text{growth in labour force}) + 0.3(\text{growth in capital stock}) = 0.7(2.5) + 0.3(1.5) = 1.75 + 0.45 = 2.2\%$. Capital stock does not grow as fast as labour force with the result that falling labour productivity reduces output per worker.

13.5 1. Annual growth in country A is 2.9% and in country B 3.9%.

2. Country A because output growth is greater than labour force growth.

3. The capital to labour ratio rises in A but falls in B.

4. Faster growth in total output in B comes from faster growth in the labour force but the fall in the capital to labour ratio in B lowers labour productivity, which is output per worker.

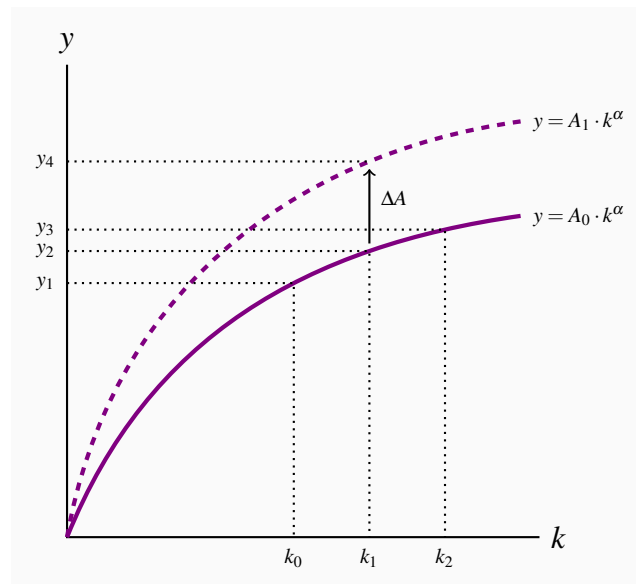
13.6 With equal growth rates of capital and labour at 2.5% a year, the capital/labour ratio is constant and the economy enjoys constant returns to scale. Potential output will grow at 2.5% a year.

Per capita output will be constant as output and labour grow at the same rate.

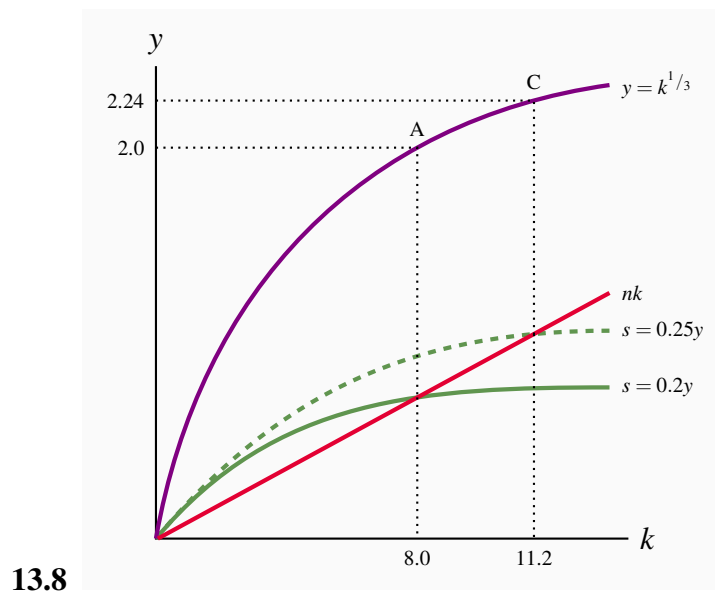
Improved technology that increased total factor productivity by 1.5% a year would result in growth in per capita real GDP by 2.5% a year.

13.7 1. Technology is the key to improved standards of living because increases in output per worker arising from increases in the capital to labour ratio are limited by diminishing returns and eventually fall to zero.

2. Increasing capital per worker ($K/N = k$) move the economy along the per worker output function with a decreasing slope caused by diminishing returns to the capital per worker ratio. Increase in k from k_0 to k_2 result in smaller and smaller increase in y .



3. An improvement in productivity (ΔA) shifts the production function up, raising y at every k and is not subject to diminishing returns. In the diagram, improved productivity increases y from y_2 to y_4 without any change in labour or capital inputs. Productivity growth from new technology has the potential to provide sustained increases in output per worker and standards of living.



1. The steady state level of output per worker is 2.
2. The rate of growth of total GDP is 5% (0.05).
3. If savings were $0.25y$ the steady state output per worker would be 2.24.
4. The rate of growth of total output in this new steady state would be 5% (0.05).
5. Points A and C show the steady state outputs per worker based on parts (a) and (c).

- 13.9**
1. The convergence hypothesis argues that countries with the same technology, population growth and savings rates will move to (converge on) the same level of steady state output per worker.
 2. OECD countries with lower per capita income are operating below their steady state per capita income and thus must grow faster than higher income countries to arrive at the same steady state per capita income levels.
 3. No. Poor African countries may have a different set of basic conditions, for example higher rates of population growth, lower savings rates and inferior technology, which result in a steady state per capita income less than that of the industrialized countries.

SOLUTIONS TO EXERCISES FOR CHAPTER 14

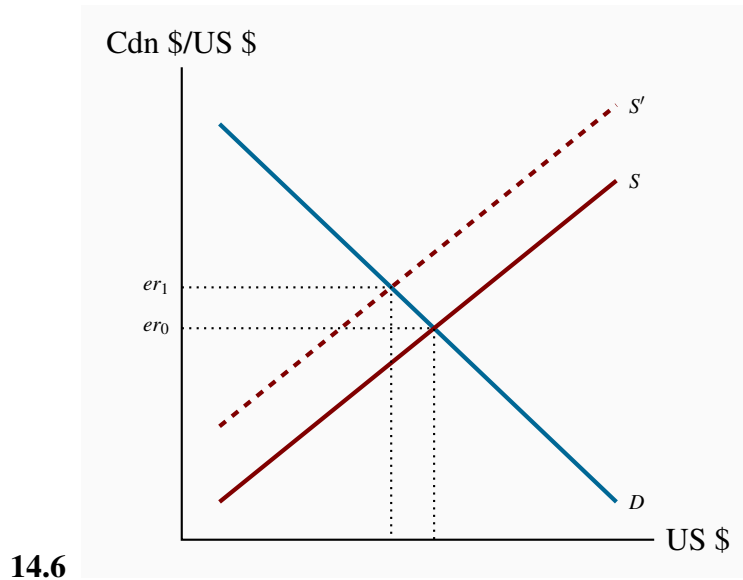
- 14.1** 1. The balance of payments is always zero, neither deficit nor surplus. Any deficit or surplus on current account that is not offset by a surplus or deficit on capital account results in a change in official reserve holdings, and a corresponding entry to balance the balance of payments account. The current account balance, the capital account balance and the change in official reserves sum to zero.
2. Official reserves would increase by \$2 billion, the difference between the surplus on current account and the deficit on capital account.
3. The central bank would buy foreign currency to add to the official reserve account.
4. The monetary base increases. The central bank pays for the foreign currency it buys by issuing new central bank deposits, which are monetary base.

14.2 The US experienced the higher inflation rate as prices doubled over 10 years while Canadian prices increase by 75%. A nominal exchange rate of \$1.05 CDN for \$1.00US would preserve the real exchange rate. The Canadian dollar appreciated in terms of US dollars and the US dollar depreciated in terms of Canadian dollars.

14.3 The purchase of US government securities by Canadian portfolio managers is an import of securities. Payment for these securities is made to residents of other countries and capital flows out from Canada to other countries. The capital account balance in the balance of payments is reduced.

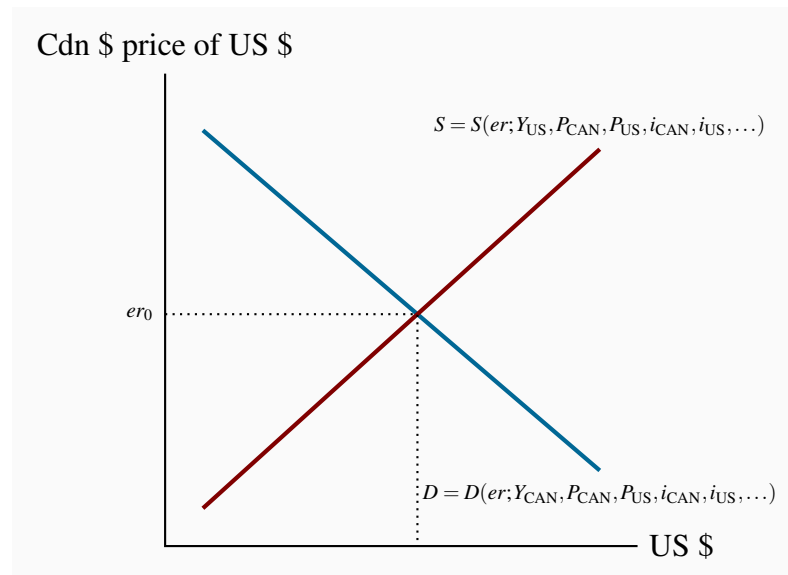
14.4 The nominal interest rate in Canada by 1 percent higher than that in the US reflects, and an expected rate of appreciation of 1 percent in the US dollar, if interest rate parity prevails.

14.5 The ‘interest parity condition’ occurs when differences in interest rates between countries are matched by the expectation that changes in exchange rates will offset interest rate differences and result in equal returns from holding assets denominated in different national currencies. If interest rates in Canada are higher than those in the US the interest parity condition predicts a fall in the international value of the Canadian dollar. The fall in the Canadian dollar results in a loss on the exchange rate transaction involved in buying and subsequently selling assets denominated in foreign currencies.



A sharp and persistent drop in natural gas and crude oil prices would lower Canadian export receipts and the supply of US dollars on the foreign exchange market. The Canadian exchange rate would rise as the Canadian dollar depreciated.

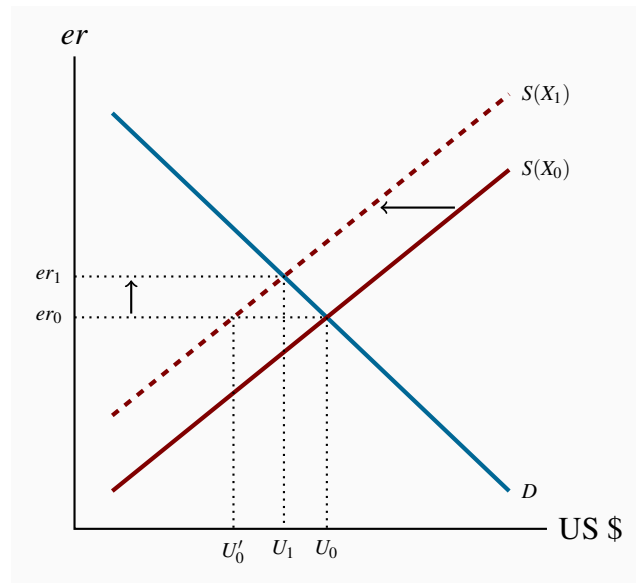
- 14.7 1. The demand for foreign exchange (US dollars) in the diagram comes from Canadian demand for imports of foreign goods and services on the current account and foreign financial assets on the capital account. The demand for goods and services comes from Canadian incomes and tastes in terms of the propensity to import and the real exchange rate. The demand for foreign assets comes from Canadian portfolio decisions to hold foreign assets based on interest rate differentials and expected returns.



2. The supply of foreign exchange (US dollars) comes from foreign demand for Canadian

goods, services and assets based on foreign incomes and tastes, the real exchange rate, interest rate differentials and expected returns.

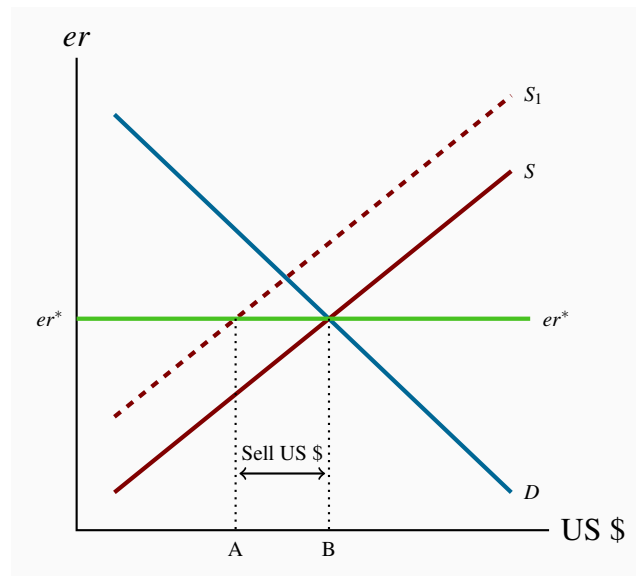
3. The equilibrium exchange rate er_0 is the exchange rate at which the balances on current account and capital account sum to zero.



14.8

1. With a flexible exchange rate the fall in exports reduces the current account balance and the supply of foreign exchange derived from export receipts. The supply curve $S(X_0)$ shifts to the left to $S(X_1)$. The exchange rate rises from er_0 to er_1 to maintain equilibrium in the balance of payments.
2. If there were no change in the exchange rate the fall in exports would reduce the supply of foreign exchange to U'_0 and create a corresponding deficit on current account. With flexible rates, the rise in the exchange rate raises the domestic price of imports and increases the profitability and competitiveness of exports. The quantity of foreign exchange demanded to finance imports is reduced while the supply of foreign exchange from exports is increased to establish equilibrium at er_1 and U_1 .
3. With flexible rates the foreign exchange market adjusts without intervention and there is no change in official reserve holdings.

14.9 1. Fixed exchange rate (er^*):



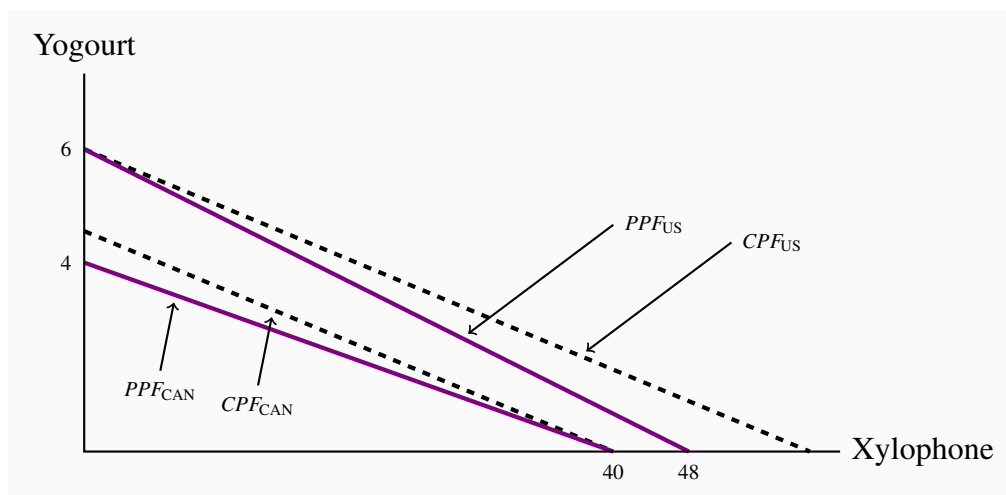
2. The decline in exports reduces the balance on the current account in the balance of payments and reduces the supply of foreign exchange in the foreign exchange market. In the diagram the decline in the current account balance, measured in US dollars is $U_0 - U_1$, ($= er^* \times (U_0 - U_1)$) in Cdn \$). The supply curve shifts to the left by this amount.
3. To defend the fixed exchange rate at er^* the central bank sells foreign exchange from the official reserve account equal to the AB in the diagram, the difference between market supply and demand at the fixed rate er^* .
4. The central bank sale of US \$ would reduce holdings of official reserves and the monetary base.

14.10 Flexible exchange rates provide for two linkages in the transmission mechanism for monetary policy. Changes in interest rates in pursuit of short-term stabilization objectives produce complementary changes in the exchange rate. Higher interest rates cause an appreciation of the domestic currency and lower interest rates depreciation. Monetary policy has simultaneous effects on domestic expenditures and net exports. By contrast, with flexible exchange rates and a monetary policy that controls money supply, fiscal policy is weakened by both interest rate and exchange rate crowding out. Fiscal expansion raises income and the demand for money pushing interest rates up and lowering the exchange rate with the result that investment and net exports are reduced.

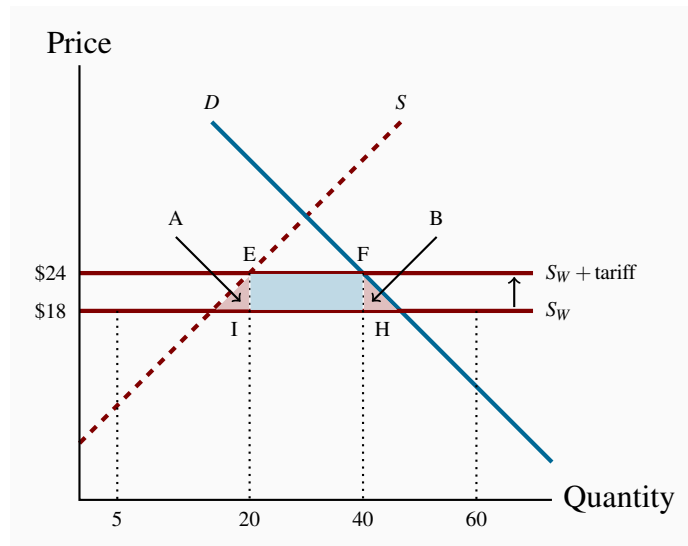
14.11 With a fixed exchange rate policy, interest rates must be maintained at the level required by the fixed exchange rate. Expansionary fiscal policies that raise real GDP and the demand for money must be matched by an expansion in the money supply to keep interest rates from rising. As a result crowding out does not impair the power of fiscal policy as it would in a closed economy or in an open economy with flexible exchange rates.

SOLUTIONS TO EXERCISES FOR CHAPTER 15

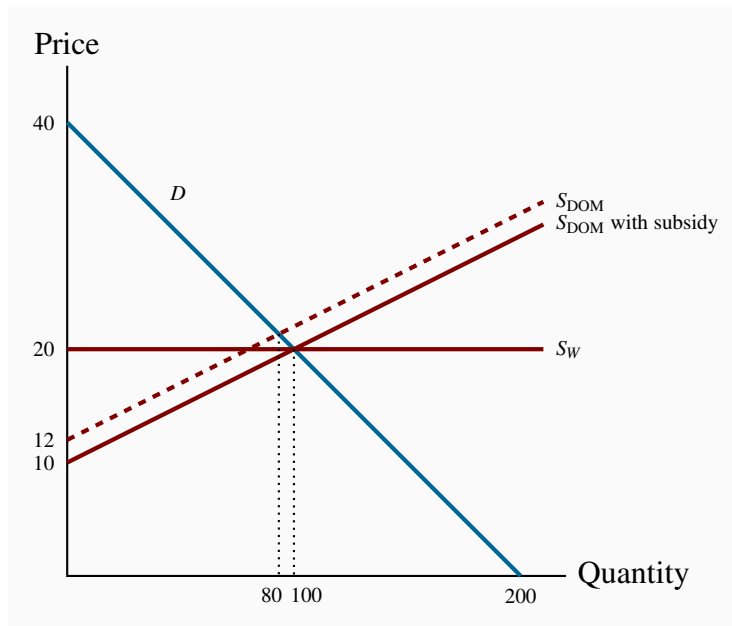
- 15.1**
1. Northland has an absolute advantage in the production of both goods, as it has lower labour requirements for each.
 2. The opportunity cost of 1 bushel of wheat is 1/2 litre of wine in Northland and 3/4 litre of wine in Southland.
 3. Northland has a comparative advantage in wheat while Southland does in wine.
 4. By reducing wheat production by 1 bushel, Southland can produce an additional 3/4 litre of wine.
 5. Both countries can gain if Northland shifts production from wine to wheat and the countries trade wine for wheat at a rate between 1/2 litre of wine for 1 bushel of wheat and 3/4 litre of wine for one bushel of wheat.
 6. By reducing wine production by 1/2 litre, Northland can increase wheat production by 1 bushel, which, at Southland's opportunity cost, exchanges for 3/4 litre of wine, giving Northland a gain of 1/4 litre of wine.
- 15.2**
1. The US has an absolute advantage in both goods.
 2. Canada has a comparative advantage in xylophones. The US has a comparative advantage in yogurt.
 3. See diagram below.
 4. See diagram below.



- 15.3** 1. The diagram shows that the amount traded is 60 units; of which domestic producers supply 5 and 55 are imported.
2. In this case, the foreign supply curve S_W shifts up from a price of \$18 to \$24. The amount traded is now 40 units, 20 of which are supplied domestically.
3. Tariff revenue is $EFHI = \$120$.

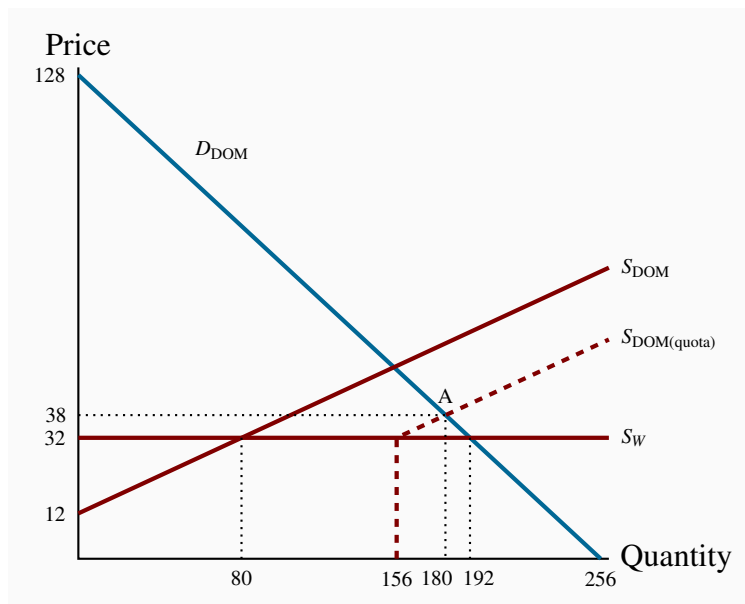


- 15.4** 1. The deadweight losses correspond to the two triangles, A and B , in the diagram, and amount to \$105.
2. The amount of additional profit for domestic producers is \$75.
- 15.5** 1. See figure below.
2. The total quantity of trade is 100 units, of which 80 are supplied domestically.
3. The subsidy shifts the domestic supply curve down by \$2 at each quantity. This supply intersects the demand curve at $Q = 100$. Foreign producers are squeezed out of the market completely.
4. Cost to the government is \$200.



15.6 1. See diagram below.

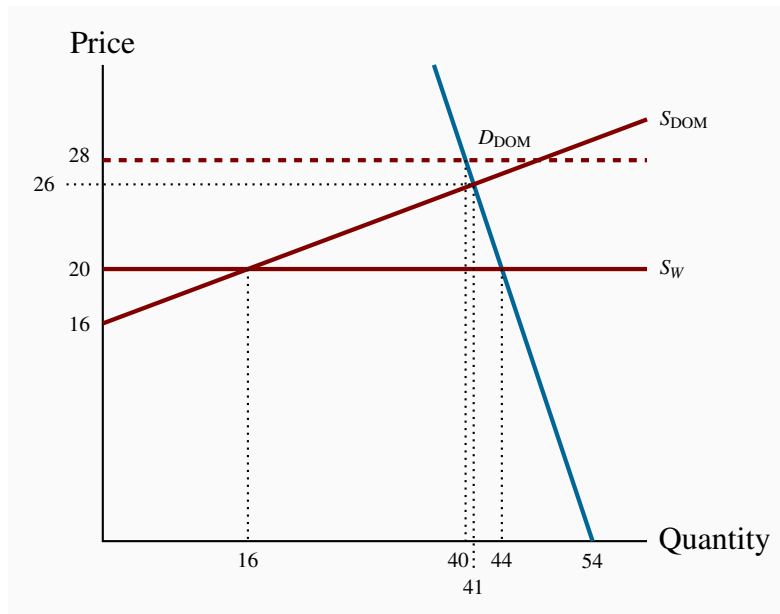
2. Domestic producers will supply 80 and imports will be 112.
3. The equilibrium with the quota is point A in the diagram with imports equal to the quota of 76.
4. The equilibrium quantity with the quota is 180, with 76 imported and 104 supplied by domestic producers. The equilibrium market price is \$38.



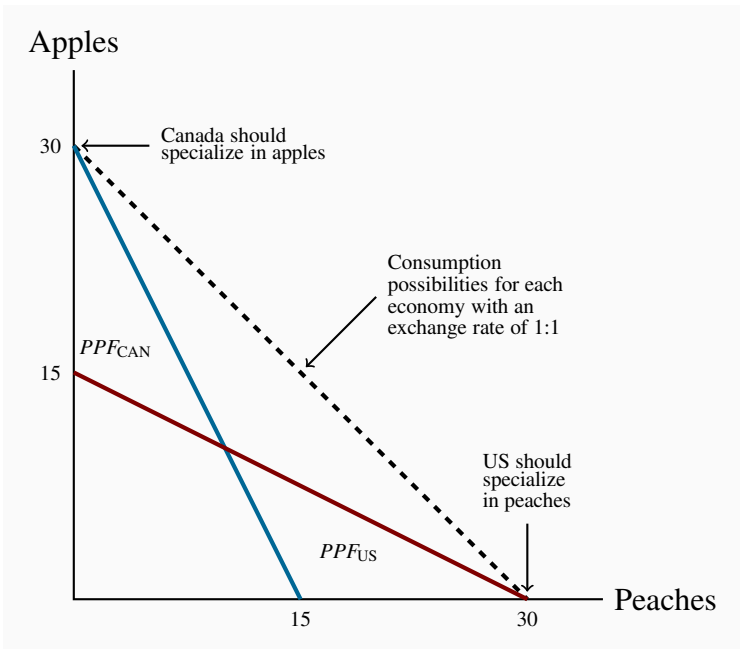
15.7 1. See diagram below.

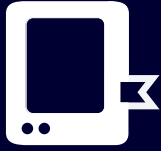
2. See diagram below.

3. The quantity permitted to be brought to market would be 40 units, even though the supply side would be willing to supply more at this price, buyers will demand just 40 at a price of \$28.



15.8 The figure below illustrates parts (a) through (f). Since the total production before trade was 20 of each, and after specialization it is 30 of each, the gain is 10 of each good.





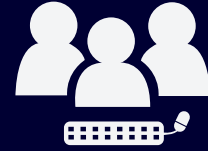
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