MOT1421
Economic Foundations
Week Five

MACRO-ECONOMICS:
NEOCLASSICAL MACRO-ECONOMICS

S. STORM & C.W.M. NAASTEPAD

LECTURE NOTE MOT1421-W-5B

The Lecture Note MOT1421-W-5B is part of the exam materials.

The required reading for Week 5 consists of:

- C.W.M. Naastepad. 2002. *Lectures on Technology and Economic Performance*, CHAPTER 2: NEOCLASSICAL ECONOMICS, pp. 3-32.
- This Lecture Note MOT1421 W-5A and Lecture Note MOT1421 W-5B.

Supplementary video:

- The market for loanable funds: https://www.youtube.com/watch?v=ztGksVnQahQ

Lecture Note W-5B is part of the exam materials.

NEOCLASSICAL MACRO-ECONOMICS

Introduction

We begin by highlighting a number of key concepts and assumptions of the neoclassical model.

- In the neoclassical macro-economic model, it is assumed that the economy as a whole has an inbuilt tendency toward 'full-employment' equilibrium. A number of mechanisms ensure (so it is assumed) that the economy converges to an outcome in which productive capacity is fully utilised and unemployment is zero.
- The so-called 'production factors' labour (L), capital (K), and land or nature (N) have a 'price' and are traded in 'markets'. Capital, K, stands for the means of production, or capital goods. Factor prices are fully flexible and adjust in order to bring about a balance between supply and demand. Factors markets as well as goods markets clear by means of the price mechanism: in case of an excess supply (demand), the price will decline (rise), until supply equals demand.
- In the neoclassical approach, consumers are assumed to be utility-maximisers, firms are profit-maximisers. Both firms and households respond to changes in relative prices, including the real wage or 'price' of labour (W/p), the real price of capital goods (Π/p), and the real interest rate.
- In the neoclassical model, investment (I) in the means of production (K) is financed out of available savings S. Savings are the source of the so-called 'loanable funds' that entrepreneurs can borrow in order to purchase means of production. The supply of loanable funds is savings (from households and firms), which may be deposited in banks. The demand for loanable fund is equal to investment. The loanable funds market clears via adjustments in the (real) interest rate. Banks operate on the loanable funds market as intermediaries between savers and investors.
- Government spending in the neoclassical model crowds out private expenditure. Crowding out occurs because an increase in public expenditure will raise the (real) interest rate in the loanable funds market; we will see below how this works.
- Money does not feature in the neoclassical model. To explain money, neoclassical economists use a monetary theory which says that money is neutral. The classical dichotomy between the real and the monetary sphere of the economy is upheld. That is, changes in the quantity of money do not originate in the economy and, *vice versa*, do not influence the economy. An (exogenous) increase in the quantity of money may increase the *overall* price level but will not affect relative prices.
- In order to prevent inflation (increases in the overall price level), the central bank should observe a money growth rule. Theoretically, inflation (a rise in the general price level *p*) has no impact on real GDP, unemployment, savings, and investment.

We begin our explanation of the neoclassical macro-economic model by looking at the so-called factor markets: the markets for labour and capital goods (machines).

Step 1: The neoclassical markets for labour and capital goods

The neoclassical labour market is depicted in Figure 1.[1] On the horizontal axis of Figure 1, we measure labour supply (millions of workers) and labour demand (millions of workers). On the vertical axis, we measure the real wage (*W*/*p*), which is the nominal wage *W* divided by an index of the general price level *p*. Labour supply depends on the labour force which is a function of population growth. In the neoclassical model, labour is assumed to be unpleasant, or a 'disutility'; therefore, labour supply varies with the real wage (*W*/*p*). The supply of labour will expand only when the real wage rises and decline when the real wage falls. To see how the labour market works, let's avoid such complications to start with, and assume that labour supply L^S is exogenous $\left(L^S = \bar{L^S}\right)$. That is, we assume for the moment that labour supply does not change in response to changes in the real wage (*W*/*p*). In Figure 1, L^S is a vertical line. Labour demand (in the economy as a whole) is a function of output (*x*) and the real wage (*W*/*p*), or $L^D = \alpha\, x \left(\frac{W}{p}\right)^{-1}$, where $L^D =$ the demand for labour, and α is a constant. The labour demand function is based on profit-maximising decision-making by firms.[2]

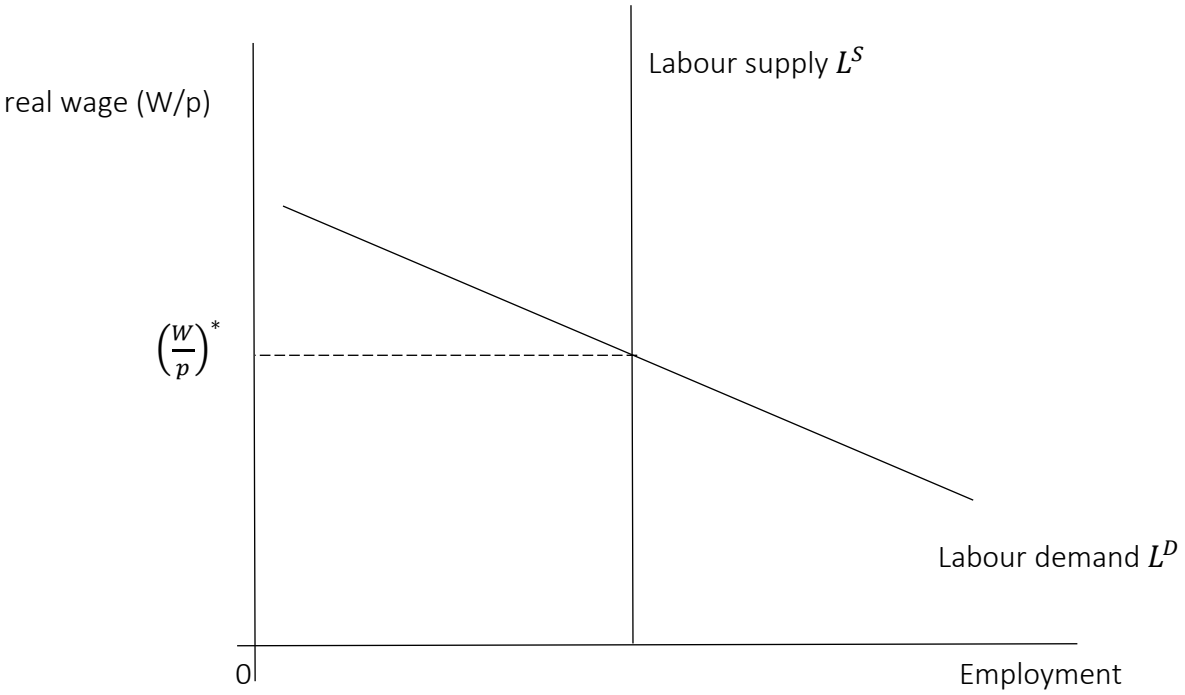


Figure 1: The Neoclassical Labour Market

[1] See also Section 2.2. of Naastepad (2002) *Lectures on Technology and Economic Performance*.
[2] The derivation of the labour demand function is explained in section 2.2.1. (pp. 6-8), Chapter 2, of Naastepad (2002).

The aggregate labour market is in equilibrium if $L^S = \bar{L^S} = L^D$; this occurs at the equilibrium real wage $\left(\frac{W}{p}\right)^*$. This outcome is called the 'full-employment' outcome (because at this point, unemployment is zero). Like the goods market, the 'labour market' is assumed to be a perfectly competitive market which clears by means of adjustments in the real wage (brought about by the "invisible hand"). The equilibrium real wage $\left(\frac{W}{p}\right)^*$ is the market-clearing 'price' of labour.

To illustrate how the neoclassical labour market works, consider the following experiment: exogenous labour supply L^S declines because of an ageing labour force. The L^S-curve will then shift to the left. This is illustrated in Figure 2.

The labour demand curve does not change. Due to the decline in labour supply, an excess demand for labour arises – and as a result, the real wage (*W/p*) rises. The real wage continues to increase until $L^S = L^D$. The labour market now clears at the higher equilibrium real wage $\left(\frac{W}{p}\right)^{NEW}$; the economy remains at full employment. Whatever happens to labour supply or labour demand, the invisible hand will ensure that the market converges to an equilibrium real wage at which $L^S = L^D$.

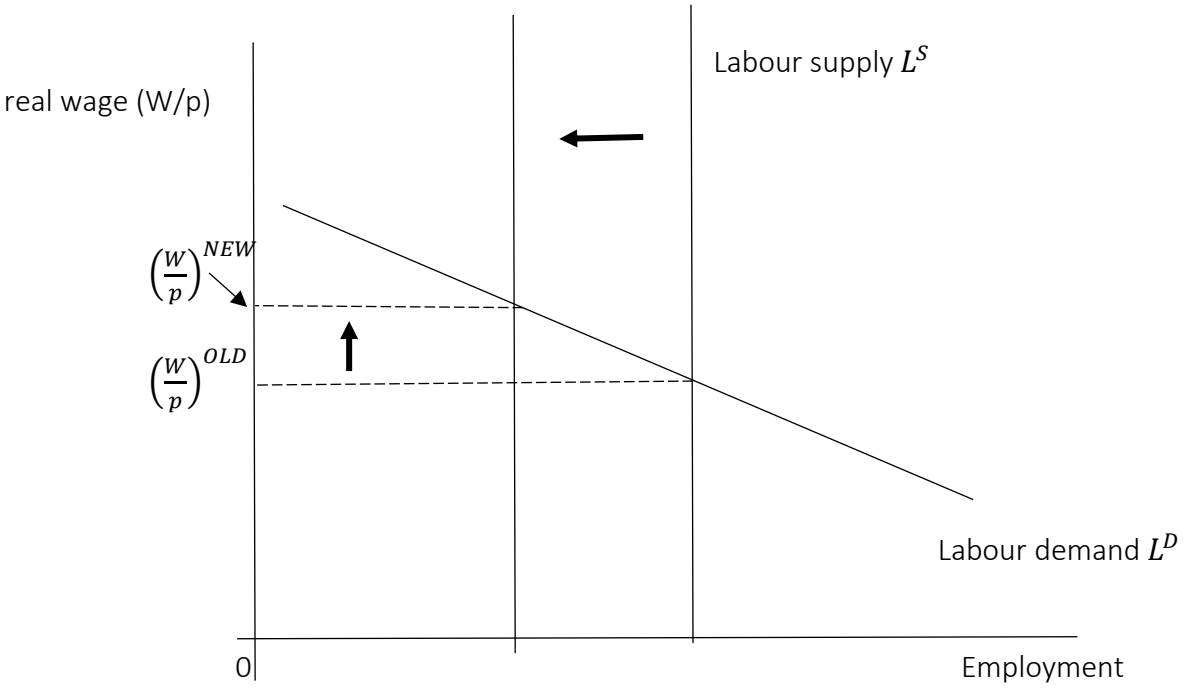


Figure 2: The Neoclassical Labour Market: L^S declines.

Let's now consider the market for capital goods (machines). Machines being goods, we are now in a goods market. Figure 3 illustrates the neoclassical capital goods market. $K^S = \overline{K^S}$ is the supply of capital goods, which (for simplicity) we will assume to be fixed in the short run. K^D is the demand for capital goods, which is a function of output (*x*) and the real price of capital goods (*Π*/*p*), or $K^D = \beta\, x \left(\frac{\Pi}{p}\right)^{-1}$, where x = output and *Π* = the price of capital goods. The market for capital goods is in equilibrium at price (*Π*/*p*)* which ensures that $K^S = \overline{K^S} = K^D$.

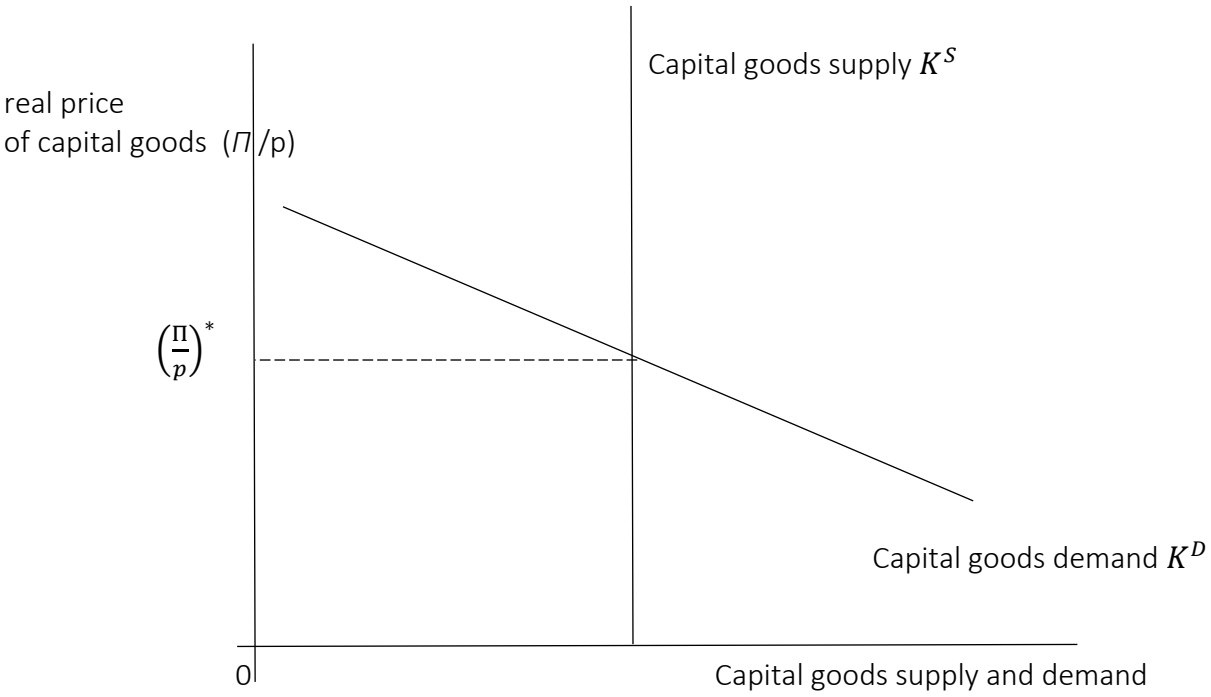


Figure 3: The Neoclassical Market for Capital Goods

To summarise, the price mechanism will ensure (supply-demand) equilibrium in the two factor markets discussed above, or:

(1) $$L^S - L^D = \overline{L^S} - \alpha\, x \left(\frac{W}{p}\right)^{-1} = 0$$

(2) $$K^S - K^D = \overline{K^S} - \beta\, x \left(\frac{\Pi}{p}\right)^{-1} = 0$$

In other words, there exists an equilibrium real wage $\left(\frac{W}{p}\right)^*$ at which labour demand is equal to labour supply, and at which the labour force is fully employed (there is no unemployment). Likewise, there exists an equilibrium real price of capital goods $\left(\frac{\Pi}{p}\right)^*$ at which capital goods demand is equal to the supply of capital goods, and there is no underutilisation of productive

capacity (all machines are in use). In other words, the neoclassical economy operates at full employment of all production factors.[3]

Step 2: The neoclassical circular flow of income

Let us now move from the factor markets to the circular flow of income – and we will enter the circular flow at the stage of production. In the neoclassical model, the production process is described by a production function,[4] for example the following Cobb-Douglas production function:

(3) $x = a\, L^{\alpha} K^{\beta}$

Output *x* is a multiplicative function of the inputs of labour (L) and capital (machines, K); *a* is a constant scale factor. The exponents α and β are technical coefficients (assumed to be constant). For simplicity, we assume a fixed supply of labour $\left(L = \overline{L^S}\right)$ and capital $\left(K = \overline{K^S}\right)$. Since neoclassical theory assumes full employment, the fixed levels of supply of labour ($\overline{L^S}$) and capital ($\overline{K^S}$) represent the maximum levels of supply of labour and capital. This gives:

(4) $x^{FE} = a\, (\overline{L^S})^{\alpha} (\overline{K^S})^{\beta}$, where x^{FE} = full-employment output.

Let us now look at the circular flow of income in Figure 4. Note that upper-case characters (for example, I) are used for nominal values; lower-case letters denote real values $(i = I/p)$.

In the Neoclassical model, the supply of goods equals the demand for goods at the full-employment level of output. How is this equilibrium brought about?

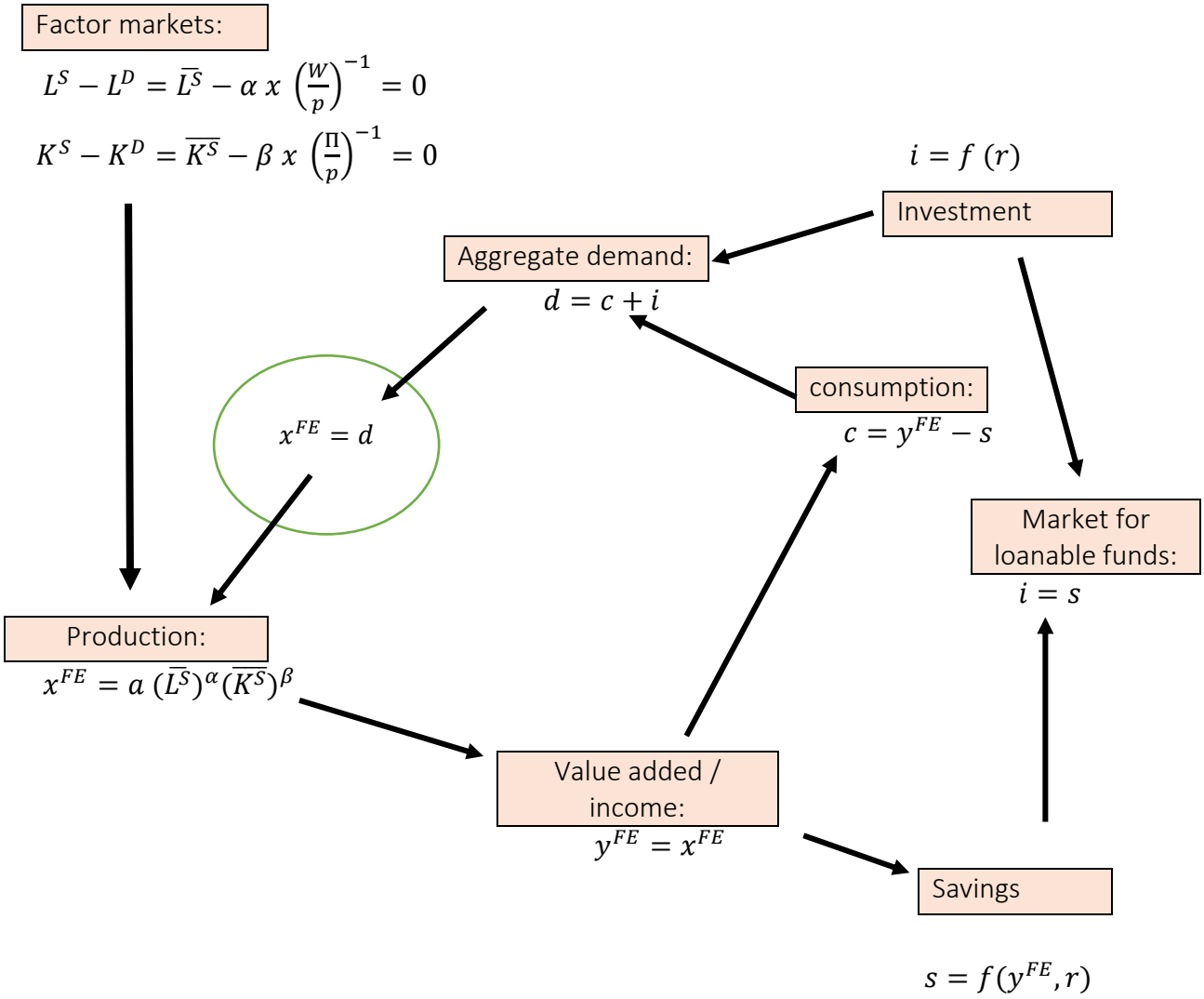
If production x is at full employment (x^{FE}), then income – or value added – must also be at its full-employment level (y^{FE}; see Figure 4). (Real) income is used for two purposes: consumption (*c*) and savings (*s*). Savings depend positively on y^{FE} and the real interest rate *r*. An increase in income will lead to higher savings; likewise, if the real rate of interest rises, people will increase their savings.

However, savings constitute a leakage out of the circular of flow of income. Let us assume that 20 per cent (one-fifth) of income is saved. These savings (by households and firms) are deposited with banks. Consumption demand (equalling 80 per cent of income) contributes directly to aggregate demand (d). Consumption is income spent on consumption goods; this income stays within the circular flow (see Figure 4). However, what happens to savings?

[3] To avoid further complication, we will abstain for the time being from a discussion of the market for land (or nature).
[4] See Naastepad (2002), Section 2.1, pp. 3-8.

Figure 4

The circular flow of income: the neoclassical model



Savings leave the circular flow as they are deposited in banks. Unless they are re-invested, aggregate demand will fall short of full employment output (x^{FE}), due to the presence of the savings leakage. Suppose x^{FE} = 100, y^{FE} = 100, consumption *c* = 80, and savings *s* = 20. Unless savings re-enter the circular flow, aggregate demand will drop to 80 $(d = 80)$. Production will decline correspondingly, because firms are facing a shortage of aggregate demand. In the neoclassical model, this will not happen. How is the full-employment level of output maintained? Our model is not yet complete. One crucial market – the market for loanable funds – is still missing.

Step 3: The neoclassical market for loanable funds

What happens in the market for loanable funds? Banks receive savings as deposits. In the Neoclassical model, banks are profit-maximising firms. Profit-maximizing banks will use savings (or loanable funds) to provide loans to firms to enable them to buy means of production. That is, the supply of loanable funds (= savings) is used to provide firms with the money they require to invest. The intermediating role of banks is conceptualized as a market – a market for loanable funds (see Figure 5). This market is also a perfect market in which the real interest rate (= the price of loanable funds) clears the market. How is this supposed to work?

Let us consider the following (neoclassical) market for loanable funds:

(1) $\varphi^S =$ savings supply $= f(y^{FE}, r)$

(2) $\varphi^D =$ investment demand $= f(r)$,

where $\varphi^S =$ the supply of loanable funds (in billions of euros); $\varphi^D =$ the demand for loanable funds (in billions of euros); and *r* = the real rate of interest (per cent). Savings or loanable funds supply increases when the real interest rate goes up (because people will be more inclined to save). Investment or demand for loanable funds declines when the real rate of interest goes up, because it becomes more costly for firms to borrow to finance investment; firms will postpone or cancel their investments because the expected rate of return on investment falls. These two equations give the two curves (a cross) in the figure for the neoclassical loanable funds market (Figure 5).

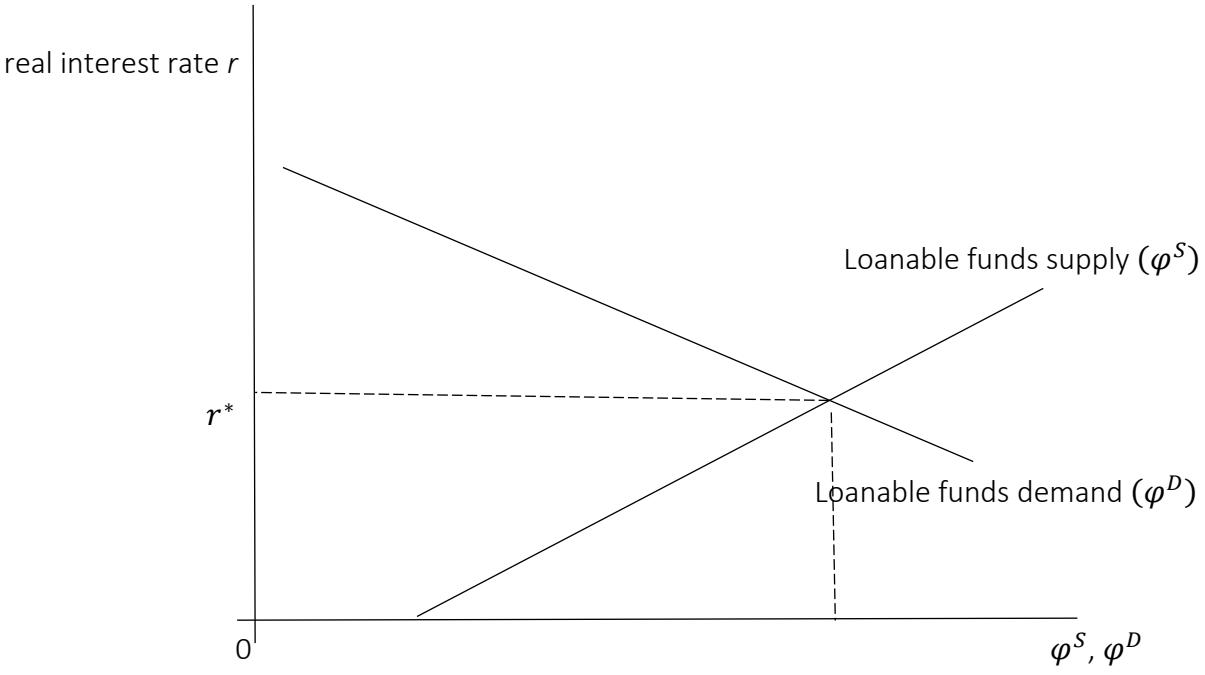


Figure 5: The Neoclassical Market for Loanable Funds

What will happen when $\varphi^S > \varphi^D$, *i.e.* when there is an excess supply of savings? Banks (the intermediating institutions) are flushed with funds and the only way to make these profitable for them is to turn these funds into (interest-bearing) loans to firms. Firms will only take additional loans when they expect their investment projects to be (sufficiently) profitable. Hence, banks will reduce the interest rate. In response to the decline in r, investment and φ^D will go up, while savings (φ^S) will go down, until equilibrium is reached. (You may think out for yourself what will happen when $\varphi^S < \varphi^D$.)

The loanable funds market is of critical importance to the neoclassical approach. A crucial Neoclassical assumption is that savings always return to the economy because in the loanable funds market *all* savings are converted into investment. Changes in the interest rate will take care of this. Hence, if *s* = 20, then investment will also equal 20; as a result, *d* = 100 and the economic system will continue to operate at full employment, *i.e.* $x^{FE} = y^{FE}$.

We can now – finally – return to the factor markets. With the economy operating at a level of output where $x^{FE} = y^{FE} = 100$, the demand for the factors of production, $L^D = \alpha\, x^{FE} \left(\frac{W}{p}\right)^{-1}$ and $K^D = \beta\, x^{FE} \left(\frac{\Pi}{p}\right)^{-1}$, can now be derived. Adjustments in the wage rate and in the price of capital goods (the 'price mechanism') will ensure that $L^S - L^D = L^S - \alpha\, x^{FE} \left(\frac{W}{p}\right)^{-1} = 0$ and $K^S - K^D = K^S - \beta\, x^{FE} \left(\frac{\Pi}{p}\right)^{-1} = 0$, so that full employment is achieved in the markets for labour and capital.

Fiscal policy in the neoclassical model: public spending crowds out private spending

What is the macroeconomic impact of fiscal stimulus in this neoclassical model? To answer this question, we must first specify what fiscal stimulus means. Fiscal stimulus (or expansionary fiscal policy) can involve:

- an increase in public current expenditure (g)
- an increase in public investment (i_G)
- a reduction in (income) taxation.

Let us here consider a policy of increased public investment (higher i_G). Public investment is part of aggregate investment: $i = i_P + i_G$, where $i_P =$ private investment.

A first point to note is that, in Neoclassical economics, the economy is assumed to already operate at maximum (full-employment) capacity. Aggregate demand equals maximum production. An increase in i_G will increase aggregate demand – and because the system is already running at maximum capacity, firms cannot meet the additional demand for capital

goods by increasing output. The result will be excess aggregate demand: $d > x^{FE}$. This leads to pressure within the economy – and this pressure starts to build first in the market for loanable funds. Why?

Because to finance the higher public investment, government will have to borrow money from banks. Fiscal stimulus leads to a higher government demand for loanable funds, hence the curve for φ^D shifts up. Recall that banks are also assumed to be always fully-loaned up ($\varphi^S = \varphi^D$); this is the original equilibrium (point A, Figure 6). Due to the increase in the demand for loanable funds, there is now an excess demand for loanable funds: $\varphi^D > \varphi^S$; the excess demand is indicated by the difference between points C and A (in Figure 6). In response to the excess demand, banks raise the rate of interest – and as a result, savings (or φ^S) go up. Because savings increase, consumption goes down (in Figure 4). Private investment, which is sensitive to the interest rate, also goes down. The loanable funds market reaches a new equilibrium in point B. In the new equilibrium, both the supply of and the demand for loanable funds have increased.

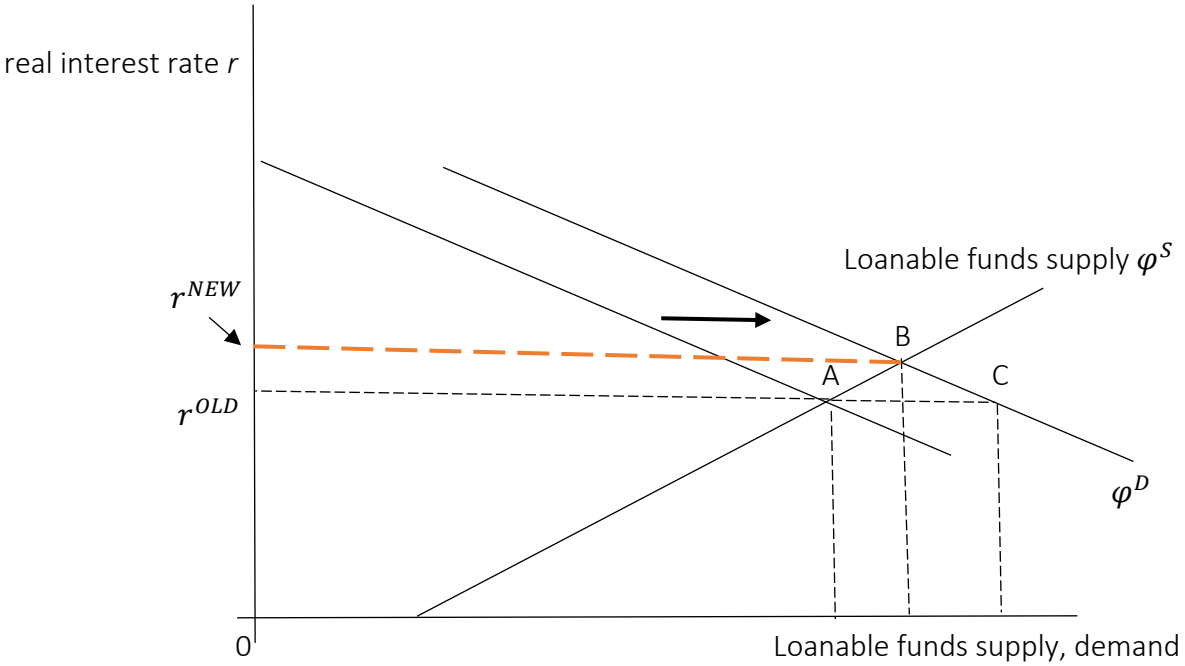


Figure 6: The Neoclassical Market for Loanable Funds: Fiscal Stimulus

The pressure due to the fiscal stimulus has been absorbed by an increase in the (real) interest rate, which has increased savings, lowered consumption, and lowered *private* investment. Total investment has increased, crowding out consumption and private investment. In terms of aggregate demand, this is what happened:

$$\Delta d = 0 = \downarrow c + \downarrow i_P + \uparrow i_G$$

The increase in public expenditure has crowded out private expenditure. In the neoclassical model, fiscal stimulus is therefore not effective in raising aggregate demand, production, and income. It merely leads to a change in the composition of aggregate spending – an increase in the share of public spending, and a decline in the share of private spending.

Monetary policy in the neoclassical model: inflation targeting and the 'money-growth rule'

The macroeconomic model in Figure 4 does not feature money. Money is missing, and this problem is solved by hooking a specific monetary theory (named Monetarism) to the neoclassical economic model.[5] Monetarism, or the 'Quantity Theory of Money', provides the neoclassical model with a 'money market' and a money growth rule.

Equilibrium in the money market requires that money supply (M^S) is equal to the demand for money (M^D). In the neoclassical model, the money supply is supposed to be exogenous $\left(M^S = \overline{M^S}\right)$, that is, the supply of money is determined outside the economy. This assumption is justified by the argument that M^S can be (directly) controlled by the central bank. (This is the so-called "exogenous money" approach; we will look at it more closely in Week 7). For now, we assume (in line with the neoclassical approach) that the central bank can determine M^S. [6]

The demand for money varies with the level of GDP, the overall price level, and the velocity of money circulation (v): $M^D = \left(\frac{1}{v}\right) p \times y$, where v is generally assumed constant.[7] M^D increases when economic activity (y) and/or the general price level (p) increase; in both cases, more money is needed for carrying out economic transactions.

Equilibrium in the money market requires that $M^S = \overline{M^S} = M^D = \left(\frac{1}{v}\right) p \times y$, or: $\overline{M^S} = \left(\frac{1}{v}\right) p \times y$. How is money-market equilibrium achieved? The answer is: through adjustments in the general price level (p). The reason is that if $\overline{M^S}$ is assumed exogenous, *v* is a constant, and the level of economic activity *y* is (by assumption) always at full employment level y^{FE} (see Figure 4), this leaves the price level as the only variable that can change.

[5] The neoclassical money market is explained in Naastepad (2002), Chapter 2, Section 2.9 (pp. 25-27).
[6] We will see in Week 7 that the "exogenous money" approach does not correspond to how the banking system works in practice; in reality, central banks do not have direct control over M^S.
[7] See Naastepad (2002), p. 25.

With all variables in the equation $\overline{M^S} = \left(\frac{1}{v}\right) p \times y^{FE}$ except p being determined, we can write: $p = \frac{v \times \overline{M^S}}{y}$, or in terms of (instantaneous) growth rates: $\hat{p} = \widehat{M^S} - \hat{y}$. That is, inflation is determined as the difference between (exogenous) money supply growth and real GDP growth. This expression can be rewritten as a money growth rule, as follows: $\widehat{M^S} = \hat{p} + \hat{y}$. This rule specifies by how much $\widehat{M^S}$ can grow for a given growth rate of real GDP. The money growth rule was meant as a rule for preventing inflation. In itself, the idea that inflation should be prevented is not a bad idea; however, note on how many theoretical assumptions the neoclassical-monetarist money growth rule is based.

The task of the central bank (the monetary authority) is strictly circumscribed in the Neoclassical-Monetarist model. Its task is to prevent inflation, and its policy instrument is the supply of money. On Neoclassical-Monetarist assumptions, changes in the supply of money will affect the general price level, but not output, income and demand. In other words, money is neutral (see also the answers to the questions of Week 2). The mandate for central banks can also be stated in growth terms. The task of the central bank then is to keep inflation constant, or below a certain inflation target (usually 2%). This means that central banks should let money supply grow in line with real GDP growth + 2%, or $\widehat{M^S} = \hat{p} + \hat{y} = 2\% + \hat{y}$. This equation is called the money growth rule or monetary policy rule which is used for inflation targeting. The underlying assumption is that central banks can indeed control the growth of money supply.

EXERCISES

EXERCISE W-2.1

This exercise concerns the neoclassical labour market in Figure 1 (which is discussed in section 2.2. of the READER). On the horizontal axis of Figure 1, we measure labour supply (millions of workers) and labour demand (millions of workers). On the vertical axis, we measure the real wage (*W*/*p*), which is the nominal wage *W* divided by the index of general price level *p*.

We assume that aggregate labour supply by workers L^S is exogenous, or $L^S = \overline{L^S}$. In Figure 1, L^S is a vertical line; labour supply (which equals the labour force) is given and does not change in response to changes in the real wage (*W*/*p*).

Labour demand (for the whole economy) is a function of output (x) and the real wage (W/p), or $L^D = \alpha\, x\, (\frac{W}{p})^{-1}$, where $L^D =$ labour demand by firms and α is a constant. The labour demand function is based on profit-maximising decision-making by firms. The derivation of the labour demand function is explained in section 2.2.1. (pp. 6-8), Chapter 2, of the READER.

The aggregate labour market is in equilibrium when $L^S = \bar{L^S} = L^D$; this occurs at the equilibrium real wage $\left(\frac{W}{p}\right)^*$. We assume (following neoclassical theory) that the labour market is a perfectly competitive market which 'clears' by means of adjustments in the real wage (done by the "invisible hand"). The equilibrium real wage $\left(\frac{W}{p}\right)^*$ is the market-clearing price.

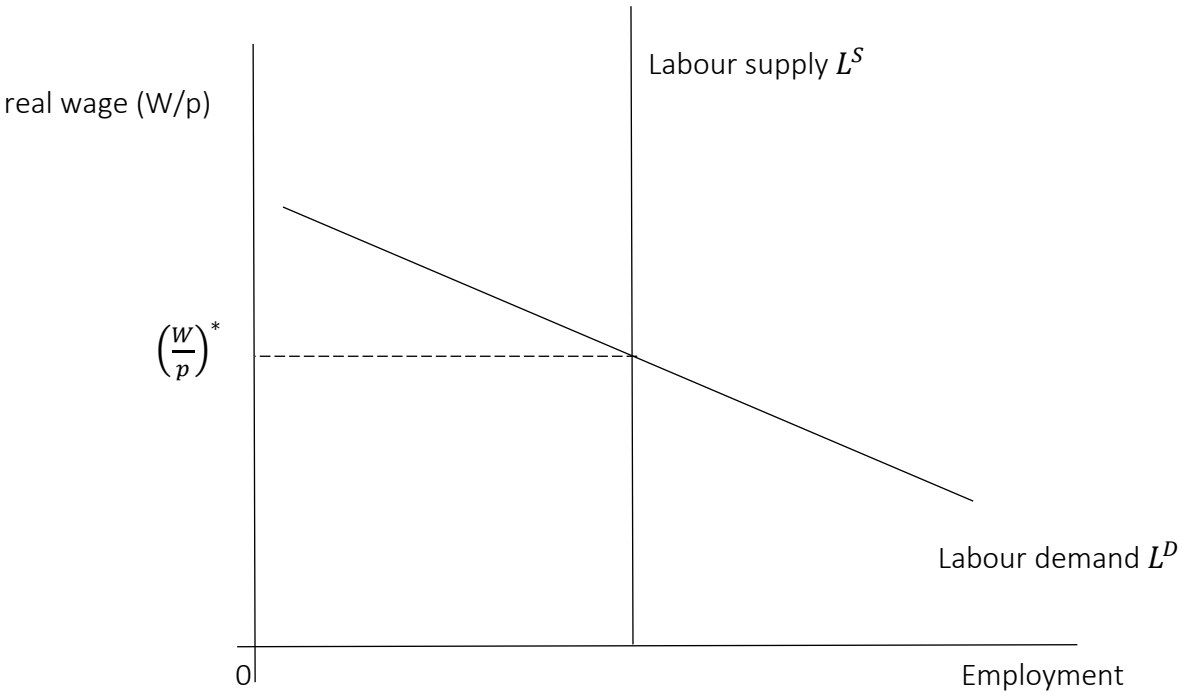


Figure 1: The Neoclassical Labour Market

1. Suppose that (exogenous) labour supply increases, for instance due to immigration. What are the consequences of this in the neoclassical labour market of Figure 1? Draw Figure 1 and show and explain what will happen to labour supply, labour demand and the equilibrium real wage $\left(\frac{W}{p}\right)^*$.

2. Consider Figure 2. In this economy, (real) wages are not determined by the invisible hand (the market mechanism), but by (centralized) bargaining between labour unions and firms. The wage bargaining process leads to a real wage $\left(\frac{W}{p}\right)^B$, acceptable to unions and firms – indicated by the red dashed line in Figure 2. What are the

consequences of the bargained real wage in the neoclassical labour market of Figure 2? Draw Figure 2 and show and explain what will happen to labour supply, labour demand and the equilibrium real wage $\left(\frac{W}{p}\right)^*$. Will there be unemployment? If so, indicate the number of unemployed workers in Figure 2. How can 'full employment' be restored in this economy?

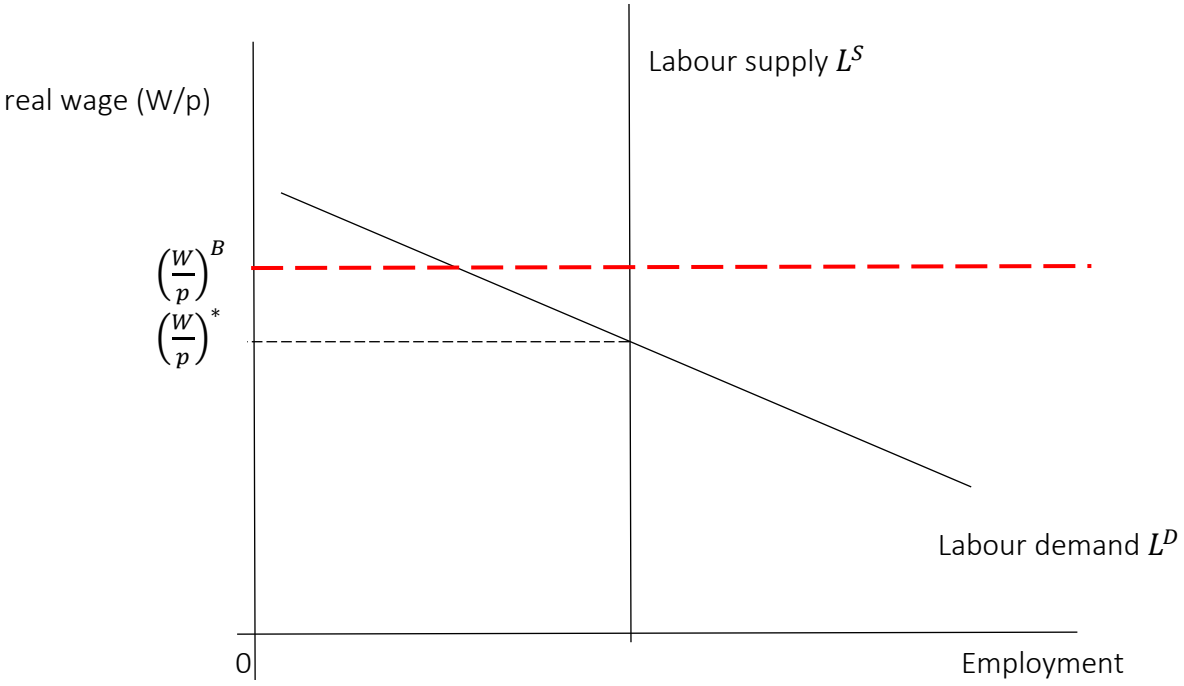


Figure 2: The Neoclassical Labour Market with Collective Wage Bargaining

EXERCISE W-2.2

Consider the following (neoclassical) market for loanable funds:

(3) $LF^S = 2.5 + 0.50\,r$

(4) $LF^D = 10 - 0.75\,r$

where $LF^S =$ the supply of loanable funds (in billions of euros); $LF^D =$ the demand for loanable funds (in billions of euros); and *r* = the real rate of interest (per cent). See sections 2.6.3 and 2.6.4 in the READER.

1. Draw the curves for LF^S and LF^D in a graph with LF^S and LF^D on the horizontal axis and *r* on the vertical axis. Calculate the equilibrium real interest rate r^*.

2. Explain why the LF^S-curve is upward-sloping in the graph. How is loanable funds supply related to savings?

3. Explain why the LF^D-curve is downward-sloping in the graph. How is loanable funds demand related to investment by firms?

4. Assume that the government increases public investment (= fiscal stimulus). The increase in public investment is financed by extra government borrowing. As a result, the demand for loanable funds changes to: $LF^D = 12.5 - 0.75\,r$. Explain the change in the equation for LF^D.

5. Calculate the new equilibrium real interest rate r^*. Why is it higher than before?

6. The fiscal stimulus has led to crowding out – of private investment by public investment. Explain how this crowding out happened. Can you estimate by how much private investment declined due to the crowding out, triggered by the fiscal stimulus?

7. Now go back to the original equations (1) and (2). Suppose there is a large inflow of foreign savings (foreign capital); as a result of this "global savings glut", the LF^S-curve becomes: $LF^S = 10 + 0.50\,r$. Calculate the new equilibrium real interest rate r^*. Why is it lower than before?

8. Suppose the inflow of global savings increases further and the new LF^S-curve becomes: $LF^S = 11 + 0.50\,r$. What happens to the equilibrium interest rate? What is the problem of the zero-lower bound? If the loanable funds market cannot reach equilibrium because of the zero-lower bound, how will this affect output, employment and incomes in the neoclassical macro-economic model? NOTE: the real interest rate is defined as the difference between the nominal interest rate and the inflation rate; we here assume that the inflation rate is zero; hence, the real interest rate and the nominal interest rate are the same.

EXERCISE W-2.3

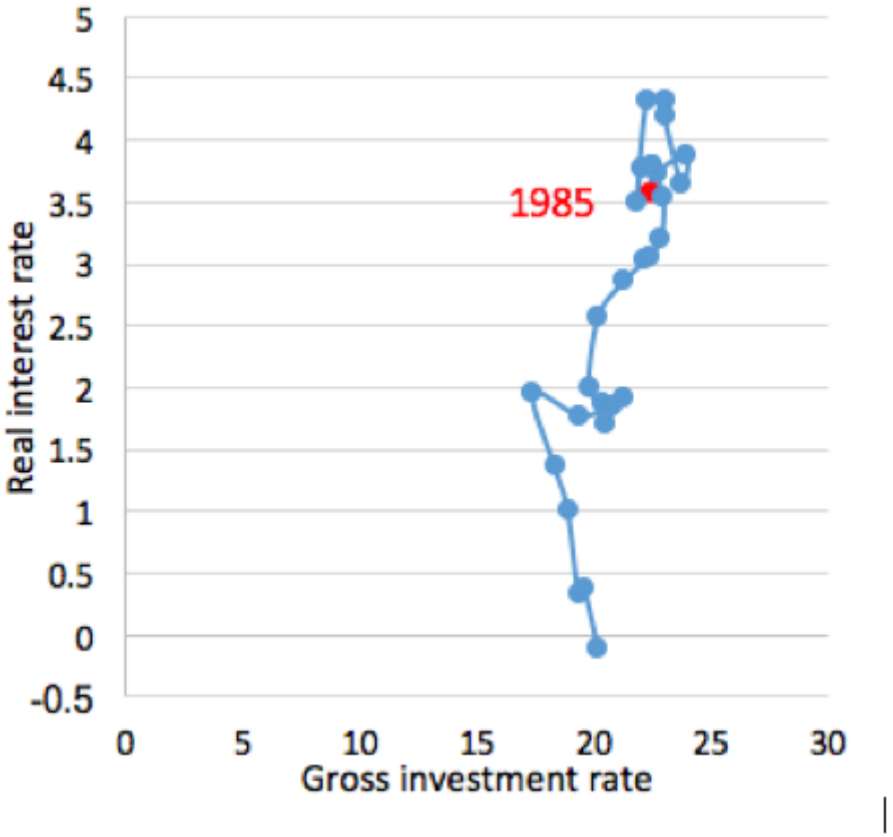
This exercise concerns the paper on the loanable funds market by Storm (2017).

1. Keynes argued that the LF^S-curve and the LF^D-curve are not independent: if one curve shifts, the other curve must shift as well. Explain Keynes' argument.

2. It is argued that savings do not fund or finance investment. Investment instead is financed by bank credit. Explain this argument.

3. What is meant by the Global Savings Glut Hypothesis?

4. Consider the following figure and explain why the evidence presented here is in conflict with the Global Savings Glut Hypothesis.



Saving/Investment Equilibria and World Real Interest Rate, 1985-2014
Source: Bofinger and Reis (2017), Figure 1(a).

EXERCISE W-2.4

This exercise concerns the neoclassical money market – which is explained in section 2.9 (pp. 25-27) of Chapter 2 in the READER. The neoclassical approach to the money market follows the Monetarist approach – the "Quantity Theory of Money".

Equilibrium in the money market requires that money supply M^S is equal to the demand for money M^D. In the neoclassical model, money supply $M^S = \overline{M^S}$ is exogenous (= determined outside the model). This assumption is justified by the argument that M^S can be (directly) controlled by the central bank. (This is the so-called "exogenous money" approach; we will look more closely into this approach in Week 7). For now, we assume (in line with the neoclassical approach) that the central bank can – indeed – "determine" M^S.[8]

[8] We will see in Week 7 that the "exogenous money" approach is not empirically true; in reality, central banks do not have direct control over M^S. Many macro-economists do continue to adhere to the falsified "exogenous money" approach, unfortunately.

Money demand $M^D = \left(\frac{1}{v}\right) p \times y$, where *v* = a constant, *p* = the index of the general price level (*p* = 1 in the base year), and *y* = real GDP (see READER, p. 25). The demand for money is the transactions demand for money: M^D increases when economic activity (*y*) and/or the general price level (*p*) increases; in both cases, more money is needed for economic transactions.

Equilibrium in the money market requires that $M^S = \overline{M^S} = M^D = \left(\frac{1}{v}\right) p \times y$, or: $\overline{M^S} = \left(\frac{1}{v}\right) p \times y$. How is money-market equilibrium achieved? The answer is: through adjustment of the general price level *p*. The reason is that $\overline{M^S}$ is exogenous, *v* is a constant, and the level of economic activity *y* is at its full employment level y^{FE}. All variables in the equation $\overline{M^S} = \left(\frac{1}{v}\right) p \times y^{FE}$ have been determined, except *p*. Hence, we can write:

$p = \frac{v \times \overline{M^S}}{y}$, or in terms of (instantaneous) growth rates: $\hat{p} = \widehat{M^S} - \hat{y}$. That is, inflation is determined (in the neoclassical approach) as the difference between (exogenous) money supply growth and real GDP growth. This expression can be rewritten as a monetary policy rule, as follows: $\widehat{M^S} = \hat{p} + \hat{y}$. This rule specifies by how much $\widehat{M^S}$ can grow given estimates of inflation and real GDP growth.

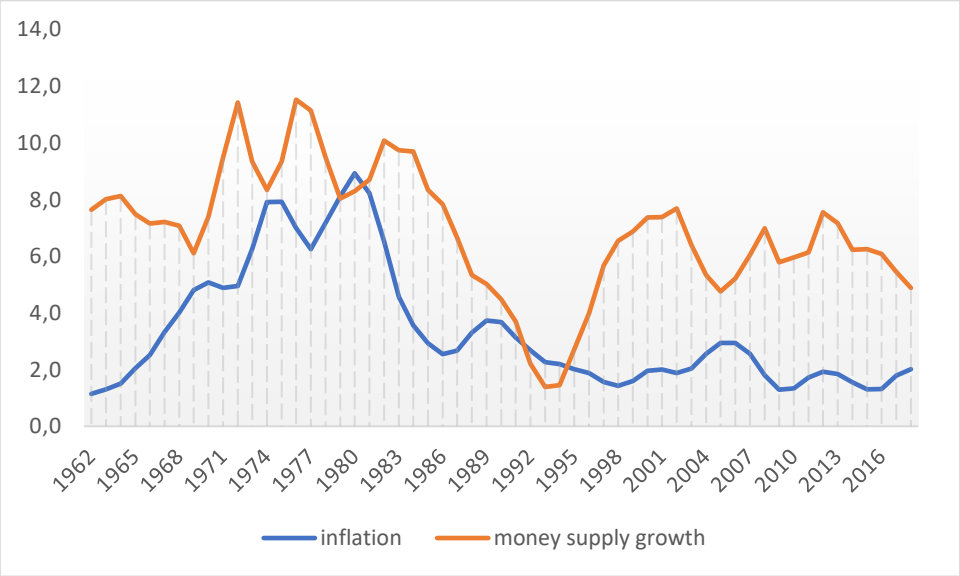
1. The official policy aim of the European Central Bank (ECB) is to maintain inflation close to but below 2%. Let us further suppose that ECB economists think that real GDP in the Eurozone economy will grow at either 2.5% next year (scenario A) or at 1.75% (scenario B). By how much can the ECB let M^S grow in scenario A and scenario B.

2. The ECB can (try to) influence M^S by "open-market operations". Explain what those open-market operations are and how these can influence M^S.

3. In the neoclassical model, the classical dichotomy between the real and monetary spheres is assumed to hold. What is this classical dichotomy?

4. Consider Figure A (below). Based on equation $\hat{p} = \widehat{M^S} - \hat{y}$, one would expect that there exists a (long-run) relationship between $\hat{p}$ and $\widehat{M^S}$. Do the two curves in Figure A show any such (long-run) relationship – particularly for the period 1980-2019?

FIGURE A
Inflation and money supply growth: U.S. economy (1961-2019)
(%; three-year moving averages)



Source: AMECO database and OECD Main Economic Indicators database.

ANSWERS

EXERCISE **W-2.1**:

1. An increase in labour supply means that the curve for L^S shifts to the right. The labour demand curve does not change or shift. The real wage goes down → labour demand by firms increases → until $L^S = L^D$ again. Employment increase and full employment of labour is maintained through a flexible downward adjustment in the equilibrium real wage. The neoclassical circular flow of income continues to operate at full employment/ full capacity.

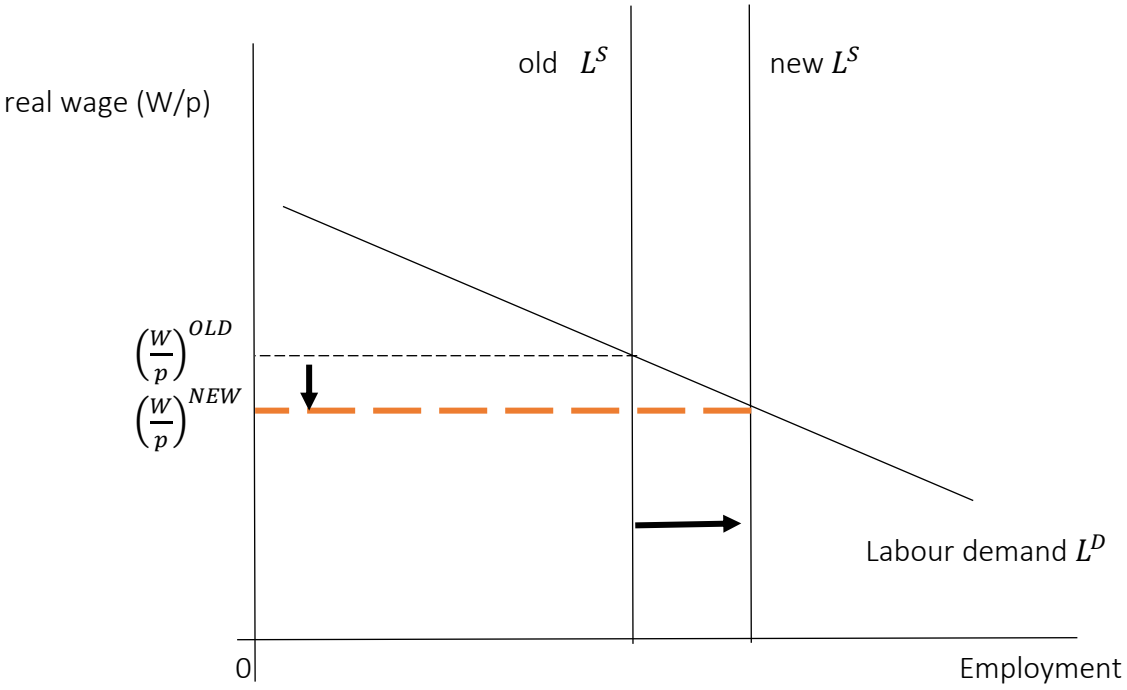


Figure 1: The Neoclassical Labour Market: increase in L^S

2. In this economy, the real wage is 'fixed' by centralized bargaining. It is no longer flexible and therefore no longer capable of 'clearing' the neoclassical labour market. Let us consider what happens. First, we can observe that $\left(\frac{W}{p}\right)^B > \left(\frac{W}{p}\right)^*$, the bargained real wage is higher than the equilibrium real wage. Firms must pay $\left(\frac{W}{p}\right)^B$ (and cannot undercut this wage); hence, L^D will be equal to L^{DB}. Labour supply does not change. Hence, labour supply is larger than labour demand and the difference $L^S - L^{DB} =$ unemployment (in millions of workers). Hence, wage bargaining in this economy led to a bargained real wage higher than the equilibrium real wage and thus created unemployment. There are two ways to restore full employment: (A) abolish

centralized wage bargaining and let the invisible hand generate a full-employment equilibrium at $\left(\frac{W}{p}\right)^*$; or (B) ensure that the wage bargaining process also takes (full) employment into consideration and produces a lower bargained wage $\left(\frac{W}{p}\right)^B = \left(\frac{W}{p}\right)^*$. Clearly, options (A) and (B) have the same outcome.

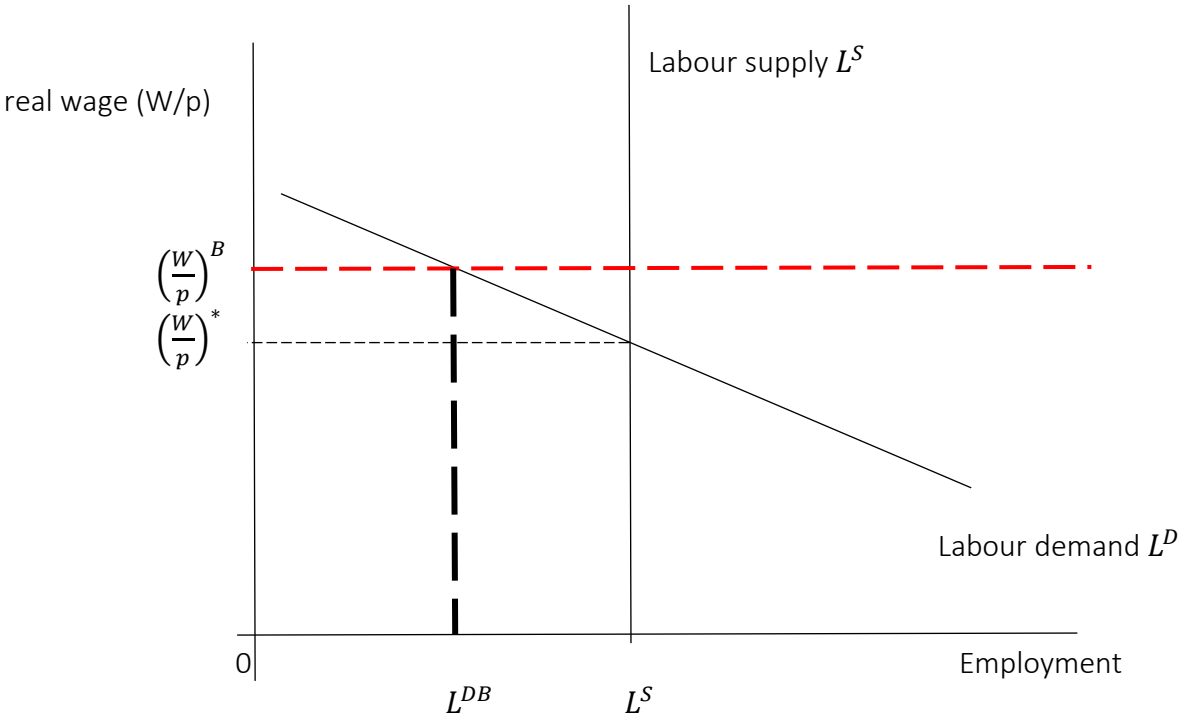


Figure 2: The Neoclassical Labour Market with Collective Wage Bargaining

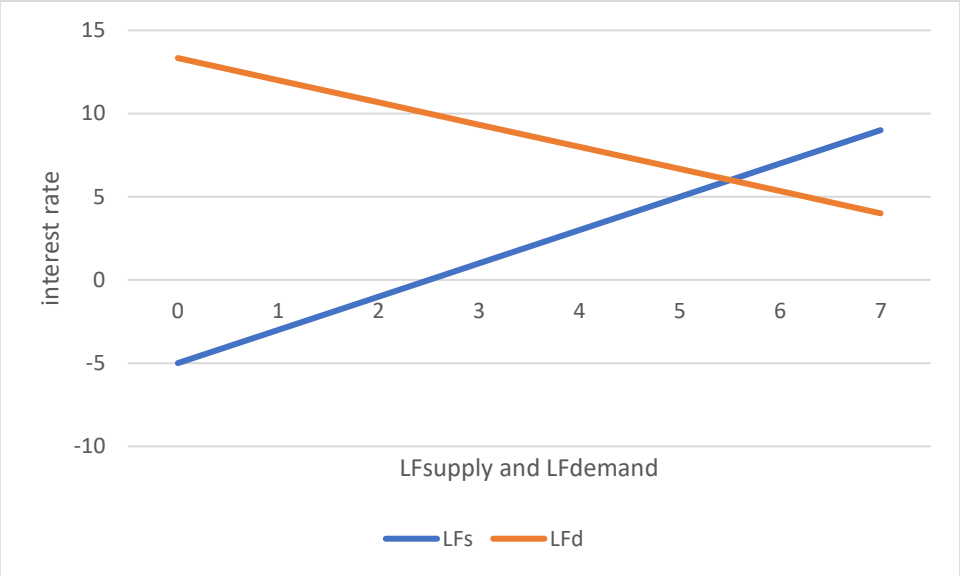
EXERCISE **W-2.2**:

1. We calculate the equilibrium interest rate *r** as follows:

   $LF^S = 2.5 + 0.50\,r = LF^D = 10 - 0.75\,r \rightarrow$

   $1.25\,r = 7{,}5 \rightarrow r^* = 6.0\% \rightarrow LF^S = LF^D = 5.5$ billion euros.

   This is the graph:

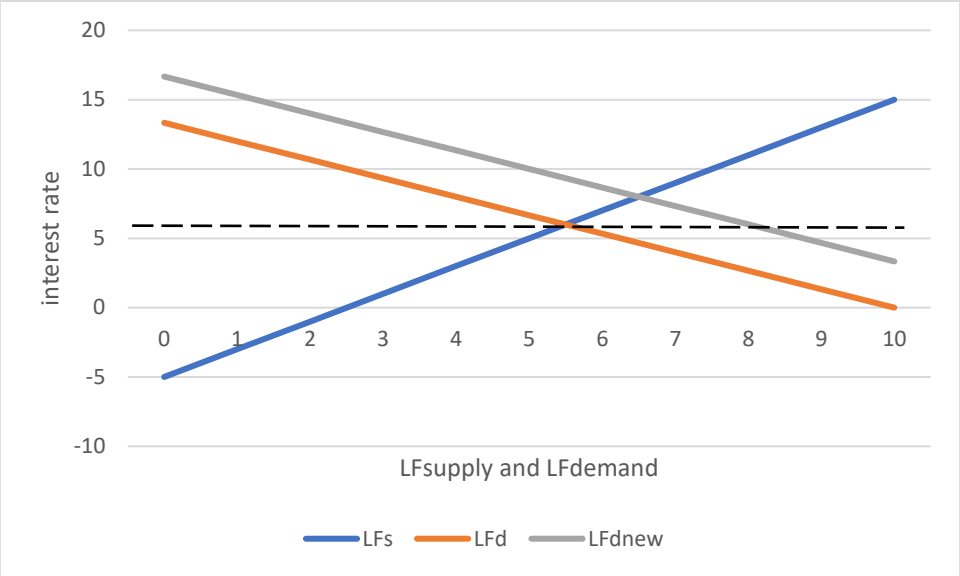


2. The LF-supply curve is upward-sloping, because savings (which is equal to the supply of loanable funds deposited in banks) are a positive function of the real interest rate. This means that households and firms will increase their savings in response to an increase in the real interest rate; the "return" to depositing savings in banks is higher → the propensity to save will be higher.

3. The LF-demand curve is downward-sloping, because business investment (which together with public investment makes up the demand for loanable funds, or bank loans) are a negative function of the real interest rate. This means that firms will reduce their investment (by postponing or cancelling their investment plans) in response to an increase in the real interest rate; the "cost" to borrow money from banks is higher → this negatively affects the expected returns from investment → investment is reduced.

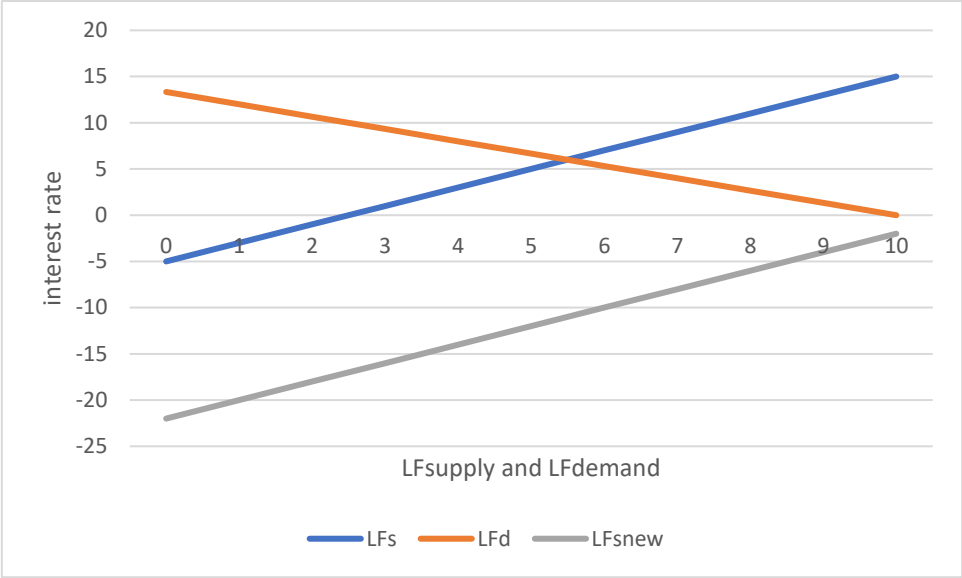
4. The new function for the demand for loanable funds is $LF^D = 12.5 - 0.75\,r$. We can see that the "constant term" has increased from euro 10 billion to euro 12.5 billion. This means that the government has decided to increase public investment by euro 2.5 billion. Public investment is assumed to be non-sensitive to the real interest rate – and hence is included in the constant term.

5. The new equilibrium interest rate *r** is 8%. $LF^S = LF^D = 6.5$ billion euros. The new equilibrium interest rate is higher because the first impact of the increase in public investment is an increase in LF^D. The LF^D-curve shifts to the right – and becomes LF^{DNew} . In the old equilibrium, banks were <u>fully loaned up</u>, *i.e.* $LF^S = LF^D = 5.5$, and they cannot issue new loans. In response to the <u>excess demand for loanable funds</u> $LF^{DNew} > LF^S$, banks raise the (real) interest rate. The higher interest rate induces higher savings (*i.e.* we move up along the LF^S-curve.

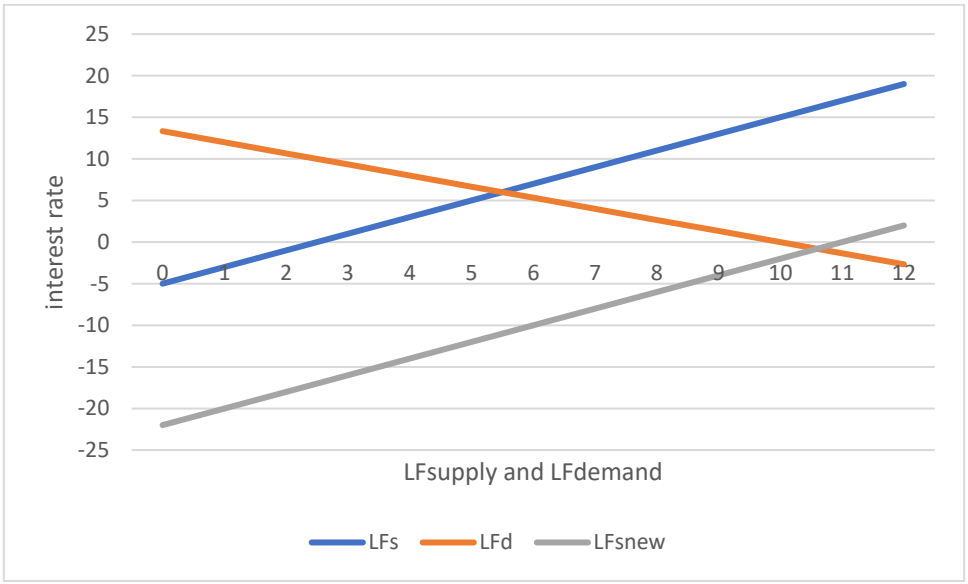


6. The fiscal stimulus did lead to <u>crowding out</u>. This can be seen in a straightforward manner. We know that public investment was raised by euro 2.5 billion (see question 4). Loanable funds demand (which was euro 5.5 billion) rises by euro 2.5 billion. We would expect new $LF^D$to equal euro 8 billion. But in the new equilibrium, $LF^S = LF^D = 6.5$ billions of euros. Hence, the difference of – 1.5 billion of euros must be due to crowding out. Crowding out happens, because banks are (assumed to be) fully loaned up and in response to the excess loan demand decide to increase the interest rate from 6% (before) to 8% (after the fiscal stimulus). The higher interest rate raises savings (or LF^S), but reduces business investment (or LF^D).

7. $LF^S = 10 + 0.50\,r$. The new equilibrium real interest rate r^*= 0%. Why is it lower than before? It is lower because the banks receive a large inflow of (foreign) loanable funds. The LF^S-curve shifts (far) to the right – see the graph below. Equilibrium in the loanable funds market is reached at the zero-lower bound.



8. Now the equilibrium real interest rate become negative. The real interest rate is equal to the difference between the nominal interest rate and the inflation rate. Let us assume that inflation is zero; this means that the real interest rate = the nominal interest rate. Let us further assume that the nominal interest rate can not be negative. In this case, the real interest rate cannot be negative, but remains stuck at 0%. Loanable funds demand (= investment) at 0% is euro 10 billion; loanable funds supply (= savings) at 0% is euro 11 billion. Savings > investment and hence there is a net leakage out of the circular flow of income. The neoclassical economy cannot and does not operate at full employment, but at a level of activity below full employment. There will be unemployment.



EXERCISE W-2.3

1. Keynes pointed out – correctly – that savings and investment do not just depend on the real interest rate, but also (and perhaps more strongly) on the level of income. The level of real income *y*, in turn, depends on investment: an exogenous rise in public or business investment will lead to an increase in real GDP and an increase in savings (households save a fixed proportion of their real incomes). In terms of the graph for the market of loanable funds, this would mean two changes. First, due to the exogenous increase in investment, the LF^D-curve will shift to the right. Second, because investment leads to higher real income and therefore higher savings, LF^S-curve will simultaneously shift to the right as well. According to Keynes, the two curves are inter-dependent – and there cannot be a shift in either the LF^S-curve or the LF^D-curve alone.

2. In the neoclassical model, banks are not money-creating institutions. Banks must first attract or mobilize deposits (= savings, deposited by households in their bank accounts) before they can give loans. Banks will try to attract additional savings by increasing the interest rate (in a situation in which there exists an excess demand for loanable funds). Banks are pure intermediaries – between 'savers' and 'investors'. This also means that investment is constrained by the availability of loanable funds or savings. In this sense, the neoclassical model is a savings-constrained model: higher savings will always lead to higher investment (via lower real interest rates), and higher investment will lead to higher growth (in future).

3. The Global Savings Glut Hypothesis: in the past 25 years or so, global savings have considerably increased for two reasons. First, savings increase due to the ageing of the population (more people save for their retirement). Second, global savings have increased especially because people in Asia (China) have become richer and are saving more (to pay for the education of their children and for retirement). A big part of these (Asian) savings has been deposited in U.S. banks and U.S. financial firms – in terms of the loanable funds market, this inflow of foreign savings, did constitute an enormous increase in LF^S – the LF^S-curve in the U.S. loanable funds market arguably has shifted far too the right. EXERCISE W-2.2. As a result, the U.S. real interest rate has fallen to the zero-lower bound (0%). This way, the Global Savings Glut Hypothesis has been invoked to explain why U.S. interest rates were low before the financial crash of 2007-08.

4. The graph shows that global investment as a proportion of global GDP has not really changed much during 1985-2014; global investment was around 24% of global GDP in the mid-1980s and declined to 21% or in 2014. Because global investment is equal to global savings, this means that there has been no increase in global savings as a proportion of global GDP. There is no evidence of a global savings glut. However, it can be seen that the global real rate of interest did decline: from 3.5% in 1985 to zero in

2014. This suggests that the real interest is not a variable determined in the loanable funds market.

EXERCISE W-2.4

1. The monetary policy rule is: $\widehat{M^S} = \hat{p} + \hat{y}$. The ECB must keep inflation $\hat{p} \leq 2\%$. If real GDP growth is 2.5% next year (scenario A), then we get: $\widehat{M^S} = \hat{p} + \hat{y} = 2\% + 2.5\% = 4.5\%$. Money supply should increase by no more than 4.5%. In scenario B, we get: $\widehat{M^S} = \hat{p} + \hat{y} = 2\% + 1.75\% = 3.75\%$. Money supply should increase by no more than 3.75%.
2. When the ECB engages in open-market operations, it buys or sells (government) bonds in the (secondary) bonds markets. Primary bonds are new bonds issued by government; the secondary bonds market is where one can sell the primary bonds one did buy earlier, or buy bonds from other bond investors. If the ECB buys bonds, it pays using newly created money; money supply increases. If the ECB sells bonds and we are buying those bonds, we pay money to the ECB; this money is taken out of circulation (and is placed on the ECB balance sheet); it is no longer part of money supply (= defined as money in circulation).
3. The classical dichotomy refers to the neat and complete separation that exists in neoclassical macro theory between the real sphere (the circular flow of production → income → demand → production) and the monetary sphere (the money market). In the neoclassical model, money is neutral, which means that the price level *p* (or the growth of the price level, inflation) does not have an impact on what happens and is decided in the real sphere. Intuitively, this can be understood as follows. The market-clearing price in the labour market is the real wage (*W/p*), which is a relative price; the market clearing price in the loanable funds market is the real interest rate; *etc*. Suppose *p* = 1 initially, but then doubles to *p* = 2. Clearly, the real wage (*W/p*) will be halved, and profit-maximising firms would hire more workers; labour demand goes up, but labour supply is exogenous and fixed; accordingly, the nominal wage *W* will rise (because there is an excess demand for labour), and hence the real wage will rise as well – until it is back at its initial level. The same process occurs in the loanable funds market. Suppose the price level increases by 10% to *p* = 1.1. The real interest rate will decline; LF-supply by savers will go down as a result, while LF-demand by firms will go up. There arises an excess demand for loanable funds, and hence, the nominal interest rate will rise, due to which the real interest rate will increase – until it is back at its initial level. Ergo: the level of *p* is immaterial to the real sphere of the economy. This is the classical dichotomy. Keynes rejected it (as we shall see): in his theory, money is always non-neutral; there is no dichotomy between real and monetary spheres.
4. According to the neoclassical approach, the macro-economy will converge to a full-employment equilibrium. This outcome will – in this theory – prevail in the long run

(there can be deviations from full-employment in the short run, but in the long run, market forces will push the economy back to full employment). This would mean that the growth of real GDP $\hat{y}$ converges to a steady state. If we assume that this is the case, then it follows from $\hat{p} = \widehat{M^S} - \hat{y}$ that if $\widehat{M^S}$ increases, $\hat{p}$ must increase as well, and *vice versa*. This is not what see in Figure A. In the 1980s, $\widehat{M^S}$ stays high, but $\hat{p}$ goes down; and during 1995-2003, $\widehat{M^S}$ goes up, but $\hat{p}$ stays down (at 2% or so). Graph A shows that there is no stable relationship between $\widehat{M^S}$ and $\hat{p}$. This is not consistent with neoclassical theory.