SOLUTIONS MANUAL

Solutions Manual

to accompany

the Second Edition of

Macroeconomics: A European Text

by

Antje Mertens
Stefan Profit
Mark Weder

with

Pierre-Olivier Gourinchas
Michael Burda
Charles Wyplosz

OXFORD 1997

CHAPTER 2

MACROECONOMIC ACCOUNTS

EXERCISE SOLUTIONS

Theory

1. * Net National Product (NNP)
= Gross National Product (GNP)
- depreciation
= 5000 - 500 = 4500.
* National Income
= NNP - indirect taxes
+ subsidies to enterprises.
= 4500 - 1000 + 400 = 3900.
* Personal income
= National income
- social security contributions
- net corporate saving
- corporate taxes
+ transfers to households.

(We assume that transfers to households = transfers to households and firms)

- subsidies to enterprises.
= 1000 - 400 = 600.
* Personal income
= 3900 - 700 - 600 - 100 + 600
= 3100.
* Personal disposable income
= Personal income
- personal taxes
- fines and fees
= 3100 - 1500 - 100 = 1500.
* Consumption
= Personal Disposable income
- household savings
= 1500 - 200 = 1300.

(Note: This can be checked from the identity:
* GNP = C+S+T, where
S = Household saving + net corporate saving
+ depreciation = 600 + 200 + 500 = 1300.

T = net taxes = total taxes less transfers
= 700 + 1000 + 100 + 100 + 1500 - 1000
= 2400,

so C = 5000 - 1300 - 2400 = 1300)

(We assume that there are no other tax revenue sources and that the social security system is in balance.)

The government runs a budget deficit to finance the gap between purchases and net taxes, so that
government budget deficit
= government purchases
- net taxes,
or
* Government Purchases
= government Deficit
+ taxes -transfers
= 100 + (100+1500+700+1000+100)-1000
= 2500.

* GDP
= GNP
+ net remittances to the rest of the world
+ net interest to foreigners
= 5700.
* CA
= GNP - Absorption
= GNP - (C+I+G).

Where I is private investment and G government purchases. Insert the above results in:
CA = 5000 -1300 -1200 -2500 = 0
(current account balance).

2. Changes in inventories, voluntary or otherwise, are treated as *investment* in national accounts. Involuntary inventory changes represent unanticipated discrepancies between demand and supply of goods, whereas voluntary changes reflect conscious decisions of managers to alter their stocks. The distinction between voluntary and involuntary inventory investment is important and will be emphasised in the discussion of business cycles (Chapter 14).

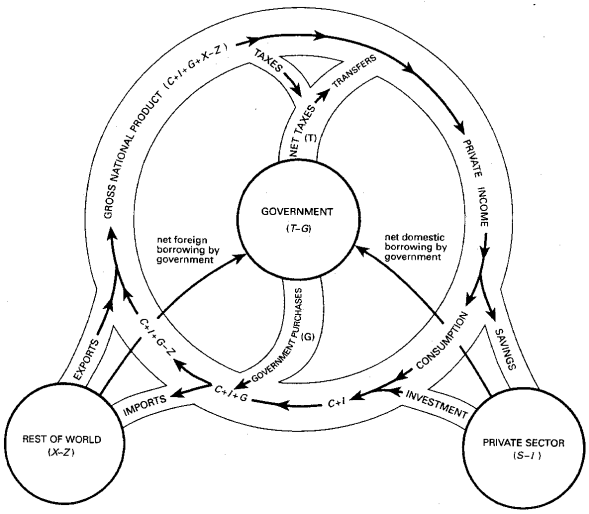


Figure T2.3

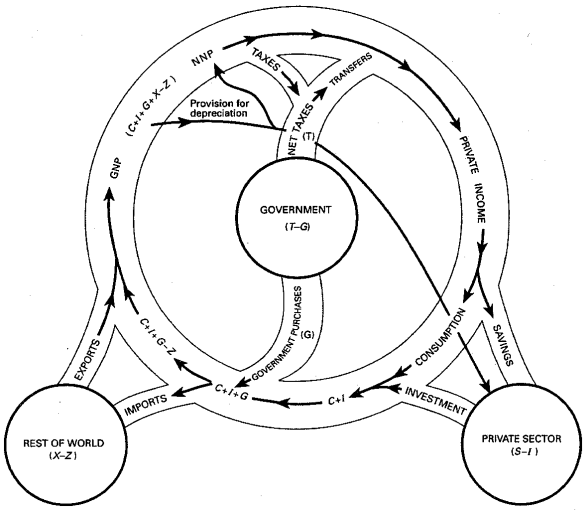


Figure T2.4

3. Arrows can be drawn connecting the inner circle of Figure 2.2 to the two outer circles (see Figure T.2.3). These arrows simply emphasise the other side of net goods transactions in the GNP accounts: an extension of credit or borrowing by the other party to the transaction. They are implicit in Figure 2.2.

4. Depreciation is savings undertaken by firms in order to renew the productive capital stock that has either worn out or become economically obsolete. In Figure 2.2 it is part of the pipe "savings". In order to locate NNP, it would be necessary to amend the diagram as in Figure T.2.4.

5. The work is still performed by the secretary. The profit of the firm rises because the secretary's wage is not paid any more, but total value added remains the same. The GDP is unchanged.

6. The GDP records all production of marketable tangible goods and intangible services. The important distinction is not between tangible and non tangible goods or services but rather between marketable and nonmarketable ones. If a good or service is sold, it is priced by the market and final sales can be evaluated, hence the contribution to GDP. In practice, all goods are marketable but there are both marketed and nonmarketed services (defense services, education, etc.).

7. GDP rises by the amount of the real estate agent commission (suppose the real estate agent has no production costs: commission and value added are equal). Therefore the change in GDP is = 110,000 * 10% = 11,000. The capital gain is not recorded in the GDP.

8. Net taxes (here fines and fees) do not contribute to GDP but the expenditures on police services' do (G). GDP increases by ECU 300,000. Since unemployment benefits are a transfer from the government and are not recorded in GDP, the answer does not change (but the government budget will be affected).

9. Public goods are those whose consumption is available to the entire community. Consumption by one individual does not exclude consumption by others. For example the existence of a well-functioning bureaucracy or law system are public goods; so is the quality of the environment or national defence. Two problems arise with respect to GDP accounts. First, since GDP is a flow measure, expenditures on public goods that have an investment quality (i.e. last a long time) are recognized only when the expenditure is made, and not after, even though benefits continue to flow. Second, and more importantly, government expenditure on public goods is valued (for lack of an alternative) at cost; that is, wages paid to workers involved in providing such goods (e.g. soldiers and policemen). In theory, the value of public goods should consist of the *sum* of all individuals' valuations. Therefore, conventional methods will undervalue such goods, and thereby total welfare.

10. Housing mortgage payments are often included in the basket used to compute the cost of living indices, since they are often an important item of household's expenses. There are, however, two main reasons why housing mortgages payments should not be included in a consumer price index:

-they correspond to financial transfers within the private sector not to consumption *per se*. One could argue that the service provided by banks in arranging mortgages, which does correspond to consumption, should be included, but this comprises a small part of the total mortgage bill faced by the average household.

-when interest rates rise, housing mortgage payments arranged on a flexible rate increases, implying that the CPI inflation rate increases as well. This does not make much sense from an economic point of view.

Applications

1. (a) Nominal:
GDP(90) = 300 + 200 + 250 = 750.
GDP(91) = 400 + 450 + 240 = 1090.
Real (computed with 1990 prices):
GDP(91) = 400 + 300 + 200 = 900.

Rate of inflation = (1090/900-1) = 21.11%

(b) CPI(90) = 1
CPI(91) = (1*300+3*100+6*50)/750 =1.20
CPI inflation rate = 20%

2. Petrol no longer contributes directly to GDP since it is imported. Yet there are two possibilities. The first is that the petrol is imported for final consumption. Then we have:
Nominal:
GDP(90) = 500.
GDP(91) = 850.
Real:
GDP(91) = 700.
GDP deflator = 1.21.
Inflation rate = 21.43%
which is slightly different from the previous example. Now suppose for the possibilty that the petrol is used as an intermediate good in the production of apples and pears. In this case the computation of GDP must take account of this fact, so value-added will be reduced by the cost of oil imports. Now we have:
Nominal:
GDP(90) = 500-250 = 250.
GDP(91) = 850-240= 610.

Real:
GDP(91) = 700-200 = 500.
GDP deflator = 1.22.
Inflation rate = 22%.
In this case, inflation is slightly higher than in the first one, because the gasoline price increase reduces the real value-added of apples and pear production and raises the implied rate of price increase.

3. The CPI includes goods that are produced abroad and consumed domestically, while the GDP deflator does not includes these. In 1979-81 the CPI rose much more than the GDP deflator reflecting the sharp increase in oil prices. The argument reverses with the 1985-86 counter shock. Generally union negotiators tend to focus on the evolution of the CPI, while managers focus on the price for the goods they sell. While no individual firm 'sells' the GDP, it is clearly in a firm's interest to advocate measuring inflation with the GDP deflator, which is more likely to track the price of their own output.

4. (a) deficit item in merchandise trade account
(b) deficit item in long term capital account (a house is considered as an asset)
(c) no effect
(d)deficit item in long term capital account (looks like direct foreign investment)
(e)surplus item on foreign remittances (unilateral transfers)
(f) surplus item on short term capital account
(g) deficit item on foreign remittances (unilateral transfers)
(h) deficit item on invisibles (net investment income) account
(i) in theory: deficit on invisibles (investment income) and a surplus item in the long term capital account (often in practice this slips by and nothing is recorded)
(j) surplus item in official interventions account
(k) no change on merchandise trade (measured) but if the DM originated in France, there will be an offsetting surplus entry in the foreign official transactions account (sales of DM by theBundesbank or the Banque de France) or surplus entry on the some capital account (e.g. sale of DM by private citizens) .

5. It is easy to see that a high level of taxation, either direct or indirect, can be consistent with an equally high disposable income level if government transfer payments are significant (as is the case for Sweden).
6. Strictly speaking the world current account should be zero; the sum of deficits should equal those of surpluses. If the sum of all nations' balances is negative, some receipts must have been omitted or underreported. This is generally true because customs authorities which monitor trade are more accurate than those monitoring capital account transactions.

7. The difference between GNP and NNP is depreciation. The lifetime of boats and nets should be shorter on the sea-coast (salt-water, storms...). The capital depreciates faster. Thus, the NNP is a better measure of welfare in this particular case. Because of higher depreciation, the village on the sea will have to devote more resources to maintaining the capital stock and will have less resources for government and private consumption.

8. The current account is close to balancing in both countries. The large surplus of net private savings is therefore necessarily matched by significant government budget deficits. One interpretation of this is that private investment has been crowded out; another is that private savings have risen to meet the budget deficit.

9. False. As they contribute to economic activity, foreign workers create value-added, hence increasing GDP. To the extent that they send some resources home, they reduce the income of residents and increase the income of residents abroad. The net gain is positive, however, even if they send all their wages home (which would be unlikely, as workers must eat!) capital and other factors of production involved will also earn income from the activity.

10. GDP increases as production and distribution activities related to the drug trade would then be recorded. Tax receipts rise for the same reasons (we may have V.A.T and excise taxes on drugs as is already the case for alcohol and tobacco). On the other hand, it is often alleged that widespread availability of drugs reduces productivity of workers, increases accidents and absenteeism and thereby reduces GDP.

Legalizing drugs leads to a reshuffling among the Balance of Payments' items. Errors and omissions linked to drugs (presumably negative) disappear and the current account worsens. This assumes that the nation under consideration is a net importer of drugs; if an exporter, the current account will improve.

CHAPTER 3

INTERTEMPORAL BUDGET CONSTRAINTS

EXERCISE SOLUTIONS

Theory

1. The answer follows the discussion in Box 3.1. The rational expectations hypothesis asserts that the expectations of agents ${}_tx_{t+1}$ of an uncertain future outcome x_{t+1} are on average correct. One way of expressing this formally is

$$x_{t+1} - {}_tx_{t+1} = \varepsilon_{t+1}$$

where ε_{t+1} is a purely random unpredictable forecast error with zero mean.

(a) The definition of static expectations is that agents' expectations do not change at all:

$${}_tx_{t+1} = \chi$$

Static and rational expectations are identical when x fluctuates randomly around some constant χ. That is :

$$x_{t+1} = \chi + \varepsilon_{t+1} \text{ where } \varepsilon_{t+1} \text{ is "white noise"}$$

In other words, the mean of x_t is correctly known to agents.

(b) With extrapolative expectations, agents' expectations follow

$${}_tx_{t+1} = x_t + ß(x_t - x_{t-1})$$

where ß is between zero and unity. Extrapolative and rational expectations are identical when actual x behaves according to

$$x_{t+1} = x_t + ß(x_t - x_{t-1}) + \varepsilon_{t+1}$$

that is, x fluctuates randomly around a trend. From past values of x, agents can construct the best possible expectation of x tomorrow. Such a process is also said to be *autoregressive.*

2. Period 1 income is Y_1 and inheritance is B_0. The household can either save (S_1) or consume (C_1) :

$$C_1 + S_1 = Y_1 + B_0$$

In period 2, the household can only consume (there is no bequest : see exercise 6) :

$$C_2 = Y_2 + S_1 (1+r).$$

Consolidating (that is, eliminating S_1 from both equations), the intertemporal budget constraint becomes:

$$C_1 + C_2/(1+r) = Y_1 + Y_2 /(1+r) + B_0.$$

3. The interest rate is negative: one coconut saved today earns 0,9 coconuts tomorrow. In other words, the price today of a coconut tomorrow is greater than one. Moreover, borrowing is no longer an available option to Crusoe : period 1 consumption must be less than Y_1 (See Figure T3.3.)

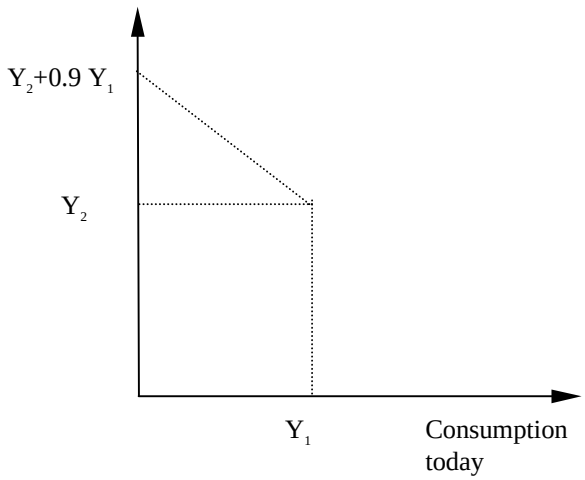


Figure T3.3

4. In the original parable, Crusoe is allowed to import (borrow) additional coconuts for current consumption, but was not allowed to plant them. (Planting season precedes trading in financial markets). In this sense, his initial endowment represented the maximal allowable

capital stock he could install. In principle the marginal product of capital, when the entire endowment is planted, could exceed the gross rate of interest available from the natives. In this case Crusoe would like to evade the "planting season restriction" because it could increase wealth even beyond the depiction in Figure 3.7. In words, planting the borrowed nuts is a good idea when the marginal product exceeds the interest rate when the entire endowment is planted.

5. The government budget constraint is (3.11) without initial debt. With initial debt D_0 we have :

$D_1 = G_1 - T_1 + D_0$ (the initial debt has to be repaid)

$D_2 = G_2 - T_2 + D_1(1+r) = 0.$

Consolidating yields:

$D_0 + (G_1-T_1) + (G_2-T_2)/(1+r) = 0.$

This is graphically shown in Figure T3.5.

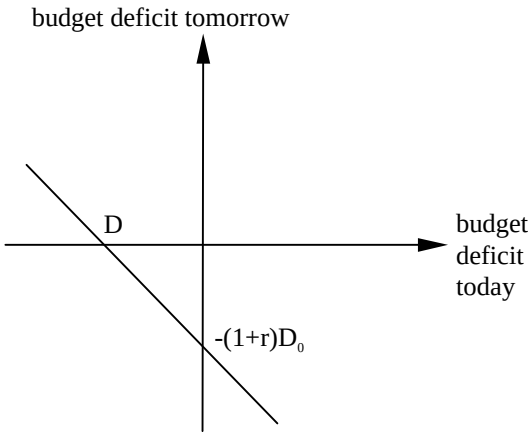


Figure T3.5

6. In period 2, Robinson Crusoe leaves a bequest B_2 :

$C_2 + B_2 = Y_2 + (Y_1 - C_1)(1+r)$

The intertemporal budget constraint is now (see figure T3.6):

$C_1 + C_2/(1+r) + B_2/(1+r) = Y_1 + Y_2/(1+r).$

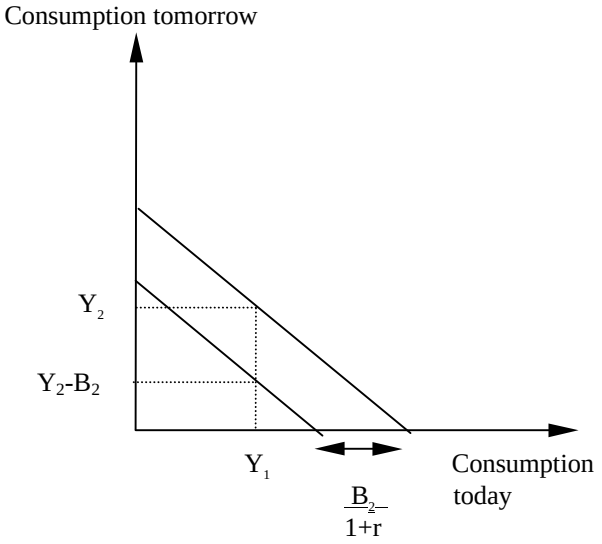


Figure T3.6

7. The discussion in the text suggests the following conditions: agents must have a planning horizon equal to that of the government's; agents are restrained in their borrowing; they must borrow and lend at the same rate as the government; taxes cannot be distortionary; agents must fully understand and correctly anticipate the plans of the government. Furthermore the two-period discussion assumed perfect foresight, which is not realistic. The model must be modified to account for uncertainty and the behaviour of agents in response to uncertainty could affect the Ricardian equivalence result. The most likely deviations seem to be the horizons of agents (parents may not be fully altruistic towards their kids) and the equality of borrowing and lending rates.

8. (a) Let us first consider the case of lump sum taxes. When investment is possible, the private sector invests in productive activities which are not consumed in period 1 :

$I_1 = K = Y_1 - C_1 - T_1$

In period two the budget constraint becomes :

$C_2 = Y_2 - T_2 + F(K)$

The intertemporal budget constraint of the private sector is then :

$$C_1 + C_2/(1+r) = (Y_1 - T_1) + (Y_2 - T_2)/(1+r) + F(K)/(1+r) - K.$$

The last line is the net present value of the firm.

As the government budget constraint is still given by (where r_G is the interest rate on public debt):

$$G_1 + G_2/(1+r_G) = T_1 + T_2/(1+r_G)$$

The Ricardian equivalence still holds as long as the interest rates for the government and the private sector are the same.

(b) We now suppose that the government levies taxes only on the capital stock capital at rate *t*. The budget constraints are:

$$K = (Y_1 - C_1)(1 - t)$$
$$C_2 = Y_2 + F(K)$$

(no taxes in period two since all capital is exhausted). The private sector intertemporal budget constraint is now:

$$C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r) + [F(K)/(1+r) - K] - t/(1-t)K$$

and the government budget constraint is :

$$G_1 + G_2/(1+r) = t(Y_1 - C_1) = t/(1-t)\,K$$

Substituting in the previous equation, it is possible to recover the Ricardian equivalence result that taxes do not appear in the private budget constraint.

9. Here the situation is different: a lump sum tax in period 1 is followed by a tax on produced output F(K) in period 2. The point of this exercise is that the second period can be distortionary and could affect Ricardian equivalence. We assume that the government and households both borrow and lend at the same rate. We can proceed as in exercise 8.

The government budget constraint is:

$$G_1 + G_2/(1+r) = T_1 + \tau F(K)/(1+r)$$

Household's wealth:

$$C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r) + (F(K)/(1+r) - K) - T_1 - \tau F(K)/(1+r)$$

It would be easy to combine the two equations and obtain for the household

$$C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r) + (F(K)/(1+r) - K) - G_1 - G_2/(1+r)$$

Yet it does not quite follow from this expression that the path of taxes is irrelevant. This is because the tax on the income from production in the second period F(K) is determined by the level of lump sum taxes in the first period by the budget constraint:

$$\tau = (1+r)[G_1 + G_2/(1+r) - T_1]/F(K)$$

For fixed G_1, G_2, and K, a higher T_1 implies a lower τ and vice versa. The key link with Ricardian equivalence is that the *tax in the second period will affect the private sector's desire to invest*. In Figure T3.9, which resembles Figure 3.7 in the text, the private return from this investment activity will shrink (shown by the shift inward of the production function). Although we have not shown which point a firm will generally choose, the diagram shows that the range of profitable options for the firm has been restricted. This demonstrates that the path of taxes can matter.

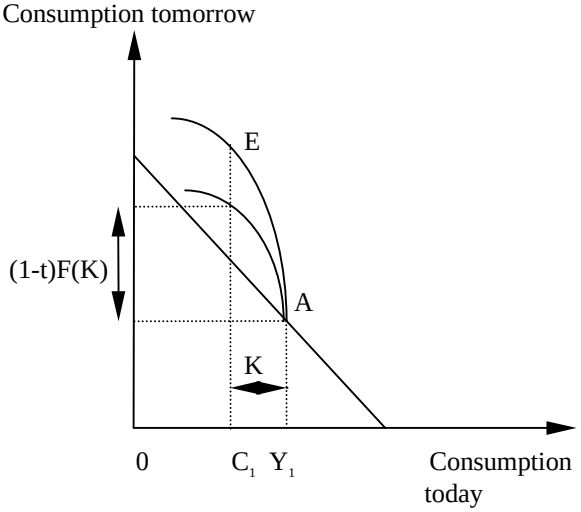


Figure T3.9

10. Each period the household receives Y_t, consumes C_t while saving S_t. The budget constraint in t is :

$$C_t + S_t = Y_t + S_{t-1}(1+r).$$

This also holds in t-1, so we can substitute S_{t-1} to get :

$$C_t + S_t = Y_t + (1+r)[Y_{t-1} - C_{t-1} + (1+r)\,S_{t-2}]$$

Working recursively from period n we find :

$$S_n = 0 = (Y_n - C_n) + (1+r)(Y_{n-1} - C_{n-1}) + \ldots + (1+r)^{n-1}(Y_1 - C_1)$$

This is the budget constraint expressed as of time n. We get the budget constraint at time 1 by discounting this expression by $(1+r)^{n-1}$:

$$Y_1 + Y_2/(1+r) + \ldots + Y_n/(1+r)^n = C_1 + C_2/(1+r) + \ldots + C_n/(1+r)^n$$

As n approaches infinity, the perspective changes slightly: we cannot impose anymore $S_n = 0$ for some n.

The household could either borrow more and more in each period, accumulating debt (always claiming to repay later, a claim which might even be true!). Alternately, he might accumulate ever increasing wealth, forever postponing consumption to the future. We want to rule out these possibilities: this amounts to saying that the present value of future wealth equals zero as time approaches infinity. This is called a transversality condition.[1] The textbook derives an analogous relation for wealth. Formally the transversality condition is:

$$\lim_{n\to\infty} S_{t+n} / (1+r)^{n+1} = 0.$$

Applying this condition, the intertemporal budget constraint is:

$$\sum_{i=1}^{\infty} Y_i (1+r)^{i-1} = \sum_{i=1}^{\infty} C_i (1+r)^{i-1}.$$

Applications

1. By deciding not to distribute dividends, the firm reduces their cash payout. The value of the firm and share prices rise, in theory, by the amount of the dividend. This is a kind of forced savings since the shareholder has no choice but to reinvest his dividend; total shareholder wealth does not change if dividend payments are merely converted into higher stock prices. Shareholder wealth will change if the firm's tax liabilities are affected by this withholding of dividend, or if the firm has a new investment project. In either case the cause of higher wealth is not the withholding of dividend per se but rather the reason for it.

2. Interest rate: 5% $W = 100 / (1+ 0.05) = 95.24$
10% $W = 100/(1+1.1) = 90.91.$

3. From the budget constraint in period 2 we have :

$$D_1 = (Y_2 - C_2)/(1+r)$$

The country cannot incur a debt greater than the discounted value of second period endowment because this is what it can reimburse when it does spend everything (C_2=0). So its borrowing limit is:

$D_1 < Y_2 /(1+r) = 1747{,}6$ if r = 3%

or

$D_1 < Y_2 /(1+r) = 1666{,}6$ if r = 8%.

It is shown in Figure A3.3 as BC (or BC' when r=8%).

4. We denote consumption in each period as C. The intertemporal budget constraint is:

$C + C/(1+r) = Y_1 + Y_2/(1+r).$
$C = [(1+r)Y_1 + Y_2] /(2+r)$
$C = 1394$ when r = 3%

or

$C = 1384$ when r = 8% .

In this economy, there is a current account surplus when Y_1>C. From the definition of C, this occurs when $Y_1 - Y_2 > 0$, and does not depend on the interest rate. In our case, the country will actually run a current account deficit.

5. The net present value of the firm is the discounted sum of all the cash flows less the initial investment, plus the resale value.

- without resale value:

$V = 40{,}000 /(1{,}1) + 52{,}000 / (1{,}1)^2 + 56{,}000 / (1{,}1)^3 - 100{,}000$
$=$ ECU 21,412

- with a 20,000 resale value:

$V^* = V + 20{,}000 / (1{,}1)^3 =$ ECU 36,438.

6. The primary deficit in the first period is given by 1 billion ECU. That is, in the second period, the government must run a surplus of 1.05 billion ECU to leave the debt position unaffected. However, the government must also cover the interest payments on its debt position. Therefore, an additional surplus for the interest payments of 5 billion ECU must be obtained.

7. The discovery of oil in the North Sea can be thought of as a large windfall. Just before the discovery the country budget constraint is (we collapse the whole future in a single period called 2) :

$$C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r) .$$

As the discovery happens, wealth is now $(Y_1+P)+ Y_2/(1+r)$, where P is the value of oil just discovered. As oil is a non renewable resource, windfall can occur only in period 1 (if this is not the case and if the endowment also goes up in period two, the result doesn't hold any

[1] For more on the transversality condition see Blanchard and Fischer (1990) and the references therein.

more as you will see in chapter 4). Graphically, the budget line shifts to the right (see Fig. A3.7). This shift in initial endowment is not matched by an equal shift in consumption: the primary current account improves, hence the net external asset position.

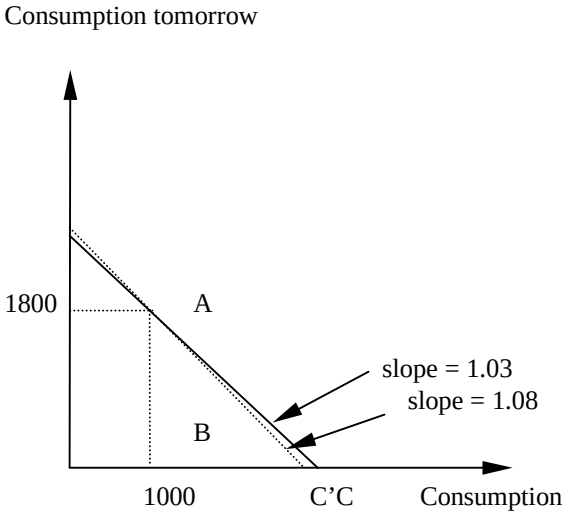


Figure A3.3

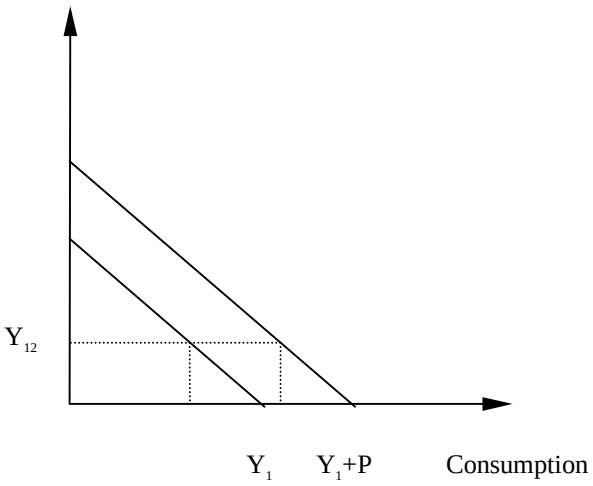


Figure A3.7

8. Wealth is the present discounted value of households' incomes. So wealth does not change with free borrowing. As intertemporal prices rise with interest rate, a decline in interest rate improves total wealth today.

9. Chain letters do not violate any individual budget constraint. An individual pays 1 ECU and expects to receive 10k ECU where k is the length of the list. However, the *aggregate* budget constraint is violated as total spending is not equal to total receipts. This case is a violation of a kind of "spatial transversality condition" (see Appendix to this chapter). The receipts grow explosively. The transversality condition is sometimes called the "No Ponzi-game condition", after Charles Ponzi, born in 1920 in Boston who started a chain-letter, became rich, went to jail and died poor!

10. If (as it seems to be the case) Germany expects the eastern Länder (states) to become productive in a few years, the intertemporal budget constraint of Germany, as expressed by (3.22) in the textbook is satisfied: they can borrow today in order to finance productive investment in the new Länder and to sustain a higher level of consumption, and will repay tomorrow.

CHAPTER 4

DEMAND OF THE PRIVATE SECTOR

EXERCISE SOLUTIONS

Theory

1. Note Y_1 is income in period 1 and Y_2 is income in period 2. As Y_2 is expected to increase, expected wealth (defined as $Y_1+Y_2/(1+r)$) increases. Consumption is a positive function of wealth: it rises in both periods. See Figure T4.1.

2. Both consumers face the same interest rate and own the same endowment. The more impatient consumer (consumer I) prefers to consume more today while the patient one (consumer P) prefers to consume more tomorrow. The marginal rate of intertemporal substitution - defined as how much consumption tomorrow the consumer is willing to substitute for one more unit of consumption today - is greater for consumer I at any consumption bundle. To demonstrate this consider the indifference curves of the two consumers which pass through a common point E; it is clear that I's indifference curves are steeper than P's. I consumes more in period 1, saves less and, hence, consumes less in 2. See Figure T4.2.

3. If the conditions discussed for Ricardian equivalence holds and the path of government expenditures is known, the path of taxes has no relevance. When there is an unexpected transitory increase in public spending, matched by an increase in taxes, the private sector smoothes consumption, reducing it less than the increase in taxes. The current account deficit worsens.
If the increase is permanent, the private sector immediately reduces consumption one for one: public spending crowds out private consumption, leaving the current account unaffected.

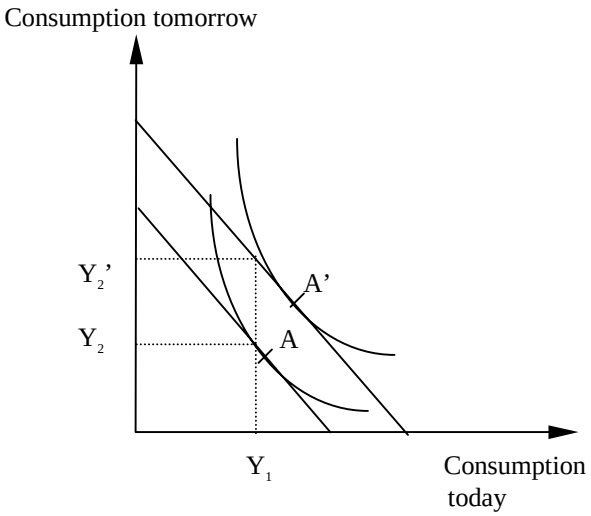


Figure T4.1

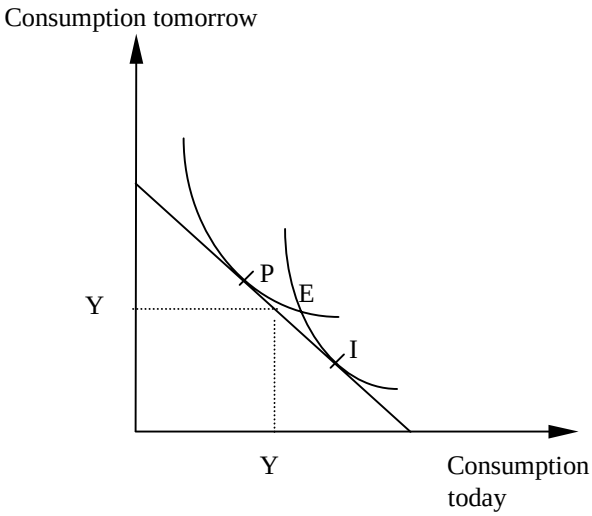


Figure T4.2

4. The private sector will try to smooth consumption: present consumption falls, savings rise. In a closed economy, investment must fall (saving = investment), but this is no longer the case when capital is mobile.

Note: The conditions for Ricardian equivalence do not hold. Taxation only on consumption is distortionary (and not lump sum).

5. If the household is willing to borrow but is unable to (the borrowing constraint is binding), a decline in interest rates does not change the consumption pattern. However, a sufficient rise in the rate of interest might trigger a fall in today's consumption and a rise in tomorrow's consumption. See Figure T4.5.

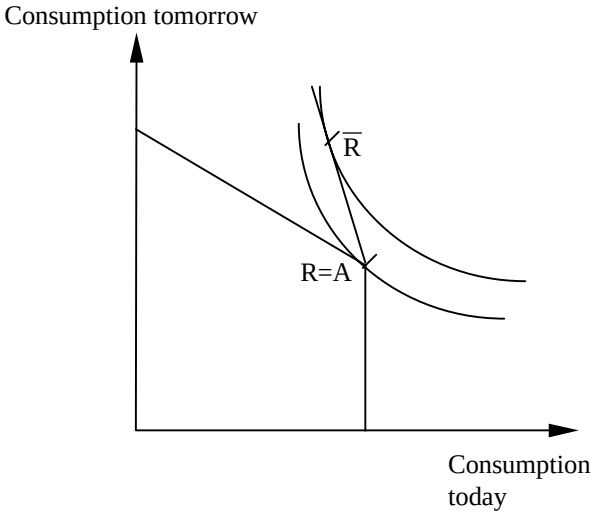


Figure T4.5

6. See Figure T4.6.

7. Investment is the difference between the desired capital stock K* and the previously accumulated capital stock K_0. The optimal desired stock of capital is given by MPK=r+δ.

i) If $K^* > K_0$, investment is positive. The effect of a higher past K_0 is that the difference $K^* - K_0$ will decrease and investment will fall. If $K^* < K_0$, investment is negative. The effect of a higher past K_0 is that the difference $K^* - K_0$ will increase and (the negative) investment will rise.

ii) If the rate of depreciation δ rises, the right hand side of

$$MPK = r + \delta$$

will increase. For the equality still to hold, the left hand side must also increase. Assuming diminishing marginal product of capital, it implies that the optimal stock of capital is lower now, that is, K* falls. If $K^* > K_0$, investment is positive. The effect of a higher δ is that the difference $K^* - K_0$ will decrease and investment will fall. If $K^* < K_0$, investment is negative. The effect of a higher δ is that the difference $K^* - K_0$ will increase and (the negative) investment will rise.

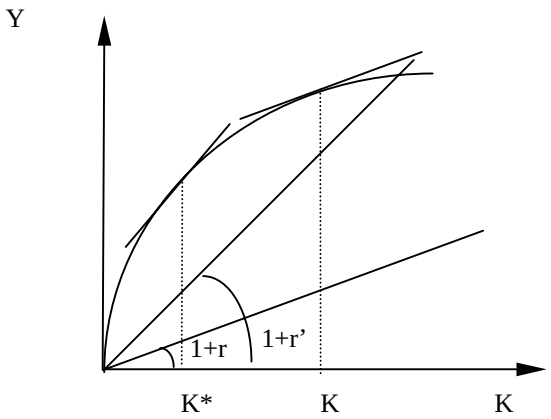


Figure T4.6(a)

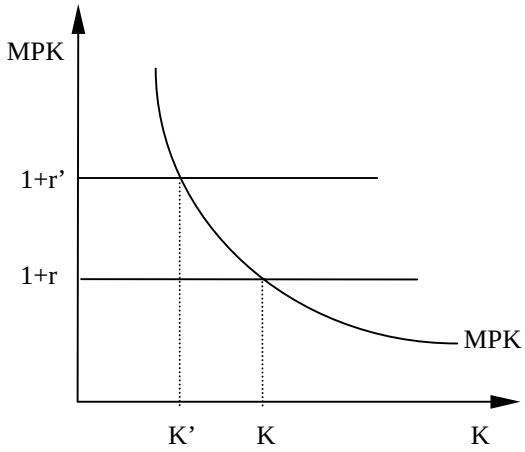


Figure T4.6(b)

8. When installation costs fall, the marginal cost of investment curve in Figure 4.18 rotates downward. Investment increases while the optimal capital stock is unaffected: convergence occurs more rapidly. Tobin's q and stock prices fall, which may seem surprising. However, with lower (marginal) costs, (marginal) return need not be as high as before so q can fall while investment increases.

9. An improvement in technology raises present and future marginal productivity of capital. In Figure T4.9 the corresponding schedule shifts upward: Tobin's q jumps to q* and stock prices rise. Not surprisingly investment increases. From Figure 4.15 we know that the long-run optimal stock of capital is also increased.

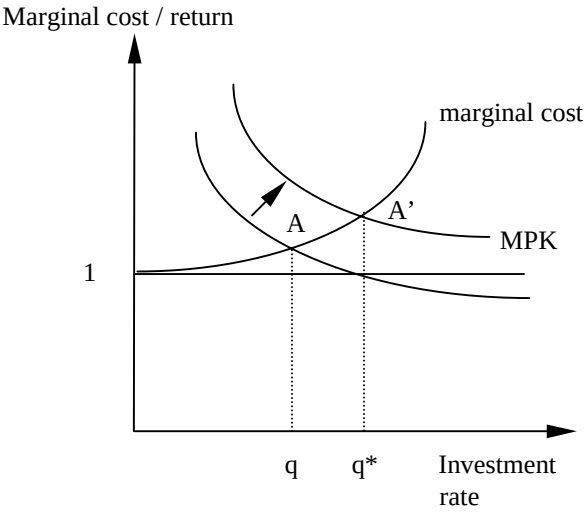


Figure T4.9

10. Crusoe has no access to capital markets. He can still save but he faces a *negative* interest rate: one coconut saved today earns (1-δ) coconut tomorrow. The budget constraint has slope less than one in absolute value (see Figure T4.10a). Crusoe may still save if his willingness to substitute today's consumption for tomorrow's consumption (his intertemporal rate of time preference measured by the shape of his indifference curve) is low enough. Formally, a necessary and sufficient condition for Crusoe to save under these conditions, is that the rate of intertemporal substitution be smaller than the gross interest rate (1-δ) at (Y_1, Y_2).

The economic reasoning is the following: suppose the rate of substitution is k in absolute value, with k < (1-δ). Then Crusoe, who is willing to substitute 1 unit of consumption today for k units tomorrow, is happy to save since he receives (1-δ) more then k. Crusoe will save at least one coconut. This point is illustrated in Figure T4.10(a). The slope of the indifference curve passing through (Y_1, Y_2) is flatter than the budget line. In Figure T4.10(b) Crusoe prefers not to save. More generally, the result derived above does not depend upon the negativity of interest rate but rather upon the inability of Crusoe to borrow. Negative interest rates are good news for borrowers and bad news for lenders.

11. In either case, the consumer will try to smooth transitory income changes. Suppose he has the same endowment in both periods and he is a net borrower, which means that he is rather impatient (Figure T4.11(a), point R). If he is not too impatient, a temporary increase in today's endowment reduces the net borrowing, allowing him to consume more in both periods (point R'). By contrast, a permanent increase does not change net borrowing (point R"). The consumer may be very impatient, however, in which case net borrowing increases even though the income change is transitory (Figure T4.11(b)).

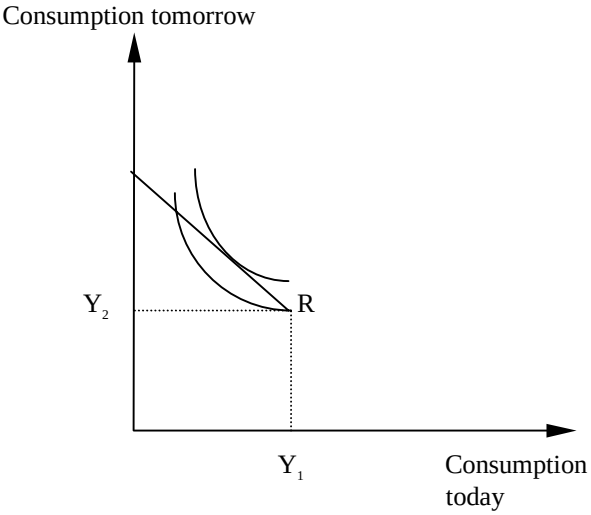


Figure T4.10(a)

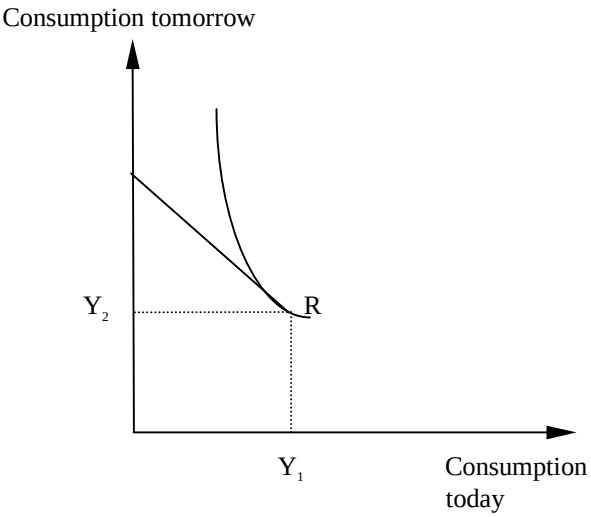


Figure T4.10(b)

12. Graphically, when the interest rate rises, the budget line becomes steeper and still passes through the endowment point A. In Figure T4.12(a), a net lender is initially shown at point R'. The new budget line is above R' so he will settle on a higher indifference curve (not shown).

A net borrower is represented initially by point R. The new indifference curve is everywhere below the indifference curve passing through point R: this borrower will be unambiguously worse-off. For a net borrower to be better-off, at least some portion of the new steeper budget line must pass above his initial indifference curve. An example is shown in Figure T4.12(b): the borrower will move from point R to point

R'. What does this "graphical" condition mean economically?

From Figure 4.9 (and for the advanced students, the Appendix) it can be seen that there are three main effects at work when the interest rate goes up: a substitution effect, an income effect and a wealth effect. The wealth effect dominates the income effect for a net borrower. But if he is willing to substitute quite a lot of today's consumption for tomorrow's he can take advantage of higher income (higher returns on saving) to make the substitution effect work in his favour.

Consumption tomorrow

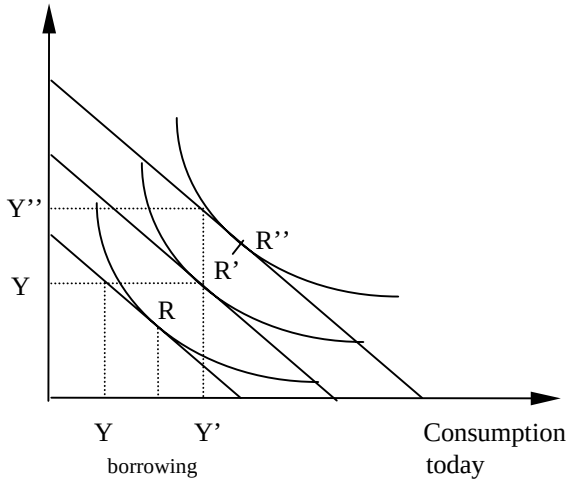


Figure T4.11(a)

Consumption tomorrow

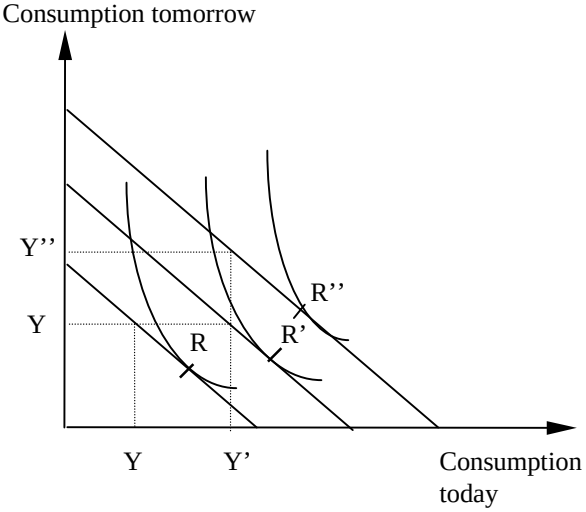


Figure T4.11(b)

Consumption tomorrow

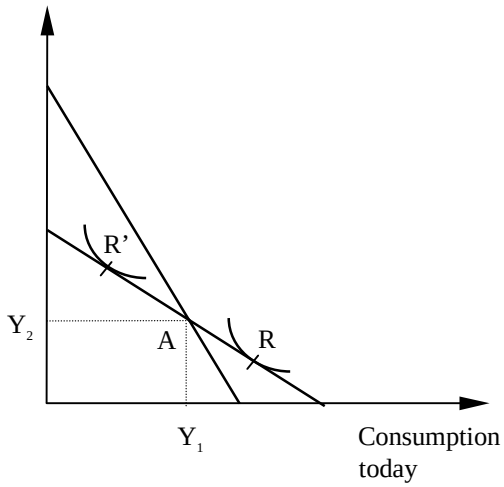


Figure T4.12(a)

Consumption tomorrow

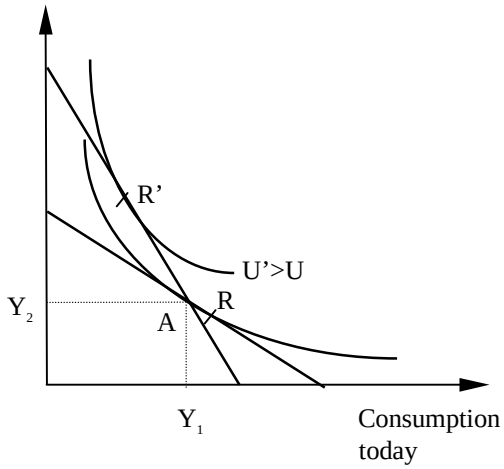


Figure T4.12(b)

Applications

1.(a) In terms of today's consumption :

$$W = 1000 + 1500 / 1.05 = 2428.57$$

In terms of tomorrow's consumption :

$$W^* = 1000 * (1.05) + 1500 = 2550$$

The permanent income Y^p is defined as :

$$Y^p + Y^p / (1.05) = W$$
$$Y^p = 1243.9$$

(b) $Y^p = 1346.3$ so the change in Y^p is 102.4
(c) $Y^p = 1443.9$ so the change in Y^p is 200.
(d) W = 2363.64; W* = 2600 ; Y = 1238.1;

Y* = 1342.86; Y** = 1438.1.

2. Durable goods expenditure is a form of saving. To buy a television provides future consumption (television watching). When there is a temporary income increase, households can now try to smooth consumption by saving or buying durable goods, as long as they consume these services in both periods. Of course, it will not be convenient to save only in this form, especially if the rate of depreciation is high.

3. In the life cycle hypothesis, there is no rationale for accumulating wealth after retirement. Note that the bequest motive does not apply in this case since retired people may leave a bequest and still stop accumulating once retired. Retired people may simply not have enough opportunities to spend their retirement benefits. Another reason may be simply the *ex ante* uncertainty of their lifespan. Older people may be saving for a rainy day which, if not provided for, could imply low consumption.

4. When interest rates rise, heavily indebted countries who cannot borrow any more must reduce their consumption and their net borrowing, hence improving the current account to meet their intertemporal budget constraint (recall Figure 4.7 and Box 4.5). This can lead to a sharp fall in investment which reduces future incomes and growth.

5. A higher proportion of young people in the economy implies that relatively more people are likely to be in a borrowing phase of their lives and are not saving. In the aggregate, this entails that these overall (poorer) economy saves less.

6. The net effect of an interest rate rise on consumption pattern is a result of three independent effects: the substitution effect, the income effect and the wealth effect (Fig. T.4.6). The substitution effect and the wealth effect tend to decrease current consumption. If the rate of interest rises, future consumption becomes cheaper at price 1/(1+r). Current consumption will fall. An increase in the rate of interest reduces the present value of income tomorrow therefore lowering today's and tomorrow's consumption. The third effect, the income effect, tends to increase current consumption.

The net effect is ambiguous. In the text the assumption is made that the income effect is the strongest for creditors because it is assumed that they are lending resources today because they expect *relatively* low future income streams. This case is the most likely, however, not the only possible one.

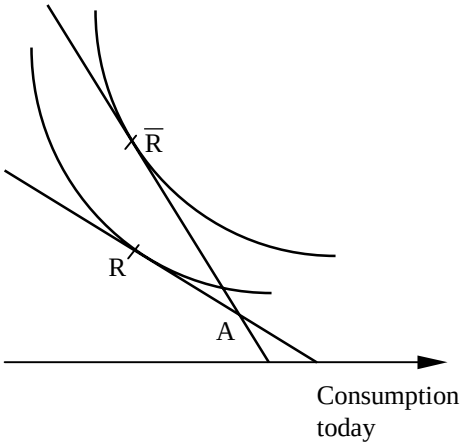


Figure A4.6

7. Borrowing rises as a result of the deregulation. National saving falls and the current account worsens (S-I = CA). However, the effect cannot be permanent since the intertemporal budget constraint must be satisfied.

8. As wealth rises consumption increases, worsening the current account. Moreover, Norway needed to invest in order to exploit the oil-field. Note that this result is in sharp contrast to Application Exercise 3.7: the reason is that the windfall lasts more than one period.

9. If the increase in spending is temporary, the government should finance it by borrowing. The government must match its intertemporal budget constraint and try to smooth taxes over time (almost like a household smoothes consumption over time). If the increase is permanent, it should be financed by taxes.

10. One interpretation is that Kuwait expected the shock to be temporary, Algeria and Nigeria to be permanent. On the investment side: there were few investment opportunities within Kuwait, in contrast to Algeria and Nigeria. The cash flow generated by the oil price increase allowed the latter two countries to overcome borrowing constraints they might have had.

Consumption tomorrow

CHAPTER 5

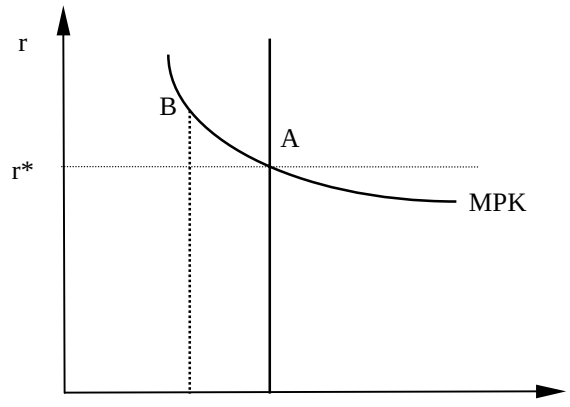
EQUILIBRIUM OUTPUT AND GROWTH

EXERCISE SOLUTIONS

Theory

1. The general equilibrium outcome from an exogenous labour supply increase is sketched in Section 5.2.2 and Figure 5.2.

2. In this diagram we assume inelastic aggregate labour supply. Initially, the economy is at equilibrium at point A (K_1, L) (see Figure T5.2). It moves to point B where half the capital stock is destroyed. The MPK curve does not move since L (employment) is unchanged.[1] The MPL schedule shifts downwards because each worker has half the average capital stock which to work. At the same time, the domestic interest rate is above the world interest rate, which triggers faster capital accumulation. Gradually, as investment begins, the MPL and in turn the MPK schedule shifts rightwards, moving the economy back to point A. General equilibrium is obtained again at point A (K_1, L).



[1] If labor supply were upward sloping, less employment would result. This leads to another shift backward of the MPK schedule which leads to another shift of the MPL curve, etc.

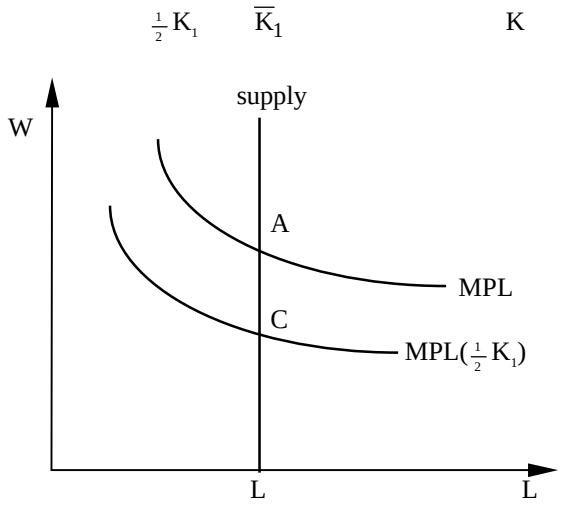


Figure T5.2 (a) and (b)

3. This case is the exact opposite of an increase in productivity represented in Figure 5.6. MPL and MPK shift downwards instantaneously, triggering a further downward move in the MPL schedule as the capital stock decreases. See Figure T5.3 (a), (b), and (c).

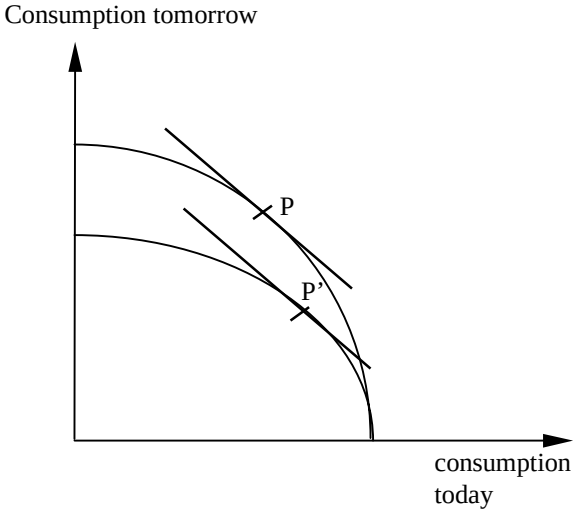


Figure T5.3(a)

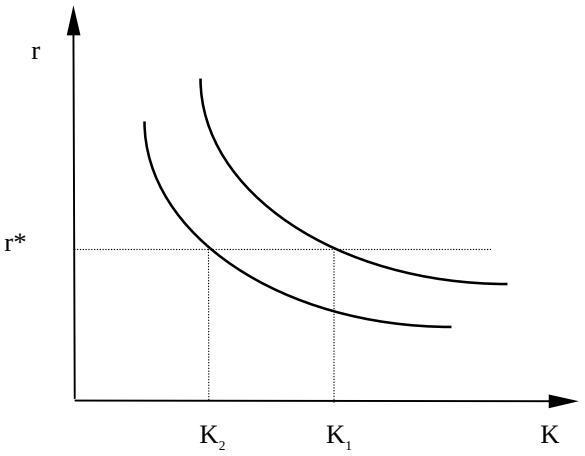


Figure T5.3(b)

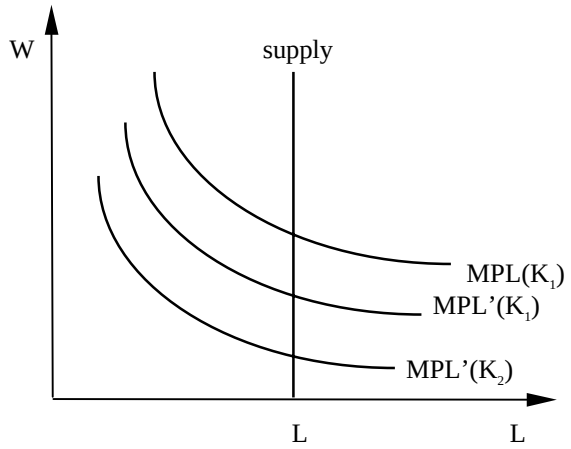


Figure T5.3(c)

4. Constant returns to scale. (Just multiply K and L by t and check that the resulting Y is multiplied by t. Students should note that this function is another way of writing the Cobb-Douglas production function (Box 5.5) with $\alpha = 0.5$.

5. Along a balanced growth path, output and capital grow at the same rate (g).

With a depreciation rate δ, investment must now be higher to replace worn-out capital and keep capital growing as fast as output. Formally the change in the capital stock is equal to gross investment minus depreciation:

$$K_{t+1} - K_t = I_t - \delta K_t .$$

Dividing both sides of this equation by K_t, the term on the left hand side is the growth rate g along the balanced path:

$$g = I_t/K_t - \delta$$

Since $I_t = sY_t$,

$$g = sY_t/K_t - \delta$$

Thus the relationship between the capital output ratio, the saving rate and the rate of growth along a balanced growth path is:

$$K/Y = s/(g + \delta).$$

6. Ignoring government, consumption is what is left after investment:

$$C_t = Y_t - I_t$$

where $I_t = (K_{t+1} - K_t) - \delta K_t$ (see previous exercise).

In the steady state we can drop subscripts; C_t=C, etc. In *per capita* terms :

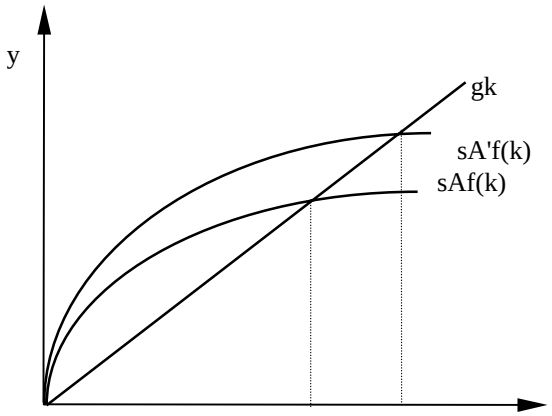
$$c = y(k) - g\,k - \delta\,k$$

We obtain the modified golden rule by maximizing c with respect to k:

$$MPK = g + \delta.$$

Graphically, the investment line (Figure 5.11) rotates counter-clockwise as its slope increases to $g+\delta$.

7. With technological progress, the production schedule shifts upwards and the savings per capita curve shifts as well (see Figure T5.7). As the investment line does not move, the capital-labor ratio rises : the economy grows at a rate higher than the rate of growth of the population (as is clear from equation 5.10 in the textbook).



k_1 k_2 k

Figure T5.7

8. The economy's aggregate production function is given by Y = A F(K, L, H, U) where H represents total human capital and U stands for infrastructure. Assuming constant returns to scale, the Solow decomposition is now :

$$g = a + \alpha\, \Delta K/K + ß\, \Delta L/L + \gamma\, \Delta H/H + (1-\alpha-ß-\gamma)\, \Delta U/U$$

9. The answer is already given in the textbook footnote 26.

Applications

1. The most plausible explanation is that France was in the process of catching up with the United States from an out-of-equilibrium situation in which a large part of its capital stock had been destroyed (see exercise 2 for the consequences of a capital stock destruction). The marginal productivity of capital was higher in France, which stimulated investment and a higher growth rate of capital. Indeed Table 5.7 shows that the capital-output ratio was lower in France than in the United States after World War II.

2. The national saving rate deviates from the national investment rate in these two cases. In Switzerland, savings exceed investment, meaning that over a long period of time this country had accumulated foreign assets, i.e. claims on the rest of the world. This may be because it is a wealthy country, home of many multinational corporations with extensive activities abroad. In addition, many of the most lucrative investment opportunities in this country may have been exhausted. In contrast, a large portion of Ireland's capital stock is owned by foreigners, and it is likely that much of the investment associated with maintaining and expanding this capital stock is undertaken by foreign corporations. In addition, it is likely that Irish expatriates finance a goodly portion of the current account deficits.

3. The capital stock is dramatically low in Eastern Europe and human capital inherited from the planned economy is relatively high. Therefore, the MPK should be high relative to Western MPK, while MPL is low. As a result, capital should accumulate faster and real wages, starting from a very low level, should rise more rapidly in Eastern Europe. If world saving is not responsive then the world real rate of interest should rise. As a result, part of saving is being channelled into Eastern Europe, investment should decline in Western Europe. Growth may be lower although high returns from investment in the East as well as growing markets may soon turn things around.

4. It is expected that the countries of Eastern Europe will undertake massive investment projects in the future. The Feldstein-Horioka puzzle predicts that the national savings of these countries will (must) increase as well. Political and economic uncertainty in these countries will limit capital inflows. That is, resources from, say Western Europe, will not be sufficient to cover all projects.

5. There are many potential economic reasons for the inverse relationship between fertility and standard of living. A natural one is the (non-)affordability of contraceptive methods. Another is that large families are a easy way of providing insurance against loss of earning power in the future or for retirement. Most often cited is the opportunity cost of raising children: as nations become wealthier, the level of wages (the opportunity cost of time) rises, and with it the cost of raising children. Women tend to be drawn out of the labour force for a greater period of their childbearing lives, leading to a postponement of the childbearing decision and a reduction in fertility. Finally, children in wealthier countries tend to enjoy more leisure; for parents the children no longer represent a source of additional family income (as they do in many poor countries).

Under such conditions population growth is endogenous: poor countries which have a higher fertility may become wedged in a poverty trap. Convergence may no longer be guaranteed.

6. This is a simple application of the Solow decomposition. Note that we need not be on a balanced path, so growth rates of output and capital may differ.

The Solow decomposition is :

$$g = a + \alpha\, \Delta K/K + (1-\alpha)\, \Delta L/L$$

The growth rate per capita is :

$$g - \Delta L/L = a + \alpha(s\, Y/K - \Delta L/L)$$

We are given that a=0 and Y/K = 3. It follows that

s = 20% g - ΔL/L = 1.17 %
s = 30% g - ΔL/L = 2.00 %.

If the rate of depreciation is equal to 0.0005, the per capita growth rates become

s = 20% g - ΔL/L = 1.15 %

s = 30% g - ΔL/L = 1.99 %.

That is, if capital depreciates, more resources must be moved towards investment.

7. We note S for Sri Lanka and E for Egypt. We have to compute the marginal productivity of capital and human capital :

$$MPK = \partial Y / \partial K = (1/2)\sqrt{(HK/L)}$$
$$MPH = \partial Y / \partial H = (1/2)\sqrt{(KL/H)}$$

The ratios of marginal productivities in both countries are:

$$MPK_E / MPK_E = \sqrt{2}$$
$$MPH_E / MPH_S = \sqrt{2(L_E / L_S)} = \sqrt{2(200/100)} = 2\sqrt{2}$$

The second result is striking: in this hypothetical example, the return on an additional unit of human capital in Egypt is *larger*, despite the fact that Egypt has more human capital and an identical capital-labor ratio to Sri Lanka. This is because the production function considered has *increasing* returns to scale in all three factors.

8. Recall that $I = \Delta K + \delta K$
Then $I/Y = (g + \delta) K/Y$
g = 5% I/Y = 20%
g = 7% I/Y = 24%

9. The effect on wages is ambiguous. Wages rise because the labor force is kept low; at the same time the marginal productivity and the rate of return on capital falls, there is a decrease in investment and a shift back in the demand of labor. Hence real wages may decline. (See section 5.2.2 and Figure 5.3 in the textbook). This is the reverse case of an increase in the labor force.

10. Migration of highly skilled workers from developing countries reduces the stock of human capital and therefore reduces the marginal productivity of capital and of the remaining labor force. As far as the reduction in the rate of investment in these countries, the growth process will be adversely affected. This is the most important consequence of the "brain drain".

CHAPTER 6

LABOUR MARKETS AND EQUILIBRIUM UNEMPLOYMENT

EXERCISE SOLUTIONS

Theory

1. The budget constraint shifts upwards (see Figure T6.1) by the amount of the inheritance *B*. If leisure and consumption are both normal goods (viz. demand rises with income), leisure and consumption increase. With these assumptions for household preferences, richer (i.e. wealthier) people will work less. If *B* is large enough, the household may even reach a corner solution $l = l^*$ where no work is performed at all.

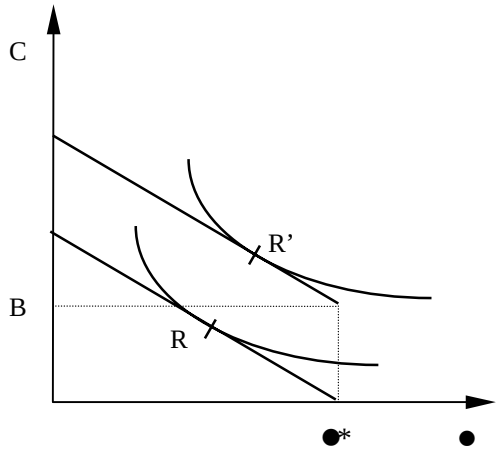


Figure T6.1

2. (a) See Figure T6.2(a). The budget constraint is kinked at point *A*. Without overtime Crusoe is at point *R*.

(b) Working overtime makes Crusoe better off if he is able to reach a higher indifference curve by working overtime (lying on the *BA* part of the budget constraint).

(c) Crusoe will choose to work overtime if *BA* crosses the indifference curve which was tangent to *R*; that is, if his marginal rate of substitution exceeds the regular wage at regular hours. See Figure T6.2(b).

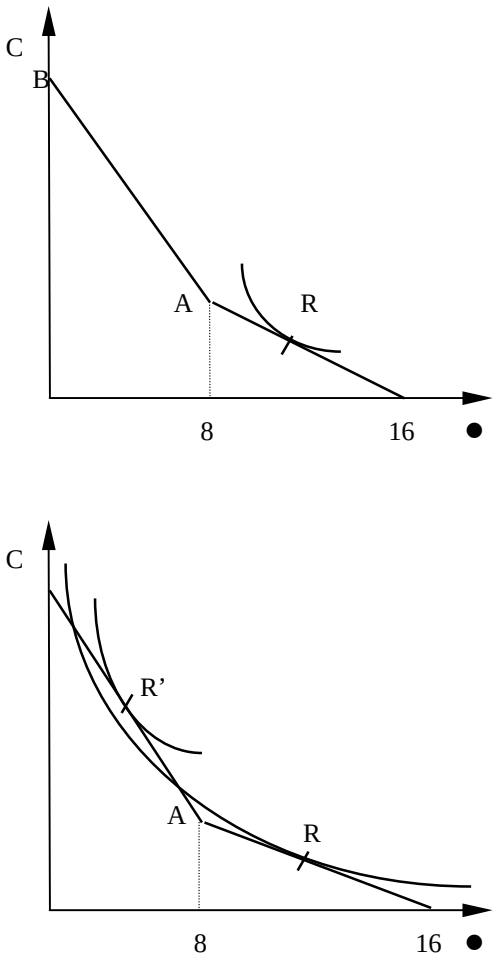


Figure T6.2 (a) and (b)

3. Crusoe would always like more leisure and consumption, but is limited by his 'endowment' of 16 waking hours. An additional hour of work or play is equivalent to an increase in the endowment. How much is this extra hour worth to him? If he uses it to increase his consumption it will be worth its value supplied in labour, or the real wage. If he uses it to get a suntan on the beach, it is worth the opportunity cost of not having worked, i.e. the real wage again. Therefore the value of the extra hour is always the real wage.

4. (a) Decreasing investment over several years reduces the pace of capital accumulation: the secular rightward shift of the labour demand curve slows down. Given labour supply, two things may happen: *(1)* the labour market clears and real wages fall relative to what they would have been; *(2)* if labour market institutions or collective bargaining prevent *(1)* from occurring, individually involuntary unemployment emerges and wages do not decline as much.

(b) An increase in productivity has the opposite effect as the labour demand curve shifts to the right. As before two things may happen: *(1)* the labour market clears with higher real wages relative to the benchmark case; *(2)* wages are less flexible, and employment grows *more* rapidly.

The answer to both questions depends on the preferences of workers and unions, and on the collective bargaining system. The above answer implicitly assumed that unions attempt to stabilize the real wage; in contrast an 'employment first' union might mimic the competitive labour market outcome. It might be useful to refer to the discussion of wage offer curves in the text.

5. This is a somewhat tricky question: to have any effect, the minimum wage must exceed the equilibrium wage in the labour market.

6. (a) The worker's budget constraint rotates counter-clockwise, the optimal combination of consumption and leisure shifts from R to R' in Figure T6.6a. With labour less rewarding and leisure being a "normal good", leisure is increased and labour supply reduced. In Figure T6.6b, the labour supply schedule accordingly shifts leftward.

(b) We suppose that the labour supply is upward sloping (the substitution effect dominates). In Figure T6.6b, equilibrium shifts from point A to point A': employment declines and the equilibrium gross (inclusive of tax) wage rises.

(c) If the union cares about after-tax wages (hard-line), the after-tax wage is unchanged: the burden is shifted onto firms, and employment falls. Unemployment emerges. If, in contrast, the union cares about employment, net wage will fall and employment will be unchanged.

(d) If the union cares about after-tax wages (hard-line), the after-tax wage is unchanged: the burden is shifted onto firms, which reduces employment. Unemployment emerges. If, in contrast, the union cares about employment, net wage will fall and employment will be unchanged.

7. Housing rent controls reduce labour mobility. This is because cheap rent-controlled housing is in short supply. If different regions of a country experience different shocks to labour demand, this may lead to mismatch unemployment. Unemployed people are reluctant to move to regions in which there are jobs, since they would lose their cheap housing. This problem does not only apply to rent control however, but also to owner-occupied housing when real estate prices have fallen; moving implies realizing a capital loss associated with the sale of the house.

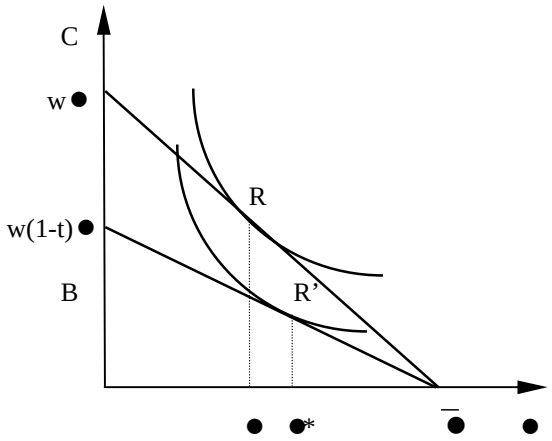


Figure T6.6(a)

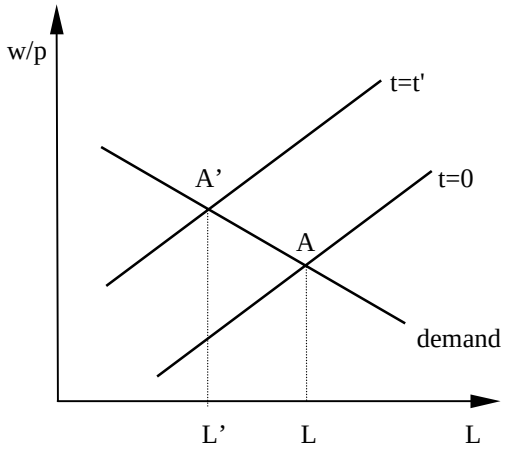


Figure T6.6(b)

8. Immigration shifts the aggregate labour supply curve to the right.

(a) Without minimum wage, going from point A to point B in Figure T6.8(a) the real wage falls and employment rises. In equilibrium, unemployment is voluntary.

(b) With a minimum wage at the level of R, which is above the new equilibrium wage, the real wage falls to the minimum wage and both employment and unemployment rise. Part of unemployment is now involuntary (Figure T6.8(b)).

9. Union's indifference curves must lie above the wage floor *R*, e.g. the unemployment benefit. This shifts the

offer curve above the level *R* since the union now only cares about the gap between *w/p* and *R* (Figure T6.9). Equilibrium unemployment increases.

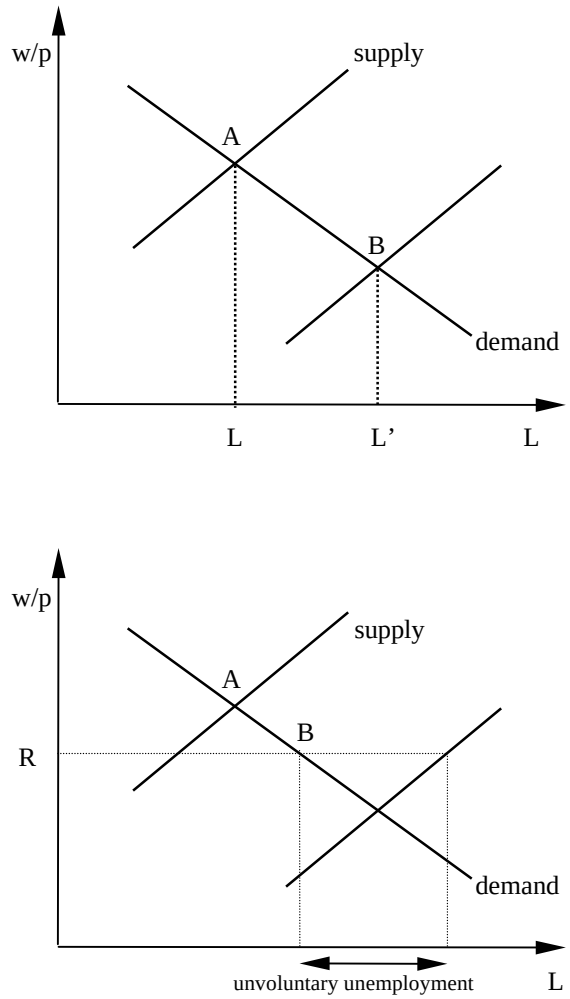


Figure T6.8(a) and (b)

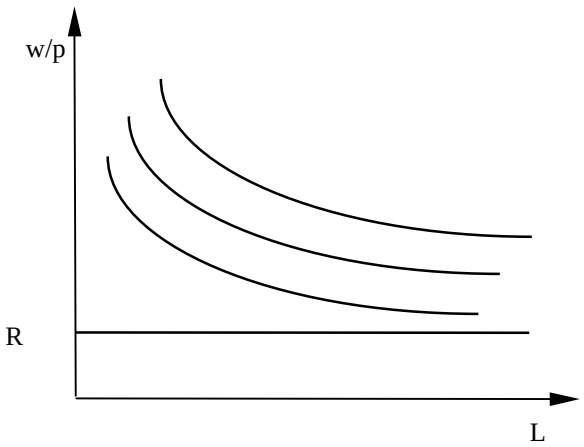


Figure T6.9

Applications

1. Migration exerts pressure towards real wage equalization between both countries. If we assume full wage flexibility, (a) real wages must fall in West Germany and (b) rise in East Germany.

(c) This triggers an increase in employment in West Germany. The effect on East German employment is not obvious: with real wages increasing faster than marginal productivity (as it has probably been the case) employment falls. However, as investment increases in Eastern Germany, employment should also rise.

If the East German workers organize themselves into unions, they will demand higher wages, hence alleviating the downward pressure on West German real wages. Note that this will tend to worsen unemployment in East Germany.

2. Unemployment benefits are believed to influence the speed at which unemployed workers search and find new jobs. Yet most workers do not quit their jobs and go into unemployment for the sake of drawing the corresponding benefits. Even though some may view transitory unemployment as a way of looking for a new and better employment opportunity, most workers go into unemployment after an involuntary separations. This is why, even with generous unemployment benefits, the 1960s and early 1970s were periods of low unemployment because growth was high and steady and few workers were losing their jobs. After the oil shocks, however, a large number of workers were dismissed. This is when unemployment benefits started to exert negative incentive effects. In addition, as workers remained unemployed for long periods of time their human capital and ultimate employability may have declined considerably.

3. Profit sharing schemes increase the flexibility of real wages, since some of the uncertainty over the business cycle is passed on to employees. When a shock occurs, total wage costs to the firm are immediately reduced through the bonus system and employment is stabilized. On the other hand, risk adverse workers may demand higher average wages to compensate them for fluctuations in income, which may have adverse effects on employment.

4. Inflows into unemployment are higher in highly seasonal industries; employees may be released at the end of a season and recalled in later months. From the definition of the frictional rate of unemployment given in equation (6.6) it is clear that for a given outflow rate, frictional unemployment will be higher.

5. These countries want to catch up with industrialized countries. They must stimulate physical investment in order to accumulate capital. By repressing labour unions they make real wages lower and more flexible. Higher profit rates generate faster capital accumulation. Of course this is by no means a policy prescription: the loss of human rights and political liberty involved in such repression may well outweigh the benefits of growth.

6. Apprenticeships, which are extensively supported by the state in Germany, allow firms to hire workers at a wage considerably lower than their marginal product. The difference is paid for by the state. In return, apprentices learn general human capital which they can take with them upon leaving their apprenticeships (sometimes they remain with the firm afterwards). This approach helps overcome the problem at the root of much of youth unemployment: that the productivity of unqualified young workers is below the minimum wage.

7. Linking unemployment benefits to labour taxes, if effectively perceived by each and individual firm, has the effect of shifting back the labour demand curve (approximately by factor of *t*, the wage tax paid by the firms[1]). In addition, question 9 in the theory section above suggests that the wage offer curve may actually shift up, worsening unemployment. In the presence of real wage rigidity due to labour supply mediated by unions, unemployment will increase.

8. (a) In Figure A6.8(a), with perfectly competitive labour markets, real wages fall and employment increases (point *B*). Some male workers, previously employed may become unemployed because the real wage falls below their reservation wage; this is the case voluntary unemployment, though. In contrast, if real wages are rigid, and cannot fall to clear the market, involuntary unemployment emerges (Figure 6).

(b) In the competitive case, as employment increases, the marginal productivity of capital rises, which triggers an increase in capital stock. This raises the marginal productivity of labour, hence raising

[1] Mathematically-minded students may wish to derive the exact extent to which the labour demand curve shifts back. Consider the inverse labour demand curve, which is identical to the marginal product of labour: *MPL(L)*. The marginal product to the firm is reduced now by its marginal tax liability, which is $d(tL \cdot MPL(L))/dL = t(MPL+dMPL/dL)$, where *t* is the fixed tax rate on the wage bill. Thus the net of tax marginal product to the firm is

$$MPL(L) - t(MPL+dMPL/dL) = (1-t)MPL(L) + t\, dMPL/dL.$$

Only if $dMPL/dL=0$ (linear labour demand curves) will the approximation be correct. Otherwise the actual net *MPL* will less, especially for high values of L (large firms).

employment and wages (see Figure A6.8(b), point *C*). If the effect is strong enough, it could overcome the negative impact of rigid real wages. This effect does not occur in the rigid wage case, however, as employment and wages do not change.

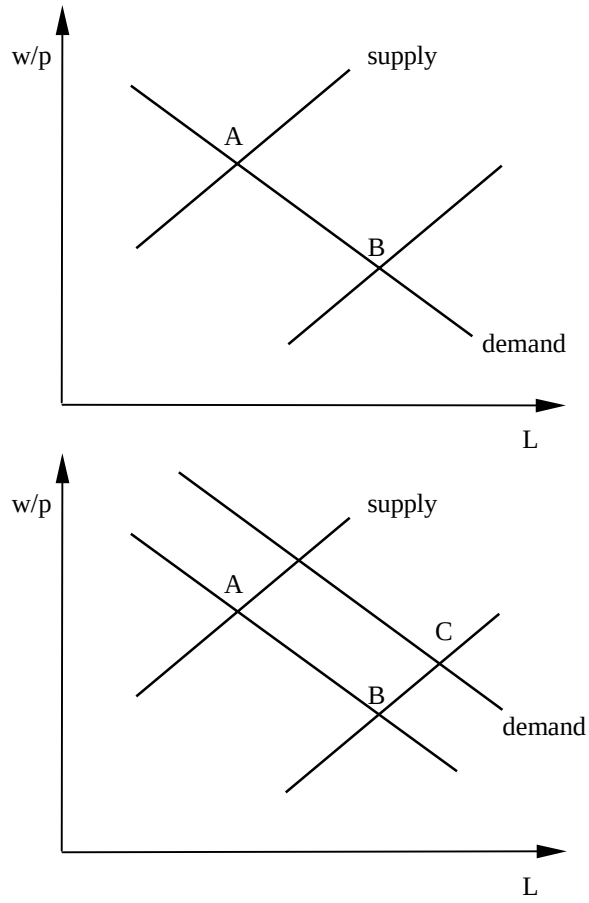


Figure A6.8 (a) and (b)

CHAPTER 7

THE REAL EXCHANGE RATE

EXERCISE SOLUTIONS

Theory

1. The real exchange rate is defined as the ratio of the foreign price index P^* denominated in domestic currency to the domestic price,

$$\lambda = E\, P^*/P,$$

where E is the nominal exchange rate. Which price indices are relevant to calculate the real exchange rate depends on the application, either import and export prices or the price indices of nontradable and tradable goods.

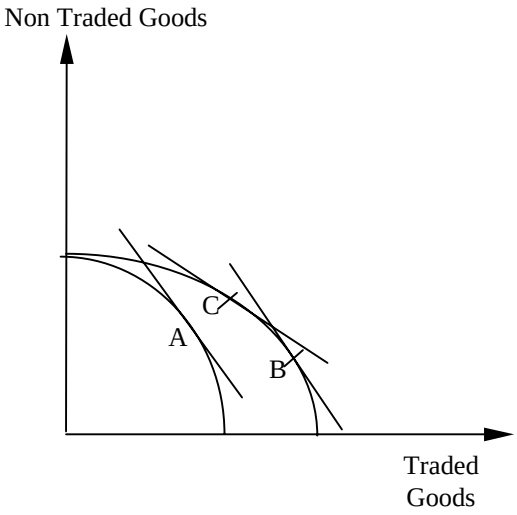
A doubling of the price of domestic goods P leads to a real appreciation (λ decreases). In contrast, increasing the price of foreign goods P^* or a nominal depreciation increases the real exchange rate, hence causes a real depreciation.

2. This question is designed to show that the distinction between traded and nontraded goods is not black and white. None of the following answers is absolutely correct, and indeed may change over time.
(a) nontraded
(b) traded (especially after the completion of the Single European market)
(c) increasingly traded, as famous architects move across national boundaries
(d) nontraded (but international newspapers are traded extensively)
(e) traded especially with refrigerator transport.
(f) nontraded

3. The production possibilities frontier may, for instance, shift out as a result of technological progress or greater availability of inputs. A broader interpretation of the *PPF* as in Chapter 17 includes increases in efficiency of the economy due to deregulation, increased competition, and increased incentives to work and produce.

Suppose the productivity for traded goods increases. The *PPF* shifts rightward as indicated in Figure T7.3(a). With an unchanged real exchange rate, production of traded goods increases while production of nontraded goods falls (point *B*). But now, there is excess demand for nontraded goods, and therefore their price must rise. A real appreciation occurs (point *C*).

The argument can be reversed for an increase in nontraded goods' productivity: a real depreciation must occur (see Figure T7.3(b)).



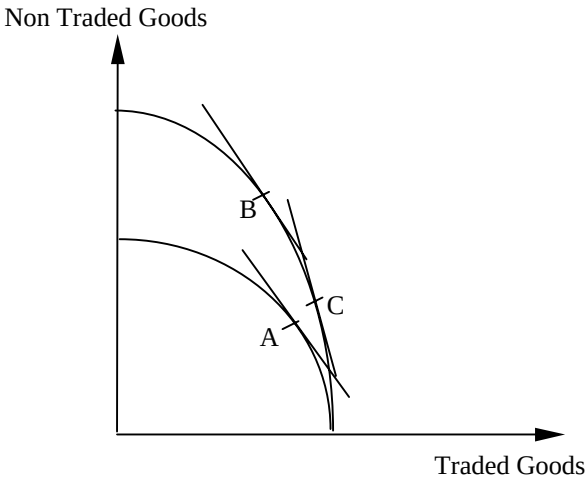


Figure T7.3(a) and (b)

4. Choosing traded goods as a numéraire we obtain: $Y = Q^T + 1/\lambda\, Q^{NT}$ (compare equation 7.5). The price line rotates around *B* (Figure T7.4). When an appreciation occurs, λ falls, hence the line rotates counter clockwise: the price of nontraded in terms of traded goods rises, and therefore we can buy less nontraded goods. The result is invariant whether we compute GDP in terms of traded or nontraded goods.

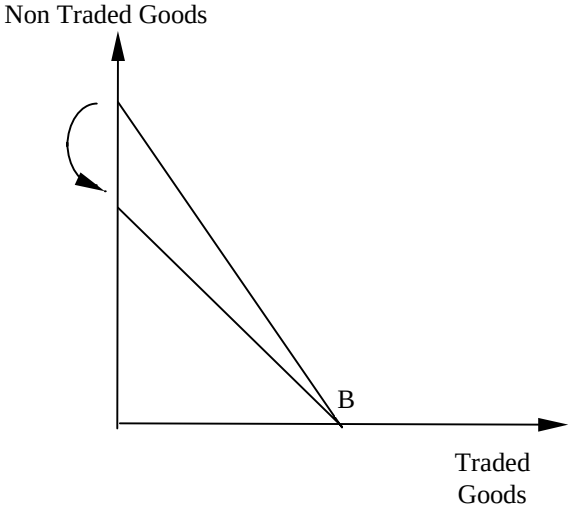


Figure T7.4

5. An anticipated increase in domestic productivity has two effects :

(i) An increase in wealth through higher value-added discounted back to the present. This increases demand for both, traded and nontraded goods and has a negative impact on the primary current account, which triggers a real depreciation.

(ii) Domestic production increases which may lead either to a real depreciation (improvement in the productivity for nontraded goods) or to a real appreciation (improvement in the productivity for traded ones).

The overall result is therefore ambiguous. When an increase in productivity is expected but has not occurred yet, only the wealth effect obtains in the short run, (as wealth is the present value of future income) which triggers a real depreciation.

6. An indebted country ($F_1<0$) must run a primary current account surplus of $-(1+r)F_1$ in order to satisfy the intertemporal budget constraint. When the interest rate rises from *r* to *r'*, as in Figure T7.6, we move from *A* to *A'*: the required surplus is higher and the real exchange rate must depreciate. For net lender countries, the primary current account deficit rises, which triggers a real appreciation (not shown but easy to verify).

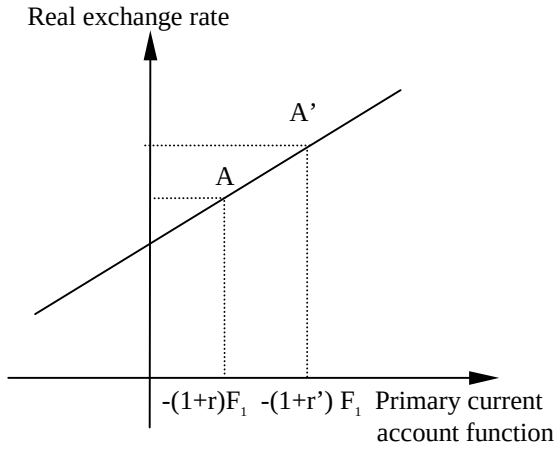


Figure T7.6

7. When a real depreciation occurs, exportable goods become cheaper. Domestic producers are more competitive and demand for their products will rise. Consumers face higher prices for foreign products, which means that the Consumer Price Index rises (recall that the *CPI* is a weighted average of importables and exportables prices while the *GDP* deflator only register movements in domestic prices). At unchanged wages, real income falls.

8. (a) Returns are constant in both sectors, hence the PPF is a straight line (see Figure T7.8):

$$10\, Y^A + 6\, Y^B = 10\,000.$$

(b) If we rule out the corner solutions in which the country produces just one good, the relative price of good A in terms of good B is equal to the marginal rate of transformation which is constant.

$$P^A/P^B = 10/6 = 1{,}67$$

(c) If $P^A = 2P^B$ on world markets, the country will shift all the resources to the production of *A*.

(d) If the country is in autarky, production occurs at the tangency point between the indifference curve and the *PPF*. Both goods are produced and the relative price is given in (b).

9. If the country operates inside the *PPF*, e.g. at point *A* in Figure T7.9(a), it is possible to produce more of both goods by moving towards the frontier. Anywhere in the shaded area we would reach a higher indifference curve and therefore be better off.

If the country operates on the frontier but not at the tangency with the price line, the marginal rate of transformation for the economy is not equal to the relative price. It is possible to increase *GDP* by producing more of one good and less of the other. Suppose, for example, that we start from point *B* in Figure T7.9(b) where the relative price of importables P_N/P_T is less than the marginal rate of transformation, denoted by *MRT*. In this case a country could increase the value of its aggregate output by producing one unit less of the traded good valued at P_T and increasing its output of nontradables by *(MRT)* valued at P_N. The change in GDP is equal to $(MRT)(P_T - P_N)$. This will be positive under the assumption made. Repeating this as long as there are gains, we would move to point *P*.

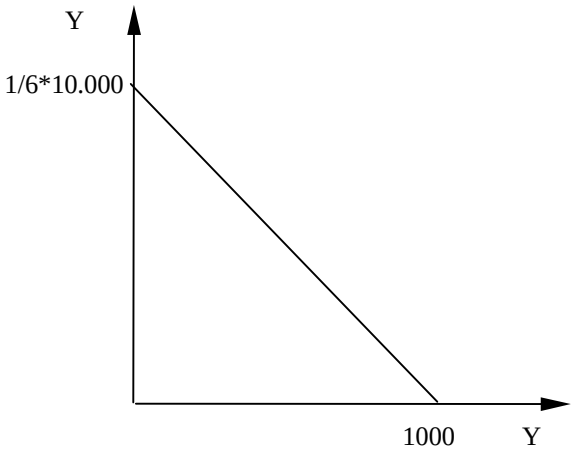
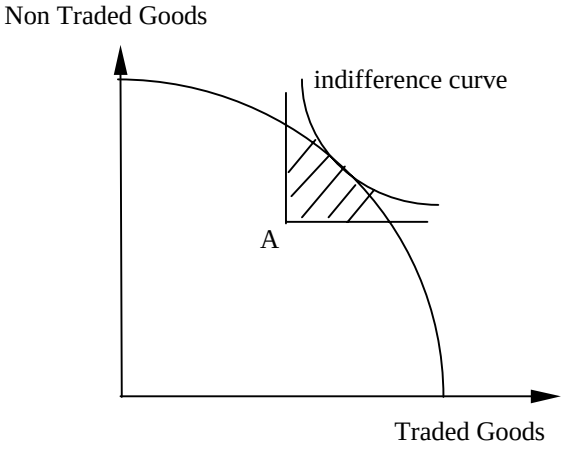
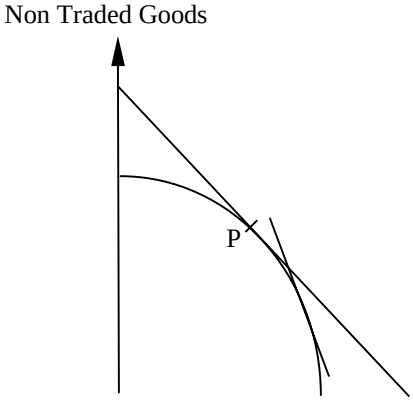


Figure T7.8





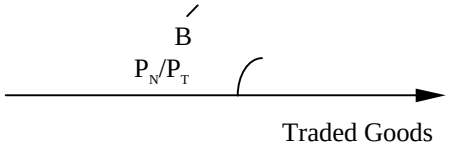


Figure T7.9(a) and (b)

10. (a) In its broader interpretation, the *PPF* characterizes maximal combinations of different goods an economy can produce given its resource constraints and its technological and regulatory and institutional environment. An increase of union militancy increases the real wage. Within an economy where labour resources are not fully employed, this shifts the PPF inwards: less will be produced of both traded and nontraded goods.

(b) In the short run, higher wages means higher prices for locally produced goods, either taken as nontradable goods or exportables. The real exchange rate appreciates, which hurts the competitiveness of the country. Demand for foreign goods increases, which worsens the current account.

In the long run, the real exchange rate is determined by the primary current account function (the budget constraint) and must return to its equilibrium level.

Applications

1. First we compute the indices in the current year. Real exchange rate λ and Consumer Price Index *P*:

$$\lambda = EP^{T*}/P^N = (0.93*110)/105 = 97.43$$
$$P = 0{,}3\ P^N + 0{,}7\ P^{T*} = 103.11$$

(To ensure that the real exchange rate index retains its original dimension (100 in base year) we deflate the nominal exchange rate index in all calculations by 100.)

(a) The real exchange rate appreciates (λ falls) by 16.67%; the CPI rises by 6.11%.

$$\lambda = 81.19 \qquad P = 109.41$$

(b) The real exchange rate appreciates (λ falls) by 8.60%; the CPI falls by 5.97%

$$\lambda = 89.05 \qquad P = 96.95$$

(c) The real exchange rate depreciates (λ rises) by 15.0%; the CPI rises by 10.42%

$$\lambda = 112.04 \qquad P = 113.85$$

(d) The real exchange rate depreciates (λ rises) by 10%; the CPI rises by 6.95%

$$\lambda = 107.17 \qquad P = 110.27$$

2. Two effects are at work: *(1)* Transferring assets and valuable resources amounts to a transfer of wealth from the defeated country to the victor. Demand for traded and nontraded goods will fall in the loser country hence triggering a fall in the price of nontraded goods: a real depreciation occurs. Conversely, a real appreciation occurs in victor countries.

(2) The net external asset position improves for victor-countries and deteriorates for losers, hence necessitating a real depreciation for losers and a real appreciation for winners.

Both effects are going the same way. Production is shifted toward nontraded goods in victor countries, and toward traded ones in loser countries.

3. By subsidizing declining industries, the government allows domestic firms to reduce their price in order to compete on international markets. This induces a real depreciation (a decrease in the terms of trade). However, in the long run the real exchange rate is determined by the intertemporal budget constraint of the nation. Therefore, the real exchange rate should return to its equilibrium level.

Another, subtly different interpretation which is consistent with the evidence is that the terms of trade deterioration came first. Industries exporting to the rest of the world were faced with bankruptcy. Were they to close, these goods would disappear from the export price index and thereby raise it. Rather than letting the 'loser industries' disappear, however, the state subsidized them, keeping them in business and in the index.

4. Between 1975 and 1985 the Italian Lira depreciated by more than 100%, whereas the real exchange rate was almost constant. Between 1985 and 1990, nominal exchange rate of the Lira was almost constant, while the real exchange rate appreciated. The real exchange rate is the nominal exchange rate doubly deflated:

$$\lambda = EP^*/P,$$

where P^* and P are the foreign and domestic *CPI*s. The rate of change of the real exchange rate can be expressed in terms of the depreciation of the nominal exchange rate and the inflation rates abroad (π^*) and at home (π):

$$d\lambda/\lambda = dE/E + (\pi^* - \pi)$$

The difference in the evolution of the Italian real and nominal exchange rates can be explained by the inflation differential: when inflation at home is higher than inflation abroad, a real appreciation occurs which hurts competitiveness. In order to restore competitiveness, the nominal exchange rate must depreciate.

The figures for Italy clearly show a regime shift in the exchange rate policy. While, over the first period, Italy tried to maintain its competitiveness by letting the lira depreciate, there seems to be evidence that Italian authorities stabilized the nominal exchange rate during the second half of the 80s.

5. The demand for exports will rise as their price expressed in foreign currency has fallen. Conversely, the demand for imports will decline. Both effects tend to improve the current account. But this effect requires time: agents may recognize the price change and alter their demands for goods only slowly; some exports and imports contracts will continue to apply for some time after the depreciation occurs; and pricing in the home currency may respond with a time lag.

In the short run, with volumes of imports and exports mostly unresponsive, exports are cheaper (they earn less Crowns) while imports are more expensive: the current account worsens. Eventually, volumes will respond to prices: as exports increase and imports fall, the current account improves. This effect is known as the *J-curve*.

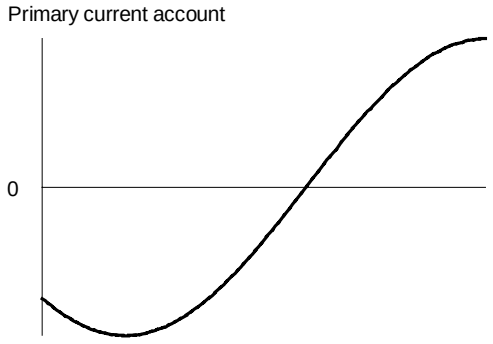


Figure A7.5

6. Box 7.3 gives another definition of the real exchange rate which is the nominal exchange rate 'doubly' deflated with import and export prices, which is exactly the reciprocal of the terms of trade.

During the oil shocks of the 70s, the price of oil rose sharply improving the terms-of-trade position of OPEC countries. Since the OPEC is the largest cartel of oil producers world-wide, production changes influence world prices. If ist limiting production were successful, keeping supply short of demand stabilizes the price of oil, as well as the terms of trade position of OPEC countries.

7. Dispersion of wealth is probably more significant among countries than among big cities. This is because internationally mobile individuals and entities

concentrate their activities in big cities. What makes the difference is wealth outside big cities (small towns, rural areas). As the price level is related to wealth, through the *Balassa-Samuelson effect*, relative prices will vary less between big cities. (Anomalies such as N'Djamena/Chad might be due to inadequate supply of the goods that constitute the cost of living index or price controls.)

Since barriers to mobility between cities within a country are even smaller than between cities in different countries, one would expect the cost of living indices for cities within a country to move even closer together than for cities in different countries.

8. What counts for the real exchange rate in the long-run is the total net external asset position of Germany. If East Germany is largely indebted *vis-à-vis* Western Germany, this part of the debt becomes 'internalized' and therefore does not affect the real exchange rate. But to the extent that East Germany was indebted to the rest of the world and the external indebtedness of united Germany has increased, the real exchange rate must depreciate relative to its pre-unification (i.e. West German) path. This can be demonstrated graphically using Figure 7.9 in the text book. In fact, Germany is a large external creditor, so in fact its net asset position has declined.

9. We know that a reduction of external debt triggers a real appreciation (recall the primary current account function). However, the price level, defined as a combination of price of traded and nontraded goods may rise or fall. This will depend on what happens to the nominal exchange rate *E*.

Let *a* denote the fraction of income devoted to nontraded goods. The Consumer Price Index *P* is defined as:

$$P = a\,P^N + (1\text{-}a)\,P^{T*},$$

where *a* is the fraction of total spending on nontraded goods. Expressed in terms of the price of traded or nontraded goods, we have

$$P = (a/\lambda + 1\text{-}a)\,E\,P^{T*}, \text{ and}$$
$$P = (a + (1\text{-}a)\,\lambda)\,P^N.$$

The price level of traded goods in foreign currency is determined on the world market, and hence does not change through the debt relief, if we assume that the country is small.

If *E* is constant (fixed nominal exchange rate), *P* rises. However, if *E* adjusts to keep the price of nontraded goods constant, *P* falls.

10. We reason in terms of the traded-nontraded goods decomposition: Wages are about equal in both sectors and real wages equal to the marginal productivity of labour in each sector. Typically most of the nontraded sector corresponds to services where productivity gains are slow. High productivity gains in the traded goods sector leads to fast growth in marginal productivity and therefore fast rising real wages. With prices set at the world level, this means fast growth in nominal wages. As such wage increases are transmitted to the nontraded good sectors, where productivity gains are slow, producers must increase prices faster than in the traded goods sector, which generates inflation. The more so the faster productivity rises in the traded goods sector.

This is apparent in Box 7.4 (the Balassa-Samuelson effect). The consumer price index is shown to be:

$$P = a\,P^N + (1\text{-}a)\,P^{T*},$$
$$P = E\,P^{T*}\,(MPL^T/MPL^N)^{1-a}$$

The faster MPL^T rises relatively to MPL^N, the higher is the rate of inflation. (This effect is an important aspect of the *Scandinavian* model, following work by Aukrust, Lindbeck and other Scandinavian economists).

11. (a) Equadoria must move from point A to point B in Figure A7.11: To be able to repay the debt, it will shift production towards traded goods sector. Therefore, the price of traded goods must rise relatively to nontraded goods: a real depreciation must occur.

(b) Consumption of nontraded goods must fall, since their production declines and production equals consumption. Consumption of traded goods may rise or fall (see Figure A7.11) depending on the tastes of residents and the size of the primary current account surplus required (likely to fall). In the case of highly indebted Equadoria, it must be the case that consumption of traded goods falls.

(c) See (a).

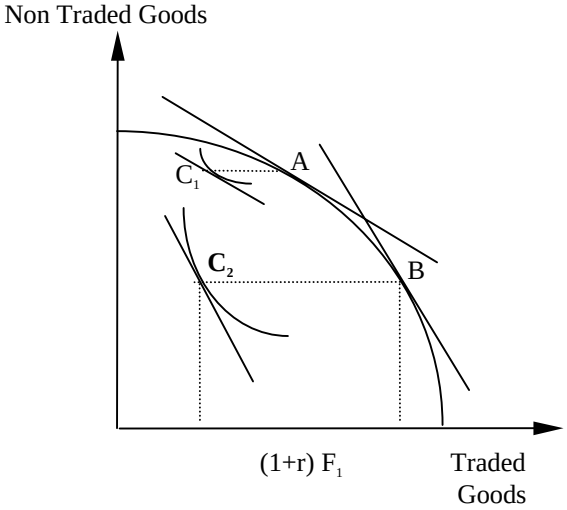
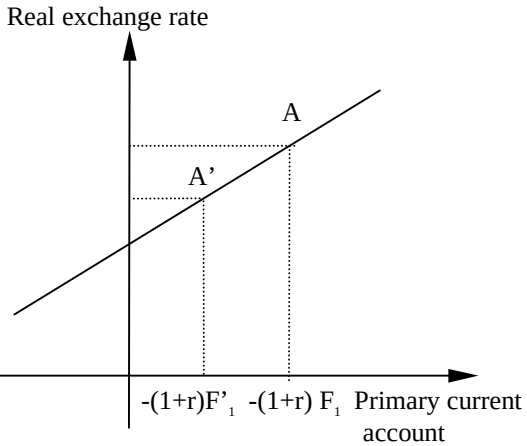


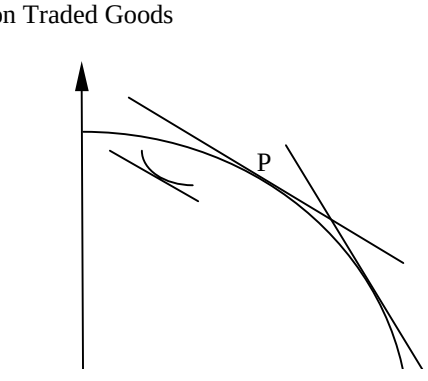
Figure A7.11

12. For indebted countries, a primary current account surplus is required to meet the budget constraint. When part of the debt is cancelled, the required primary account surplus falls. As the debt is reduced from F_1 to F_2, we move from A_1 to A_2 in Figure A7.12(a) and a real appreciation occurs. This means that the ratio of traded to nontraded goods produced falls.

As the real exchange rate falls, the country can shift more resources towards the production of nontraded goods. As in Figure T7.12(b), relative prices shift from P_1 to P_2. Consumption of nontraded goods rises (it must match production). For traded goods, the effect on consumption is unclear and depends on the countries preferences. If traded and nontraded goods are normal goods, consumption in both goods rises. The required primary current account surplus is reduced. This exercise demonstrates exactly the opposite case described in question 11 above.

13. Many formerly centrally planned economies in Central and Eastern Europe pegged their currencies to a basket of western currencies (typically including the US Dollar or the Deutschmark) in the first phase of the transition. Letting domestic prices gradually adjust to market conditions has usually led to inflation, which by large exceeded inflation in countries the currency was pegged to. Recalling the definition of the real exchange rate ($\lambda = E\ P^*/P$), higher inflation in 'transition' countries triggered a real appreciation.
A second explanation is the Balassa-Samuelson effect: as these reforming economies begin adopting western market production methods, productivity in tradable goods will increase and ultimately cause above-proportional price increases in nontrade goods.





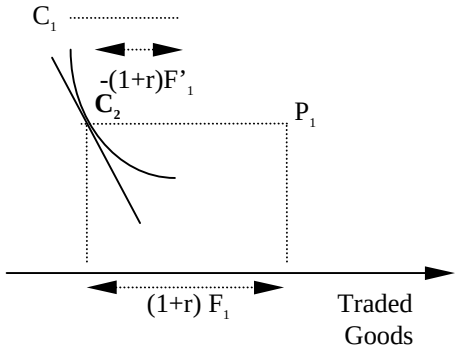


Figure A7.12 (a) and (b)

CHAPTER 8

MONEY AND THE DEMAND FOR MONEY

EXERCISE SOLUTIONS

Theory

1. International differences in the definition of money aggregates mimic institutional features and the stage of development of the banking sector as well as national regulations. Finding out such definitions in central bank publications is a good companion assignment. The following list gives a few examples:

Denmark
M1 = currency + demand deposits at banks
M2 = M1 + time deposits + non-bank holdings or treasury notes

France
M1 = currency + sight deposits
M2 = M1 + savings deposits
M3 = M2 + time deposits + money market instruments
L = M3 + contractional savings

Germany
M1 = currency + sight deposits
M2 = M1 + time deposits (< 4 years)
M3 = M2 + savings deposits

Italy
M1 = currency + current deposits at banks, post-offices and treasury
M2 = M1 + savings deposits + CDs
M3 = M2 + bankers' acceptances + treasury bills

Japan
M1 = currency + deposit money
M2 = M1 + time deposits (regulated and unregulated rates)
M3 = M2 + deposits at post-offices, agricultural co-operatives, fisherey co-operatives, credit co-operatives, labour credit associations and trust accounts

Spain
M1 = currency + sight deposits
M2 = M1 + savings deposits
M3 = M2 + time deposits
ALP = M3 + other liquid assets

Switzerland
M1 = currency + sight deposits
M2 = M1 + time deposits by residents
M3 = M2 + savings deposits by residents

UK
M1 = currency + sight deposits
£M3 = M1 + time deposits
M3 = £M3 + other time deposits
PSL2 = £M3 - deposits over 2 years maturity + money market instruments + savings deposits + CDs + building societies

US
M1 = currency + travellers checks + demand deposits + NOWs + ATSs
M2 = M1 + overnight RPs + savings deposits + general purpose money market funds + small time deposits
M3 = M2 + large (> $100,000) time deposits + term RPs + term euro$ deposits + institutional money market funds
L = M3 + US savings bonds + treasury securities + commercial paper + bankers acceptances

2. Corresponding to the liability side (excluding net worth) of the consolidated banking sector the definition of money is given by

A — Consolidated Banking Sector — L	
- Foreign assets - Claims on government - Loans and securities	- **Money:** - Government deposits - Bank notes held by nonbanks - Deposits of the private sector - Net Worth

3. (a) When the commercial bank keeps the amount of currency in its vaults, its balance sheet is expanded by the value of the foreign exchange. For liabilities, deposits grow correspondingly.

(b) If the commercial bank decides then to sell $X of foreign exchange to the central bank, these are added as foreign assets in the central banks' balance sheet in exchange for an increase in reserve holdings. Hence balance sheets will change to:

A	Commercial Bank	L
Reserves (Deposits at Central Bank) + $X		Deposits + $X

A	Central Bank	L
Foreign Assets + $X		Reserves (Deposists at Central Bank) + $X

4. From the balance sheet of the government and the nonbank private sector the value of banknotes and currency in circulation is derived follows:

A	Government and nonbank private sector		L
- **Bank notes & Currency**	**400**	- Gross gov't debt	1000
- Deposits	2000	- Gross private debt	1600
of which: Gov't debt held by private sector	(200)		
- Real Assets	600	- Net Worth	400
	3000		3000

Hence the value of bank notes and currency is 400 and M1 is 2200 (=2000-200+400).

5. M1 is meant to reflect the degree of liquidity in hands of the public.

(a) Including the credit line of the card provides the maximum value of liquidity available to the nonbank private sector.

(b) Here, only the actual means of payment that have been used are included in M1.

(c) It is argued that adding such transactions to the money aggregate M1 is unnecessary since being paid by credit card is equivalent to having a bank deposit drawn to a bank which has issued the credit card and grants the credit. Since this deposit can be used in other transactions, it is already included in M1.

Argument (c) has been adopted by most central banks and hence most central banks have excluded credit card payments from narrow monetary aggregates.

6. As standards of living increase, agents find their leisure time more valuable (recall that the real wage is the opportunity cost of leisure). To the extent that trips to the bank take time (transportation costs, standing in line, etc) this increases the transaction cost c. Households will react to this increased cost by increasing their demand for money. The demand for real money increases both because real income rises (with an elasticity close to or equal to one) and because the cost of transactions increases. As a result, the ratio of money to nominal GNP increases.

7. True. When nominal money supply is held constant with increasing price level, real money supply declines, which characterizes a contractionary monetary policy.

8. Recall from (8.2) that the velocity of money is defined by

$$V = Y/(M/P) = Y/L(Y,i,c).$$

(a) According to *Fisher's principle* ($i=r+\pi^e$) the nominal interest rate change as the result of an unexpected temporary increase of inflation. Hence, the velocity of money is also unchanged.

(b) When the increase is permanent and expected, the nominal interest rate rises, decreasing real monetary balances. Consequently the velocity of money rises.

9. (a) Since government and private nonbank sector balance sheets are consolidated, an increase in government borrowing from the public has no impact.

(b) Increased government lending from commercial banks may be compensated by

- decreased lending to the private nonbank sector, which means that government debt crowds out private debt.
- increased liabilities to the central bank. Such financing can be interpreted as a direct monetary accommodation of government debt.
- increased deposits from the private sector

(c) Increased central bank borrowing to the government can be matched by

- directly lending to the government
- increasing the amount of circulating banknotes and currency
- purchasing government bonds.

This exercise shows that increased government borrowing has to compensated by an increase in private lending, a decrease in private debt or by a monetary expansion.

10. (a) Following the Fisher Principle, the nominal interest rate is defined as

$$i = r + \pi^e$$

where r is the real interest rate (= forgone real opportunity cost of the loan) and π^e is expected inflation (= the expected capital loss on the nominal value of the loan due to a change in price level). Hence, an increase of the real interest rate from *2%* to *4%* with constant nominal interest rates of *9%* implies that expected inflation decreases from *7%* to *5%*.

(b) A change in expected inflation has an impact on money demand through the nominal interest rate: an increase in inflation increases i, which decreases real money balances. Other things equal, a change in expected inflation with a constant nominal interest rate leaves real money demand unchanged.

11. Real money balances are a function of real *GDP*, nominal interest rates and transaction costs. Assuming the latter to be constant and at a given level of real output an increase in expected inflation and in nominal interest rates decreases the real money balance. This implies that prices grow at a faster rate than nominal money. Since, in the long run, the nominal interest rate does not exhibit a trend, real money demand grows with real *GDP* (see Box 8.4.).

Applications

1. Money market equilibrium is given by

$$M^s/P = L(Y,i,...) \text{ and } M^s = M,$$
$$+\ -$$

where M^s is the exogenously given money supply. Define the semi-elasticity of real money demand with respect to the nominal interest rate as

$$\eta_{(M/P),i} = 1/\Delta i \times \Delta(M/P)/(M/P)$$

and the elasticity with respect to real income as

$$\eta_{(M/P),Y} = [\Delta(M/P)/(M/P)]/\Delta Y/Y,$$

which are assumed to have the values of -0.1 and 0.8 respectively. The relative increase of real money balances can be determined by

$$\Delta(M/P)/(M/P) = \eta_{(M/P),Y}\, \Delta Y/Y - \eta_{(M/P),i}\, \Delta i$$

In order to maintain money market equilibrium, at unchanged real money supply ($\Delta(M^s/P) = 0$), the nominal interest rate must adapt to changes in real output. Therefore:

if $\Delta Y/Y = 1\%$, $\Delta i = 8\%$
if $\Delta Y/Y = 2\%$, $\Delta i = 16\%$
if $\Delta Y/Y = 5\%$, $\Delta i = 40\%$

2. (a) Other things equal, an increase in nominal interest rates from *5%* to *10%* per annum decreases the real money demand by *0.2*5%=1%*.

(b) We compute first the per annum equivalent of a *10%* interest rate per month. Denoting by i_a (i_m) the per annum (per month) interest rate:

$$(1 + i_m)^{12} = 1 + i_a\ .$$
$$i_a = 213.84\%.$$

The interest rate rises by *208.84%*, hence the real money supply falls by:

$$0{,}2 * 213.84\% = 41.77\%.$$

3. As demonstrated above, a rate of inflation of *10%* per month is approximately equivalent to an inflation rate about *214%* on a per annum basis. Following the Fisher principle, this will cause the nominal interest rate to be very high (as a first approximation, we can neglect the real interest rate and assume the nominal interest rate to be roughly equal to the inflation rate). As soon as the hyperinflation process ends (and people believe it) the expectation of future inflation and hence the nominal interest rate fall dramatically. This triggers a sharp increase in the demand for real money (recall from the previous exercise that with a *-0.2* interest rate semi-elasticity, the real money demand increases by *41.77%*).

Yet how can a central bank provide this liquidity without re-igniting fears of more inflation? As long as people remain sceptical about the central bank's intentions, the money supply will remain tight and no reliquification occurs.

There is another (not necessarily incompatible) interpretation of high nominal interest rates in the aftermath of a hyperinflation: scepticism about future inflation. If the public expects the decline of nominal money supply to be temporary, π^e remains high, and apparently high nominal rates may actually correspond to low real rates, given the public's high value of π^e.

4. In the early phases of inflationary processes, agents expect the increase in the inflation rate to be transitory: expectation of future inflation remains below observed inflation. Therefore, the nominal interest rate may be smaller than the inflation rate.

5. Financial innovation is one explanation: as new assets almost perfectly liquid but bearing higher interest rates have appeared, people shifted holdings

from sight deposits, which are part of M1, to non-chequable accounts at banks, which are included in M2.

Another explanation is inflation. Since the nominal yield of checking accounts was largely fixed at zero but variable for M2-type assets, the rise of inflation since the 1960s until the early 1980s may have accelerated this trend. This explanation is in line with the fact that the declining trend in M1 seems to be reversed in the late 1990s when inflation ceased.

6. (a) Increasing competition in the banking sector, may have ambiguous effects on the interest rate and thus on real money balances: A first effect of deregulation is to reduce transaction costs c, increasing the real demand for money. At a given real money supply, the interest rate falls to restore money market equilibrium. On the other hand, increased competition forces banks to raise interest rates on sight deposits closer to the money market interest rate. The real demand for money should decline as agents now face a higher opportunity cost (measured by the lending interest rate).

(b) This question actually relates to the money supply side introduced in Chapter 9: Assume the second effect in *(a)* dominates, the public will shift currency to deposit holdings, increasing the money multiplier. To restore money market equilibrium at a given price level, the central bank must conduct a restrictive monetary policy.

7. (a) Fiscal pressures led the Polish government to cutting subsidies to state owned corporations. To avoid bankruptcy, the latter started to defer payments for inputs purchased from other firms. This induces a credit creation process (which is also widely used practice in Western economies as well, but under strict legal guide-lines). The increase in interfirm credit is similar to money creation in that other firms are willing to hold it as an asset (even though they do not have much choice!)

(b) However, this is not really a parallel currency as long as these deferred payment claims are not accepted by third parties and do not circulate in transactions. It is not really a readily acceptable medium of exchange.

8. Long-run inflation is due to nominal money growth, supply, and the GNP rate of growth. With a real interest rate between 0 and 5%, the nominal interest rate must have ranged between 20 and 35% per annum (according to the Fisher principle).

One might add that the exchange rate *vis-à-vis* foreign currency with a smaller money rate of growth must have depreciated sharply.

ICELAND 1984-1989

Average Annual Growth Rates

Prices	25%
Money Supply (M1)	35%
Interest Rate	27%

CHAPTER 9

THE SUPPLY OF MONEY AND MONETARY POLICY

EXERCISE SOLUTIONS

Theory

1. The central bank controls the monetary base, the sum of currency and bank reserves. The private sector is free to decide how much M1 it is willing to hold in the form of currency, and how much in the form of deposits. This rests on the free internal convertibility between currency and deposits. The banking system, subject to a reserve requirement or desired reserve ratio, decides how much reserves to hold against outstanding deposits. Thus the private banking and nonbanking sectors determine the breakdown of monetary base between currency and reserves.

2. A commercial bank will still hold reserves at the central bank for prudential reasons: it has to settle payments with other commercial banks and faces withdrawals by customers. But without reserve requirements, the reserve ratio may change with the supply of high-powered money. This is best illustrated in the case of an expansive monetary policy: the monetary authorities raise the monetary base (directly or by lowering the money market rate). But commercial banks may not increase their lending, and refrain from lowering their lending rates, for example, in order to restore their profitability. The money supply does not change (the private sector has not changed its demand for credit) and the money multiplier falls. The recent experience in the United States during the period 1989-1991, in which the Federal Reserve System aggressively lowered its interest rates with little effect on monetary growth, supports this view.

Similarly, when the central bank attempts to contract monetary policy, commercial banks may have a 'cushion' of extra liquidity which they can tender to the central bank without having to call in outstanding loans.

3. (a) The reserves of commercial banks increase by ECU 40 million, vault cash (foreign exchange) increases by ECU 10 million while foreign assets decrease by ECU 10 million in the central bank's balance sheet.

A	Central Bank		L
Foreign Assets	-10	Reserves	+40
Claims on Gov't	+50		

A	Commercial Bank		L
Vault Cash	+10	.....	
Reserves	+40		
Loans and Securities	-50		

(b) Ignore currency holdings by the public. Taken together, commercial banks may now lend to their customers ECU 160 million (ECU 40 million times the money multiplier). New net lending is ECU 110 million.

4. Recall from Box 9.1 in the text that the money multiplier is M1/M0 = 1/(*cc*+*rr*(1-*cc*)) where *cc* is the fraction of M1 held in the form of currency, while *rr* is the reserve requirement ratio. Normalizing M1 to 100, we calculate the money multiplier as M1/M0 = 100/(25+0.75) = 3.88.

In order to increase M1 by ECU 10 million, the central bank must increase high powered money by ECU 10/3.88 = ECU 2.575 million.

5. A foreign currency inflow purchased by the central bank increases the monetary base. This triggers, through the multiplier mechanism, an increases in M1. Since we assume here that monetary authorities only intend to increase M0 by ECU 50 million, the central bank may decide to sterilize part of the foreign currency inflow: it will sell enough securities in the money market to keep the monetary base unchanged.

This means a tightening of domestic monetary policy. Domestic credit to the economy decreases by

ECU 150 million. The following shows the effects of these transactions on the central bank balance sheet:

A	Central Bank		L
Foreign Assets	+200	Bank Notes held	
Claims on Gov't	-150	by the nonbank	
		sector	+50

6. (a) The Bank of Denmark must buy foreign currencies and sell Danish crownes. Both the monetary base, on the liability side, and foreign assets, on the asset side, rise. Therefore, the money supply increases.

(b) From a balance sheet point of view, it does not make any difference whether the Bank of Denmark purchases its additional foreign exchange reserves from foreigners or domestic agents. In both cases, the monetary base increases by the same amount.

(c) However, what matters is whether the crownes are deposited in Danish banks or not. If they are deposited in London, they do not represent an injection into the domestically-held base and are less likely to trigger a multiplier process. This is another form of leakage which can reduce the money multiplier.

7. A high reserve ratio implies that the money multiplier is low. For a given increase in the money supply, the central bank may raise more seigniorage because it is able to create more high powered money.

With high reserve requirements, commercial banks face high opportunity costs (at least as long as the interest rate on reserves is below the money market rate). These costs are passed onto the nonbanking sector through higher borrowing rates. Ultimately, the private sector as a whole bears the cost of high reserve ratios, since it is shared between the banks (in the form of lower profit margins) and households (in the form of lower lending and higher borrowing rates).

8. The inflation tax is borne by the holders of all nominally denominated assets. However, what matters for decisions of economic agents is the real interest rate. Thus, if agents expect inflation in the future, they will demand higher nominal interest rates as compensation: this is the rationale of Fisher's principle, described in Chapter 8. Hence, only unexpected inflation matters, by reducing the real *ex-post* interest rate on nominally denominated assets.

Commercial banks are intermediaries. They collect deposits from households, businesses, and other institutions and lend to others. Both their assets and liabilities are denominated in nominal terms. To some extend they are protected from unanticipated shocks to the inflation rate: to the extent that assets are made less valuable, so are the liabilities on the other side of the balance sheet; capital is protected.

9. This is a difficult question. Clearly the required reserve ratio affects the money multiplier (see the discussion in Section 9.2.2). Capital adequacy ratios, which link banks' net worth in various ways to the volume of total lending or assets held by a bank, may reduce the money multiplier if, at any given level of reserves, it constrains commercial banks to restrict lending and thereby deposit creation. The question is: which binds first?

In the long-run, the capital adequacy ratio will be binding, because commercial banks as a whole always have the option of raising capital on the financial markets (issuing new shares for instance) in order to increase their loans to the private sector. Alternatively, new banks can enter, taking deposits and making creating loans. Therefore, in the long-run, the capital adequacy ratio does not matter for supply of money.

However, in the short-run, banks may be unable to raise such funds. This is best illustrated by the case of Japan: as the *Kabuto-Cho* (the Japanese financial market) experienced a very sharp decline starting in 1990, Japanese commercial banks lost considerable net worth (reflected also in falling stock prices of banks). Some commercial banks which suddenly no longer met capital adequacy ratio requirements were forced either to issue new equity or make new provisions, or to restrict sharply their loans to the private sector. In this case the Cooke ratios unambiguously were binding first, which reduces the money multiplier.

10. As long as the reserve requirements are not binding the demand of reserves by commercial banks is negatively related to the interest rate. Indeed, the interest rate represents an opportunity cost for banks as well. So when the interest rate rises, commercial banks prefer to reduce their excess holdings of reserves. Therefore, the money multiplier, defined as the ratio of deposits to reserves, increases. Of course, if the reserves are at their minimum level, there is nothing that commercial banks do any more. This explains the link between the multiplier and the interest rate in Figure T9.10.

11. See Box 9.6 in the textbook.

12. Write M0 and M1 as :

$$M0 = CU + R = (\alpha + rr)\, D$$
$$M1 = CU + D = (\alpha + 1)\, D$$

The money multiplier is :

$$M1/M0 = (1+\alpha)/(rr+\alpha).$$

Holding a fraction α of deposits in currency form is rigorously equivalent to holding a fraction $\alpha/(1+\alpha)$ of the total money stock in currency form. Applying equation (9.7) in the textbook gives the answer.

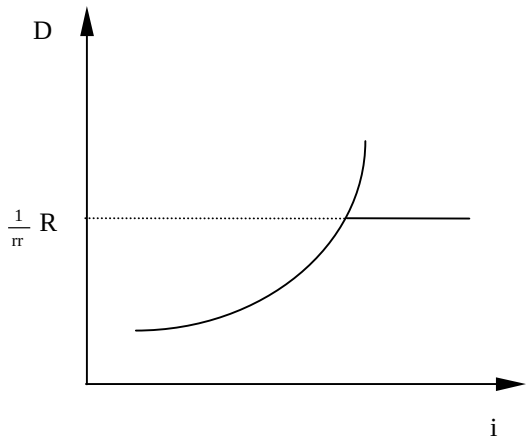


Figure T9.10

Applications

1. The exchange rate between two countries is determined through the price of gold in both countries: central banks cannot affect their exchange rate unless they change the price of gold in their own currency, which means giving up the Standard. Therefore, the Central Banks are bound to buy and sell their own currency against gold at the official price.

That means that if a central bank expands the supply of paper money, the price of money *vis-à-vis* gold will fall and it will to buy back its newly created paper money. Similarly, if it restricts the supply of paper money, its price will rise *vis-à-vis* gold, and the central bank must provide more paper money. In short, there is no possibility of conducting an independent monetary policy under the Gold Standard, at least in theory. (The Gold Standard is treated in more detail in Chapter 20.)

2. By increasing the denomination of coins, the Treasury creates directly real resources for the government (this is seigniorage in its narrow definition). Unfortunately, minting coins means creating high-powered money, therefore increasing the money supply and undermine the independence of a central bank (in case it has any). This may increase the inflation rate. As the central bank is responsible for controlling inflation, it is usually reluctant to such proposals.

3. By lowering reserve ratios on bank deposits by non-residents, the Banque de France reduced the opportunity cost of commercial banking and thus provided banks with an incentive to offer deposits to non-residents on better terms. This was expected to have a stimulating effect on the demand for FF deposits and helped to support the value of the currency. The reasoning works the other way for Switzerland: the idea was to deter foreign deposits into Swiss Francs to avoid an excessive appreciation.

4. (a) Since credit and money represent parallel aspects of the same process, a restriction on credit creation will restrict the amount of money created by the banking system. As shown in Figure A9.4 the money supply schedule becomes vertical when lending to the private sector reaches the imposed ceiling. When the credit control is binding, this policy allows to go from point *A* to point *B*.

(b) When interest rates are free to move, money market equilibrium at point *B* requires that interest rates rise. Exactly the same effect could be achieved without credit controls, just by restricting money supply, moving the schedule until it goes through point *B*. So for credit controls to make a difference, interest rates too must be controlled. The outcome is represented by point *C*. As both prices and quantities are fixed now, the money market is not in equilibrium any more: at point *C* we are not on the demand curve which means that not all demand for credit can be satisfied at the going rate of interest. This is the case of credit rationing with all its potentially undesirable allocative consequences.

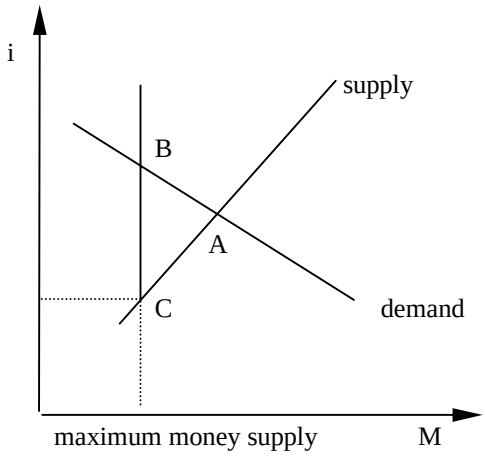


Figure A9.4

5. Sterilization occurs when the central bank keeps the monetary base unchanged as it offsets changes in its reserves holdings by other assets changes of same size and in the opposite direction.

(a) But as long as the monetary base is unchanged, the conditions which create the need for exchange market interventions remain. Sterilization is a way of treating the symptom (the movement of the exchange rate) rather than the cause (the real forces driving money supply and demand).

(b) Countries trying to prevent an appreciation will experience a downward trend in domestic credit as the central bank will sell more and more securities and accumulate foreign exchange reserves, while countries fighting a depreciation will experience a dangerous downward trend in reserves: the latter are likely to give up first as they run out of foreign assets to sell. Speculative attacks on a depreciating currency may force a central bank to give up resisting a devaluation even earlier.

6. In principle, nothing changes as commercial banks would still need high-powered money in order to settle accounts between themselves and the central bank. As long as they hold reserves, monetary authorities control the money supply. On the other hand, if there were only a single 'monopoly' bank which runs the system of payments (as in the original vision of the dream) even this need would disappear.

7. Each instrument has its own advantages and disadvantages. Open market operations provide anonymity (banks have many traders with whom they deal). On the other hand, the bond market must be sufficiently 'deep' so that large purchases or sales by the central bank do not move the market too much. Thus a key determinant of monetary policy instrument seems to be the size of the domestic bond market.

8. (a) Operating a currency board which forces the central bank to keep its liabilities, most importantly the monetary base, in line with its foreign exchange reserves produces the following effect on its balance sheet:

A	Central Bank	L
Foreign Assets	Reserves Currency Gov't Deposits	
Loans and Claims	Net Worth	

(b) A capital outflow (for example an Argentinean investor buying US securities) would reduce foreign reserves holdings of the Central bank. Through the currency board arrangement capital outflows produce the effect of a restrictive monetary policy, raising the interest rate. Eventually, this may have the effect of reducing expected inflation and alleviate the pressure to devaluate the Argentinean currency. As such the currency board arrangement is a measure to discourage capital outflows.

The central bank could sterilize this operation by substituting loans to commercial banks or claims on the government for foreign currency reserves on the asset side of the balance sheet.

(c) During the currency crisis of the Mexican peso in 1995 Argentina, similar to most South American countries, experienced large capital outflows. The demand for foreign currency ran down foreign currency reserves of the central bank. With the currency board arrangement, reserve holdings of commercial banks and currency in hands of the public had to be reduced to match foreign assets. This imposes a ceiling on deposits reserves of commercial banks, and restraints their liquidity, driving up interest rates.

(d) Reducing the reserve requirements for commercial banks increases the money multiplier and enables the commercial banking sector to create more money from a given monetary base.

9. (a) Suppose the Bundesbank had bought Ostmarks against Deutschmarks on the open market. This would have had two effects. First, there would have been a monetary expansion in West Germany (as a result of the open market intervention). Second, the monetary union would have occurred with an artificially high price for Ostmarks, hence triggering a further monetary expansion much more dramatic. This explains why the Bundesbank did not agree to this proposal.

(b) Sterilizing open market interventions amounts keeping the monetary base unchanged and to selling other securities for Ostmarks. However, as long as agents can reallocate their portfolios, monetary conditions would have been unchanged: the supply of securities would have been in excess of demand. As a result the interest rate would have fallen until money creation has restored equilibrium on the money market. This illustrates the general result that sterilization is only temporarily feasible (see exercise 5).

Another practical reason the Bundesbank resisted supporting the Ostmark on the open market was the likelihood of monetary union, in which case the Ostmarks held by the Buba would probably become worthless. This would significantly reduce the Buba's annual operating profit, which is remitted to the Federal Government each year. A significant loss would weaken the stature of the central bank in a period in which its independence was severely threatened.

CHAPTER 10

OUTPUT, EMPLOYMENT, AND PRICES

EXERCISE SOLUTIONS

Theory

1. (a) Equilibrium occurs at

$$Y = AD = 1500 + 0.8(Y-T) + G - 80i$$

$$Y = (1/0.2)\ (1500 - 0.8\ T + G - 80i)$$

Y = 8500 with G = 3000 and i = 5%.

(b) i = 2% Y = 9700
i = 8% Y = 7300

The IS curve is a straight line in i-Y space.

(c) G = 4000 i = 2% Y = 14700
i = 5% Y = 13500
i = 8% Y = 12300

When government purchases increase, the IS curve shifts rightwards (see Figure T10.1).

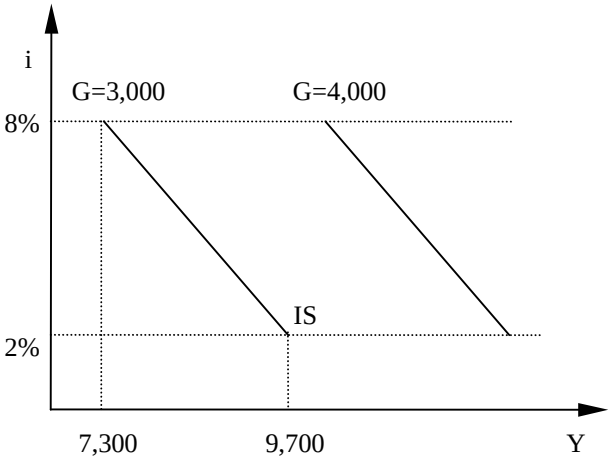
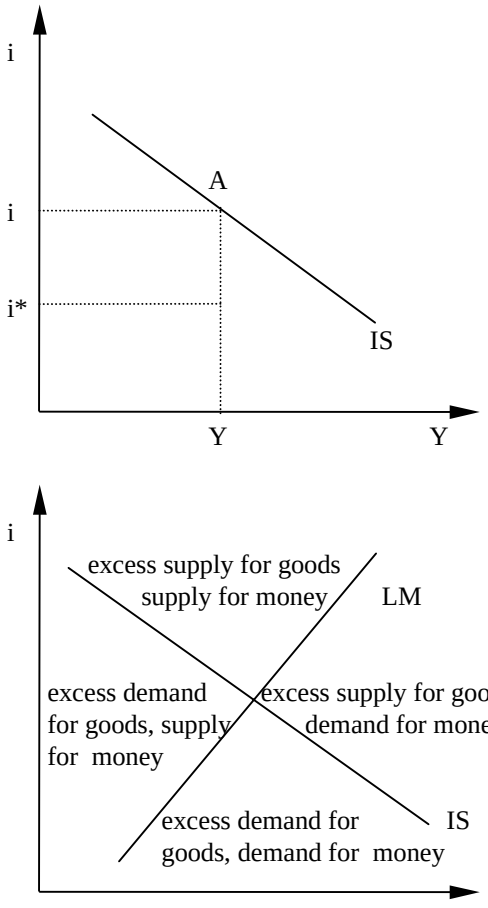


Figure T10.1

2. Let's start from point A (Y,i) on the IS curve in Figure T10.2 (a). The goods market is in equilibrium: aggregate demand and output are equal. Suppose now that the interest rate falls from i to i* at given Y. The economy is now out of equilibrium at point B (i*, Y): as aggregate demand falls when the interest rate rises, there is an excess demand for goods. Therefore, every point below the IS curve characterizes an excess demand situation, while every point above characterizes one of excess supply. By the same logic, it is clear that every point below the LM curve corresponds to an excess demand of money, while every point above corresponds to an excess supply.

The IS and LM curves then define four quadrants in Figure T10.3 (b), each one corresponding to a disequilibrium situation on both markets.



Y

Figure T10.2 (a) and (b)

3. See Figure T10.3. The equation of the LM curve is:

$$i = (1/300)\,[0.5\,Y - M/P]$$

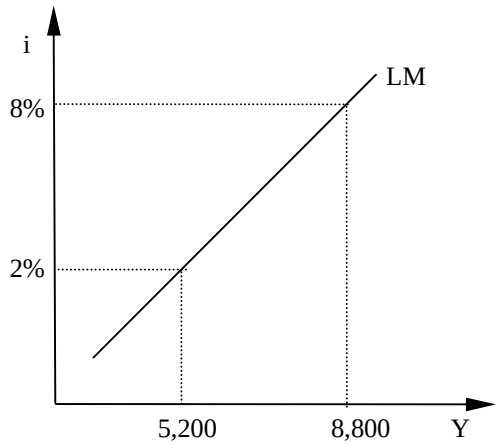


Figure T10.3

4. This exercise focuses on the role of the price level in bringing the economy towards general equilibrium in the goods, labour and money markets. This is described in detail in Chapter 10 Section 10.5 (Figure 10.8). If the IS and LM curves intersect at some point to the right of the equilibrium supply schedule (point D in Figure 10.8) demand is in excess of supply. Prices will increase, reducing real money balances, shifting the real money supply schedule in panels (e) and (f) to the left and hence the LM curve. The economy moves towards equilibrium at the intersection of all three schedules in panel (c). If supply is in excess of demand the opposite will happen.

5. An increase in productivity shifts the production function in panel (b) of Figure T10.5 upwards: more output can be produced using the same amounts of labour. Equilibrium output increases from Y^*_1 to Y^*_2 and the supply schedule in the IS-LM diagram (panel (c)) shifts to the right from S_1 to S_2. Increasing output leads to a rightward shift of the money demand schedule. Supply is now in excess of demand and falling prices lead to a new equilibrium with higher real money balances (rightward shift in the LM curve and real money supply schedule: see Exercise Theory 4 above).

When prices are sticky in the short run unemployment will result, as demand determines output. The economy will stay at the old level of output Y^*_1 left of the new supply schedule and the money demand schedule does not shift. Due to the increase in productivity, this output can now be produced with less labour.

Moreover, an increase in productivity increases wealth, so that consumption may increase, shifting IS to the right. Hence, in the first case prices decrease by less and in the second case employment decreases by less.

6. In the case of real wage rigidity, where wages are above market clearing levels, supply in the labour market exceeds demand. Labour demand therefore determines the amount of labour used in production, which is less than the equilibrium employment level (see Figure T10.6). Hence, less is being produced and the supply schedule in panel (c) shifts to the left to S'. Equilibrium in the money and goods market can still be reached via flexible prices. Excess demand in the goods market (point A) will lead to rising prices, a leftward shift in the real money supply in panels (e) and (f) and to a leftward shift of the LM function in panel (c) (see also Exercise Theory 4 above). At the same time as output decreases, the money demand curve shifts to the left. Prices rise until the IS curve, the LM curve and the supply schedule intersect at point B. Remember, though, that there is no equilibrium in the labour market, because with real wage rigidity nominal wages rise by the same amount as prices do.

7. In the Keynesian case demand determines supply. Therefore an intersection of LM and IS to the right of the supply schedule in panel (c) (caused maybe an expansionary monetary policy) is combined with lower interest rates and production above the equilibrium level. This means that more labour is employed than at the equilibrium level in the labour market, where labour demand and collective labour supply intersect. For this to be possible, either workers or firms (or both) are not on their supply or demand schedules.

(a) This alternative assumes that firms are on their demand schedule and real wages are so low, that the amount of labour necessary to produce above equilibrium output is employed (point A in Figure T10.7). Obviously, labour supplied according to the collective supply schedule in point A' is lower than labour demanded at that real wage level. Firms may therefore offer higher nominal wages to get enough workers, but at the same time they will have to increase prices, too, because labour costs increase and the marginal product of workers is assumed to follow diminishing returns to scale. When workers suffer from money illusion higher nominal wages are interpreted as higher real wages (workers think they are in point B) and more labour is supplied. However, this is very unlikely to happen as information about prices and inflation rates are relatively easily obtained.

Immigration or delayed retirement shift the labour supply schedule to the right. Equilibrium wages fall and employment increases, which makes the result more likely. Moreover, immigrants are very often willing to accept lower real wages.

(b) Within the framework of the model presented here this is not feasible: with diminishing returns to scale and labour costs exceeding productivity, firms will suffer losses. However, if production occurs at constant returns (maybe because there are excess capacities) and if firms make profits, because wages paid lie below the marginal product, an increase in wages and more employment were possible.

(c) It is often proposed that wages and prices are flexible upwards but sticky downwards. Imagine for example that firms increased prices so that real wages fell. Workers and their representatives will now certainly press for higher nominal wages at the next round of wage negotiations and depending on their power will succeed more or less in rising real wages again. On the other hand if prices fell (or rose by less than anticipated in last years negotiations) workers will certainly not press for a reduction in nominal wages. Along the same line of argument firms will try to pass on cost increases onto prices, but cost reductions, which increase profits, are not as readily passed onto consumers.

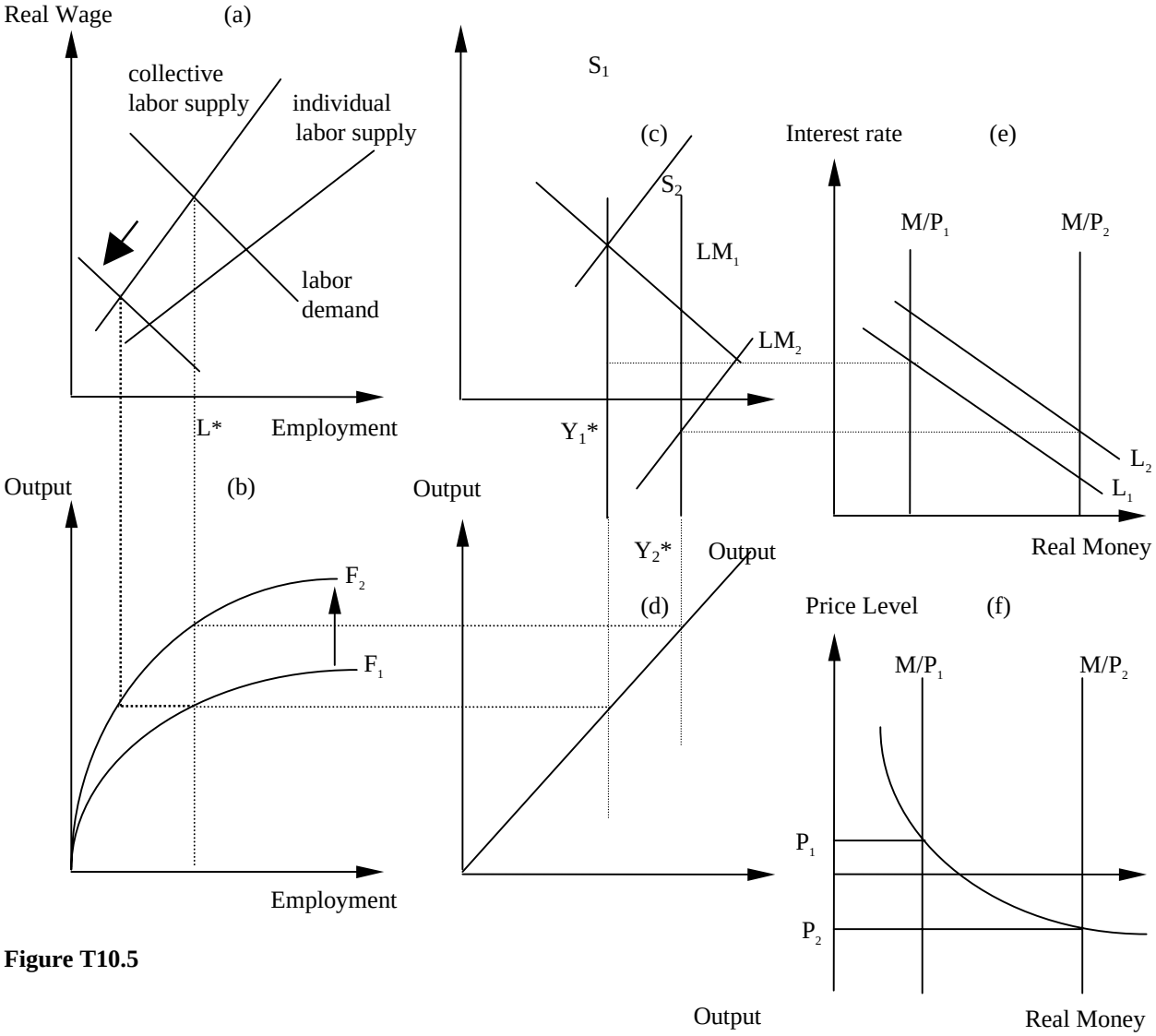


Figure T10.5

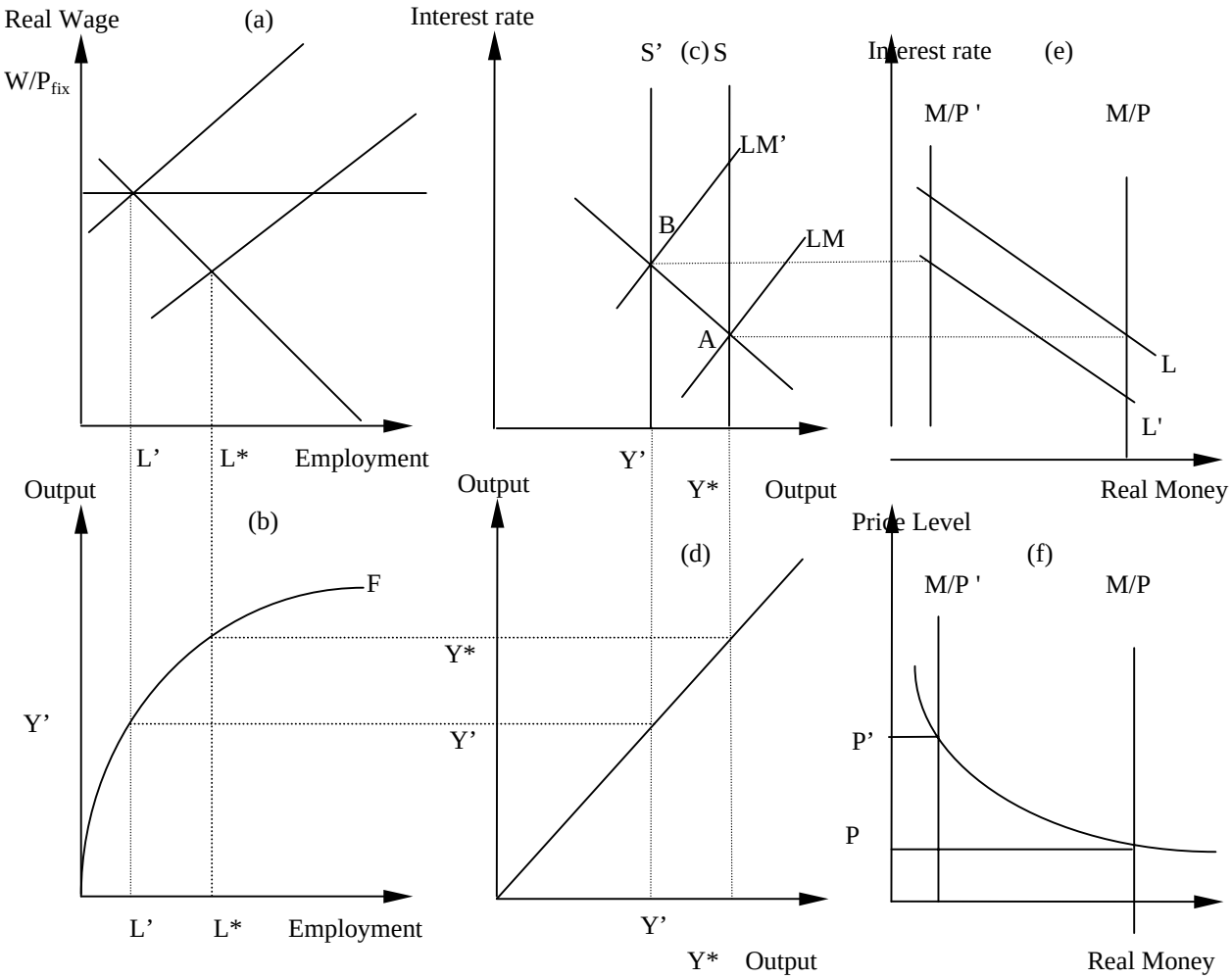


Figure T10.6

8. There are four possible cases of which three cases have already been discussed: (a) flexible prices and real wages lead to the classical result that all markets are always in equilibrium; the real sector and monetary sector are dichotomized. (b) With sticky prices and real wages we have the Keynesian model with possible unemployment and no equilibrium in goods markets. (c) The case of flexible prices and sticky real wages has been discussed in exercise T.6 above with resulting equilibrium in the money and goods market, but possible unemployment in the labour market. (d) Finally, there is the possibility of sticky prices and flexible real wages. Firms will now employ labour up to the prevailing demand and sell goods at a constant price. It follows that even though real wages are flexible to clear the labour market, demand determines output supplied and hence employment due to sticky prices.

9. (a) Note that because labour is inelastically supplied at 5000, the equilibrium level of output Y is

$$Y = (KL)^{1/2} = (20000*5000)^{1/2} = 10000$$

Real wages (W/P) are equal to marginal productivity

$$W/P = \partial Y/\partial L = \tfrac{1}{2} K^{1/2}L^{-1/2}$$

$$= \tfrac{1}{2} (K/L)^{1/2}$$
$$= 1$$

Substituting Y into

$$Y = 1500 + 0.8(Y-T) + G - 80i$$

$$Y = 1500 + 0.8(10000-3000) + 3300 - 80i$$

yields i = 5%

(b) Because M/P = L (Y,i) we can calculate the price level as follows:

$$16000/P = 2Y - 800i \quad \Rightarrow \quad P = 1$$

10. In the following analysis it is assumed that prices are constant at P = 1 and that supply is elastic: demand determines supply. When money supply M/P = 9000 it follows from the equilibrium condition of the money market that

$$9000 = 2Y - 800i \quad \Rightarrow i = (2Y - 9000)/800$$

From the aggregate demand equation it follows that

$$i = 1500 - 0.2Y - 0.8T + G$$

Equating both yields Y = 8250. Substituing this into any of the two equations yields i = 9.375%. If M/P = 10000, Y = 8500 and i = 10%. As L is a function in Y, L will increase when Y does.

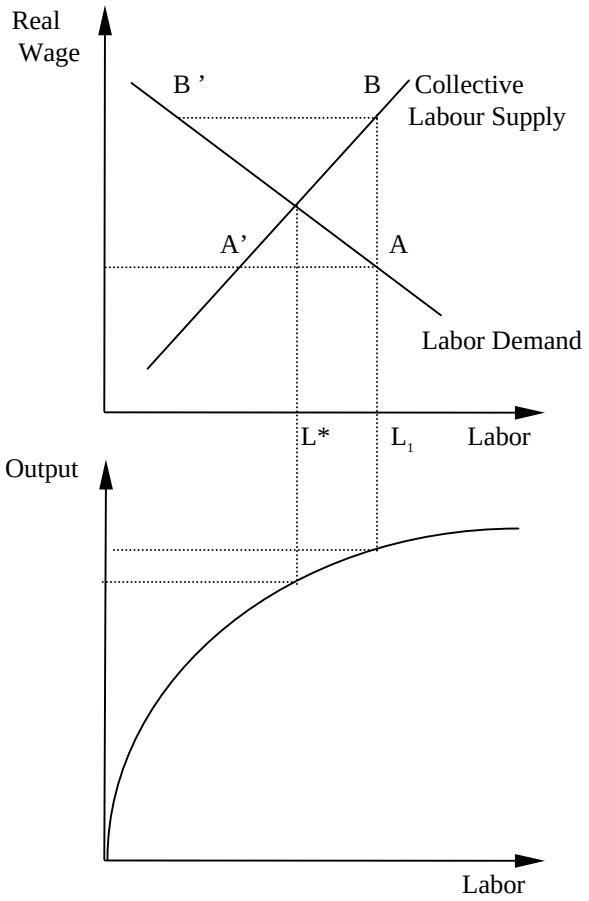


Figure T10.7 (a) and (b)

.

Applications

1. With fully flexible prices an increased labour militancy will shift up the collective labour supply in panel *(a)*. This will shift the supply schedule *S* to the left. Demand for goods is now in excess of supply and prices will rise to reduce real money balances (in panel *e* and *f*), which shifts the LM curve to the left in panel *(c)*, restoring equilibrium in goods, labour and money markets, see Figure A10.1.

Hence, higher militancy of labour will leave the economy with reduced output and higher prices and interest rates. With flexible prices voluntary unemployment will be higher from a collective point of view but individual-involuntary unemployment has increased.

When prices are sticky in the short-run a shift of the collective labour supply produces the Keynesian case where demand determines supply and the IS and LM curve intersect right of the aggregate supply schedule *S'*. This case is discussed in T10.7.

2. An increase in transaction costs shifts up real money demand and drives the LM schedule to the left. In goods markets this will yield an excess supply, and when prices are fully flexible this will simply lower prices until the LM schedule has moved back to its original position. GDP, employment and the interest rate are unchanged.

With sticky prices, output is determined by demand: and GDP will fall below, and the interest rate will rise above its equilibrium level. This will produce involuntary unemployment of *L-L'*. Assuming that the real wage is bounded from below at w^0 the wage will lie between w^0 and *A'*, see Figure A10.2.

3. When prices are fully flexible a cut in defence expenditures will shift the IS schedule down creating excess supply in goods markets. Prices will fall and the LM schedule will shift to the right. The new equilibrium is characterized by a lower price level and interest rate, but unchanged output and employment, see Figure A10.3(a).

With sticky prices the shift of IS will result in involuntary unemployment and lower output and interest rates, see Figure A10.3(b).

4. The situation with full equilibrium in goods markets and involuntary unemployment is drawn in Figure A10.4. A real wage cut from w^0 to *w'* will raise output creating excess supply of goods. With falling prices the LM schedule will shift right to equilibrate goods markets. But as long as prices are rigid and do not adjust, goods and labour market disequilibria will coexist even at lower real wages.

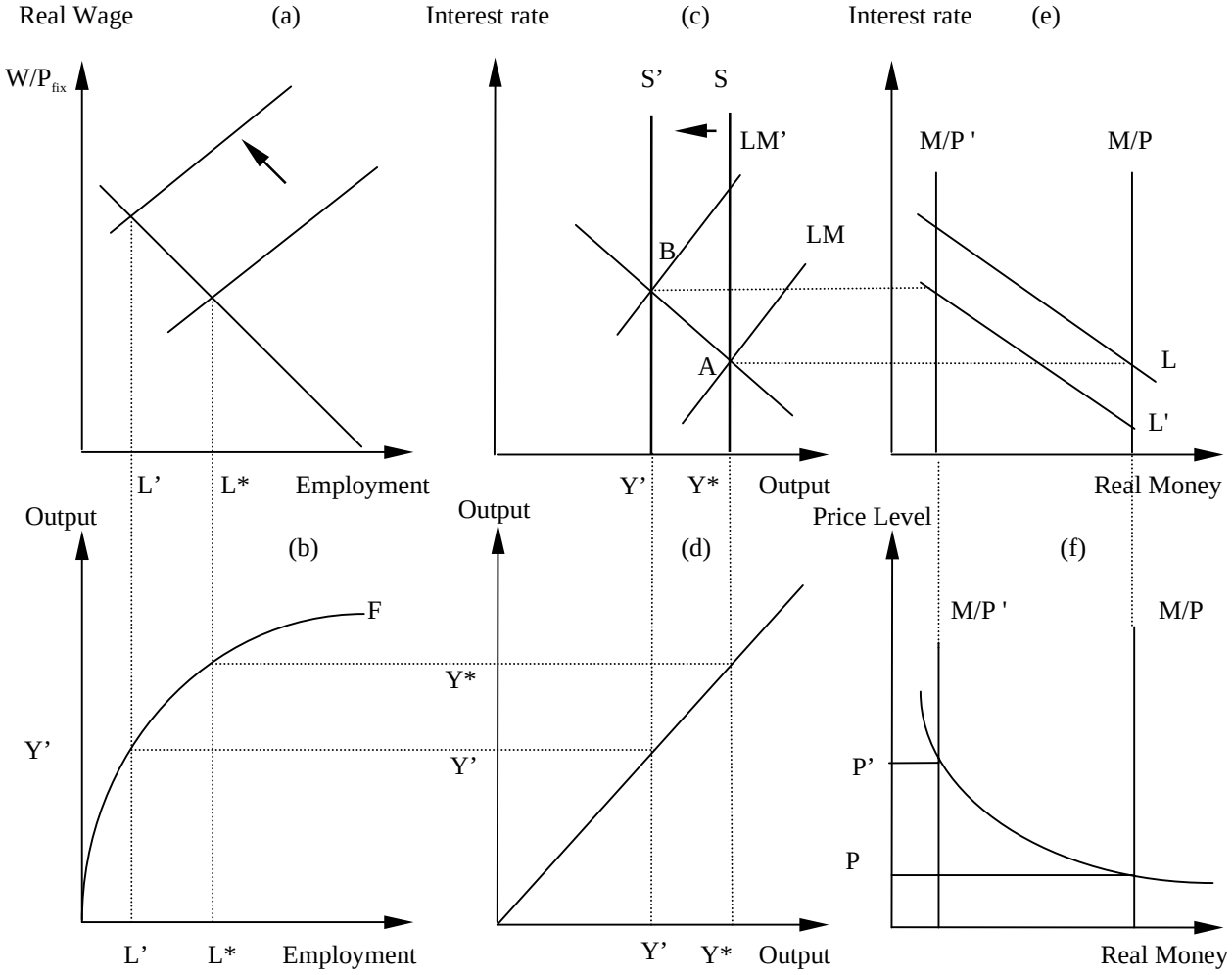


Figure A 10.1

This model tells us that the effectiveness of employment policies based on wage cuts crucially depends on its effects on price level in an economy.

5. Assume authorities want to lower the interest rate. With flexible prices, a restrictive fiscal policy shifts the IS schedule to the left creating excess supply of goods. This in turn lowers prices, which shifts out the LM schedule, which reduces the interest rate even further. An expansionary monetary policy is ineffective since prices adjust immediately without any effect on interest rates and output.

In contrast, when prices are sticky, both monetary and fiscal policy can affect interest rates.

6. (a) Investment which quickly raises productivity shifts up the production function in panel (b), leaving panel (a) unchanged, compare Figure T10.5.

(b) Raising productivity the economy can increase output with a given amount of labour. This shifts the supply schedule in panel (c) to the right, creating access supply in goods markets. In addition, increasing productivity raises wealth, and at least to a certain extent consumption, which shifts the IS schedule to the right.

(c) Excess supply in goods markets will result in falling prices, shifting the LM schedule to the right, lowering the interest rate and increasing GDP, until goods markets are in equilibrium. If the wealth effect is taken into account, prices decrease by less.

(d) With sticky prices goods markets remain in disequilibrium and GDP is demand-determined at Y_1*.

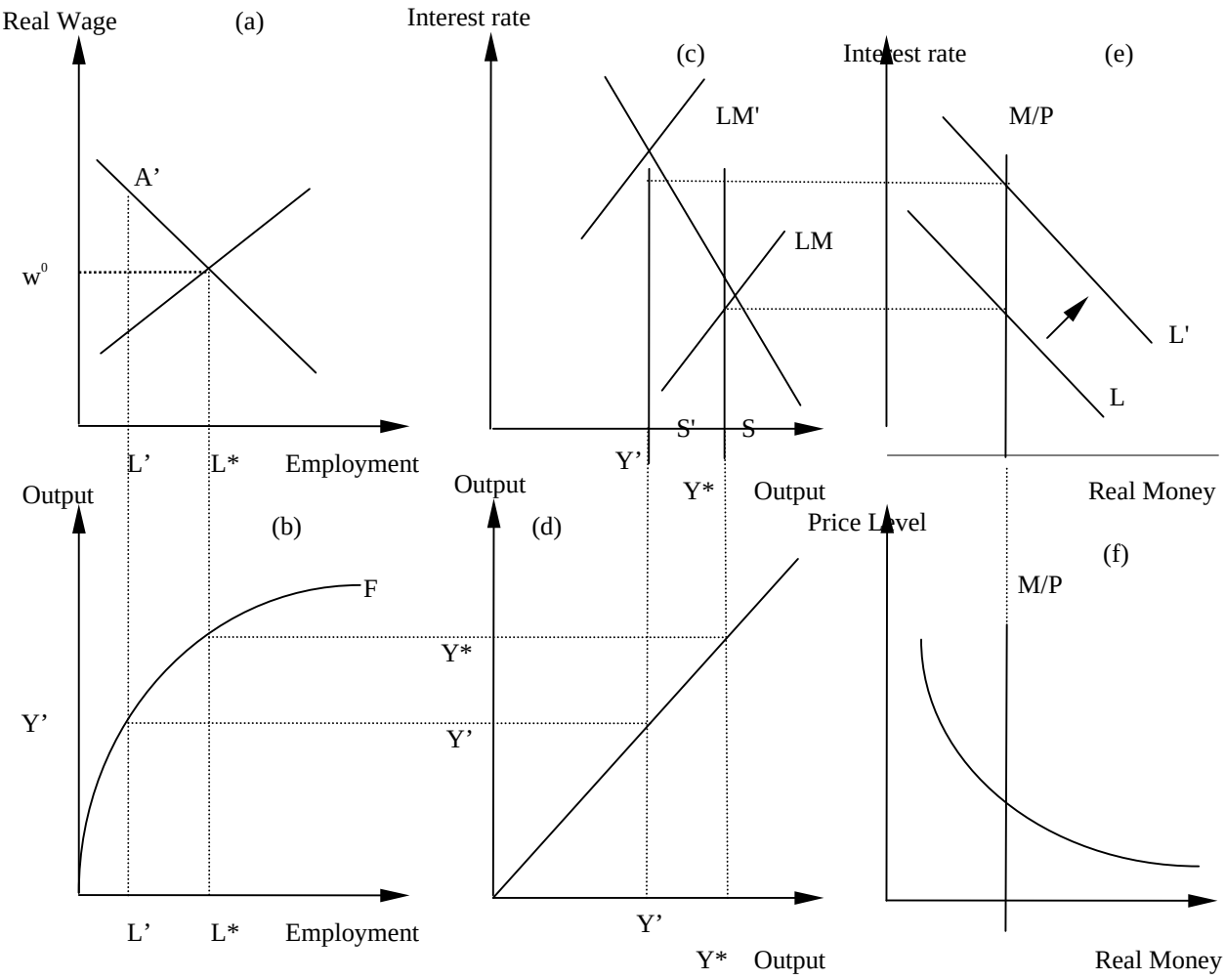
(e) Yes, the central bank could increase the money supply, which shifts out the LM schedule until equilibrium on goods markets is restored at Y_2*.

7. The classical model predicts that as investment demand increases, the IS curve is shifted upwards. The intersection of IS and LM now lies to the right of the old supply schedule. However, as new production sites using new technology are built, also the production function shifts up and the supply schedule to the right. Money demand increases accordingly. So it is not really clear, whether the economy will end up with higher or lower interest rates. Prices will move so that the LM curve always passes through the intersection of the new IS curve and the supply schedule. At the beginning, when only IS shifts interest rates and prices will increase shifting the supply of real money balances to the left. Once also the supply schedule shifts, because the production function is shifted upwards, prices and interest rates will start to decline and the economy moves to its new equilibrium output level.

The Keynesian model assumes fixed prices, hence, the upward shift of the IS curve will not lead to increasing prices and therefore no change in the supply of real money balances. However, money demand will increase as production increases. Therefore interest rates will increase as well. Once the supply curve shifts, there is no immediate move towards the new equilibrium output, because prices are sticky.

8. When half of the labour force is wiped out, the labour supply schedule is shifted drastically to the left. With everything else constant, this induces an increase in the real wage rate and a reduction in equilibrium employment. Less is produced in equilibrium and the supply schedule shifts to the left. Demand is now in excess of supply. This leads to rising prices, falling output, falling money demand, a reduction in the supply of real money balances and an interest rate increase. (see Exercise Theory 4 above and also Applications 9 below).

Figure A 10.2



9. The demand for labour is derived from a production function assuming diminishing returns to scale: firms pay wages equal to workers' marginal product. As less workers are employed, their marginal product immediately increases.

Investment is in this Chapter assumed to be only a function of the interest rate: I = I (r). Even with *r* constant, a reduction in investment as reaction to a decreasing population is more than likely. The reduction in the labour force has not only reduced labour supply, but has also reduced the demand for goods and services. Hence, the production capacities are already too large and investment is likely to drop. Firms will only start to invest again when the capital stock has depreciated enough. Therefore, the marginal product of capital will slowly start to increase as the old capital stock depreciates. In order to account for this, the investment function should account for the evolution of the marginal product capital and its determinants. Tobin's q as modeled in Chapter 4 is one way to do this.

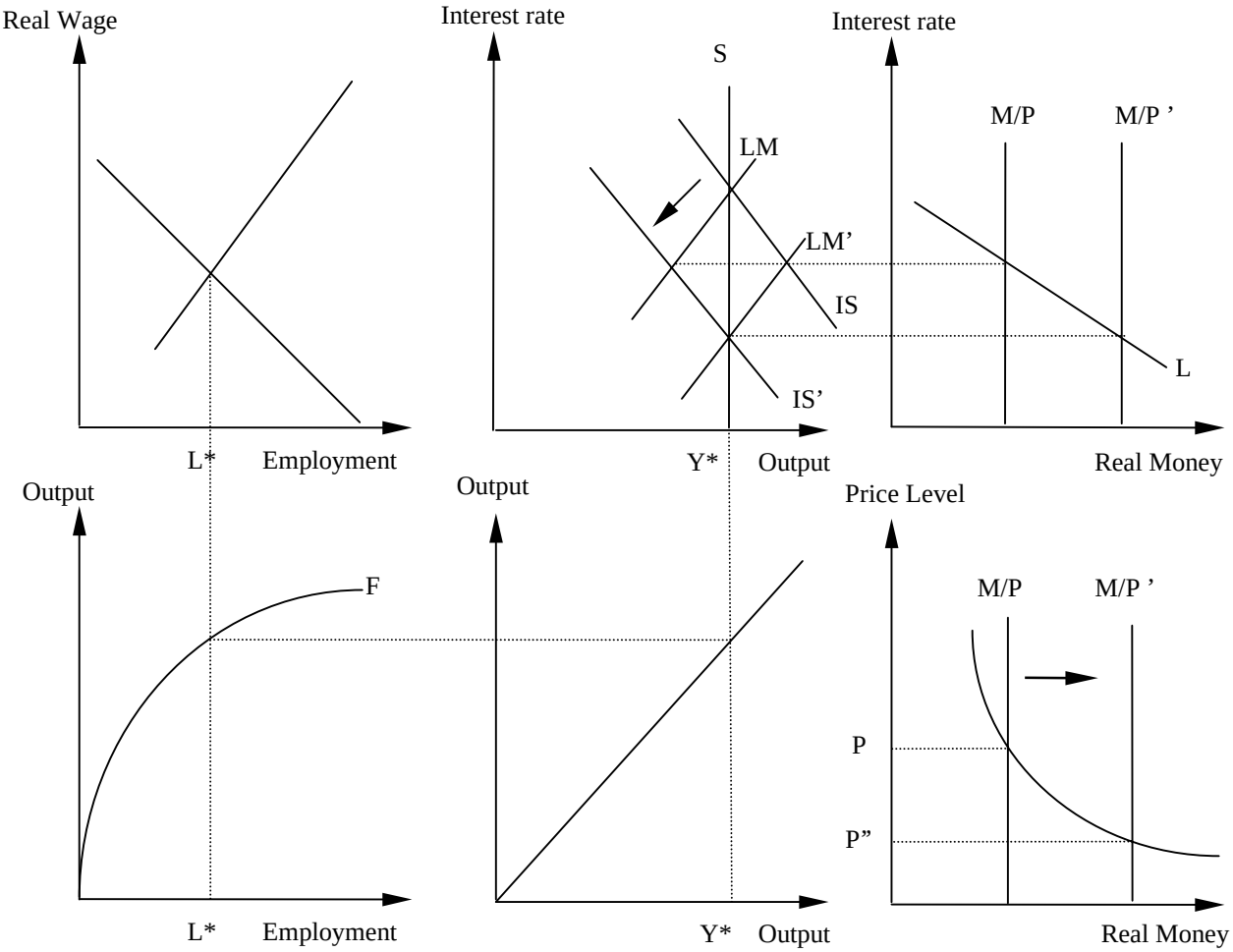


Figure A10.3 (a)

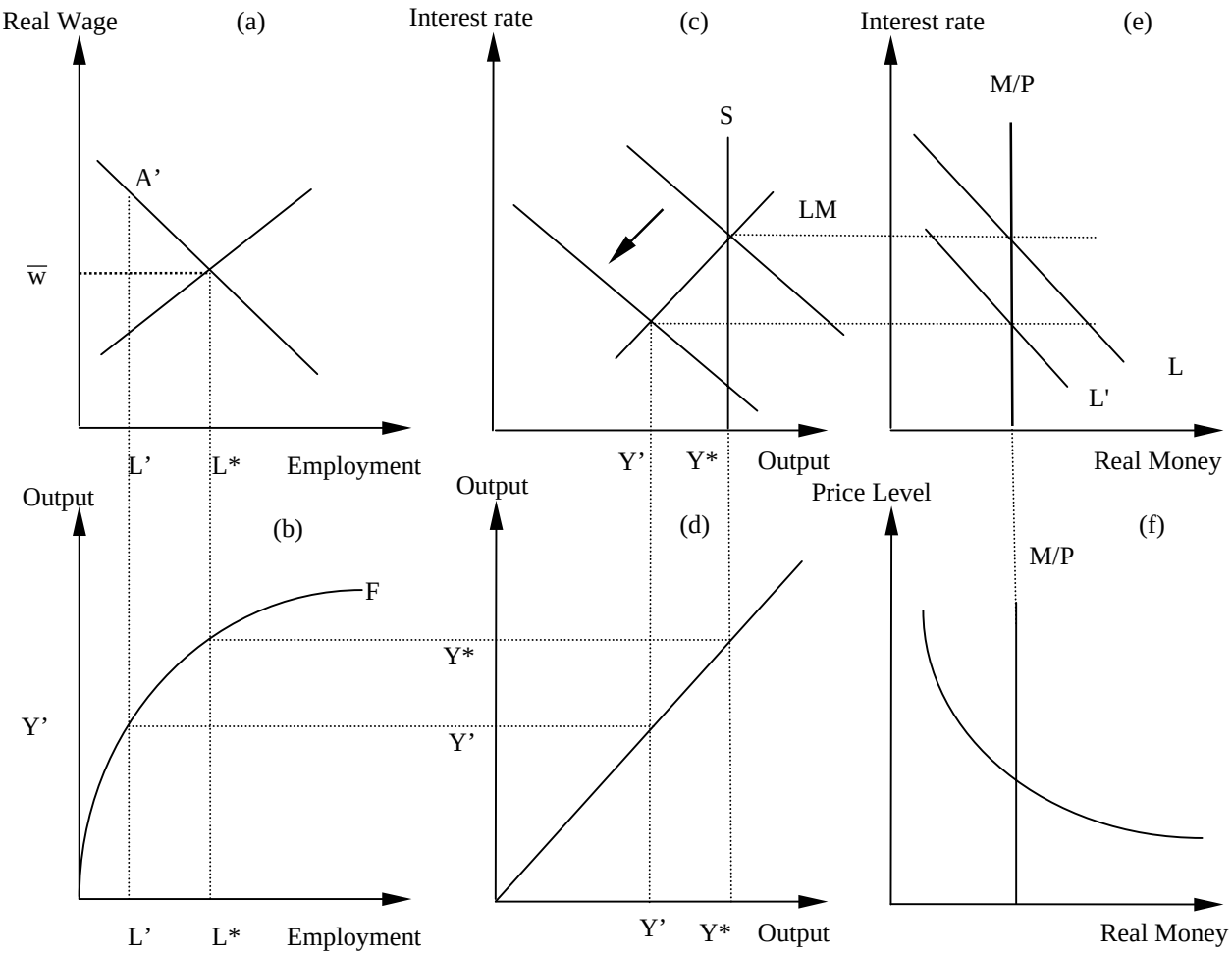


Figure A 10.3 (b)

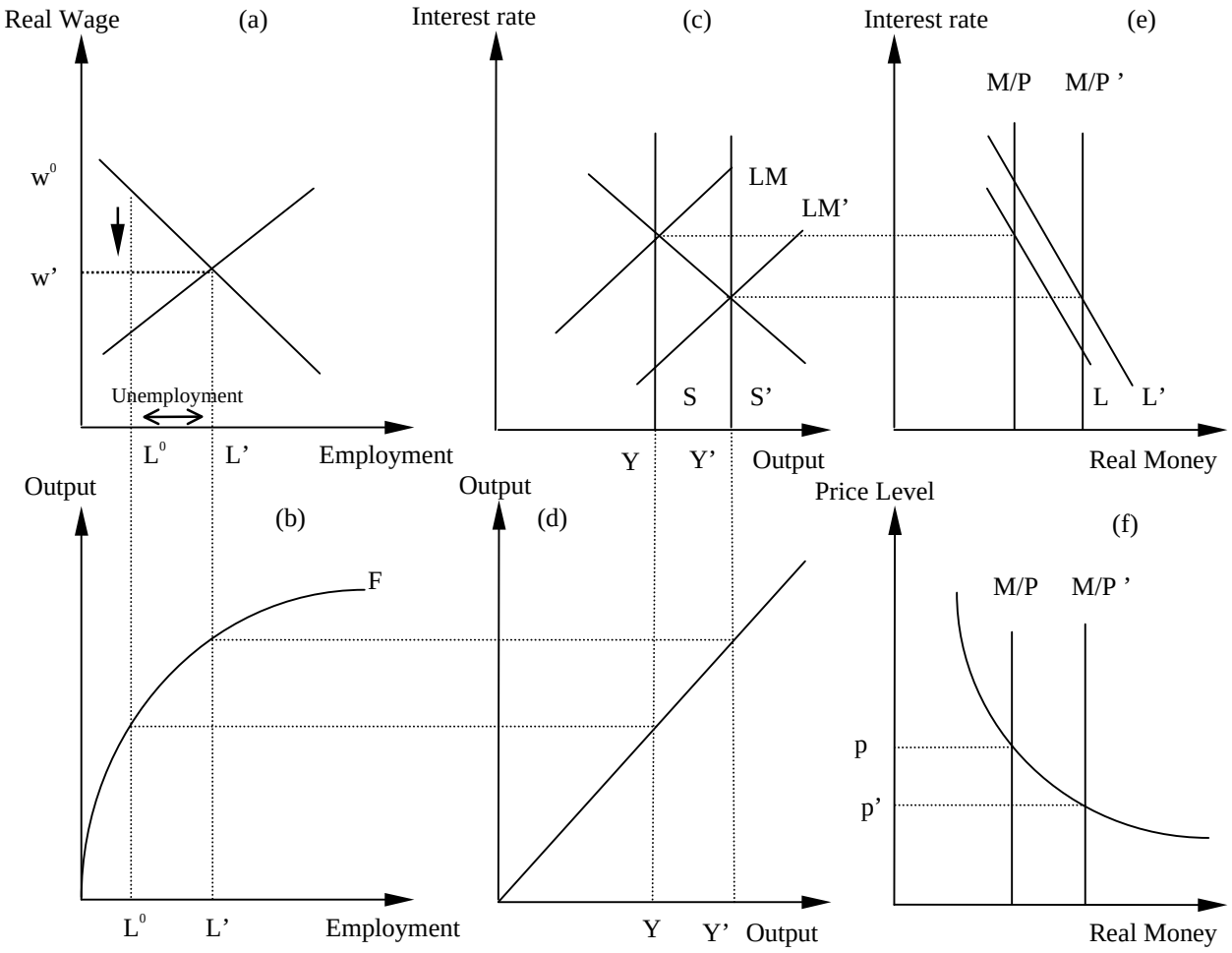

Real Wage
(a)
w0
w'
Unemployment
L0
L'
Employment
Interest rate
(c)
LM
LM'
S
S'
Y
Y'
Output
Interest rate
(e)
M/P
M/P '
L
L'
Real Money
Output
(b)
F
L0
L'
Employment
Output
(d)
Y
Y'
Output
Price Level
(f)
M/P
M/P '
p
p'
Real Money

Figure A 10.4

CHAPTER 11

AGGREGATE DEMAND AND OUTPUT

EXERCISE SOLUTIONS

Theory

1. GDP (Y) is determined by the following equation:

$$Y = (1500 - 0.8T + G - 80i + 300E)/0.2$$

(a) The lump-sum tax multiplier can be computed by taking the first derivative of Y with respect to T: $\partial Y/\partial T = -0.8/0.2 = -4$. The lump-sum tax multiplier shows that an increase in T of 1 decreases Y by -4. As the change in T is 500, the change in Y will be -2000. In the 45° diagram (see Figure T11.1) desired demand shifts down and output decreases from 0 to (a).

(b) In the same way the change in Y to a change in G can be computed: $\partial Y/\partial T = 1/0.2 = 5$. Therefore the change in Y is +2500. In Figure T11.1 desired demand shifts up and output increases from 0 to (b).

(c) The balanced budget multiplier can be computed by setting T=G so that:

$$\begin{aligned} Y &= (1500 - 0.8G + G - 80i + 300E)/0.2 \\ &= (1500 + 0.2G - 80i + 300E)/0.2 \end{aligned}$$

Hence $\partial Y/\partial T = 0.2/0.2 = 1$ and the change in Y is now +500. In Figure T11.1 desired demand shifts up and output increases, but only to the level (c).

(d) The balanced budget multiplier is simply the result in (b) minus the result in (a). It shows that an equal rise in both lump sum taxes and government spending still leads to an increase in GDP. The reason is that as government spending translates to a one for one increase in aggregate demand in the first period, an increase in taxes reduces private sector consumption and savings.

2. Private savings, taxes and imports (see the textbook: Section 11.2.3**).** For most European economies, taxes and imports are quite significant sources of leakages.

3. Lets start from point A (Y,i) on the IS curve in Figure T11.3 (a). The goods market is in equilibrium: aggregate demand and output are equal. Suppose now that the interest rate falls from i* to i for some exogenous reason, with unchanged output. The economy is now at point B (i*, Y), out of equilibrium : as aggregate demand rises when the interest rate falls, there is an excess demand for goods. Therefore, every point below the IS curve characterizes an excess demand situation, while every point above characterizes an excess supply. By the same logic, it is clear that every point below the LM curve corresponds to an excess demand for money, while every point above corresponds to an excess supply. Moreover, when i > i* short capital inflow will take place and short capital outflow when i < i*. The IS and LM curves and the financial integration line then define six quadrants in Figure T11.3 (b) each one corresponding to a disequilibrium situation on both markets.

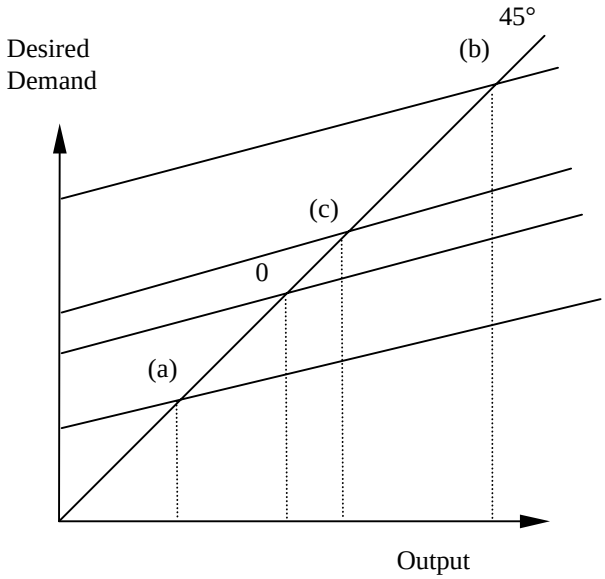


Figure T11.1

4. Consider first how the LM curve shifts. As transaction costs rise, the demand for money increases (see Chapter 8 for a full explanation). As long as the money supply is unchanged, all old points along the LM curve represent points of excess demand; the increase in money demand must be offset either by a decrease in GDP or a rise in interest rates. In Figure T11.4 the LM curve shifts to the left. We now consider the impact on the economy under both exchange rates regimes.

- Under fixed exchange rates the equilibrium is determined by the interest parity condition and the IS curve. As the LM curve shifts leftwards, the interest rate rises above the world level which triggers a capital inflow (movement from point A to point B). As the central bank intervenes to keep the exchange rate constant, the LM curve shifts back to its initial position. The money supply has now increased, but GDP remains constant at point A.

- Under flexible exchange rates the monetary authorities do not intervene on foreign exchange markets. A real appreciation occurs, which worsens domestic competitiveness and shifts the IS curve leftward. This worsens the initial contractionary effect so that GDP decreases to point C.

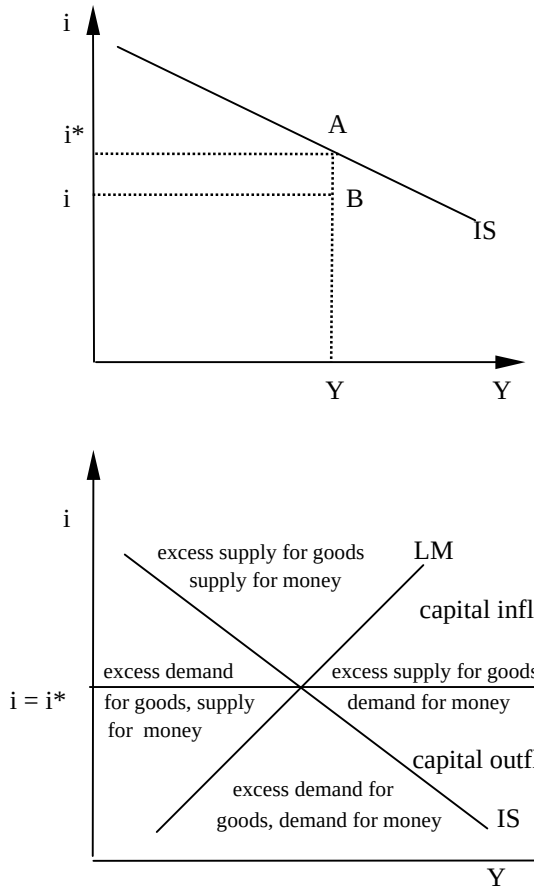


Figure T11.3 (a) and (b)

6. GDP is determined by:

$$Y = (1500 - 0.8T + G - 80i + 300E)/0.2$$

$$\Rightarrow (1) \qquad Y = (2400 - 80i)/0.2$$

and equilibrium on the money market is described by:

$$M/P = 0.5Y - 300i + 50c$$

$$\Rightarrow (2) \qquad Y = (2000 + 300i)/0.5$$

Setting (1) and (2) equal yields i = 8% and substituting this into either (1) or (2) yields Y = 8800. However, as i* = 10%, this is not the equilibrium. In equilibrium i = 10%, Y = 8000, hence M/P must be equal to 1500 in equilibrium. (The real money supply is endogenous when the exchange rate is fixed.)

The increase in government expenditure is the same like in Exercise 1 (b) (+2500), because the government spending multiplier is unchanged.

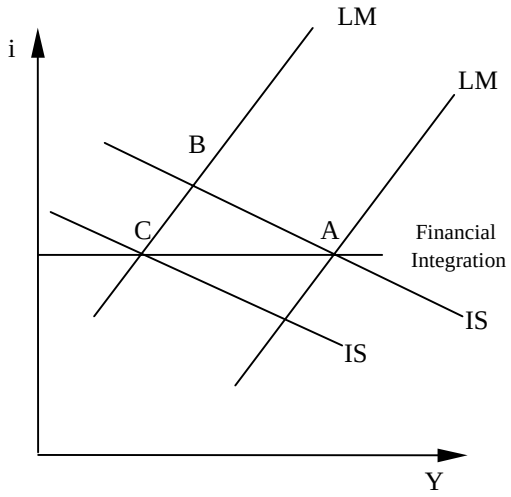


Figure T11.4

5. Setting M/P equal to L, we find the equation of the LM curve: i = [0.5 Y + 50c - M/P]/300 = [0.5 Y -2000]/300. Setting Y equal to say 5200 and 8800 yields interest rates of 2% and 8% respectively. See Figure T11.5.

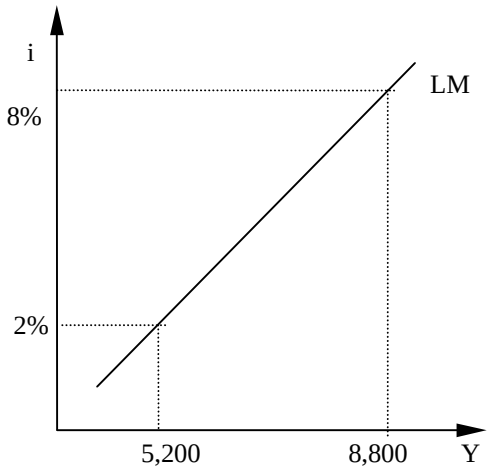


Figure T11.5.

7. Initially i < i* with resulting outflows of capital. As the exchange rate tends to depreciate, the central bank intervenes and buys own currency while selling foreign

currency. This increases the money supply. (See also solution to Exercise 6.)

8. GDP at exchange rates of 0.5 and 0.75 with M/P = 2000 can be determined like in Exercise 6 above:

with E = 0.5 Y = 7950 i = 8.25%
with E = 0.75 Y = 8175 i = 8.625%

and ΔY = 225. However, these are not equilibrium values as long as i*=10% and the LM curve shifts to meet IS and the financial integration line through central bank intervention (see solution to Exercise 7.):

with E = 0.5 Y = 7250 M/P = 1125
with E = 0.75 Y = 7625 M/P = 1312.5

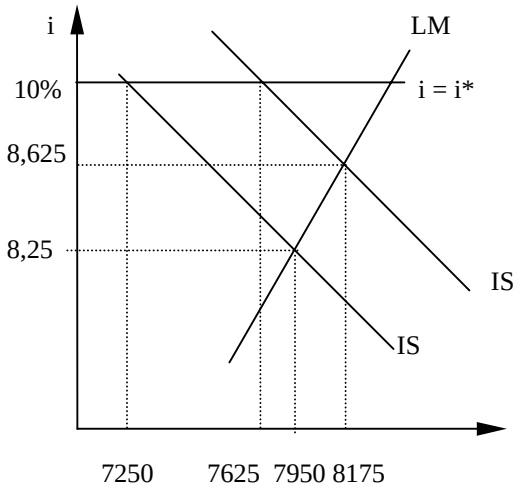


Figure T11.8

9. With flexible exchange rates and an interest rate of i* = 10% there will be no effect on output from a change in taxes. As taxes increase the IS curve shifts down, but falling interest rates with resulting capital outflows lead to currency depreciations and therefore increases in the competitiveness: the IS curve shifts back. From the money market equilibrium equation it follows that with i* = 10%, c = 10 and M/P = 2500 equilibrium output is 10000. The exchange rate can now be determined from the goods market equation:

$$E = (Y - 1500 - 0.8 (Y-T) - G + 80i)/300$$

Because Y = 10000, G = 3000 and i = i* = 10% we know that with T = 3000 E must be equal to 2.33 and with T = 3500 E must equal 3.66.

10. When E = 0.5 we know from Exercise 8 that Y = 7250. When the interest rate i* increases, output in the economy will drop, because the IS curve and the financial integration line determine equilibrium. The LM curve moves endogenously. The interest rate increases to i = 15% and output decreases to Y = 5250. When the exchange rate is allowed to float, the LM curve and the financial integration determine output. An increase in i* increase output, because it induces a depreciation and a rightward shift in the IS-curve.

Applications

1. (a) The expansionary policy shifts the IS curve rightwards. As the government accommodates the increase in money demand through increase in money supply, the LM curve shifts rightwards as well. The new equilibrium is at point B in Figure A11.1 (a) where output is now Y* and interest rate remains unchanged. The current account has deteriorated.

(b) Capital outflows within a fixed exchange rate system indicates that agents fear a devaluation. As long as capital is freely mobile, returns must be equal across countries. However, when the market expects a devaluation, agents are reluctant to buy domestic currency at the world level interest rate. They now face a higher opportunity cost. Therefore, the market requires a higher nominal return on assets denominated in the weak currency. From the domestic country point of view, this is equivalent to an increase in foreign interest rates: the financial integration line shifts upwards and the economy moves up to point C in Figure A11.1 (b). Capital controls allows the government some control over the interest rate: the economy can stay (for a while) at point B.

(c) Two reasons are worth mentioning. First, the opening up of a budget deficit meant that the public sector budget constraint was being violated unless future corrective action was taken. The second reason anticipates the next chapter: with beefed up demand prices were to rise and competitiveness to be eroded. Ultimately a depreciation would be required, prompting further price increases, requiring further depreciations, etc...

2. The decline in the price of oil means a loss of income for Norway. In Figure A11.2 this is represented by a leftward shift of the IS curve. As Norway fixes its exchange rate to a basket of currencies, the fall in interest rate (point B on Figure A11.2) triggers a reduction in money supply until the LM curve passes through point C. The result is a sharp recession. Two options are available :

- A demand policy, shifting the IS curve back to point A.
- A devaluation which shifts simultaneously the IS and the LM curves to the right.

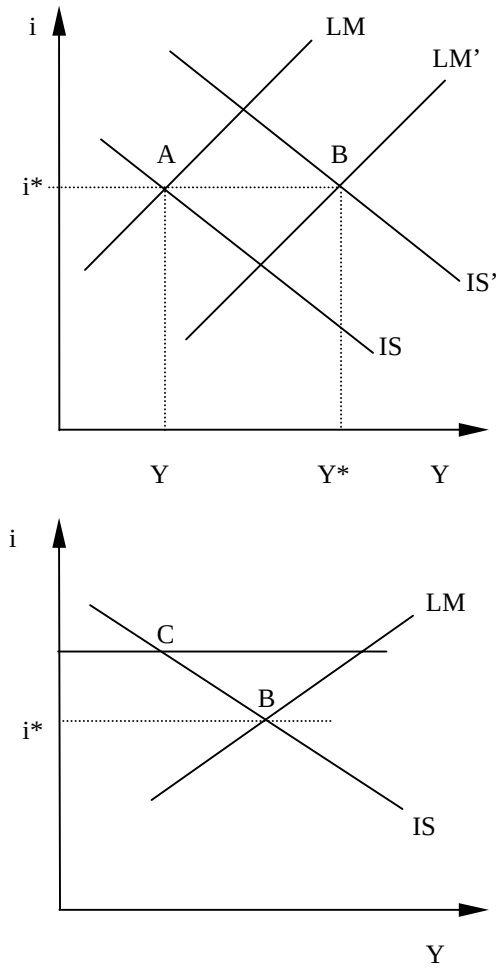


Figure A 11.1 (a) and (b)

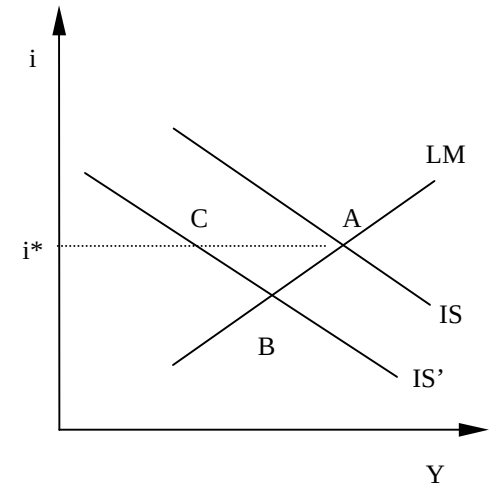


Figure A 11.2

3. A monetary expansion shifts the LM curve to the right in Figure A11.3. The domestic interest rate falls below the foreign rate as money is now more abundant (point B). Therefore, capital flows out of the country and the financial exchange rate depreciates.

However, the current account remains unaffected, as the commercial Belgian Franc is held fixed by monetary authorities. Thus, the IS curve does not shift and the economy remains at point B. A monetary expansion now increases GDP because the adverse effect on the capital balance is offset through variations of the financial exchange rate. However, as long as the economy remains at point B, the domestic interest rate is lower than abroad and the financial exchange rate keeps depreciating.

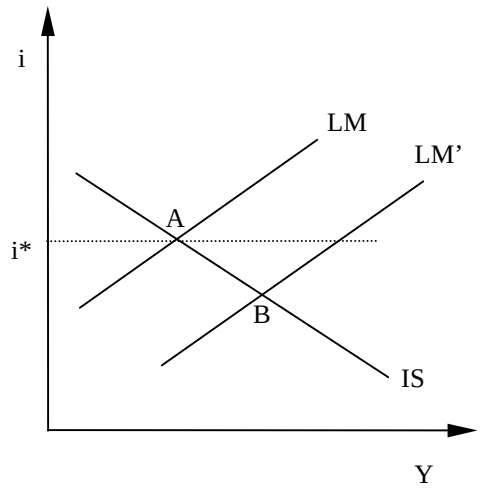


Figure A 11.3

4. The Swedish government was running a high budget deficit. It had to finance it either through borrowing or through monetization. At the same time, inflation was rather high compared to foreign countries: the real exchange rate was overvalued which harmed the current account and raised unemployment. The need of borrowing, the fear of monetization and high inflation rates drove up the interest rates, hence worsening investment. Therefore, the economy is at point B in Figure A11.4: interest rates are above foreign rates and the financial integration line is shifted up.

One way to restore competitiveness is to devalue. A devaluation shifts rightwards both IS and LM curve (to IS' and LM'). Cutting simultaneously public spending helps to restore confidence in the domestic currency and to push down interest rates back to the world level while shifting leftwards the IS curve (IS"): the economy reaches point C.

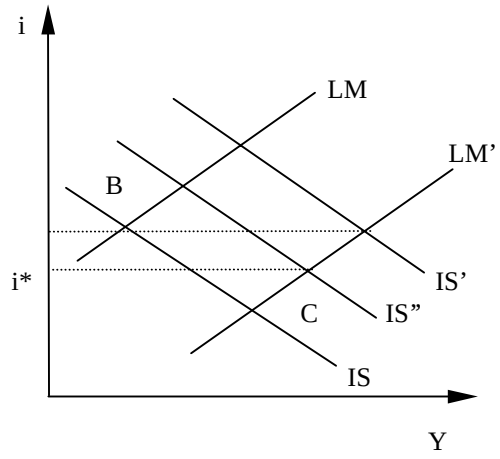


Figure A11.4

5. Starting from equilibrium (as at point A, see Figure A11.2), the dramatic fall in exports shifts the IS curve leftwards, hence the economy initially slumps (point B) and the interest rate falls. As Finland pegs its currency, monetary authorities are forced to sell reserves: the LM curve shifts leftwards, which intensifies the recession as the economy moves to point C.

6. The devaluation simultaneously improves competitiveness and increases the money supply as the central bank buys foreign exchange to enforces the parity. The IS and LM curves shifts rightwards and the economy comes back to point A in Figure A11.2.

7. This is an illustration of the adverse effect of an anticipated devaluation under fixed exchange rates leading to an upward shift in the FI (i*) line. As people expect the nominal exchange rate to depreciate, they sell domestic currency, which reduces the central bank's holdings of reserves. This may even culminate in a speculative crisis, forcing the central bank to devalue sooner than expected as reserves deplete rapidly. One way to avoid the devaluation is to raise interest rates high enough above the world level, to make domestic currency attractive again. To do this monetary policy must be very restrictive, triggering a domestic recession (see Figure A11.1 (b)).

The case of Sweden and Finland illustrates a general result about fixed exchange rates: without coordination, each country tries to export recessions by devaluing its currency. In the end, no one succeeds, and the increase in money supply generates inflation. Uncoordinated policies are suboptimal, especially in the face of common shocks.

8. (a) The increase in public spending shifts the IS curve rightwards. The economy moves from point A to point B (see Figure A11.8).

(b) However, as Germany participates in the EMS, monetary authorities must accommodate the increase in money demand through a higher money supply. The economy moves further to point C. If the *Bundesbank* chooses to sterilize the inflows, interest rates remain above European levels, and capital inflows continue. The decision not to allow an increase in the money supply is consistent with fixed exchange rates only to the extent that the *Bundesbank* can continue to sterilize its foreign exchange purchases with other open market sales.

(c) In other European countries, the upward shift of the financial integration line induced by German unification forces monetary authorities to contract the money supply. These economies move from point B to point C in Figure A11.1 (b).

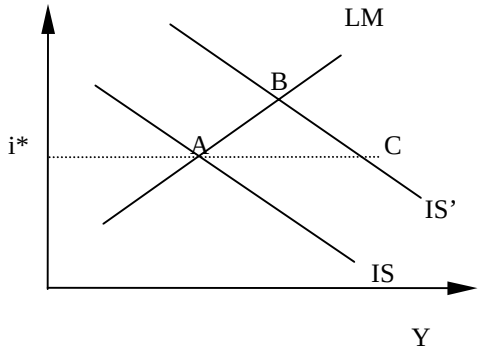


Figure A11.8

9. (a) German monetary policy has an influence on i*, so when Germany follows a restrictive monetary policy German interest rates will rise and i* will increase, too. So the result is an upward shift of the financial integration line and a reduction in output in Italy. (See solution to Exercise 8. (c)).

(b) A tightened budget reduces domestic demand and shifts the IS curve to the left. Interest rates decrease and the economy moves from point A to point B in Figure A11.2. Monetary authorities are forced to intervene and the LM curve shifts to the left leading to equilibrium in point C.

10. The immediate depreciation of the Italian Lira shows that the fixed exchange rate was not compatible with Italian monetary policy and interest rates. If monetary policy is such, that the Italian interest rate lies below the international interest rate capital will flow out of Italy. So imagine initially the economy was at a point like B in Figure A11.2. Now when the exchange rate starts to flow freely, the exchange rate depreciates and competitiveness increases leading to a rightward

shift of the IS curve and a new equilibrium at point A in Figure A11.2.

CHAPTER 12

AGGREGATE SUPPLY AND INFLATION

EXERCISE SOLUTIONS

Theory

1. Denote by $\bar{U}$ the true equilibrium rate of unemployment. The government estimate is $U_0 < \bar{U}$. Initially the economy moves along the short run Phillips curve. To reduce unemployment to U_0 the government must accept an inflation rate π_1 above the core inflation rate π_0 as it moves the economy from point A to point B in Figure T12.1. But as soon as agents recognize this, core inflation is revised upwards (the backward looking component of core inflation catches up) and the short run Phillips curve is shifted upwards. The government can still keep the unemployment rate at U_0, however, at the cost of a still higher inflation rate π_2 (point C).

Thus, inflation must keep increasing forever, which is evidently not sustainable. Eventually, the unemployment rate must go back to its equilibrium level which is independent of monetary forces. The long run outcome of an attempt to lower unemployment below equilibrium is a high inflation rate and no effect on the labour market. How in fact the government executes these policies is the subject of the next chapter.

Inflation

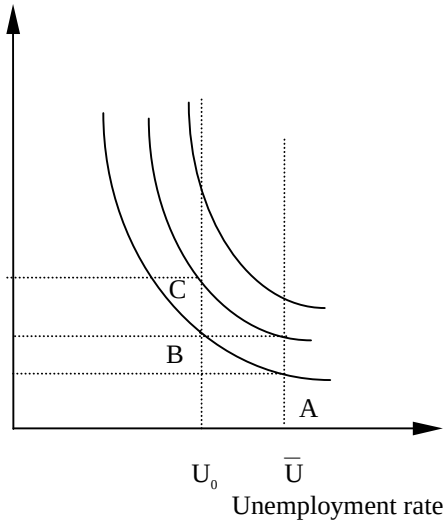


Figure T 12.1

2. Equation (12.10) in the text embodies both the short and the long run Phillips curves:

$$\pi = \bar{\pi} - (1-\alpha)\, f(U - \bar{U}) + \alpha\, s$$

In the long run, s = 0 as the oil price increase is "one shot". Therefore, the long run Phillips curve is unchanged (Chapter 13 presents a full description of the consequences of oil shocks). In the short run, the Phillips curve shifts upward in Figure T12.2. As inflation increases, agents revise their expectations of future inflation and core inflation rises, hence once the shock is over, the short run Phillips curve may remain in its high position for a long time but should eventually return to its initial level.

Inflation

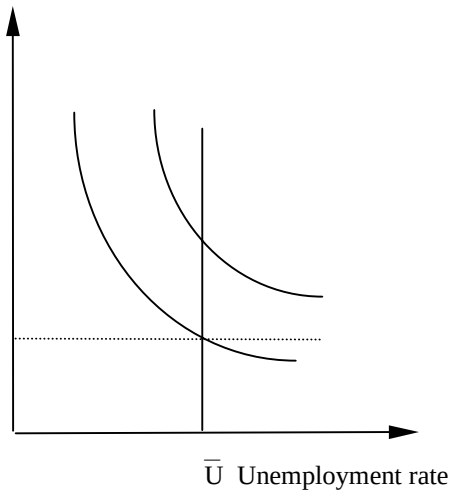


Figure T 12.2

3. Recall from (12.7) that wage increases come from three components: core inflation, productivity gains and cyclical effects.

$$\Delta W/W = \bar{\pi} + \Delta LP/LP - f(U - \bar{U})$$

When wages are fully indexed to past inflation, core inflation is adjusted at the end of each period to past inflation rate

$$\bar{\pi} = \pi_{-1}.$$

The short run Phillips curve then shifts each time the indexation takes effect. The shorter the period, the shorter lasts the trade-off between inflation and unemployment.

When indexation applies on a yearly basis, there may be enough time for the government to be tempted to stimulate the economy through inflation. With monthly indexation, inflation surprises do not last enough for the surprise be worth its long run legacy of higher inflation. Money becomes neutral even in the short run.

4. Value added taxes and corporate profit taxes lead to a one-shot increase in the price level and thereby in the inflation rate (the short run Phillips curve shifts upwards with the increase in non labour costs). In contrast an increase in personal income taxes does not have a direct effect on costs and prices unless trade unions are strong enough to maintain the same level of after-tax (net) wages. Personal income taxes then are passed onto firms and increase labour costs and prices.

5. Such policies disconnect wage increases from core inflation. This can be thought of as setting the inflation rate used in wage negotiations artificially below what is the conventional view of the core inflation rate. As long as the policy is in effect the Phillips curve is simply pushed down. This can be done by legislative act or by government pressure. Unsurprisingly, it does not work for long but may be useful if accompanied by strong anti-inflation policy.

6. As money supply decreases, domestic interest rates rise above the foreign rate. The resulting capital inflow triggers an appreciation of the domestic currency. This harms the current account and reduces demand (see chapter 11 for more details). The decline in demand is accommodated through a decrease in employment (Okun's law). Therefore, unemployment rises and the Phillips curve effect produces a decline in the inflation rate.

Another mechanism is often sought by governments. As the exchange rate appreciates, the cost of imported materials and intermediate goods declines. The reduction in production costs should have a moderating effect on final goods prices. This is similar to a "good" supply shock ($s<0$).

7. We may write (12.10) in the following way:

$$\pi - \bar{\pi} = -(1-\alpha) f(U - \bar{U}) + \alpha s$$

Unemployment is affected by the difference between inflation and core inflation. Core inflation has a forward looking component: agents must guess what future inflation will be. Therefore, as long as they behave rationally, their expectations of future inflation fully embodies all current information available about future inflation rate. Thus, only unexpected change in the inflation rate are associated with deviations of the unemployment rate from its equilibrium.

8. (a) In a fixed exchange rate regime, a rise in the price of foreign goods, which affect domestic inflation (measured with the CPI) through imports.

(b) The effect of a devaluation/depreciation on the price of imports for given foreign local prices.

(c) An increase in the price of imported intermediate goods prices such as petroleum.

9. Under flexible exchange rates, an expansionary fiscal policy shifts the IS curve rightwards (see Figure T12.9). Such a policy, however does not affect output under flexible exchange rates because the domestic currency appreciates, the current account worsens and the IS curve shifts back to its initial position. However, as long as domestic currency appreciates, import prices decrease. This has a moderating effects on prices via costs of imported materials and the competitive pressure of imported goods and directly on the consumer price index (see Exercise 8 above).

An expansionary monetary policy under flexible exchange rates increases inflation through depreciation of the currency (see Exercise 6 for the opposite case of a contractionary monetary policy).

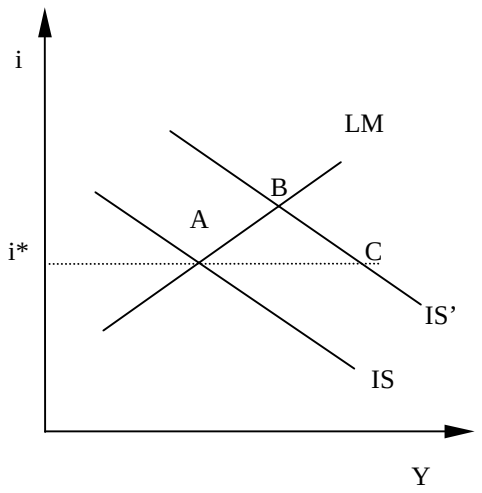


Figure T 12.9

10. This statement illustrates simply the fact that the short run Phillips curve moves as soon as core inflation changes. Attempts to maintain unemployment below its equilibrium rate, exploiting the trade-off, ineluctably

trigger a process of "escalating " Phillips curves (see Exercise T1 above).

11. (a) Backward-looking:

- When inflation in the past was stable, past inflation is a good predictor of future inflation.
- If inflation last period increased more than previously expected (maybe because of a sudden increase in oil-prices), workers demand higher wages today because of real wage losses last period.

(b) Forward-looking:

- When the inflation rate is expected to change, maybe because the country enters a fixed exchange rate system, or because of other changes in policy.

12. (a) The Phillips curve is described by a negatively sloped function:

$$\pi - \bar{\pi} = -10\,(U - \bar{U}) + s$$

It is always assumed that there are no supply shocks s=0.

$\Rightarrow \pi = 10\%$ $U = 6\%$
$\Rightarrow \pi = \bar{\pi} = 4\%$ $U = \bar{U} = 7\%$.
$\Rightarrow \pi = 2\%$ $U = 7.2\%$

When core inflation increases the curve shifts up, so that it goes through the point $\pi = 6\%$ and $U = 7\%$.

(b) As equilibrium unemployment decreases the long run Phillips curve shifts leftward and unemployment declines along the short run Phillips curve leading to increasing inflation. Assuming, however, that core inflation is unchanged, the short run Phillips curve shifts to the left with the long run curve and inflation is unchanged.

(c) Okun's law is given by

$$U - \bar{U} = -(Y - \bar{Y})/10000$$

Taking the same values as in (a) output is given as

$\Rightarrow \pi = 10\%$ $U = 6\%$ $Y = 20000$
$\Rightarrow \pi = 4\%$ $U = \bar{U} = 7\%$ $Y = \bar{Y} = 10000$
$\Rightarrow \pi = 2\%$ $U = 7.2\%$ $Y = 8000$

Output increases with inflation.

Applications

1. Credibility shields the core inflation rate from temporary one-off shocks to the price *level*. For example, a shock to commodity prices pushes the Phillips curve upwards. To reduce the inflationary impact, the central bank may be tempted to *tighten* monetary policy to put downward pressure on labour costs. They may allow the domestic currency to appreciate, which further helps reduce the price of commodities imported. If people know that the inflation rate will not be allowed to increase, they do not revise their expectations of future inflation. Therefore, the short run Phillips curve reverts quickly to its original position once the commodity price hike has passed.

If, on the contrary, the central bank is known to be little concerned by inflation, expectations that inflation will rise push up the core inflation rate and the Phillips curve goes up for two reasons: the increase in commodity prices and higher core inflation.

2. As long as the price of oil is determined at the world level, it doesn't matter whether the country is a net oil importer or if it is self-sufficient. Only if a country can artificially control the domestic price of oil will the supply-shock be averted.

3. A contractionary monetary policy increases interest rates, hence increasing the interest charge on mortgage loans. The inflation rate calculated using the CPI may therefore rise! If this is incorporated into core inflation, the short run Phillips curve will shift up at the very moment such a policy is implemented.

4. As soon as subsidies granted to basic goods are cut, there is a one shot increase in prices. Workers will ask for higher wages: the Phillips curve shifts up. Once this is done, the Phillips curve should go back down unless prices rise as the result of the increase in wages, thus pushing up core inflation and wages up again. This is only *sustainable* if the authorities allow inflation to go unchecked with an accommodating monetary policy. (See Exercise A8).

5. Central bank announcements can directly have an influence on the core inflation rate. Announcing for example tight monetary policies might lead to low inflation expectations and therefore wage agreements, which in turn leads to low inflation. However, the credibility of the central bank is of importance here. When the central bank is known to have followed a tight path in the past announcements can have an effect. If inflation rates on the other hand were constantly high and/or were fluctuating strongly, economic agents' expectations will most probably be influenced less by announcements and inflation will be hardly influenced.

6. Countries' Phillips curves usually show loops and no clear long run or short run curves. This can be interpreted by shifting short run and long run Phillips

curves. For example equilibrium unemployment is believed to have increased in many industrial countries since the 1970s, shifting the long run Phillips curve to the right. Moreover the oil price shocks might have led to higher wage rises compensating higher prices, i.e. core inflation and the short run Phillips curve are pushed up.

7. A depreciation raises the price of imported goods, especially raw materials and energy, used as inputs in the production process. This increases non-labour costs. For net oil importer countries, depreciation *vis-a-vis* the dollar (oil contracts are denominated in dollars) raises significantly non labour costs and, ultimately, inflation. This explains why popular wisdom asserts that the best way to fight inflation is a strong currency.

8. When wages and prices are controlled, equilibrium occurs through quantity adjustments: demand or supply are rationed. As soon as controls are lifted, adjustments occur through price variations: inflation is simply frozen for the period of wage and price control. (See Exercise A4).

There is also an economic cost of price controls, which is the suppression of those forces by which the market responds to scarcity. Most governments which have imposed wage and price controls are willing to admit this, and allow exceptions -- for example, under unusual conditions. The result is that unusual conditions become the norm; workers are "promoted" to higher paying positions and "new" more expensive products are introduced in order to get around controls. Seeking administrative permission to raise wages and prices becomes a wasteful activity.

9. The short run Phillips curve shows that low levels of unemployment go hand in hand with high inflation rates and vice versa. In case this curve were a long run relationship between inflation and unemployment governments were able to choose between different combinations by choice of their fiscal and monetary policies. Conservative parties usually put more emphasis on low inflation rates than on low unemployment, while Social Democratic Parties generally focus on low unemployment as being more important. Therefore Social Democratic Parties would chose a point like A in Figure T12.9 and Conservative Parties point B.

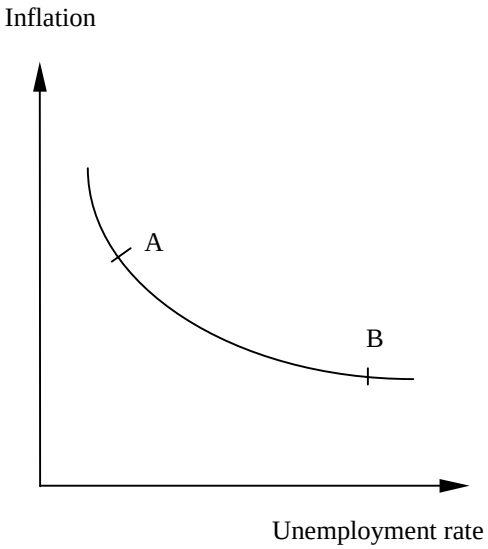


Figure A 12.9

10. Taxes on 'excess wages' are intentioned to limit wage increases. Contrary to income policies where an absolute maximum wage level is set, taxes on 'excess wages' are more 'liberal' by allowing to pay higher wages than the 'normal' level.

Imagine first of all decentralized wage setting. Granting high pay rises a single firm will see itself faced with a higher wage bill than its competitors and can easily be priced out of the market, as higher costs result in higher prices. Production costs increase out of two reasons: the wage bill and increasing tax payments.

However, with centralized wage bargaining exactly the opposite than the intented effect may occur. Inflation rates in many Central and Eastern European countries are very high and workers are hence likely to push for higher than 'normal' wages. If all wages in an economy rise local competitors face the same cost increases. Resulting will be even higher prices and inflation rates leading to new wage push resulting in a price-wage spiral.

CHAPTER 13

AGGREGATE DEMAND AND AGGREGATE SUPPLY

EXERCISE SOLUTIONS

Theory

1. Figure 13.2 and 13.9 (bottom panels) in the text draw the aggregate demand curve under both exchange rate regimes. They can be thought of as characterizing the situation at the time horizon of, say, one year.

- Under fixed exchange rates, as long as the domestic inflation rate exceeds the foreign rate, the real exchange rate appreciates and the current account worsens. After two years, the IS curve has shifted further away from IS_0 (see figure T13.1 (a)), to IS_2 and to IS_3 after three years. As the money supply is endogenous, the LM curves shifts to LM_2 and LM_3 respectively. Reporting the output level in panel (b) we see that the longer the time horizon, the flatter is the aggregate demand curve.

- Under flexible exchange rates, following a rise in inflation, the LM curves shifts leftwards in Figure T13.1 (c) (holding constant the rate of money growth), to LM_2 and LM_3 respectively for 2 and 3 years. The aggregate demand curve also becomes increasingly flatter at the time horizon increases.

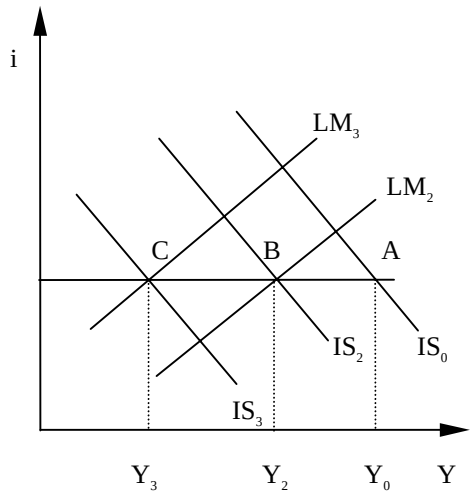
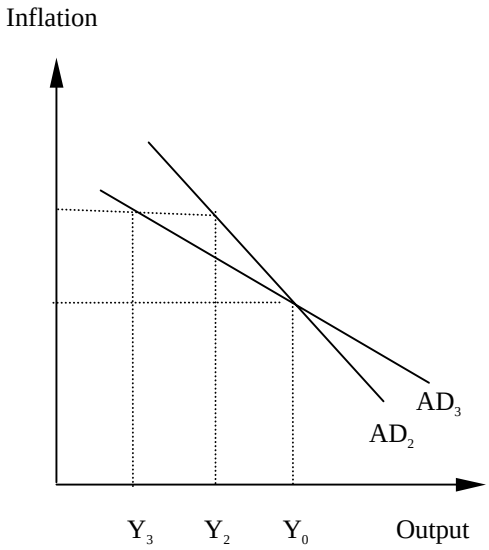


Figure T13.1 (a)



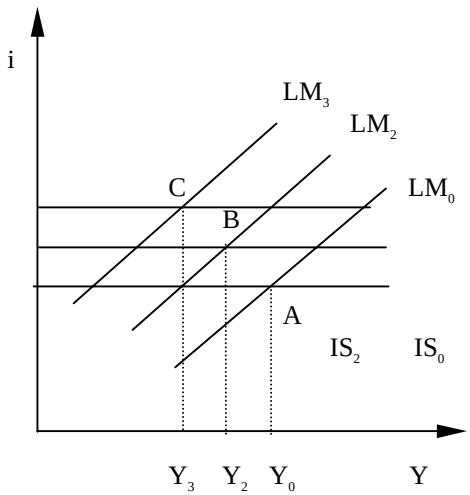


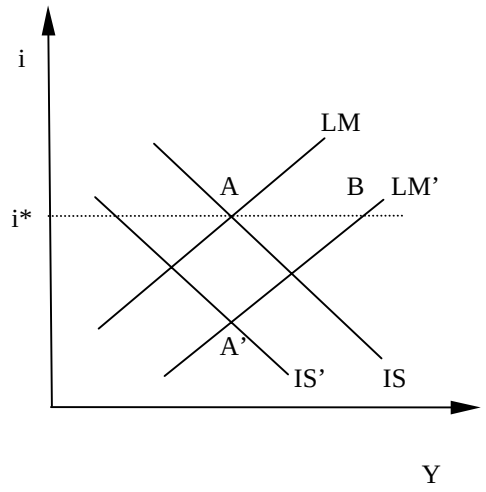
Figure T13.1 (b) and (c)

2. (a) Flexible exchange rates. Looking first at the IS-LM diagram in Figure T13.2 (a), tight fiscal policy combined with an expansionary monetary policy tends to reduce the interest rate while the net effect on output is ambiguous at this stage of the reasoning. The capital

outflow makes the domestic currency depreciate, the current account improves until the IS curve passes through point B. The initial tight fiscal policy is more than fully offset by the depreciation. The reason is that fiscal policy is ineffective under flexible exchange rates and what is observed is simply the effect of the monetary expansion. However, the composition of aggregate demand has changed: the government deficit declined while the primary current account improves.

This is why the position of the aggregate demand curve in the AD-AS diagram is determined exclusively by the growth rate of money supply. Therefore, if the increase in the growth rate of money supply is "one-shot", the aggregate demand curve shifts rightwards to AD_2 in the lower panel of Figure T13.2 (a) before going back to AD_1. In this case, the expansion is only temporary and the economy first jumps to point B before turning back to point A, through an increase in the short run supply curve. If the monetary expansion is permanent, the growth rate of money supply is permanently increased and the AD curve stays at AD_2. The economy will converge to point C through successive shifts of the short run AS curve.

Figure T 13.2 (a)



(b) Fixed exchange rates. Monetary policy is irrelevant as the money supply is endogenous. Only the IS curve shifts because of the reduction in government expenditure is effective. In the upper panel of Figure T13.2 (b) the outcome is a tendency for a reduction in interest rates which leads via intervention of the central bank to a fall in the money supply which offsets the initial monetary expansion: the economy ends at point B, with a fall in output.

In the AD-AS diagram in the lower panel of Figure T13.2 (b), the AD curve shifts leftwards as only fiscal policy matters: the economy reaches point B where inflation and output fall. The AD curve has to go back to its initial position, because world inflation is now above the national inflation rate and because the tightening of fiscal policy is only temporary. As core inflation - tracking actual inflation - falls, the AS curve shifts downwards and the transition path goes through point D where inflation is below world level and output above trend and leads back to equilibrium in A.

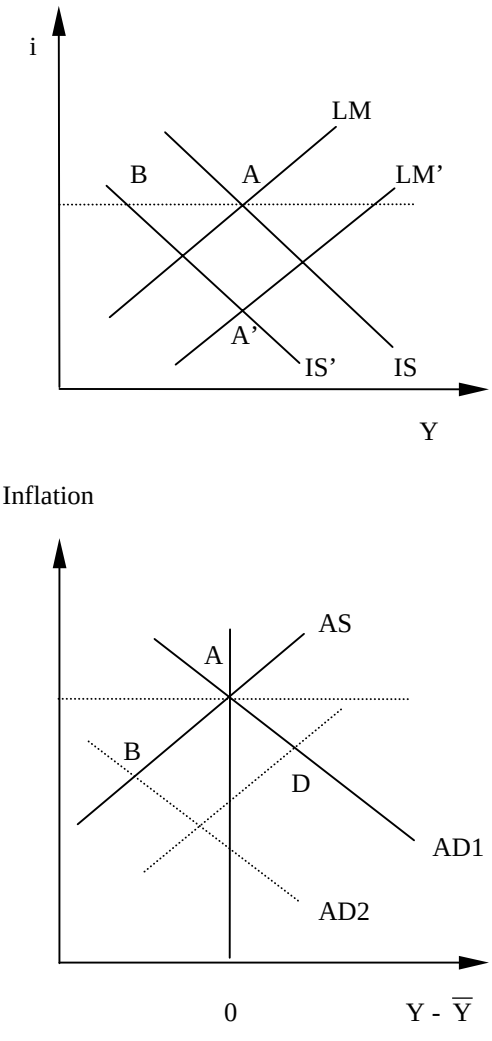


Figure T 13.2 (b)

3. Obviously the short-run outcomes and the long-run steady states are the opposite of the previous exercise.

4. Under flexible exchange rates, the position of the AD curve is determined by the growth rate of money supply. Increasing this growth rate shifts the AD curve rightwards in Figure T13.4. In the short run, inflation and output rise. As core inflation catches up with actual inflation the AS curve shifts upward. The output gap is reduced and inflation increases (point C). The only way for the government to keep stimulating the economy is to raise again the rate of money growth (point D), and so on. Prices and money must grow increasingly faster: the inflation rate accelerates. Such a policy is doomed to failure. As agents recognize more rapidly that the government is continuously shifting the AD curve, core inflation catches up faster with actual inflation. Such policies may end in hyperinflation.

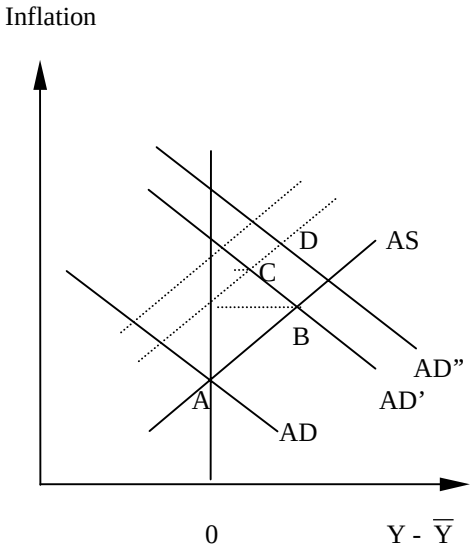


Figure T 13.4

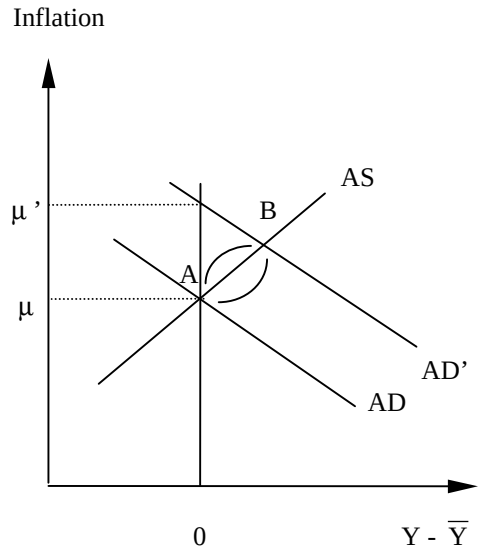
5. What matters for firms is the real wage defined as the nominal wage divided by the price of production (W/P). If wage settlement aim for example, at keeping the *ex ante* real wage W/P^e constant, where P^e is the expected future price level, the *ex post* real wage is:

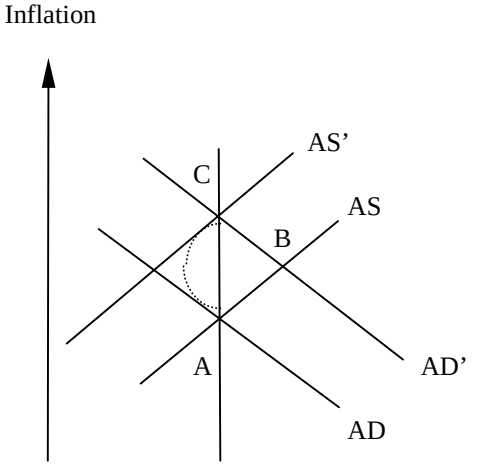
$$W/P = (W/P^e)(P^e/P)$$

Overestimating the future inflation rate means raising labour costs. As long as the mark-up charged by firms over marginal cost is constant (recall Chapter 12 for more explanations about mark-ups), the firm will increase its price: competitiveness worsens while profitability remains unaffected. However, if the firm faces menu costs (see Chapter 12), it may be prudent not to raise prices after a temporary increase in labour costs. In such a case, profitability worsens while competitiveness is unaltered. The general result is that there exists a trade-off between profitability (that is, mark-up over costs) and competitiveness.

6. (a) Fixed exchange rates. Agents know that the AD curve position is determined by the foreign inflation rate in the long run. Therefore, the best expectation of future inflation rate is the foreign rate. The short run AS curve does not shift. The economy moves from A to B and then comes back to A in Figure T13.6 (a). (Monetary policy is ineffective in any case and is ignored).

(b) Flexible exchange rates. The rate of inflation is determined by the rate of money growth. As money growth increases to μ', the AD curve shifts rightwards in Figure T13.6 (b) to AD'. Agents expect the inflation rate to converge in the long run to its new equilibrium value μ' (ignoring real growth): the AS curve jumps immediately and monetary policy is ineffective. Even in the short run, the economy is dichotomous since core inflation is entirely forward looking.





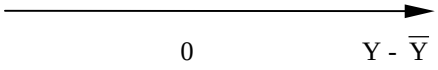


Figure T 13.6 (a) and (b)

7. In both cases, for the sake of compatibility, we assume that the fiscal expansion is temporary, because this is necessary when the expansion is bond-financed and the public budget constraint must be respected.

Under flexible exchange rates, the growth rate of money determines the position of the AD curve. Fiscal policy is fully offset by movements in the nominal exchange rate. A bond-financed fiscal expansion has no effect on the economy.

A money-financed expansion implies a temporary higher rate of growth of the money supply. The AD curve shifts rightwards. As agents are forward looking and expectations are rational, the short-run AS curve does not shift upwards as long as it is surprise inflation and the AD curve is expected to shift back. Therefore, unexpected money financed expansions have a temporary effect on the economy.

8. This is a trick question. Students should have recognized that under a flexible exchange rate regime, the exchange rate is *endogenous*. One must ask, therefore, why the depreciation occurred and answer that it must have been due to an expansionary monetary policy.

(a) Hence, in order to answer this question we need to look at the effect of an increase in the rate of money growth on the AS and AD curves. We know that the AD curve is shifted outwards permanently under flexible exchange rates. The short-run aggregate supply curve may be affected immediately by the increased cost of non-labour inputs or shifts catching up with actual inflation.

(b) None, if the increase in the rate of money growth is perfectly anticipated. Core inflation rises, shifting AS back to exactly offset the shift in AD.

(c) It will be mitigated to the extent that the devaluation is expected and core inflation is forward looking.

9. In a fixed exchange rate system world inflation determines national inflation and money supply is endogenous. Hence, only with flexible exchange rates a decline in the rate of money growth is permanently feasible and therefore disinflation possible. Starting from point A in Figure T13.9 with very high inflation rates the central bank may shift the AD curve down to AD' by reducing the rate of money growth leading to a point like B. Here output and the inflation rate have declined. The economy stays in B as long as core inflation and therefore the AS curve do not change. As soon as core inflation catches up with the inflation rate, the AS curve shifts down and a new equilibrium is reached at point C, where the actual inflation rate has decreased by the same amount like the money growth rate (neglecting output growth). If core inflation is sticky, the economy stays in B longer so that output also deviates longer from its trend growth path, and the statement that stickiness in core inflation implies that disinflation leads to output losses is correct.

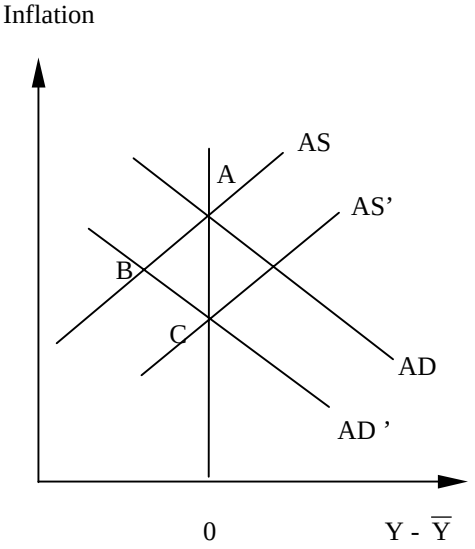


Figure T 13.9

10. An oil shock triggers an upward shift in the short run AS curve. At point B in Figure T13.10 the economy experiences both inflation and recession. People will ask for higher wages as inflation is now above its initial core rate, and the recession will last. Once the shock is absorbed (what matters here is the shock, i.e. the variation in oil price, not the oil price level), the AS curve will revert slowly to its equilibrium position. If there are permanently adverse supply side effects the decline in output may be for a part permanent, while inflation stays for a long time (depending on the formation of expectations) above equilibrium.

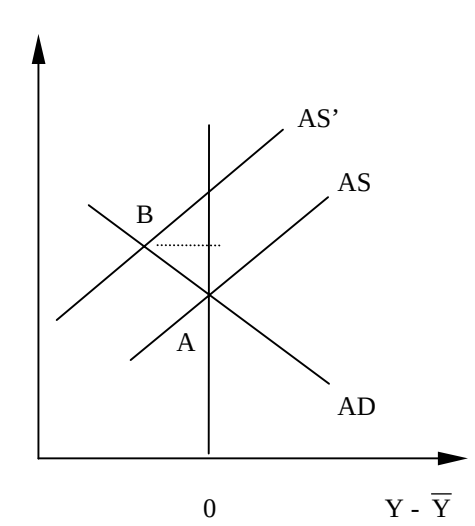


Figure T 13.10

11. No, because a country that permanently inflates at more than the world level and recurrently devalues may shift the PPP line up (see also Figure 13.7 in the text). How does this happen? Higher money growth shifts the AD curve up which raises inflation over its PPP level and increases output. As core inflation catches up over time the AS curve also shifts up and output drops back to its initial level. With inflation higher than world inflation competitiveness drops and pushes AD back towards the origin. This can be stopped by frequent devaluations that restore external competitiveness; the PPP line shifts up. The country has now higher inflation rates, but output cannot be held permanently above its trend level.

Applications

1. This question already hints at Chapter 21 where the evolution of the EMS and the N-1 problem is described in detail. The following answer focuses on the importance of strength in an exchange rate mechanism.

While Hermania (H) fears inflation and therefore follows a tight monetary policy, Mediterranea (M) uses seigniorage to finance budget deficits and follows a loose monetary policy. Inflation in H can thus be expected to be lower than in M and interest rates in H will be higher than in M. So in the short run capital should flow from country M to country H putting upward pressure on the exchange rate of currency M to currency H. In the following it is assumed that neither country can from the start completely control the international interest rate and, hence, the financial integration line lies somewhere in-between both national interest rates. The two central banks will now intervene buying currency M and selling currency H, which increases the money supply in country H and reduces it in country M. As long as both countries sterilize their interventions this process will continue leading to higher inflation rates in M than in H.

These higher inflation rates reduce the real exchange rate and competitiveness in M. So M is likely to have a worsening primary current account, falling output and increasing unemployment while the economy booms in H. The intervention will at some point lead to country M running out of reserves and a realignment will now (at the latest) have to take place devaluing currency M against H. The devaluation also restores competitiveness to its previous level.

The whole process then starts all over again as long as both countries stick to their policies. Country M is most likely to give up in the end because it is the one which will constantly run out of reserves.

2. Suppose a high inflation country fixes its nominal exchange rate with some more inflation-adverse country. Its real exchange rate first appreciates which worsens the current account and shifts the IS curve leftwards in Figure A13.2 (a). At point B there is a tendency for the domestic interest rate to fall and capital to flow out which forces the central bank to reduce the money supply. In Figure 13.2 (b) the AD curve shifts backward: its new position is determined in the long run by the inflation rate abroad. Therefore, the economy initially jumps to point B where output declines and inflation falls. From B, as core inflation tracks down actual inflation, the economy converges to C, through successive moves of the short run AS curve. Along this path, the real exchange rate appreciates and money supply rises.

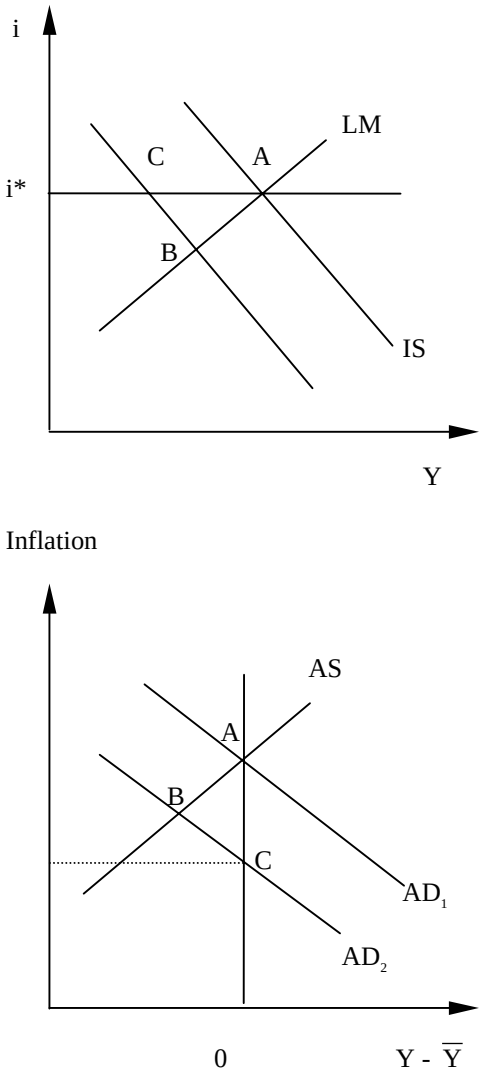


Figure A 13.2 (a) and (b)

3. If energy prices enter the price index, core inflation will inevitably rise following an oil shock. This leads to increases in wages and therefore prices, triggering a wage-price spiral. To fight inflation, the government can move down along the Phillips curve, which has the unfortunate effect of slowing down the economy and creating unemployment. A more attractive idea is to take the energy price out of the price index, which may succeed in preventing the wage-price spiral and thus allows the Phillips curve to shift back more rapidly.

4. Suppose that the government imposes a ceiling π_m on the inflation rate. In Figure A13.4, starting from equilibrium at point A, imagine that a supply shock occurs. The short run AS curve shifts up. If the shock is large enough, prices may be unable to restore equilibrium at point B. At the maximum inflation rate, supply (point C) falls short of demand (point D) as firms do not want to produce more at the prevailing price. Demand must be rationed somehow. This worsens the recession and may have strong adverse supply side effects as prices no longer reflect scarcities, a significant inefficiency from a microeconomic point of view. Inefficient input substitution may occur, lowering the trend growth rate of output.

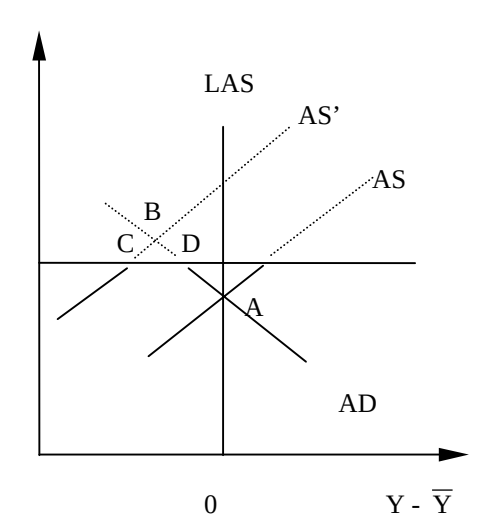


Figure A 13.4

5. Several reasons may be invoked:

- The public deficit may be significant as a result of war expenditures. The government often wants to reduce the real debt value through inflation tax and monetization. Moreover, as public investment is important in post-war periods (rebuilding), the government has no room for financing the budget but anything else than monetization.

- On the demand side, war is often associated with pent-up inflation: agents were often unable to spend their money due to shortages and were accumulating savings. This "monetary overhang", the downloading of savings, increases inflation as it shifts the demand curve rightwards.

- On the supply side, firms may be unable to accommodate the rise in demand because of destroyed productive capacities. They must therefore first invest in new capacity, so the short run supply curve is very steep.

6. The economic transformation in Eastern European countries may be thought of in the long run as a rightward shift of the long run supply curve: economic inputs will be used up more efficiently in the production process (less defense expenditures, a growth path closer to the golden rule...) and price inefficiencies are removed (inflation was virtually zero as prices were administratively fixed).

One interpretation of the situation is depicted in Figure A13.6. At the time of the collapse, the AS_0 curve passes through the zero inflation point, while demand AD_0 is in excess of supply (equilibrium occurs through demand rationing at point A). The initial effect of transition is a supply shock: the AS curve moves up to AS_1 because the old system of central planning is destroyed and prices are freed. The AD curve remains unchanged. The short run equilibrium occurs at point B with a high rate of inflation and a recession. It takes time to build a new economic system and to shift resources to more productive uses: output drops.

In order to soften the blow, governments may try to move the AD curve (with expansionary monetary or fiscal policies). This pushes the inflation rate further (point D). There are many good reasons for this outcome. First, the only credible way to finance expansionary policies is money creation as Eastern European countries have inherited large external debt from the communist era, and had poorly functioning tax systems. Second, inflation was already sky-rocketing at the outset of the transformation. This raises the possibility of a hyperinflation process, which may endanger the whole transition.

In the long run, the economy must converge towards its new long run AS curve LAS_1. This occurs both through a rightward shift in the AD curve (as long run output rises wealth and spending increases) and through a downward trend in the AS curve, as core inflation tracks the inflation rate. A possible transition path would go from point B to point A'. Raising the speed at which the AS curve goes back down can be achieved through slow wage growth, fixed exchange rates, and tight monetary policy. The first two elements are designed to reduce core inflation: monetary policy is made endogenous through fixed exchange rates, so the government cannot follow expansionary (and inflationary) monetary policies. Combined with structural policies (privatization, banking system

reform...) this policy helps to accelerate the transition period by shifting the AS curve downwards.

7. Nominal GNP targeting can take many forms. One popular suggestion is to set money growth to maintain a constant growth in nominal GNP. Should velocity change, money growth must respond in the opposite direction: a decline (increase) in velocity is countered by an increase (decrease) in money growth.

The proposal helps to move down the short-run AS curve after a supply shock, as agents recognize that monetary authorities have no discretionary use of the money supply and are committed to a fixed rule. Core inflation adapts rapidly to lower actual inflation. However, this raises two objections:

- First, such an announcement is not time-consistent (for a description of time inconsistency, see Chapter 16). Once the government has announced a money growth target and people believe it, the temptation is great to increase the money growth rate further (create surprise inflation) which stimulates the economy.

- Second, such a monetary policy does not react to cyclical economic fluctuations. Suppose a temporary demand shock occurs, the economy will experience deflation and recession. A countercyclical monetary policy, which shifts back the AD curve to its initial position, softens the blow.

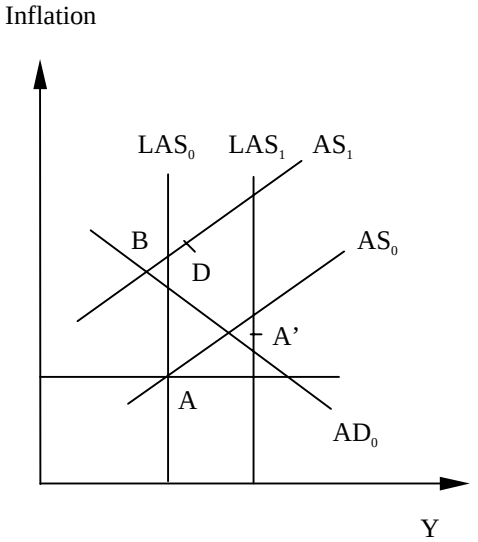


Figure A 13.6

8. The increase in the money stock is a one-off change, not a change in the growth rate, so in the long run this cannot be a source of inflation. In addition, unification increases economic activity of the DM Zone by the size of the East German economy. This can be thought of as a shift in the AS long run curve in Figure A13.8. In the short run the margin for error may be great -- increasing the money supply on the basis of overestimated East German output levels for example -- and this might lead to an increase in aggregate demand (point B). It turns out that in the course of German unification, the primary source of aggregate demand came from the fiscal side, due to increased transfers and infrastructure investment in the East.

10. Under flexible exchange rates, the rate of money growth is the sole determinant of the AD curve's position. Monetary policy is extraneous and the central bank has no particular incentive to abstain from surprise inflation as a means of stimulating the economy.

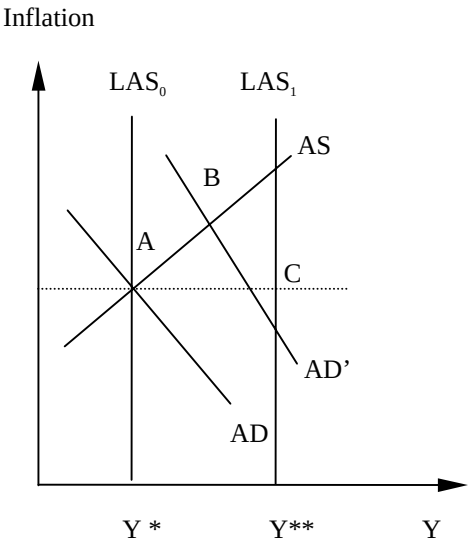


Figure A 13.8

9. (a) Permanent increase. In the long run, the AD curve position is determined by the German inflation rate. The long run corresponds to point C in Figure A13.9 where Dutch inflation rises permanently and output is on its trend growth path. In the short run, higher inflation in Germany leads to a real exchange rate depreciation for the Netherlands. This gain in competitiveness *vis-a-vis* a key trading partner has the effect of shifting the AD curve to the right: at point B output and inflation rise. The Netherlands may try to prevent the inflation rate from rising by revaluing their currency against the Deutschmark. However, in the long run, PPP requires that inflation rates will be equal, unless these revaluations occur regularly.

(b) Suppose the increase is temporary. Netherlands can now fight inflation by revaluing against the Deutschmark.

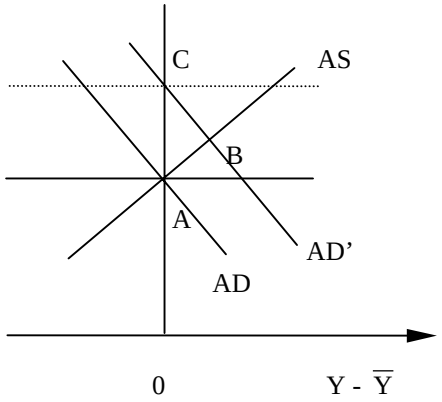


Figure A 13.9

Under fixed exchange rates, the long run AD curve position is determined by the foreign inflation rate. Fixing the exchange rate to an adverse-inflation country helps credibly to fight inflation: agents recognize that the inflation rate will converge to the foreign rate in the long run, because the central bank has to intervene once the exchange rate moves away from its central parity.

However, as long as realignments are not ruled out, the commitment is not really credible: monetary authorities can stay on a high inflation path and devalue from time to time (see Theory Exercise 11 above). Core inflation will not track declining actual inflation as the private sector recognizes that it can be fooled. This is an illustration of the time-inconsistency problem which will be developed in further detail in Chapter 16. For fixed exchange rates to have any disciplinary effect on the monetary policy, realignments must be credibly ruled out.

CHAPTER 14

BUSINESS CYCLES

EXERCISE SOLUTIONS

Theory

1. The term $1/(1-a_1)$ gives the relationship of given autonomous expenditures, that is, $a_0 + b_0 + c_0$ and the level of output $\bar{Y}$ in long-run equilibrium. To visualise the multiplying effect, assume that $a_1=0.5$ and that $b_1=0.2$, so that the first version of the model is stable. Further assume that $b_0=c_0=0$. For $a_0=100$ equilibrium output equals $\bar{Y}=200$. Assume that a_0 rises at one unit. It is easily checked that the new steady-state Y=202. Output has risen at more than the initial effect: the multiplier is equal to $1/(1-a_1) =2$.

2. If $a_1 \rightarrow 1$, the households spend all their income on consumption. Box 14.2. shows that the model becomes unstable (unless $b_1 \rightarrow 0$). That is, the multiplier becomes infinitely large. For a given amount of expenditures equilibrium output is infinite. The economic reasoning is that consumption (and possibly investment) react strongly to changes in output. Because the multiplier is infinite, the complete income of one period will be consumed, thereby creating new income in the next period of equal size. As the increments never decrease, the effect is unlimited. This can be checked numerically similar to the proceeding exercise: set $a_1=0.9999999$ (that is, very close to unity). An increase of a_0 from 100 to 101 now results in an increase of output of 10^7 units!

3. Suppose the money shock is only temporary for the moment. That is, expected inflation and, therefore, core inflation is not affected. In this case the cycle can be generated by shifts of the LM curve alone. The cycle begins with the standard shift of the LM curve to the right, along the IS-curve. (If prices react sluggishly, the real exchange rate rises and exports increase. However, this effect is only of short duration. Since prices will catch up and the competitiveness will deteriorate, the IS curve shifts back. In the medium run, the real exchange rate can be assumed to be constant.) As long as the money growth rate is still larger than the induced inflation, real money balances rise and output increases. However, sooner or later inflation overtakes the money growth rate and real money balances start to decline (see footnote 12 in text). The LM shifts back to the left, most probably so strong as to overshoot the initial curve. The cyclical pattern is repeated.

However, one might also think of an additional effect that changes inflation expectations. This is the shift of the AS curve in the original textbook formulation. Changes in inflation expectations can affect the interest rate and therefore investment. The IS curve shifts as well: Investment expenditures are a function of the real rate of interest: $r=i-\pi$. If inflation starts to rise, for any given nominal interest rate, the real rate decreases. The IS-curve shifts to the right, sometimes known as the *Mundell-Tobin* effect.

4. A permanent decline in the foreign rate of inflation implies that, ceteris paribus, home products become less competitive over time (or equivalently that foreign goods become more competitive). As long as the exchange rate does not change, expenditures are shifted towards foreign products. The AD curve shifts to the left and actual inflation falls. Gradually core inflation decreases as well, resulting in a movement of the AS schedule to the right. Output increases again and inflation at home slows down also in relation to the foreign economies. In the end both economies will ultimately return to their old level of output yet at a lower rate of inflation.

5. Basically the models differ only in their timing: by simply introducing time lags, as in the second version of the multiplier-accelerator model, the stationary solution is not changed. The two basic ingredients (equations) of the model, the Keynesian consumption function and the accelerator principle, are not changed. However, equations 14.3 and 14.4 differ in their dynamic responses: only the second one is able to produce potential cycles (as it is a second-order difference equation).

To scrutinize the short-run mulitipliers (*or dynamic multipliers*), assume a shock to a_0 in both models at time zero (set $b_0=c_0=0$). The initial effect of a shock to a_0 is the same in both models: it is simply $a_0/(1-a_1-b_1) \equiv$

w. However, as time unfolds the solutions diverge. Let us start with the first-order case (Y_{-1} is given as Y and defining $b_1/(1-a_1-b_1) \equiv \phi$. Thus, equation 14.3 is rewritten as: $Y_t=\phi\ Y_{t-1}$ for all t>0). The following Table reports the evolution of output:

period	value of Y_t
t=0	$w+\phi Y$
t=1	$w\phi+\phi^2 Y$
t=2	$w\phi^2+\phi^3 Y$
...	
t=n	$w\phi^n+\phi^{n+1} Y$

The *dynamic multiplier* of the first-order difference equation is given by:

$$\partial Y_{t+n} / \partial w = \phi^n.$$

The second-order version of the model is considered in the next table. We conveniently have set $b_0=c_0=0$ and $Y_{-1}=Y_{-2}=0$. Equation 14.4 rewrites as $Y_t=\phi_1\ Y_{t-1}+\phi_2\ Y_{t-2}$ for t>0 where we have defined $\phi_1 \equiv a_1+b_1$ and $\phi_2 \equiv -b_1$. The dynamic multiplier for the second-order difference equation is given by:

period	dynamic multiplier
t=0	w
t=1	$\phi_1 w$
t=2	$(\phi_1^2+\phi_2)w$
t=3	$(\phi_1^3+2\phi_1\phi_2)w$
t=4	$(\phi_1^4+3\phi_1^2\phi_2+\phi_2^2)w$
t=5	$(\phi_1^5+4\phi_1^3\phi_2+3\phi_1\phi_2^2)w$
...	...

Unfortunately, no „easy“ solution as in the case which was considered first exists. See however Hamilton (1994): *Time Series Analysis*, Princeton University Press, who outlines an algorithm that can compute all steps.

6. One observes a shift of the LAS and the AS curves to the right (given the fiscal and monetary policies), output rises. Since the new technology allows the production of more output with the same amount of inputs, wealth rises. This effect implies higher consumption and the AD curve shifts to the right. If the shock is permanent, the economy stays at this higher equilibrium output level. However, if technology improves temporarily, the whole process moves into the opposite direction again.

7. If supply shocks dominate, the cycle is primarily described by shifts of the AS curve along the (more or less fixed) AD curve. It is easily checked that inflation is countercyclical. If demand shocks dominate, however, the cycle is primarily interpreted as shifts of the AD curve along the AS curve. It is easily shown that inflation is procyclical in this case.

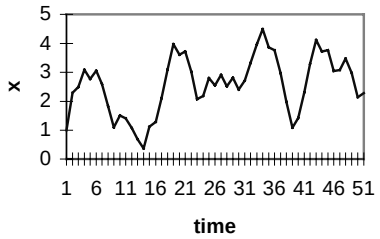
8. A negative PCA implies high imports and/or low exports. High imports in a boom can be the result of high consumption expenditures on foreign goods (wealth increases) or the result of an increase in the demand for foreign investment goods. Since investment displays a somewhat more cyclical pattern, it is plausible that this is the most prominent source.

9. A temporary positive technology shock implies a temporary response of the economy (consider an improvement of the technology for a single period). The household will supply more labour (as wages and the return to capital rises). Unlike the case of a permanent shock, the response will be short (and strong). The agent can profit from improved technology over a very short horizon only. A borrowing constraint (Chapter 4) can change the picture however, if consumption and investment projects cannot be easily financed.

Applications

1. In the simulation in exercises 1 through 3, the same shock sequence was used. The following output is generated for the stochastic difference equation:

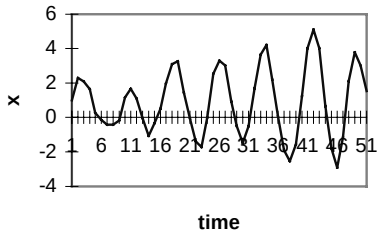
x(t)=1.3 x(t-1)-0.5 x(t-2) + e(t)



Four full cycles are observed. The roots of the difference equation are given by $\lambda_{1,2}=0.65 \pm 0.28\ i$ with mod=0.70.

2. In the second example:

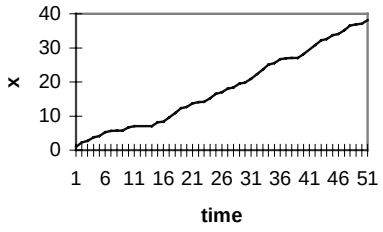
x(t)=1.3 x(t-1)-0.9x(t-2)+e(t)



The frequency of the cycles rises as one can observe 7 full cycles over the same period. The roots of the difference equation are given by $\lambda_{1,2}$ =0.65 ±0.69 i with mod=0.95.

3. In this case the stationary cyclical pattern is lost. The variable follows instead a steady growth path, and is said to be nonstationary.

x(t)=1.3 x(t-1)-0.3 x(t-2) + e(t)



The roots of the difference equation are given by $\lambda_{1,}$=0.30 and λ_{2} =1.00. Since one root is no longer inside the unit circle, the difference equation becomes unstable. Intuitively the pattern of coefficients does not "force" the economy to return to its starting point after being temporarily shocked.

4. Europe displays a strong positive response in exports (and imports) to changes in output. This points to the case that European countries are highly integrated. The cycles are synchronised. In the US economy, foreign trade plays only a minor role (at least when compared with Europe). A given exogenous shifts in exports, for example, affects the overall economy to a lesser extent in the US, and the correlation of exports and output is low. Somewhat puzzling is the low and negative correlation for Japan. However, by checking Table 1.5, one sees that Japan's economy is not as open as it is sometimes perceived. The ratio of exports to GNP is only insignificantly higher than that of the USA (9.6 vs. 10.6 in 1990). Compare this figure to Belgium's 72 percent.

5. Figure 14.5 shows that the PCA is a leading and countercyclical indicator. If cycles are synchronised across countries, exports of all countries rise during the same time (booms), improving the PCA. However, the opposite is true for imports. Since in surging times the economies are increasingly dependent on imports (resources), imports rise and the PCA deteriorates. For the economies that are considered in Figure 14.5 the latter effect appears to dominate.

6. A strong procyclical behaviour of the interest rate cannot be easily reconciled with monetary theories of the cycle. Using the IS-LM model, an expansionary monetary policy (shift of LM to the right) increases output through a decline of the interest rate along the IS schedule. However, if the cycle is a result of the shift of real demand (e. g. animal spirits) the IS-LM framework would primarily display movements of the IS curve along the LM schedule. Interest rates are procyclical. The procyclical behaviour of the interest rates points to real shocks rather than monetary ones as the principal causes of the cycle. The challenge is again to place inflation and therefore the real interest into the IS-LM framework. Theory-Exercise 3 gives us some idea of how inflation can work through investment and shifts of the IS-curve (via the Tobin effect).

7. (a) One interpretation of the observation that exports lead the cycle in the German economy, is that impulses for recoveries and downturns appear to arrive at least partially from abroad. The West German economy is known for its dependence on foreign demand (for example in investment equipment, cars etc.). Considering the sticky price theory of the cycle, the initial response is a shift of the AD curve to the right (an increase in exports). German output rises.

(b) The real business cycle would be somewhat similar, focusing on exports of equipment and durables (Germany possesses hardly any natural resources). Two types of shocks could be imagined. The first is a positive productivity shock in the technology used to produce German exports. This presumably would stimulate foreign demand, possibly more than proportionately if many countries import these high value-added German goods. On the other hand, it is not clear why foreign demand should lead domestic output, unless a lag between purchase and installation is assumed in both Germany and abroad. This is because unless the productivity shock also increases German supply potential, there should be no effect on output.

The second type of shock may make this subtle distinction more clear. This would involve a shock to the general technology of production in some foreign country alone -- say Spain. This ultimately increases the demand for investment goods in Spain. It would be

reasonable to assume that some of this demand spills over to Germany. The German PCA improves. At the same time higher demand in the RBC model does *not* affect output. Thus while the PCA improves, it does so at the expense of other components of demand, making a boom in German output unlikely.

A natural conclusion is that while the RBC model can explain the German pattern, it is somewhat strained and not completely plausible.

8. In the Burns-Mitchell diagram Figure 14.5, consumption exhibits hardly any cyclical pattern. If nondurables (i.e. food) were considered instead, the cycle would be even less visible. However, durables must generally not be bought every period (unlike food, drink and services). Consider a new TV set or a new car the purchases of which can be easily delayed over time. If the economy falls into a recession, households often wait with their purchases of these goods. This is the origin of the cyclical behavior of durables.

9. The wealth effect reduces (home) consumption, the IS curve shifts to the left. With fixed exchange rates, the new situation cannot be supported any longer. The central bank must decrease the money supply and the LM curve shifts to the left, depressing output even further. If Sweden would have been operating under a floating exchange rate regime, the initial shift of the IS-curve would have led to a depreciation. This would have increased exports and therefore led to a movement of the IS-curve back to its original position. Output would not have fluctuated as much in a flexible exchange rate regime.

10. This question is not plausibly answered with the use of the AS-AD model. The initial situation is described by a point left of the LAS. The output gap is negative. The expectations of a further decline in inflation results in a rightward shift of the AS curve. AD also moves to the right because of the expansionary money policy: inflation must not rise strongly in this situation as both curve-shifts more or less cancel concerning the inflation variable. However, sooner or later the monetary impulses will transform into higher inflation. Consumption will also pick up because of its dependence on output (and wealth). Investment increases too and the PCA will start to deteriorate and unemployment (in the Keynesian sense) will decrease (check chapters 4 and 6 for details).

CHAPTER 15

FISCAL POLICY, DEBT, AND SEIGNIORAGE

EXERCISE SOLUTIONS

Theory

1. Progressive taxation allows governments to redistribute wealth and income among economic agents and thereby reduce inequality. There are many philosophical issues involved, including the notion of the philosopher, John Rawls that under a "veil of ignorance" concerning their future income and wealth, individuals would prefer a form of insurance against very low earnings. It also corresponds vaguely to notions that "ability to pay" should be a primary consideration in assessing individuals' tax liabilities.

Another feature of progressive income taxes is their function as automatic stabilizers. Cyclical fluctuations directly affect the income tax. Consider the effect of a recession. We may think that the whole range of incomes is shifted downwards (in other words, everyone earns less). In this case aggregate taxes are a convex function (with increasing slope) of aggregate income. Therefore, when output falls, taxes fall more than proportionally. This need not be the case: suppose that during a recession, the poor become poorer and rich become richer in such a way that when aggregate income falls, tax revenues may actually increase! Normally one rules this out by hypothesizing that the economy moves homothetically.

2. Suppose income tax is replaced with VAT, which is explicitly proportional. As pointed out in solution 1 above, when a recession occurs, we may think that the whole range of incomes is shifted downwards. As aggregate taxes are a convex function (with increasing slope) of aggregate income, taxes fall more than proportionally. The automatic stabilizer function is enhanced. With a VAT system, taxes on consumption fall proportionally: the automatic stabilizer is reduced when we turn to a VAT system. If wealthier people spend a lower percentage of their income on consumption, the average tax rate will be more countercyclically, meaning the automatic stabilizer function is reduced.

3. The inflation tax reduces the real interest rate paid on debt issued in domestic currency. However, when the debt is issued in foreign currency, the key factor becomes the foreign rate of inflation, which is beyond the control of the government. Governments have less incentive to engage in inflationary finance. Moreover, seigniorage is impossible with foreign debt: the central bank must sell foreign exchange reserves in order to buy back public debt. This amounts to a reshuffling of the asset side of the central bank's balance sheet and leaves the money supply unchanged.

Denote by B* the public debt issued in foreign currency (and expressed in foreign currency). Its real domestic value is EB*/P where E stands for the nominal exchange rate and P for the domestic price index. A devaluation of the currency *increases* the real value of debt issued in foreign currency, measured in terms of the local currency, as well as the local currency value of debt service.

4. That the national debt is an emotional issue, was for example seen in the 1992 US presidential election, the debate over the financing of German unification, and of course the fiscal requirements for the EMU (Chapter 21). The statement that the debt will never be repaid is an example of the fallacy of composition: what is true for the sum of individuals need not be true for each individual. For the great majority of countries and historical episodes, each individual creditor has been repaid the nominal amount which he or she lent the government plus interest. The representative individual is content to lend to the government and expects to be repaid over his lifetime. The debt serves as a means by which the public can save, either for retirement, for a rainy day, or against future tax liabilities. In the extreme case of Ricardian equivalence we know that the national debt does not represent wealth at all, which implies that it is not a net liability either. In this view the public has fully anticipated and discounted its future tax liabilities against the government debt it owns.

Of course, someone must deliver the principal and interest when government borrowing comes due: this resources are obtained via higher taxes, economic

growth (with a larger tax base), borrowing from other individuals, or monetization. The central feature one needs to follow is the sustainability of the debt, and for this reason the debt/GDP ratio is widely followed. The national debt is not a scam as long as each individual's debt contract is honoured and the government meets its aggregate intertemporal budget constraint.

5. Surprise (unanticipated) inflation reduces the real value of nominally denominated assets, as it reduces the ex-post real interest rate. This includes non-indexed treasury debt as well as money. At the same time, newly printed money can finance government spending (seigniorage).

By demanding higher nominal interest rates, creditors can immunize themselves against anticipated inflation (recall the Fisher principle: the nominal interest rate embodies expected inflation). Therefore, only pure seigniorage -- that is, the real resources acquired by the government via creation of real means of payment -- remains when inflation is anticipated.

6. Recall the equation which describes the evolution of real debt with growth and inflation (15.5):

$$\Delta (B/Y) + \Delta M0/PY = (G - T)/ Y + (r - g) B/Y$$

During hyperinflations, the real value of tax revenues declines as a consequence of delays in payment and assessment. The first term on the right hand side (the primary budget surplus) falls. It makes it more difficult for the government to stop monetization of the public debt (the second term on the left hand side) as debt issue becomes increasingly difficult.

One solution consists in raising taxes and in cutting government spending in order to reduce the primary budget deficit at the time money growth is brought under control. This kind of stabilization policy was implemented successfully in Bolivia (1985-6) for instance. However, it involves major political risks, as such policies are very costly and unpopular.

7. Seigniorage revenues derive from newly printed money. As a function in continuous time, it is:

$$S(t) = (dM0(t)/dt)/P(t) = \mu\ M0(t)/P(t).$$

Under the assumption of flexible wages and prices, the price level in the short run fully adjusts to any increase in money supply to equate money supply and demand. Let us ignore real economic growth for the moment, so constant real money balances imply $\pi = \mu$, and

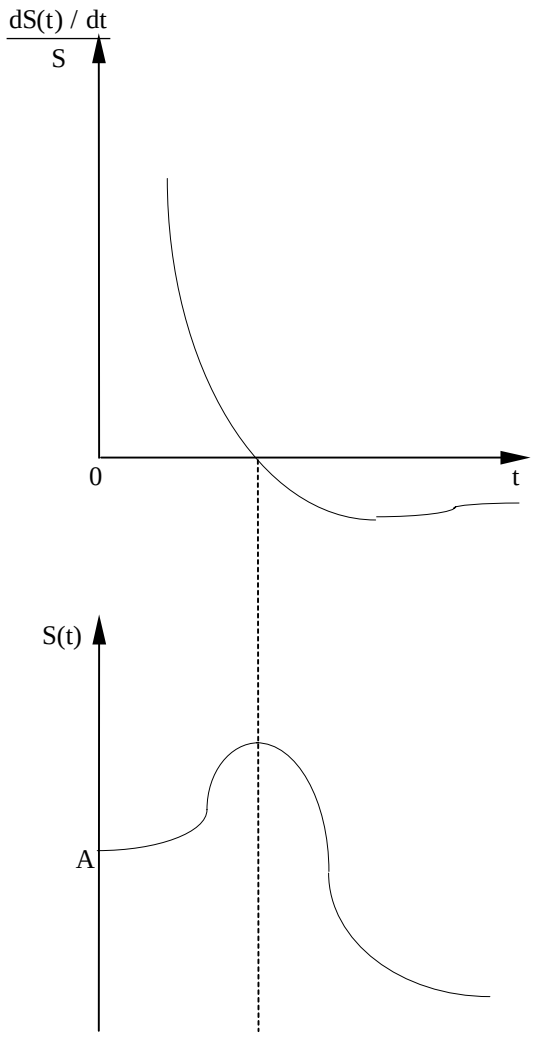
$$S(t) = \pi M0(t)/P(t).$$

(Thus, in the steady state of seigniorage and the inflation tax are equal). The government's ability to raise real resources depends on the responsiveness of the real demand for money M0(t)/P(t). Increasing π has two effects: it raises S directly (via the tax rate), but in doing so will raise nominal interest rates and thereby reduce M0/P (the tax base).

Suppose the government increases nominal money growth from μ to μ'. This will cause an upward jump in seigniorage revenue ($dS = d\mu\ M/P$; point A on figure T15.7). From there, taking logs and differentiating with respect to time, we get the law of motion of seigniorage revenues (recalling that money growth is constant):

$$1/S\ dS/dt = \mu' - \pi(t)$$

Inflation will gradually catch up with the money growth rate (in the long run, both are equal). This triggers a nominal interest rate increase (recall the Fisher Principle) and a decline in real money demand. Therefore, along the transition path, inflation must be higher than money growth. This reduces seigniorage revenues (the second term in the above expression).



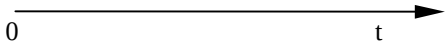


Figure T 15.7

8. The monetary aggregate (M1 or M2) is central bank money (M0) multiplied with the money multiplier. Under the condition that the public holds no currency the money multiplier is simply (recall Chapter 9):

$$M1/M0 = 1/rr$$

Velocity is V = PY/M. If velocity increases for constant prices (P) and constant GDP (Y), the monetary aggregate has to fall. Hence, also the demand for central bank money will fall, reducing the base for seigniorage. (See also answer to Exercise T7 above).

9. One explanation of the lag between capacity utilization and net tax receipts involves the building up of inventories. When firms expect demand to increase they will start to produce more. If demand does not expand until expected inventories are built up, tax receipts will not increase initially. Only when more is being sold in the market will tax receipts react. Similarly, when the economy starts to move into recession inventories start to be built up reducing tax receipts. First, capacity utilization may not immediately drop when firms expect that demand revives soon. Second, it might be better to use capital and labour reserves to produce at least a small amount of output rather than leaving these reserves idle. Making workers too quickly redundant could also deprive the firm of valuable human capital. Moreover, there may also be job protection legislation in place which leads to labour *hoarding* and capacity utilization declines not as quickly as demand does. This shows that obviously the lag varies between business cycles.

10. No, bank notes are liabilities of the central bank. See Chapters 8 and 9.

11. For period t the *ex ante* real interest rate at the beginning of the period can be written as

$$ {}_tr^e_t = i_t - {}_t\pi^e_t $$

where ${}_tr^e_t$ is the expected real interest at the beginning of period t, i_t the given nominal interest rate of period t and ${}_t\pi^e_t$ expected inflation at the beginning of the period. It is an expected interest rate, because it depends on expectations about the inflation rate. At the end of the period t, when inflation is known, the real interest rate is

$$r_t = i_t - \pi_t$$

where r_t is the *ex post* real interest, i_t the nominal interest rate and π_t actual inflation in period t. The difference between the two is that at the beginning of the period π is not known: ${}_t\pi^e_t - \pi_t$. Therefore creditors (debtors) cannot be sure whether lending (borrowing) will yield (cost) a certain real amount at the end of the period. If the difference is positive there is redistribution from borrowers to lenders and vice versa redistribution from creditors to debtors if the difference is negative. Surprise inflation erodes the real return on lending.

12. Every 1 Euro reduction of government spending reduces aggregate demand by 1 Euro, while 1 Euro reduction of taxes is not necessarily spent on domestic output; some will be saved, some will be spent on foreign goods. Part of the increase in disposable income flows out in the form of savings and imports (which are demand leakages; recall Chapter 11). This explains why a balanced reduction of the government size is contractionary (probably mildly so). Conversely, a balanced expansion is (mildly) expansionary.

Formally we take a simple closed economy model with fixed prices. A more complex model can be found in the appendix to Chapter 11.

$$Y = C(Y^d) + I(Y) + \bar{G}$$

where disposable income $Y^d = Y - \bar{T}$. Here Y is GDP and $\bar{T}$ is the lump sum tax.

Total differentiation yields:

$$dY = \partial C/\partial Y^d \, dY - \partial C/\partial Y^d \, dT + \partial I/\partial Y \, dI + dG$$

Now setting $dG = dT$, $\partial C/\partial Y^d \equiv c$ and $\partial I/\partial Y \equiv b$:

$$dY = c \, dY - c \, dG + b \, dI + dG$$

$$dY = ((1-c) \, dG) / (1-c-b)$$

Hence, the balanced budget multiplier which shows the effect on aggregate demand is:

$$dY/dG_{|G=T} = (1-c)/(1-c-b)$$

Imagine the multiplier is equal to 1 (when b=0) then G/Y and T/Y stay constant as Y changes like G and T do. If the multiplier > 1 output decreases even more than G and T do and the ratios increase! This shows that it is difficult to reduce the size of the government: when the government reduces both G and T by the same amount aggregate demand drops.

Applications

1. Define PBS ≡ (T - G)/Y as the primary budget surplus as a percentage of GDP required with growth and without inflation (15.4):

$$PBS \equiv (T - G)/Y = (r - g)\, B/Y$$

When r = 6% the primary budget surplus has to equal 1% of GDP to keep the debt/GDP ratio constant at 40%. When r = 2%, r < g and any primary surplus is sustainable as the debt process is no longer explosive. In that case a PBS of up to -0.6% (i.e. a primary budget deficit) is possible.

2. B/Y = 100% , g = 3% , r = 5%.

(a) PBS = (r - g) B/Y = 2% (for the details see previous exercise).

(b) With r = 2% any primary budget surplus is sustainable. With g = 1%, PBS = 4%.

3. When $\pi = \mu$, seigniorage (s) is equal to the inflation tax $\pi(M0/P)$, i.e. the inflation tax when the Fisher effect holds for interest bearing assets. (See also solution to Exercise T7 above)

$\pi = 0\% \quad \Rightarrow s = 0$
$\pi = 1\% \quad \Rightarrow s = 9$
$\pi = 2\% \quad \Rightarrow s = 16.4$
$\pi = 5\% \quad \Rightarrow s = 30.3$
$\pi = 10\% \quad \Rightarrow s = 36.8$
$\pi = 20\% \quad \Rightarrow s = 27$
$\pi = 25\% \quad \Rightarrow s = 20.5$
$\pi = 50\% \quad \Rightarrow s = 3.5$

Seigniorage follows a hump-shaped pattern when inflation rises because, as inflation increases, people will tend to hold fewer real monetary balances, which reduces the tax base on which seigniorage is set. A 10% inflation rate maximizes seigniorage.

4. This problem requires a continuous time analysis. The instantaneous rate of inflation is:

$$\pi = 1/P\, dPdt.$$

The nominal demand for central bank money is:

$$H = P\, A \exp(-\alpha\pi).$$

We compute the first derivative of nominal money demand with respect to time ($\partial H/\partial t$):

$$dH/dt = dP/dt\, A \exp(-\alpha\pi) - \alpha\, d\pi/dt\, P\, A \exp(-\alpha\pi)$$

(both P and π are functions of time, hence the two terms on the right hand side)

$$dH/dt = A\, P \exp(-\alpha\pi)\, (\pi - \alpha\, d\pi/dt)$$

Then we calculate seigniorage:

$$S = 1/P\, dH/dt = A \exp(-\alpha\pi)\, (\pi - \alpha\, d\pi/dt).$$

In the long run inflation reaches its equilibrium level ($d\pi/dt = 0$) hence seigniorage is:

$$S = \pi\, A \exp(-\alpha\pi)$$

It is maximized when $dS/d\pi = 0$ (and $d^2S/d\pi^2 < 0$, to be precise; this second order condition is satisfied).

$$dS/d\pi = A \exp(-\alpha\pi)\, (1 - \alpha\pi).$$

Seigniorage is maximized for $\pi = 1/\alpha$. Economically, α stands for the semi-elasticity of money demand with respect to inflation. When demand is inelastic, $\alpha = 0$, seigniorage is an increasing function of inflation: governments have the incentive to make as much inflation as possible. When demand is perfectly elastic, a tends to infinity and the optimal rate of inflation is close to zero.

5. There is a negative, if not systematic, relationship between the debt/GDP ratio and the average maturity, and a positive one between the debt/GDP ratio and the fraction of debt issued in foreign currencies. Exceptions are Ireland, with a debt GDP ratio close to 115% and long average maturities, and Italy with a small part of debt issued in foreign currency. At the same time the lion's share of Italian debt is refinanced continuously at short term rates, while Ireland has a substantial fraction of debt in foreign terms.

6. In Box 15.4 the pension system was discussed. Similarly unemployment benefits or other social security payments cannot be planned in advance. The environment also plays an important role. Some countries are frequently troubled with hurricanes, earthquakes or flood and usually the state has to pay for the damage caused. Also pollution and the global warming may result in unmeasurable liabilities to be posed on the state by future voters. (However, for some countries global warming may lead to better farming conditions, i.e. global warming would be an asset for those countries!). Another unmeasurable liability is that countries may also be involved in wars. Implicit assets are for example yet undiscovered resources that at some future day increase output and tax receipts.

7. Immigration simply increases labour supply hence also the number of people paying taxes, contributing

social security payments and also claiming those payments. Whether or not a country is willing to accept massive immigration will most probably depend on the age structure of the population. In a country in which the birth rate is declining, controlled immigration may be an important source of new workers. If these additional workers pay more taxes and social security contributions than the government has to increase spending due to immigration, the debt/GDP ratio tends to fall. Also recall from Chapter 5 and the Solow decomposition that new workers may be a source for economic growth further reducing the pressure of the debt. (See also answers to Exercise A.1 and A.2 above).

CHAPTER 16

THE LIMITS OF DEMAND MANAGEMENT

EXERCISE SOLUTIONS

Theory

1. In principle the real interest rate reflects the probability that a borrower will not meet its obligations: a premium is charged to compensate the lender in this case. What matters for public debts, therefore, is whether the government is violating its intertemporal budget constraint. The government can stabilize any debt (that is, the stock) by running an appropriate primary budget surplus (that is, the flow). The deficit is a crucial indicator of sustainability because 1) it indicates whether the debt is currently growing without bounds; 2) it shows whether the existing debt is close or not from stabilization.

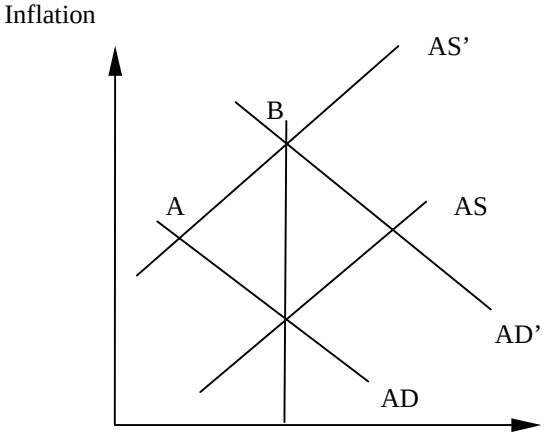
2. A sudden increase in wages shifts the AS curve up in Figure T14.2 as production costs rise. The outcome is point A where inflation is above its trend level and where output falls.

Monetarists will try to raise the speed at which the AS curve goes back to equilibrium. This may be achieved through contractionary fiscal or monetary policy. Alternatively, hardiness may advocate no active policy at all, relying on the market's ability to solve the problem.

Keynesians would rather try to fight recession with a monetary or a fiscal expansion, returning back the economy to full employment (point B), at the cost of higher inflation.

3. This is an illustration of how private sector's expectations of future government policies may come into play. Suppose the government conducts a tight monetary policy and, at the same time, let the debt rise sharply. As soon as agents expect the government to monetize the debt at some future date, core inflation will rise, pushing up actual inflation. We have the "unpleasant" result that tight monetary policy is not sufficient by itself to reduce inflation. Expectations of future money growth matter. This was first emphasized by Thomas Sargent and Neil Wallace of the University of Minnesota in 1981.

4. Among the most important costs of inflation are the following:
- Redistribution between creditors and debtors. Imagine for example inflation increases surprisingly. Then the creditor is paid back less in real terms than expected. (Similarly there can be redistribution between workers and firms). The importance of redistributive effects depends on one hand on the stability of the inflation rate and on the other hand on the level of the inflation rate. If inflation is relatively low (say 2-3% a year) and stable over time it can be well anticipated and thus incorporated into contracts. There will be hardly any redistribution in this case. If inflation is rather unstable frequently errors in inflation expectations will be made leading to redistribution. With very high levels of inflation and high expectation errors the costs increase as redistribution increases.
- All payments set in nominal terms like maybe unemployment benefits or pensions and all nominal indexed assets are worth less in real terms.
- The state benefits from inflation as the public debt falls in real terms, to the extend that the nominal interest rate on debt reacts. This is often referred to as the inflation tax.
- Especially at very high inflation rates the functions of money degenerate. Experiences with hyperinflations show that usually parallel currencies evolve and the inflation currency is no longer used for comparing relative prices, as means of payment or store of value.
- Finally, in hyperinflation periods relative prices can be distorted which leads to inefficiencies.



0 $Y - \overline{Y}$

Figure T 16.2

5. Monetary policy is endogenous with fixed exchange rates, because the central bank has to intervene in the foreign exchange markets to keep the exchange rate constant. As soon as the exchange rate starts to deviate from the fixed parity the central bank buys or sells own currency in exchange for foreign currencies. This influences directly money supply and thus interest rates without major lags. Without knowing more about firms expectations about future demand conditions and the current economic situation no further statements about the working through of these interest rate changes to the labour and goods market can be made. It may take some time until investment and consumption react to lower interest rates.

With flexible exchange rates money supply is exogenous and the central bank's policies are not bound by exchange rate interventions. The effectiveness of expansionary or restrictive policies depend rather on the monetary instrument used. Those instruments that directly influence money supply, like open market interventions or monetization of the public debt, should have the same direct effects on the interest rate as purchasing or selling foreign exchange. Measures that only influence the possibility of commercial banks to obtain credit from the central bank, like changing the discount rate, are likely to take longer to work through on the interest rate. Commercial banks have to first change the interest they charge on credit and the amount of credit granted has to be changed before the money supply increases.

6. Large deficits mean runaway debt and the need to stabilize. Forward-looking exchange markets (Chapters 18 and 19 elaborate on that aspect) take into account the effect of future stabilization to value today's currency:

- Stabilization means a durable shift to a restrictive fiscal policy. Domestic demand will fall and foreign markets will have to provide a replacement outlet for domestic production. This requires a gain in competitiveness, hence a depreciation.
- If part of the solution takes the form of money financing, inflation is expected to increase. Core inflation rises accordingly and actual inflation follows, which harms competitiveness and implies the need for a depreciation.
- An expansionary fiscal policy means a strong demand and the likelihood of a primary current account deficit which needs to be corrected, hence a depreciation.

7. Recall Box 13.7 on the effects of indexation. Indexation has the adverse supply side effect of removing any flexibility in core inflation's backward component. Once a supply shock has occurred, the AS curve is shifted upwards for a long time. Therefore, indexation does not raise the equilibrium inflation rate per se, but it transforms transitory shocks into long lasting ones. However, in the long run, the AS curve is vertical and inflation is determined by the position of the AD curve. Thus, indexation puts upwards pressure on the short term equilibrium inflation rate.

8. In fixed exchange rate regimes, the inflation rate and hence inflationary expectations are usually determined by world inflation, so this answer will assume flexible exchange rates. A country that wants to bring down inflation faces the problem that this is always associated with recessions. Wanting to bring down inflation a country may reduce the rate of money growth shifting the AD curve down. This leads to decreasing inflation and output, hence increasing unemployment. If inflationary expectations can be influenced such that core inflation immediately falls with the rate of money growth the AS curve shifts down with the AD curve circumventing the drop in output.

9. Both policies are equally faced with the problem that the need for policy intervention has first to be discovered (recognition lag). However, the decision, implementation and effectiveness lags are very likely to differ.

(a) Fiscal policy: Governments need time to form decisions, pass and implement new legislation. This can take up a considerable amount of time. However, once government expenditure or taxation are changed they have usually a direct effect on aggregate demand, output and unemployment. There are exceptions to this, when for example increases in government expenditure lead to increases in savings (Ricard-Barro equivalence theorem) there is no real effect of the policy change.

(b) Monetary policy: The decision and implementation lags for central bank policy are very short. Central banks may very frequently change the discount rate, buy or sell bonds in the open market or intervene in foreign exchange markets. The effectiveness of these policies on the real sector of the economy depends on how strongly investment and consumption react to changing conditions in money markets and may take longer to change output and employment than direct government expenditures.

10. A zero budget rule means that the intertemporal budget constraint is always fulfilled. This is not really necessary as long as governments care about that constraint and pay back the debt accumulated during recessions in the following boom periods. Such a rule

deprives the public sector of the possibility to stabilize aggregate demand. In recessions public spending on unemployment benefit and welfare programmes automatically expands. If the budget has to be balanced this increase has to be met by other reductions, for example in public investments. The budget does not act countercyclical. On the other hand if governments without discipline accumulate increasing debt also in boom periods, it might be sensible to tie their hands with a zero budget deficit rule.

Applications

1. In principle in the long run inflation is equal to the rate money growth once we account for GDP growth ($\pi = \mu - \eta\, g$ where $\eta > 0$ stands for the elasticity of money demand with respect to income). When real money declines ($\mu - \pi < 0$) output should decline.

This is a consequence of the demand for money function. The reasoning only holds when the other determinants of the demand for money are unchanged. What happened is that inflation has not been constant over the period 1955-86 in New Zealand. The average data provided in the text conceal the fact that inflation has steadily increased, and nominal interest rates followed suit. This would imply a secular decline in the demand for real money, *despite* economic growth and the commensurate need for more real balances. Indeed it turns out that inflation in New Zealand rose from near zero in the late 1950s to more than 15% in the early 1980s. (In addition, financial innovation may also lead to the reduction of M/P over time as a fraction of GDP.)

2. This is the reliquification phenomenon which was explained in Chapter 8, Box 8.5. When inflation rises, nominal interest rates rise, and real money demand falls. As soon as hyperinflation disappears, interest rates fall, and the real money demand rises, as people regain trust in the national money. Additional evidence is provided by the exchange rate: if the exchange rate keeps depreciating, the hyperinflation episode may not be over. This was not the case in Bolivia.

3. In selecting investment projects, a firm compares the net present value (the discounted sum of future earnings) with the investment cost. As long as the former exceeds the latter, it is profitable to undertake the project and the firm will borrow. The same rationale may be applied to public investment: they generate a stream of earnings, sometimes hardly measurable in monetary terms (schools, police services...). Linking the borrowing amount to public investment is a way to reduce the default risk. In this case, a link is established between the asset and liability sides of the government's balance sheet, and the government's net debt does not vary very much.

4. By issuing debt in Italian Lira, the government retains the possibility of defaulting or monetizing the debt. In order to protect itself, the private sector insists on debt of shorter and shorter maturities (this is a kind of indecision). When the debt is issued in foreign currency, the government can still default (but lenders may take punitive actions) but cannot monetize any more the debt. This commitment improves its credibility.

5. Ruling out devaluation of the Belgium franc *vis-a-vis* the Deutsche Mark practically amounts to ruling out the monetization option. However, recall from Chapter 15 that there are only three ways to stabilize debt: running primary surpluses, money financing and default. Under a hard "Belgian Franc" and ruling out default, cutting the budget deficit is the only solution. By tying its hands this way, Belgian politicians may find it easier to justify tough fiscal programs to their constituents.

The announcement of a permanent parity does not entail time-consistency problems. Once it is believed, the government has no particular incentive to generate a primary budget surplus. One way of checking the credibility of the policy is to compare yields on Belgian long term bonds with those in Germany. The difference has narrowed in recent years, suggesting that financial markets count Belgium "in".

6. This is a perfect illustration of time-inconsistency: once trade unions and employers have agreed on a "social contract" with moderate wages, the optimal policy is to create surprise inflation which boosts the economy. Furthermore, the tax cut itself may increase the likelihood of a surprise inflation if it is not matched elsewhere by spending cuts.

7. Debt stabilization policies are costly and unpopular. Each interest group (workers, rentiers, exporting firms...) tries to shift the burden onto others. When the political system - as in Italy - is fragmented and unstable and when governments do not stay in place for a long time, they are tempted not to undertake any anti-deficit measures, shifting the burden onto their successors. The result is often a deadlock, sometimes called war of attrition. As time goes on, the burden of not adjusting becomes so large that one group concedes. Political durability is therefore crucial in limiting the social cost of the adjustment. Italy may have to modify its electoral system which is a key determinant of government durability, in order to tackle the debt problem. (The argument follows the article by Alberto Alesina and Allan Drazen, "Why Are

Stabilizations Delayed", *American Economic Review*, Dec. 1991, p. 1170-1188.)

8. This is a typical time-inconsistency problem: the government wants to increase the level of employment by facilitating the possibilities of firms to dismiss workers. However, as long as firms do not believe that the change in legislation is permanent, they will refrain from employing more workers. Once more workers are employed it would be easy for the government to introduce new regulations making it costly again for employers to dismiss workers. In that case the government had reached both goals, higher and secure employment.

CHAPTER 17

SUPPLY-SIDE AND UNEMPLOYMENT POLICY

EXERCISE SOLUTIONS

1. We need to distinguish between the two exchange rate regimes. Note that in the following figures the horizontal axis represents output, not the output gaps.

- Fixed exchange rates. In Figure 17.1 (a) the long run aggregate supply curve shifts to the left from LAS* to LAS** corresponding to the old and new trend output Y* and Y**, respectively. The new long run equilibrium is entirely characterized therefore given the foreign inflation rate π^* (point C). The short run is described by the AS curve associated to LAS** and by the AD curve which may be slower to adjust if agents take time to recognize that their wealth level has been reduced and that they have to permanently reduce spending. The economy moves to point B where inflation is above its trend level and where output falls because the real exchange rate appreciates and the economy's competitiveness declines. From there up to point C, the dynamics may become somewhat complex as the AS curve shifts leftward (core inflation catches up with actual inflation). After the transition the economy has to end up in C. If the AD curve adjusts immediately to its new equilibrium value, there are no dynamics: the economy jumps from point A to point C.

- Flexible exchange rates. As above, the long-run supply curve shifts to the left from LAS* to LAS**. Long-run inflation is now determined by the domestically determined rate of money growth (μ). As long as the long-run rate of growth and the money growth rate are unchanged, the long-run inflation rate does not change. The AD curve eventually shifts to the left. Under these assumptions the short and long run effects are the same as under fixed exchange rates. The dynamics will also be similar but the mechanism is different. Now inflation leads to nominal depreciation and to a reduction in the real money supply. High nominal and real interest rates depress demand and the AD curve gradually move to the left until it stabilizes at point C in Figure 17.1 (b).

A permanent increase in the rate of inflation could occur if the government misunderstood the decrease in equilibrium output and tried to stop the decline in output with a permanently expansionary monetary policy.

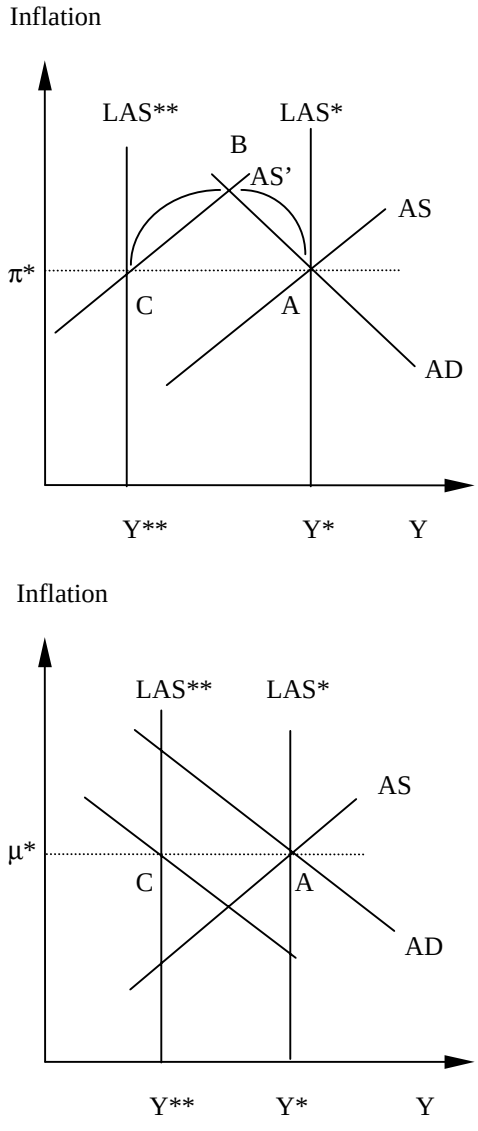


Figure T 17.1 (a) and (b)

2. In order to assess the supply side effect, one has to compare the respective distortionary effects of both taxes:

- Reducing social security contributions reduces the labour tax wedge. Employment and take-home wage

(before income tax) rise from w_0 to w_1 along S_0 (the supply of labour in terms of take-home wages) as the supply in terms of gross wages shifts from S' to S" in Figure T17.2. (Note that the wedge is the vertical distance between S_0 and S' or S");

- Increasing income taxes, which usually are progressive, may have offsetting effects as people will tend to reduce their labour supply (or will turn to the black market). In Figure T17.2, the labour supply schedule is cut back from S_0 to S_1 which reduces employment and increases the take home wage to w. In the limiting case where trade unions are powerful enough to fully protect the after-income tax wage, the income tax burden is entirely shifted onto firms which lose in wages what was gained in social security contributions and nothing changes. It should be stated, that in the longer run, capital is likely to be more mobile and the labour demand curve is likely to be highly elastic, so that tax burdens fall entirely on labour.

take home wage

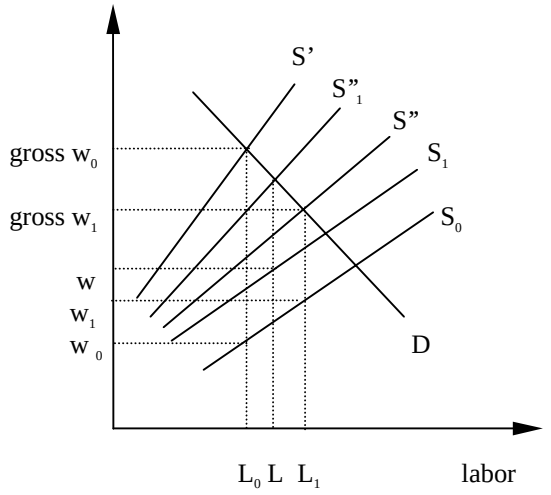


Figure T 17.2

3. This is a time inconsistency problem. Once apartments are built, the government has an incentive to impose rent controls (to gain favour with urban voters, for example). It is almost like taxing existing capital: rent controls on apartments already built are non-diversionary with respect to the existing stock of dwellings. Because this can be anticipated, the outcome is an inefficiently low production of new apartments. If the government commits credibly to never impose rent controls, it solves the problem. However, in democracies with changing governments achieving credible commitment may be very difficult.

4. Gasoline demand and labour supply are more inelastic than jewelry demand and capital income, respectively. They should be taxed more heavily. Note that the Ramsey principle can lead to politically difficult situations: necessities such as food, fuel and housing are all characterized by low price elasticities of demand. Taxing these heavily leads to severe inequality across individuals in society, and this may not be tolerable to a majority of voters.

5. When the minimum wage is above the equilibrium wage, it reduces employment leading to unemployment especially among the youth and unskilled workers (recall Chapter 6). This reduction in employment corresponds to a lower level of equilibrium output as long *as there is no alternative sector to which resources can turn*. In economies with lax enforcement of such laws, the underground economy will benefit, and unreported and untaxed economic activity will result. A similar outcome can be isolated for an increase in union wages; here activity is driven into the non-unionized sector, which may either be other industries or smaller plants in the same industry.

6. The problem was to identify point D on the Laffer curve (Figure 17.7 in the text). Ex post, it appears that the US economy was on the left side of the curve. In countries with very high tax rates, chances are greater of being on the right branch. This is why a tax reduction may have increased tax receipts in Sweden where average and marginal income tax rates were very high in 1988 (50.8 and 77.4 respectively).

7. Immigration simply increases labour supply and exerts downwards pressure on wages and leads to a rightward shift of the LAS curve. This is why trade unions are often reluctant to accept massive immigration. Yet in a country in which the birth rate is declining, controlled immigration may be an important source of new workers and therefore economic growth (think of the Solow decomposition of Chapter 5).

8. Recall Box 7.6. By subsidizing manufacturing industry, Norway was able to prevent the exchange rate appreciation which characterizes the Dutch disease and does harm to domestic competitiveness. This loss of competitiveness will reduce the importance of the traded goods sector for a long time. Especially if the Dutch disease is perceived as being temporary (as in the case of Holland) and if large costs of adjustment are associated with shrinking the traded goods sector, such a policy may be good supply side policy as well.

9. The equilibrium rate of unemployment is composed of many different forms of unemployment. The

problem is to identify which type of unemployment is the most important in order to find the appropriate unemployment reducing measures. Following a selection of causes and remedies of unemployment are considered.

- While people look for work they may be frictionally unemployed. A certain amount of search unemployment may be efficient since it increases the probability of more favourable job-worker matches. The problem is that they do not have perfect information on vacancies. Frictional unemployment could be reduced by improving information about job openings. For example local labour offices could be connected via the internet, so that searchers can easily obtain information on jobs in other regions and cities. In some countries like Germany it is being discussed whether private job placement services can improve job search conditions.
- Unemployment caused by wages above market clearing levels can be reduced by either lowering the minimum wages or by moderate wage agreements between trade unions and employers associations. If the employed workers (insiders) primarily negotiate wages with employers and care about wages rather than unemployment (the outsiders), wages may not fall even with high levels of unemployment. Also non-wage labour costs like social security contributions may lead to lower than market-clearing unemployment.
- High vacancy rates with simultaneous high unemployment may indicate that there exists mismatch: labour supplied is not the type of labour that is demanded. Mismatch unemployment may be caused through structural change; there are always expanding and shrinking industries which may demand different types of labour. Hence, workers becoming unemployed may not find a job in expanding sectors due to a lack of qualifications. Public training and qualification programmes are means of providing the labour market with the type of workers that are demanded. As it is impossible to perfectly foresee labour demand and because the quality of training programmes is difficult to supervise, training programmes are not always successful.
- It is sometimes assumed that the equilibrium rate of unemployment includes many long-term unemployed. Having been unemployed for a long time most probably signals to employers that the worker is not productive enough. Longer unemployment spells also stops the process of human capital accumulation and the stock of human capital only depreciates. Therefore qualification programmes might be helpful. Moreover, the workers need some help to get back into the labour market, maybe with the help of public employment programmes. Certainly also these measures do not necessarily increase employment. Private firms sometimes complain that employment from the first labour market is simply shifted to the second labour market harming private businesses, who have to compete with subsidized employment.

CHAPTER 18

FINANCIAL AND EXCHANGE MARKETS

EXERCISE SOLUTIONS

Theory

1. Bid-ask spreads compensate financial market intermediaries for the costs of providing market-making services. See Section 18.4.3.2. Besides covering fixed costs bid-ask spreads also compensate for the exposure to risk involved in trading activities. This should not be confused with the risk premium which compensates investors for holding volatile assets. The bid-ask spread compensates traders for risks involved in the physical distribution or for holding inventories of assets. When holding inventories traders are forced to have an open position and are exposed to price risk. This also explains the narrower spread in inter-bank or institutional markets where transactions have generally larger volumes, do not require physical delivery, and positions are generally closed within the trading day.

2. Spatial arbitrage is the easiest one to exploit; one simply compares returns on the same asset in different markets. However, in order to take advantage of such arbitrage opportunities, one needs access to the relevant markets, which may span national borders and different regulatory regimes. In most sophisticated markets, the transactions costs involved are small enough so that prices and yields in these markets (for example Eurodollars and US Federal Funds) move lock-step with each other.

Triangular arbitrage is limited by the existence of large bid-ask spreads: trading across three exchange rates involves paying the spread three times.

Yield arbitrage is more difficult. Suppose that you are able to identify assets with the same characteristics, then yield arbitrage should drive together prices of such assets. While this is obvious in the case of Euro- or domestic interest rates, it is much more difficult on the stock markets, where *risk* must be estimated; how can one really be sure that two assets bear the same risk? If this is not the case, the trade is no longer truly arbitrage.

Therefore, when bid-ask spreads are low and high technology available, triangular and spatial arbitrage may be more profitable.

3. All three assets are financial derivatives, which entail the delivery of underlying assets in the future and/or under some prespecified conditions.

Financial futures are contracts for future delivery, which are traded in standardized amounts and with fixed delivery dates. Usually a margin of the face value of the futures contract is paid upfront, and traders have to make additional payments when the market turns against them.

A call (put) option entitles the owner to buy (sell) an underlying asset at a predetermined strike price until the option expires. Options need not to be exercised, hence the maximal loss to be experienced by the holder of an option is the price of the option itself. A call (put) option will only be exercised when the market value of the underlying asset rises above (falls below) the strike price. (for further discussion see the textbook, Sections 18.4.2.3 and 18.4.2.4).

4. We start by deriving the arbitrage relation between long and short term interest rates. Denote by i_t the interest rate between year t and year $t+1$, and denote by i_{kt} the k year interest rate between year t and year $t+k$. At time t, both i_t and i_{kt} are known with certainty, while future short term interest rates i_{t+j} have to be forecasted. Denote by Ei_{t+j} the expected interest rate between year $t+j$ and year $t+j+1$. An investor may either invest for k years directly, buying a long term security, in which case the rate of return is i_{kt}, or invest for one year and then roll over the investment to year $t+1$ and $t+2$ and so on until year $t+k$. In the latter case, the (periodic) rate of return is:

$$[(1+ i_t)(1+ Ei_{t+1})...(1+ Ei_{t+k-1})]^k - 1$$

or approximately $(i_t + Ei_{t+1} + ... + Ei_{t+k-1})/k$.

If the investor is risk neutral (which implies that there is no risk premium for longer term securities), or if there is no uncertainty (the Ei_{t+k} are set to be equal to the

i_{t+k}), the expected returns of both strategies (buying a short term security or rolling over short term investments) must be equal. This is an arbitrage relation:

$$i_{t+k} = (i_t + Ei_{t+1} + ... + Ei_{t+k-1})/k$$

The long run interest rate is roughly equal to the sum of short terms expected interest rates. The relationship between short and long term interest rates describes the simplest version of the so-called *expectations hypothesis* of the term structure of interest rates.

Recalling from Chapter 8 that the short-run interest rate is determined by the *Fisher principle*: $i=r+\pi^e$, where r and π^e stand for the real interest rate and the expected inflation rate, respectively. Thus, long term interest rates depend both on the expectations of future real interest rates and inflation.

5. (a) With insider trading, prices will new information reflect more rapidly, as these information are not yet publicly available. This increases market efficiency. However, insiders will often earn abnormal profits (they 'beat' the market), which means that non-informed traders will lose on average. The information asymmetry systematically put outsiders at a disadvantage. The increased perceived overall riskiness will possibly show up as a higher bid-ask spread, which will reduce liquidity and increase transaction costs. It can be thought of as a "tax" on trading.

Finally, there is a potential conflict of interest for firm managers, who have a fiduciary responsibility to shareholders. If they were allowed to trade in an unrestricted way, they could easily earn large fortunes by manipulating the timing of announcements and other events and trading on this basis.

(b) Participants in a foreign exchange market are physically unidentifiable, since there is no physical presence and transactions may occur all over the world. Moreover, the daily turnover on exchange markets is extremely high. Tracing insider trading would be very difficult to implement. Finally, in foreign exchange markets, government institutions, such as central banks, often intervene (using insider knowledge) to achieve policy objectives.

6. Markets seem to overreact to the latest information. One may look at the sharp stock markets daily volatility following the release of economic data for instance, or following some major political event, which is often reversed over time. On the other hand, the Danish 'nej' to the Maastricht agreement increased the forward discount on European currencies *vis-à-vis* the Deutschmark, as convergence expectations towards a monetary union were postponed. This turned out to be a correct assessment of the events to follow.

Financial markets seem 'more volatile' than the fundamentals would justify and efficiency theory would assert. This was first emphasized by Robert Schiller in a series of papers in the late 1970s and early 1980s. Others have sought to find underlying behaviour of the fundamentals which might nevertheless be consistent with such volatility.

7. A new car is a durable good: it provides a stream of services. Therefore, almost like an investment project, its price should equal the discounted sum of services, assuming one can calculate their monetary equivalent. As time passes, its price declines as the value of these services declines (obsolescence, less reliability, higher probability of breakdown, etc.).

An old car is an asset just like a stock, an artwork or a stamp. Its price today reflects its expected price tomorrow. Car collectors buy old cars with a look at their resale value. However, unlike stocks or bonds, their price is more likely to reflect a *speculative* bubble, since the fundamental value of an old car (the discounted sum of future services) is close to zero.

8. In a deep market, investors cannot drive prices far away from their fundamentals (unless all investors try to drive the price away, in the same direction; this is the case of a *speculative* bubble). Each investor may be considered small enough not to have any market power.

In a thin market, this is no longer the case, and a single investor can, possibly for a long time, drive prices away from their fundamental values. Prices in thin markets are likely to be much more volatile and much more sensitive to the overall volume of trading and the size of individual trades.

In addition, the depth of a market may be reflected in the size of the bid-ask spread, which reflects the risk of traders finding a suitable trading partner and transaction costs.

9. (a) The expected price of the asset tomorrow is:

$$E_t q_{t+1} = s\,0 + (1\text{-}s)\,q_{t+1} = (1\text{-}s)\,q_{t+1}$$

The arbitrage condition (for a risk neutral investor, an averse one would require a premium, as the asset is riskier than the government bonds) is:

$$(E_t q_{t+1} - q_t)/q_{t+1} + d/q_t = r$$

The first term is the expected capital gain, while the second is the dividend yield. Plugging the expected asset price into the arbitrage relation yields q_t:

$$q_t = (1-s)/(1+r)\, q_{t+1} + d/(1+r) .$$

The asset price tomorrow (if the bubble keeps growing) depends on the bursting probability s. As s increases, q_{t+1} must increase, in order to keep the expected rate of return in line with r.

(b) We have two methods to calculate the non-exploding value for q_t: *(i)* we iterate the arbitrage relation:

$$q_t = [(1-s)/(1+r)]^k\, q_{t+k} + d/(1+r)\, \{1 + [(1-s)/(1+r)] + [(1-s)/(1+r)]^2 + ... + [(1-s)/(1+r)]^{k-1}\}$$

We obtain the non-exploding solution by letting the first right hand side term go to zero as k approaches infinity (implying that the asset price cannot rise fasterthan the real rate of interest): $q_t = d/(s+r)$

(ii) The second method is more intuitive but easier. Assume the real dividend d is constant. Thus, it follows that the fundamental value will be constant over time. Let q be this constant. Replacing q_t and q_{t+1} with this q in the arbitrage relation, one can find the non-exploding asset value.

Applications

1. One can construct a *triangular arbitrage* opportunity from the FF/$ and the FF/DM exchange rates. Without transaction costs we know that the DM/$ should be the same as that when purchased through French Francs, or

$$(5 \text{ FF/\$})/(3.4 \text{ FF/DM}) = 1.4706 \text{ DM/\$}.$$

As long as the $/DM rate is 1.48 DM/$, it is profitable to buy FF with DM, to sell FF for dollars, and to sell dollars for DM. Initially selling DM 1000 yields a profit from arbitrage of DM 6.39.

The profit opportunity will disappear as either the Dollar appreciates and/or the Deutschmark will depreciate *vis-à-vis* the Franc.

2. When bid-ask spreads are taken into account the two strategies of triangular trading can be distinguished: (*i*) we could by Deutschmark via dollars, selling FF 5.00/$ at the ask rate and buying DM 1.478/$ at the bid rate. This strategy yields an implicit exchange rate of (FF5.00/$ / DM1.478/$ =) FF 3.3829/DM, which is cheaper that buying DM directly from FF at the bid rate of 3.395. Hence, there is an opportunity of arbitrage profits. (*ii*) we could buy dollars via Deutschmark, selling FF 3.405/DM at the ask rate, and buy dollars at the ask rate of DM 1.479/$. This strategy yields an effective FF/$ exchange rate of (3.405×1.479 =) 5.036, which is more expensive than the bilateral ask rate of FF 4.9925/$. Hence this strategy would result in a loss.

3. Recall from Theory question 4 *the expectations hypothesis* of the term structure of interest rates. By an arbitrage argument and given that investors are risk neutral, expected returns for short and long term Treasury bills must be equal. Assume an investor can choose, either to buy a two-year Treasury bill at 7% interest at a face value of 100 Euro, which will yield 114.5 Euro at maturity, or to buy a one-year Treasury bill at 5% interest and reinvest the pay-off at the expected one-year interest rate for the second period. Since the expected pay-offs of both strategies must be equal, it follows that the expected one-year interest rate for the second period is expected to be 9.04%.

4. The Danish crown is expected to depreciate *vis-à-vis* the Swiss Franc: the forward price of Swiss Francs is higher than the spot price. Hence, we have a discount on the Danish crown. The per annum equivalent is:

$$(F_{t,t+1}/E_t)^4 = 1.0547.$$

The discount per annum is 5.47%. Holding the crowns in cash over the period, the per annum rate of return on this trade is -5.47%.

5. A 4.6% premium p.a. means that: $(F_{t,t+1}/E_t)^{12} = 1 - 0.046 = 0.954$. With a spot rate of 5.05, the 1 month forward rate is $F_{t,t+1} = 5.03$.

6. Be careful: we have to compute the Sterling forward discount. *Vis-à-vis* the French Franc and in European terms, the spot rate is 0.1 £/FF while the forward rate is 0.101 £/FF. The forward discount is 0.0101. The forward discount is 4.06% p.a.

As the interest rate differential (2%) is less than the forward discount, it is profitable to borrow Sterling and to invest in French assets for three months: *the covered interest parity* condition fails to hold in this case giving room to arbitrage activities.

7. This exercise will illustrate a widely used method in finance, based on the *no-arbitrage-opportunity* principle. We construct a portfolio with no initial net assets (by selling some assets short while buying others at the same time). For simplicity we ignore discounting. As this portfolio is free, its expected return must be zero. Otherwise, an arbitrage opportunity appears (a 'money pump': without initial funds, the return is infinite).

Suppose we make a portfolio by selling a call option on one Sterling at 3 DM in one year. With the

price of the call (C), we buy Sterling cash and hold it. With a spot rate of 3, we can buy C/3 Sterling. At the end of the year, we have two cases: *(i)* The exchange rate is now at 3.1 DM/£. The call will be exercised and we will have to give one Sterling for 3 DM. The portfolio is now worth: V_1=(C/3 - 1) *3.1 + 3.

The exchange rate has fallen to 2.95 DM/£ and the call option will not be exercised. In this case, the portfolio is worth: V_2 = C/3 * 2.95.

(ii) Ignoring discounting, the expected value of the portfolio is 1/2 V_1 + 1/2 V_2 and must equal zero by the *no-arbitrage-opportunity* principle. This allows us to compute the call price,

C = 0.1 * 3 /(2.95 + 3.1) = 0.0496 DM.

CHAPTER 19

EXCHANGE RATES IN THE SHORT RUN

EXERCISE SOLUTIONS

Theory

1. Along the MM schedule, financial and money markets are in equilibrium. Starting from point *A* moving to *B* in figure T19.1, the current exchange rate depreciates at an unchanged price level. The domestic nominal interest rate falls and the real money demand increases. For every point above the MM schedule, the money market is in excess demand. Symmetrically, for every point below the MM curve the money market is in excess supply.

The same reasoning applies to the GG curve. We have an excess demand for domestic goods above the GG curve and an excess supply below.

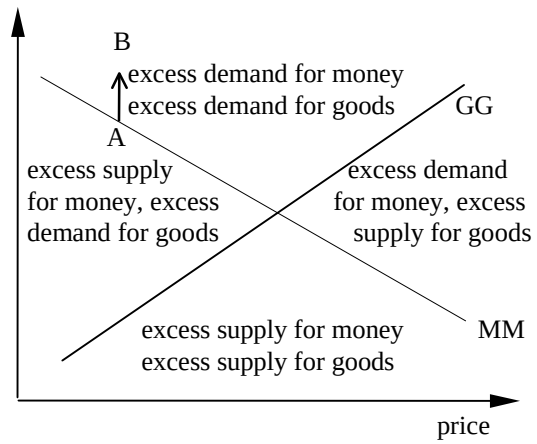


Figure T19.1

2. (a) At *C* in Figure 19.6, we have an excess demand for goods. Moving from *C* to *A*, the price level rises. Keeping nominal money stock unchanged, the real money stock declines.

(b) The domestic interest rate converges from below towards its long-run equilibrium level *i** (the foreign nominal interest rate). The nominal exchange rate is initially above its long-run equilibrium level. Thus, the domestic nominal interest rate is below the foreign one.

3. (a) We obtain the MM curve by rearranging the equation representing money market equilibrium as

$$E_t = E_{t+1}/[1-i^* - (M/P - 0.5\bar{Y})/30{,}000]$$

Figure T19.3 shows the MM curve as a decreasing line. When money supply increases from 2000 to 3000 the MM schedule shifts upwards.

(b) For given values of P^* and λ the GG schedule is described by $E_t = 2P$ as shown in T19.3, the initial long-run equilibrium is at A.

(c) Inserting the equation for equilibrium in goods markets into the money market equilibrium and solving we get $E_t = 170/164 = 1.04$ and $P_t = 85/164 = 0.52$, initially, and after money supply is increased to 3000, the exchange rate depreciates to $E_t = 180/164 = 1.10$ and prices rise to $P_t = 90/164 = 0.55$, compare point A' in Figure 19.3.

(d) With sticky prices in the short run an increase in money supply the economy instantaneously jumps to *B* in Figure T19.3. The exchange rate depreciates immediately above its long-run equilibrium value to restore money market equilibrium (it overshoots to a value of $E_t = 1.11$). As prices increase gradually (excess demand of domestic goods), real money balances are reduced. To maintain money market equilibrium, the interest rate increases requiring an exchange rate depreciation to its long-run equilibrium level *A'*.

4. Yes. An increase in money supply triggers a fall in domestic interest rates, and an increase in the price level. In the long run, however, the inflation rate depends on the rate of money growth, which is unchanged (a once-for-all increase in money supply does not change the speed at which money is created except briefly). As inflation is unchanged in the long run, the rate of depreciation returns to its previous level. Finally, interest rate parity implies that the interest rate will revert in the long run towards *i**.

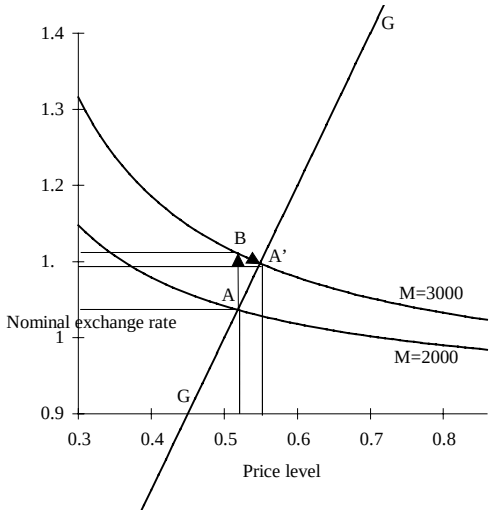


Figure T19.3

5. The money supply contraction shifts the MM curve down and to the left in Figure T19.5. The new long-run equilibrium is point B. Long-run neutrality implies that the price level and the nominal exchange rates both fall to the point where the real money supply and the real exchange rate are unchanged.

In the short run, the dynamics depend on the degree of price flexibility. When prices are fully flexible, short- and long-run outcomes are the same. The economy directly jumps to point *B*. When prices are completely rigid, the short-run outcome is point *C*, where the money market reaches equilibrium. The initial money contraction increases the domestic interest rate, which leads to an expected depreciation. As point *C* lies below the *PPP* curve, we have an excess supply of goods which will gradually push down prices. The nominal exchange rate must initially overshoot its long-run equilibrium level in order to make an expected depreciation possible. Interest rates initially rise before reverting towards their long-run level.

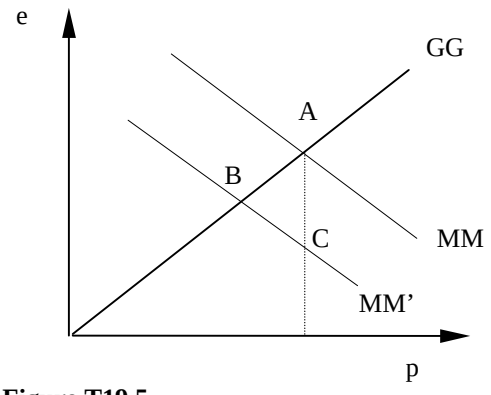


Figure T19.5

6. This is a hard question and we only sketch the answer. An increase in the growth rate of the money supply starting from zero to μ has aspects similar to overshooting induced by a level increase in the money supply.

The first step is to consider the steady state. As in the text, we assume a constant foreign price level and interest rate, and ignore domestic output growth. In the steady state, inflation is equal to money growth. The exchange rate depreciates at a constant rate equal to $\varepsilon = \mu = \pi > 0$. Because of interest parity ($\varepsilon = i - i^*$) domestic interest rates increase above foreign rates and stay permanently higher. This in turn implies that real balances are smaller than before, so that at some point during the adjustment $\pi > \mu$. But μ is constant throughout, so π rises from 0 to some level above μ temporarily, then converges from above to μ. Thus there is an overshooting of the inflation rate with respect to its long-run level. For relative PPP to hold the same has to be true of the nominal exchange rate, and therefore the rate of nominal exchange rate depreciation. If this is true, then $i > i^* - \mu$ for some time.

7. If the domestic interest rate includes a risk premium ψ the *UIP* modifies to:

$$i = i^* + ({}_tE_{t+1} - E_t)/E_t + \psi$$

An increase in ψ pushes the interest rate up and reduces the demand for domestic money. This shifts the MM curve up and to the right in Figure T19.7. In the long run, at point *C*, the exchange rate has depreciated as domestic assets are less attractive. In the short run with sticky prices, the exchange rate can overshoot (point *B*).

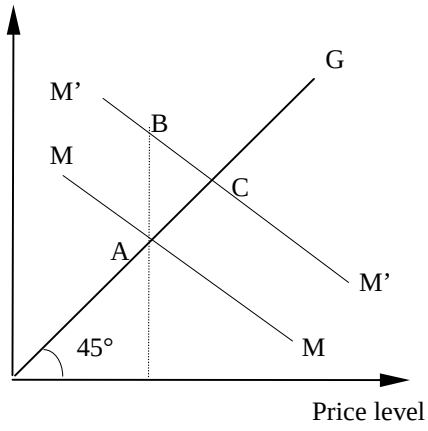


Figure T19.6

8. A permanent increase in output raises money demand: the MM curves shifts down as in Figure T19.5. The long-run effect is a price reduction and an exchange rate appreciation (point B). In the short run, depending on price flexibility, the exchange rate may overshoot its long-run appreciation (point C).

The reasoning assumes that the long-run real exchange rate does not change. Yet, a permanent increase in output may increase *wealth*, which may modify the long-run real exchange rate. See exercise 9.

9. This question is designed to provoke discussion among students. The long-run effect on the real exchange rate depends upon issues developed in Chapter 7. For the sake of the argument, assume that the real exchange rate depreciates in the long run. The GG curve rotates counter-clockwise in Figure T19.9. Prices will fall even more in the long run, while the nominal exchange rate may rise or fall.

It is not, however, entirely clear whether an increase in output will necessarily lead to a real depreciation or an appreciation. The students should understand that it is important to specify the sector in which the increase in output has occurred. If the relevant distinction is *exportables* versus *importables*, and the increase in output occurred in the exportables sector, it is likely that a real depreciation will be required in order either to clear the market for exports, or to meet the intertemporal budget constraint. A similar story can be told if, the relevant distinction is between *tradable* and *nontradable* goods and the productivity increase occurs in nontradables. On the other hand, if higher productivity occurs in tradables, wealth and the demand for nontradables increases and the real exchange rate will appreciate in the long run.

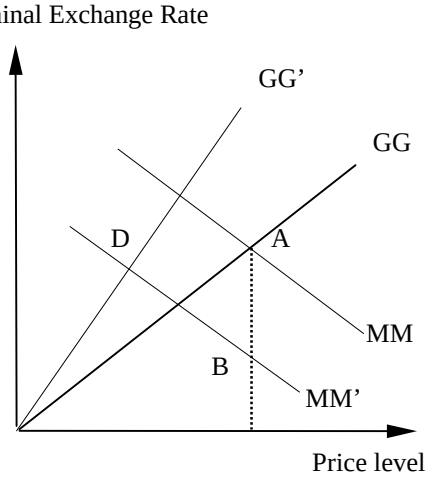


Figure T19.9

10. The discussion in Chapter 11 ignored the overshooting phenomenon. The assumption there was that whenever domestic interest rates exceed the foreign interest rate, the exchange rate immediately appreciates, and whenever domestic interest rates fall below world levels the exchange rate immediately depreciates. Chapter 19 introduces some dynamics and replaces the assumption of an immediate change in the exchange rate by a whole path, with overshooting in the short run (resulting from sticky prices) and a compensating move in the opposite direction thereafter. Thus while the *IS-LM* model for the open economy introduced in Chapter 11 captures all the important points qualitatively, the dynamics are less realistic than in this chapter. Most important, the Mundell-Flemming model of Chapter 11 implies the possibility of earning limitless arbitrage profits.

11. This is the so-called 'peso problem'. It occurs when a very large depreciation or appreciation may happen, although the probability of such an event is very small, and may have never occured in the past (so that history doesn't help us forecast very much). Therefore, the forward rate, which embodies expectations of the future exchange rate, may differ significantly from the spot rate. As long as this event does not materialize, and remains quite unlikely there is no way to assess for sure what moves the forward rate. This phenomenon was first noticed in the late 1970s in a study on the fluctuations of the Mexican peso. For a long period, the peso was pegged to the dollar. Yet, a persistent forward discount was observed on the peso until a sharp devaluation occurred in August 1976. In this case, *ex post* the large discount was rationalized. (cf. J. Lizondo, "Foreign Exchange Futures Prices under Fixed Exchange Rates", *Journal of International Economics*, Feb. 1983, p. 69-84.)

12. A real disturbance which triggers a long-run appreciation (λ decreases) rotates the GG clockwise. Note that $\bar{y}$ is unchanged so that the MM curve remains in its original position. When prices are sticky in the short run, the nominal exchange rate will overshoot to point *B* in Figure T19.12(a): the nominal exchange rate appreciates below its long-run value. At *B* there is an excess demand for goods which will eventually increase domestic prices. At the end of this process goods and money markets are in equilibrium, *C*.

Recall the analysis of the current account function in Chapter 7: an exogeneous and unexpected increase in external debt causes a long-run real depreciation of the domestic currency in order to meet the intertemporal budget constraint, T19.12(b). Hence, the GG schedule rotates counter clockwise.

What happens in the short-run depends on the nature of the shift in external debt. Suppose the government surprisingly increases public spending financed through increasing foreign debt. With sticky prices this would increase output and real money demand. In Figure T19.12(c) the MM schedule shifts down, short-run equilibrium is at *B'*. The nominal exchange rate appreciates and overshoots.

In the long-run, prices gradually adjust and the real exchange rate depreciates, the GG schedule rotates counter clockwise to *C'*. While prices decline, the long-run effect on the nominal exchange rate is ambiguous in this example.

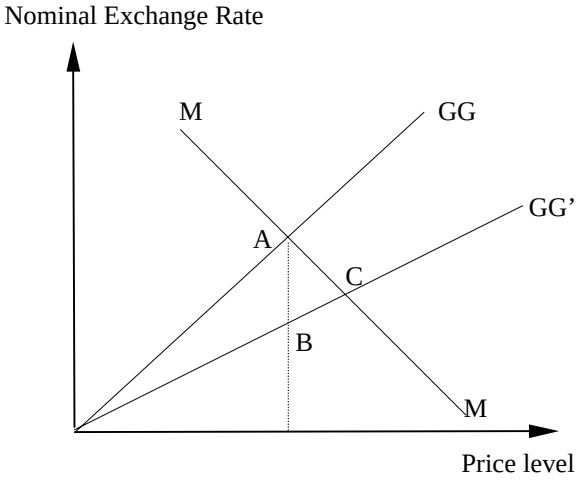


Figure T19.12 (a)

Applications

1. The covered interest parity condition does not hold: the quarterly forward discount is at $1.01^{1/4}-1 = 0.249\%$. If investors can borrow FF, exchange them against DM, lend in DM for three months and sell the proceeds forward against FF, they have found a "money pump". This strategy involves no risk as all since the interest rates, the spot and the forward rate are known with certainty.

2. There is no profit opportunity: the covered interest parity relationship holds. However, the exchange rate

between Francs and Deutschmarks is fixed within narrow band inside the *ERM*. The forward and the spot rates should be equal. Under uncovered interest rate

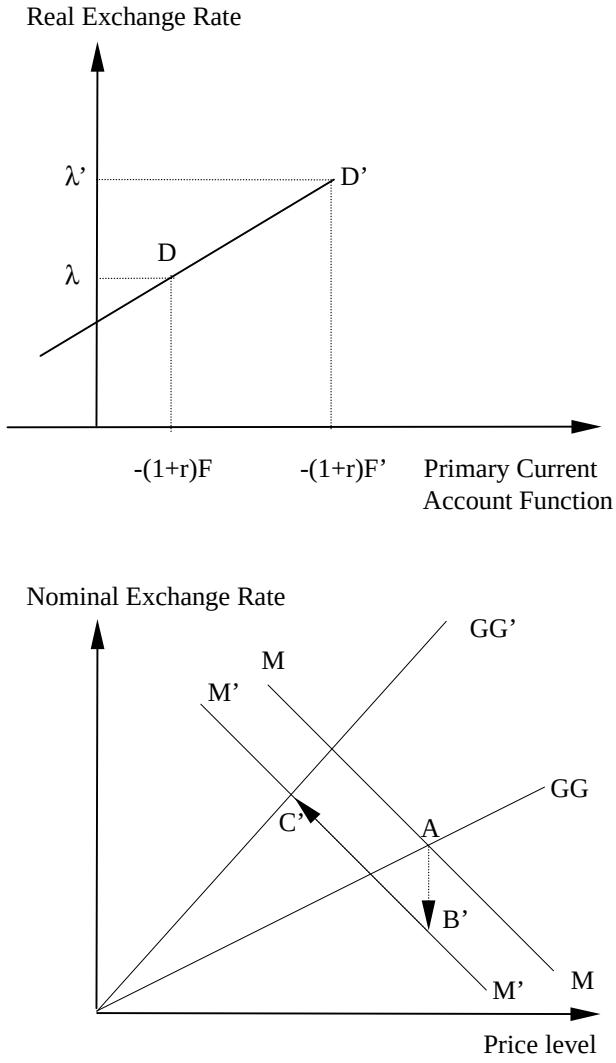


Figure T19.12 (b) and (c)

parity, persistence of a forward discount on the Deutschmark indicates that the market assigns some positive probability to a devaluation of the German currency (see Exercise 11 in the theory section above). Alternatively the market assigns a risk premium to German assets.

As long as markets believe that the exchange rate will remain fixed for the next three months, uncovered interest parity does not hold and it is possible to make a profit by borrowing Francs and lending DM. But this is risky since the DM position is not covered with a forward contract. Thus this is not really an arbitrage opportunity.

3. Medium to long-term are more important when buying a foreign business. In the long-run PPP holds - at least in its relative form - and exchange rate movements do not matter. In the medium run, though, one must recall the fact that exchange rates tend to overshoot, which explains part of their volatility. Therefore, and quite trivially, the company will be better off buying after a sharp and sudden appreciation (of the domestic currency), which will probably be followed by a smooth depreciation.

4. The Fisher equation comes from a combination of uncovered interest parity and purchasing power parity (in its relative form). As PPP comes into play, the Fisher equation is a medium-term relation. In the short run, either PPP or UIP or both are wrong. Then, either the inflation rates will converge and the PPP will be satisfied, either financial markets will recognize that in the United States inflation is higher than in Germany and put a forward discount on the Dollar, in which case the UIP will be satisfied.

An alternative interpretation is the existence of a risk premium. Suppose instead that current and future inflation are equal. Since the long-term ex-ante real interest rates in Germany are higher than in the US, this provides a positive risk premium required by international investors for placing long-term funds in Germany.

5. The interest rate on US bonds for ten years is $i = 136.7\%$ $(=(1+i)^{10}-1)$. The corresponding rate on German bonds is $i^* = 115.9\%$. Therefore, the expected depreciation of the US $ *vis-à-vis* the DM over the ten years (as long as the UIP holds) is:

$$({}_tE_{t+10}-E_t)/E_t = i_t - i^*_t = 20.8\%.$$

On a per annum basis, it is 1.9%. As five years bonds yield 8% in both countries, no exchange rate variations is expected over the next five years. This may be reconciled with the ten year depreciation for two reasons:

(i) First, expected inflation rates may be roughly equal for the next five years (no expected deviation from the PPP), and the US inflation rate may be expected to rise above the German between the fifth and the tenth year, leading to a nominal depreciation of the Dollar.

(ii) Second, agents may be more risk averse in the long run than in the medium run. In this case, the UIP holds for five years, while we have a risk premium on the ten years returns:

$$i_t = i^*_t + ({}_tE_{t+10} - E_t)/E_t + \psi_{t,t+10},$$

As long as the exchange rate expected to prevail does not change $({}_tE_{t+10} = E_t)$, the interest rate differential is equal to the risk premium.

6. Clearly, under the assumption that the covered interest parity holds, the three-month forward premium is 1% on a per annum basis. Danish and Swedish interest rates on a quarterly basis are given by $[(1+i)^{1/4}-1] = 1.59\%$ and 1.82% respectively. With a spot rate of 0.85 DKK/SEK, we calculate a value of 0.848 DKK/SEK for the three-month forward rate.

7. As before, we have to calculate the respective interest rates over the six month period: this yields a value of 2.71% for German and 3.44% for the UK interest rates. Assuming that the UIP holds, and participants in financial markets do not demand a risk premium, the spot rate would be at 1.813. The Deutschmark is expected to appreciate *vis-à-vis* the Sterling.

Suppose the Bank of England pursues a policy which 'targets' the spot exchange rate at 1.82 and assuming that exchange rate expectations do not change, it should raise interest rates to 7.77%.

CHAPTER 20

THE INTERNATIONAL MONETARY SYSTEM

EXERCISE SOLUTIONS

1. See section 20.4 for a short discussion of pros and cons of fixed and flexible exchange rate systems. Recall also the Mundell-Flemming box (Table 11.4) and the alternative interpretation of policy interventions as exogenous shocks.

2. Most developing countries have pegged their domestic currencies to the currency of an industrialized country or to a basket of currencies, combined with tight foreign exchange controls. One possible reason for doing so was the intentions of governments to conduct commercial policy via exchange rate arrangements. Another is imperfect capital markets in these countries.

Developing countries' exports typically consist of a small number of natural resources or agricultural goods, of which prices are generally more volatile compared to those of manufactured goods. Such dependence creates macroeconomic problems since price changes may have severe negative effects on real income and the current account position.

With fixed or pegged exchange rates, declining export prices will have an negative effect on the terms of trade position of a developing country, reducing real income and leaving the country with a current account deficit. Especially when a terms of trade deterioration is permanent, it may be useful to rely on the role of floating exchange rates a stabilizer: a depreciation of the domestic currency will counteract the adverse effects of declining export prices. In contrast, if price movements are only transitory it may be preferable to have fixed or pegged exchange rates for reasons discussed above.

3. In a currency board system monetary authorities are obliged to exchange domestic currency for foreign reserve currency at a pre-specified and fixed rate. The effect of the 100% reserve-backing requirement of currency board systems can be demonstrated using the balance sheet of the central bank introduced in Chapter 8 and 9, compare question T9.8:

A	Central Bank	L
Foreign Assets	Reserves Currency Gov't Deposits	
Loans and Claims	Net Worth	

Figure 9.3

Suppose, for example, the country experiences a confidence crisis which produces a capital flight. This will run down foreign reserve currency holdings at the central bank putting pressure on the domestic currency to depreciate. With a currency board, monetary authorities are forced to reduce domestic currency accordingly. This monetary contraction will raise interest rates, which in turn alleviates the pressure on the domestic currency to depreciate. It is nothing but the Hume mechanism at work (p.515).

Currency boards, which were originally established in British colonies in the nineteenth century, successfully operate today in countries like Hong Kong, Singapore, Estonia and Argentina. Their main purpose and advantage is to built up confidence and to stabilize monetary policies within countries. The matching rule 'depoliticizes' monetary policy, alleviates the threat of excessive deficit spending, and helps to control inflation.

Opponents of currency board systems argued that such monetary regimes promote procyclical policies which actually depress growth. In addition, in case of large currency crises, it may lead to liquidity and solvency problems in the commercial banking sector. It also requires complete or near-complete capital account convertibility, which has political ramifications (foreign acquisition of domestic assets).

4. Originally SDRs were supposed to provide unconditional liquidity supplementing international reserves. In particular, governments from industrialized countries fear that allocations of newly issued SDRs provide another means of extended credit to developing countries. They argue that countries which are not considered creditworthy by capital markets should not

be 'subsidized' through IMF lending at non-market conditions, since such a policy would alleviate pressure to pursue measures of economic adjustment.

On the other hand, many developing countries argue that extended allocation of SDRs could help to overcome credit constraints and may support the pace of development in these countries. In addition, they argue that extended lending to Eastern European transition economies shifted away IMF resources from many developing countries.

Compromises seem possible (for example introducing tight conditionality for IMF lending financed through SDRs or reinforcing the temporary and discretionary character of such lending facilities), but seem unlikely since new allocations would require an 85% majority of total voting power of IMF members.

5. This question extends the discussion on IMF lending policies discussed above. Artificially stabilizing the exchange rate will only work as long as capital markets believe that governments and monetary authorities are willing and able to stick to certain parities. But since central banks have limited foreign reserve assets, eventually speculative attacks may occur, as happened in case of the Mexican peso in 1994.

As known from the analysis in Chapter 19, exchange rates tend to overshoot their 'fundamental' values in such circumstances. The huge support of the IMF and the US during the peso crisis can be explained, first by the objective to avoid such overshooting behaviour, and second by the expected negative 'external' effects of the financial crisis for other, especially South American countries and for the commercial banking sector as a hole.

CHAPTER 21

POLICY COORDINATION AND EXCHANGE RATE CRISIS: THE EMS AND THE EMU

EXERCISE SOLUTIONS

Given the nature of this chapter, the exercises are more in the nature of essays. Answers are sketched below.

1. Excessive exchange rate fluctuations are believed to disrupt trade because firms fear exchange losses. When exchange rates are flexible and volatile, firms may engage in less foreign trade. This is because the nonfinancial private sector must bear exchange risk (or pay for insurance along the lines exposed in Chapter 18) whenever they invoice in foreign currency. In addition, they pay exchange rate commissions as well as the bid-ask spread. As a consequence, with exchange rates more stable within the EU (Figure 21.6), firms have an incentive to trade more within the EU zone and less with outside. This is called trade diversion. It has the drawback that some of the gains from trade are foregone: EU consumers do not get the most efficiently produced goods if they happen to be manufactured outside the EU and are replaced by EU-produced goods. On this view, the EMS may not be welfare-increasing. In addition this may harm outside countries' welfare.

On the other side, resources devoted to seek protection against exchange rate fluctuations could be used more productively elsewhere. Moreover, exchange rate fluctuations which are unrelated to fundamentals may inhibit optimal allocation of resources. Therefore, a fixed exchange rate system, which stimulates international trade and specialisation along the lines of comparative advantages amongst its members is more efficient. This may offset the losses from trade diversion.

On the other hand, when exchange rate parities do not coincide with fundamentals intra-EU relative prices may be distorted too. This may apply to some countries before the 1992 EMS-crisis, when realignments where politically abandoned despite considerably high and cumulative inflation differentials.

2. There are several interpretations of this phenomenon:

As long as the Italian inflation rate persistently exceeds the German rate with a fixed nominal parity, the bilateral real exchange rate of Italy *vis-à-vis* Germany will appreciate. As this occurs, the (rational) expectation of markets is that this overvaluation will be corrected at some point by a nominal devaluation of the Lira. In anticipation of this, there is a forward discount on the Italian Lira against the DM.

Alternatively, the Italian Lira may be a 'peso problem' (see T19.11). Especially in the late 1980s and early 1990s, devaluations where rather rare events, but still the Lira sold at a forward discount, implying a higher interest rate.

Finally, markets may simply demand a higher risk premium on Italian assets.

3. If all other EMS members were to follow more inflationary monetary policies than Germany, German foreign exchange reserves would increase steadily. For a given level of domestic credit, this would lead to a inflationary increase in the German money supply. If sterilized, these reserve inflows would lead to a very sharp decrease in domestic credit. However, such a policy is only possible in the short run, as EMS members will eventually run short of reserves.

This is the N-1 problem: as long as Germany has leadership in EMS monetary policy, it retains its monetary independence. Frequent realignments, especially in the early stages of the EMS were the result.

4. This is linked to the so-called credibility argument in favour of fixed exchange rate when fighting inflation (see Section 21.3.2.1 and Chapter 16).

5. Under a single currency in Europe, seigniorage will be raised in the first instance by the European Central Bank. Two questions arise: how much seigniorage should there be, and who should get how much?

The theory of optimal taxation says that each country should simultaneously try to smooth taxes and minimize tax distortions within national boundaries (this is the Ramsey principle from Chapter 15). Given different tax structures among EMU member countries, this might mean a different need for seigniorage and therefore different views about the inflation rate. In a monetary union there is only one inflation rate, however. If all countries had the same underlying real economic structure, tax rates would be equal in all countries and there would be no conflict, but that is not necessarily true. For example, seigniorage (or the inflation tax in the long run) may be an important source of revenues in countries where a significant

fraction of economic activity evades the tax system (Italy for example). In principle, these countries may lose most from a low rate of inflation and may ask, in return, a large share of overall seigniorage revenues.

It is precisely those fears that high deficit countries could get disproportionately more seigniorage revenues that explains the limits on public deficits and debt (as a fraction of GDP) that the Maastricht treaty has imposed on EC member countries.

Anyway the solution adopted in Maastricht puts the issue to rest: each country will get a precisely defined share of seigniorage revenue. The share is based on population or GDP size.

6. Even when the EC official joining the assemblies does not vote, they are likely to take influence in the Board's decisions concerning the conduct of monetary policy (Americans like to call this 'moral suasion'). The central bank would appear and perhaps actually be less independent. This in turn raises the problem of reputation (see Chapter 16).

At the same time a central bank has to serve public interests and must be subject to some democratic control. This is especially true in light of the fact that contractionary policies have important implications for welfare in the short run. The Maastricht treaty requests that the European Central Bank reports to the European Parliament.

7. From the point of view of EMS members with the exception of Germany, the absence of realignments is not equivalent to a monetary union: their currencies may still trade at a forward discount as the possibility of some future exchange rate movements cannot credibly ruled out. From the German point of view, little is to be gained from a monetary union in terms of monetary policy, while gains are possible in terms of international trade, and from gains flowing from the larger "clout" of the Euro area.

8. It is often noted that Denmark is the only Scandinavian country with a record of high unemployment, despite very similar labour institutions as Sweden or Norway (see Chapter 6). And Denmark also is the only Scandinavian country member of the EMS.

The argument is that the leadership exercised by Germany imposes that all member countries adopt the tight German monetary policy while they have different price and wage setting traditions and institutions (see Chapter 12 on the price/wage mechanism).

This chapter presents mixed evidence on the inflation performance of EMS countries. It is true that EMS countries have tended to have lower inflation and higher real interest rates than non-EMS countries (Figures 21.4 and 21.5). But this is true only for the second half of its history. Before that, inflation-prone countries kept their preferred inflation rates at the cost of regular realignments.

Anyway, there is no long-run link between inflation and the equilibrium rate of unemployment or the trend growth rate. It may be just a coincidence that EMS countries have had high unemployment and low growth. But then, maybe not.

9. Of the two positions, one line of argument is via goods markets, one via capital markets. From the point of view of the West German economy, the unification can be interpreted as a large economic shock, increasing the demand for domestic goods in the short run. A larger share of domestic output is absorbed within the country, which drives up prices. This in turn will yield a real appreciation of the DM.

On the other hand, the need for capital in the *New German Länder* raised the real interest rate and induced strong capital inflows. According to the current account function introduced in Chapter 7, meeting the intertemporal budget constraint necessitates a real depreciation in the long run (also compare Theory question 7.8)

10. Most likely, only few countries will start off the EMU in January 1999. The monetary 'constitution' of potential 'outs' (or politically correctly speaking, the 'pre-ins') is still an open question. Some countries may chose to peg their currencies to the Euro, which amounts to relinquishing an independent monetary policy similar to the reality of the ERM, others may let their currencies float against the Euro. There is a large range of proposals how the monetary arrangements of 'outs' and 'pre-ins' will possibly be shaped. Countries may impose an institutional arrangement, such as an EMS II, which clearly defines the duties for foreign exchange market interventions and the possibility of realignments. But in contrast to EMS I, foreign exchange market interventions will most likely be asymmetric (i.e. the European Central Bank will not intervene).