



Exercises

Makroekonomi, NA0133

Rob Hart

Version 3*

The problems are divided up following the chapters of my book. We will give more information nearer the time about which problems Abenezer will go through in each class. I will put short answers out on the website after each class. Please remind me if these answers do not appear!

It is optional to take part in the classes. However, note that the questions are highly relevant for the exam. If you try to solve the problems before each class then you will get much more benefit from attending the class.

1 An economy without money

- 1.1 Assume an island community with 100 people, without money. The group decides collectively what job each individual should do—agriculture, silviculture, hunting, building, etc.—and then they share the goods produced. Population is constant.
 - (a) Discuss briefly how the islanders might achieve economic growth, as measured by the value of their net production in USD.
 - (b) Is unemployment likely to arise on the island, under any circumstances? Explain.
 - (c) How would the islanders react if they became increasingly concerned about the future? Would there be a downturn in economic activity? Explain.
- 1.2 Accumulation of capital cannot drive economic growth in the long run. Discuss.
- 1.3 Define GDP in a closed economy without government spending.

2 The circular flow, money, and interest

- 2.1 You live on an island and pick coconuts, 2 per day. You have 20 dollars and pay yourself with them every night. In the morning you can buy the nuts from your firm, eat breakfast, and go to work. Illustrate the circular flow. What are M , V , P and Y ?
- 2.2 If GDP growth in a country is 3% per year, the velocity of money is constant, and the central bank wants to achieve an inflation rate of 2 percent per year, how fast must the money supply increase? Explain!
- 2.3 In a closed economy the government is running a deficit and the government debt is increasing. Axel thinks this is wrong because the debt will be a burden for future generations, while Bert believes that Axel is wrong because the government does not borrow from future generations, but rather from today's citizens. Who is right?

* Additions are at the back; there are also some tiny corrections. Note that question 4.3 is replaced by 4.3* (at the back), now with new numbers (Version 3).

2.4 In an economy, there are four hundred people, three hundred people working and a hundred who have retired. Those who work earn 100 USD per day, and both workers and retirees receive 30 USD per day as returns on their capital. Workers save 30 USD per day, and retirees spend 60 USD per day on consumption. The financial transactions are handled by a bank that lends money left over to companies who want to invest in capital.

- (a) Illustrate the circular flow.
- (b) What is the GDP of the economy?
- (c) What is the level of the nation's investment, as a percentage of GDP?
- (d) What proportion of GDP goes to capital owners?

2.5 Assume an economy—Coconut Island—with 100 workers, and no capital. Each of the workers earns 100 000 SEK per year, of which the government takes 20 percent in income tax. The government spends 1.8 million SEK per year on government consumption. The government debt at the start of the year is 50 percent of GDP, on which the government must pay interest at 2 percent per year. The economy is in long-run equilibrium in the sense that inventory investment is zero.

Illustrate the circular flow. What is the government budget deficit (or surplus) that year?

2.6 In a year, 1999, the prices and quantities of three products change as follows.

	Tennis rackets		Chocolate	
	Price, SEK.	Quantity.	Price, SEK.	Quantity.
1998	200	10	5	200
1999	300	10	10	200

- (a) What is the percentage change in prices of the different goods?
 - (b) What is the rise in the consumer price index?
 - (c) Has the price change of tennis rackets been relatively higher or lower than for chocolate?
 - (d) Has the welfare of some consumers increased or decreased relative to other consumers? Explain.
 - (e) Explain why it is harder to measure inflation when the amount of goods purchased are subject to change due to price changes.
- 2.7 Assume that the Spanish government wants to raise money by selling government bonds. Anyone who buys such a bond obtains EUR 1000 after exactly one year. How much can the Spanish government raise per bond if the risk-free interest rate in the euro area is 5 percent per year, and the market believes that it is certain that Spain will be able to fulfill its obligation to pay?

3 Economic growth 1: Empirical observations

- 3.1 Explain why it is easier to interpret a graph of GDP over time when the (natural) logarithm of GDP is plotted.
- 3.2 Are European countries such as France and Sweden falling behind the United States in terms of GDP?
- 3.3 What is the most remarkable feature of U.S. growth since 1870?
- 3.4 Explain why technological progress prior to 1700 led to a greater global population but not higher GDP per capita, at least for the majority. How rapid was that progress?
- 3.5 The question is about the development of GDP per capita in the United States and China since 1870. Use Figure 1 to help you answer the questions.
 - (a) GDP per capita in the US is more than 10 times higher today than in 1870. Does that mean that US citizens consume 10 times more today than in 1870?
 - (b) China's growth has accelerated considerably since the late 1970s. The amount of capital per capita has also increased tremendously over the same period. Can we therefore conclude that the capital increase is the main reason behind the growth?

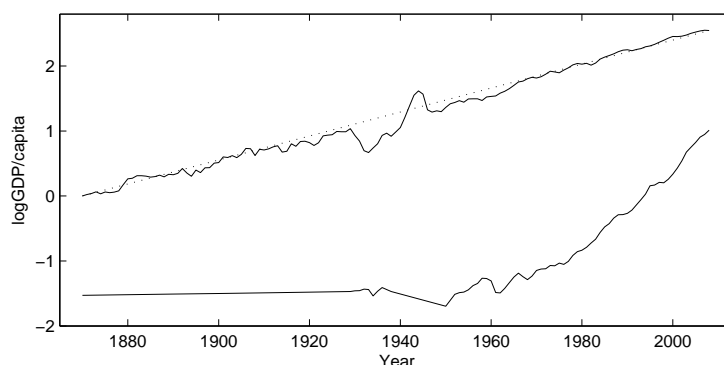


Figure 1: GDP per capita since 1870: comparison between the US (upper curve) and China. Source: Maddison.

4 Economic growth 2: Capital accumulation and technology adoption

- 4.1 Assume an economy with a single product, widgets. Widgets can be easily (freely) converted to consumer goods or capital goods (machines): one widget gives one unit of consumption, or 0.2 machines. The price of a widget is 1 SEK. Machines are used in production, and a worker with a machine is twice as productive as one without a machine.

Assume that the economy starts off in a state with no machines, and that the population suddenly decide to save 20 percent of their income, forever. Describe what happens (in general terms) to Y , C and I in the short run, the medium run, and the long run.

- 4.2 Assume an economy with a single product, widgets. Widgets can be easily (freely) converted to consumer goods or capital goods (machines): one widget gives one unit of consumption, or 0.2 machines. The price of a widget is 1 SEK. Machines are used in production, and a worker with a machine is twice as productive as one without a machine.

In the initial state—in the year 1900—there are 1000 workers and no machines, and each worker produces 1 widget per year. Of the total widget production, 20 percent is converted into machines and 80 percent is converted into consumption goods.

- Draw the circular flow for the year 1900. What are Y , C , and I ?
 - How many machines are there in 1901? What are Y , C , and I ?
 - Assume that 8 percent of machines break down irreparably each year. Furthermore, assume that by the year 2000 there are 1000 machines in the economy. What are Y , C , and I ? Is this a long-run steady state of the economy?
 - Illustrate approximately how Y , C , and I develop between 1880 and 2000, assuming there is no investment prior to 1900.
 - Assume that the investment rate rises to 40 percent in the year 2000. What happens as a result?
- 4.3 Assume an economy in which there are people and machines, and each machine needs one person to operate it. Machines last for one period (corresponding to several years), at which point they fall apart irreparably and must be replaced by new machines. In period 1 there are 100 people and 100 (new) machines. Of these, 75 people—each with a machine—work on the production of consumer goods, while 25 people—each with a machine—work on the manufacture of the next-generation machines. 100 new machines are ready in period 2, and they are 25 percent more productive than the old. That is, they generate 25 percent higher output per period. All workers command the same wage, which is 100 crowns per period in period 1. The interest rate is 100 percent per period. Finally, assume that the economy is growing steadily, in the sense that the growth rate, savings rate, and interest rate are all constant.
- Draw the circular flow, and fill in wage payments.
 - Denote GDP in period 1 as Y_1 (in units of crowns per period). Write down expressions for C_1 and I_1 in period 1.

- (c) Given that the interest rate is 100 percent, how much must capital owners in period 2 (i.e. those who invested in capital in period 1) pay back to those from whom they borrowed in period 1? Write your answer in terms of Y_1 .
 - (d) Now rewrite your answer for part (c) in terms of Y_2 .
 - (e) Now write payments to capital in period 1 as a function of Y_1 .
 - (f) Characterize the allocation in period 1 by completing your picture of the circular flow. In particular, state (for period 1) GDP, the wage, consumption, investment, and the shares of labour and capital.
- 4.4 Plot a schematic diagram showing the supply of and demand for investment funds as a function of the interest rate, assuming a perfect market. Use your diagram to analyse the effects of the following shocks, in an economy in which new machines are rolled out every 10 years, and the quality of next-generation machines is an increasing function of investment.
- (a) Households suddenly become more concerned about the future.
 - (b) Households suddenly become less concerned about the future.
 - (c) Firms suddenly become more optimistic about the future, in the sense that they expect higher returns to investment *ceteris paribus*.

5 Economic growth 3: Endogenous growth

- 5.1 Two countries, A and B have the same GDP in 2000. Country A, however, had twice the GDP in 1995, but production then dropped drastically because of the devastation associated with a lost war that is now over. The GDP of Country B grew steadily, by 2 percent per year, during the same period.
- (a) Compare the countries' likely growth over the next 20 years.
 - (b) Explain the difference using Solow's theory of growth through capital accumulation.
 - (c) Explain the difference by reference to possible differences in the institutions in the two countries.
- 5.2
- (a) Why might a firm's investment in new technology give that firm less in return than the *social* return on the investment?
 - (b) Why might this be perceived as a problem for society, and thus also for the government's economic policies? How can the problem be solved?
 - (c) Could investment in new machinery give lower expected returns to the investor than the social return?
- 5.3 Assume a closed economy in equilibrium with zero growth, with 1000 individuals, each with her own firm which manufactures, with the help of machines, goods that are then traded on a market. Workers allocate 10 percent of their time to building machines.
- (a) In the year 2000 the individuals decide that they want to invest more in the future, and therefore they decide to allocate 20 percent of their time to building machines—which are highly demanded—and 80 percent to producing consumer goods. What happens to GDP over time?
 - i. Right Away;
 - ii. In the medium term;
 - iii. In the long term.
 - (b) They realize that they must invest in new technology in order to achieve long-run growth. However, no-one is willing to invest. Explain why not, suggest two possible solutions to the problem, and discuss their advantages and disadvantages.
- 5.4 Assume two primitive economies isolated from one another, but starting with similar technologies. One economy is a small island, current population 1000, the other a continent with a current population of 1 000 000.
- Discuss the likely growth rates of GDP in the two economies over the following centuries, assuming that they remain isolated.

- 5.5 In an economy without money, the growth rate depends on the quantity of resources allocated to improving productivity in the long run through technological change. The same applies in a market economy!

Discuss factors which tend to lead to too few resources being allocated to technological change in the market, compared to what would be allocated in a perfectly managed economy without a market. How can these problems be overcome?

6 The business cycle 1: Empirical observations

- 6.1 The year is 1993, and there is an economic crisis in Sweden. According to the Department of Economic History at Lund University, Swedish GDP per capita was 3705 1910-SEK per year in 1993. In retrospect we can see that trend GDP was roughly 4100 1910-SEK per year. In 2013 Swedish GDP per capita was 378 600 SEK per year

- (a) Explain the enormous difference between levels of GDP in 1993 and 2013.
 (b) GDP was below trend in 1993. By how much? Comment.

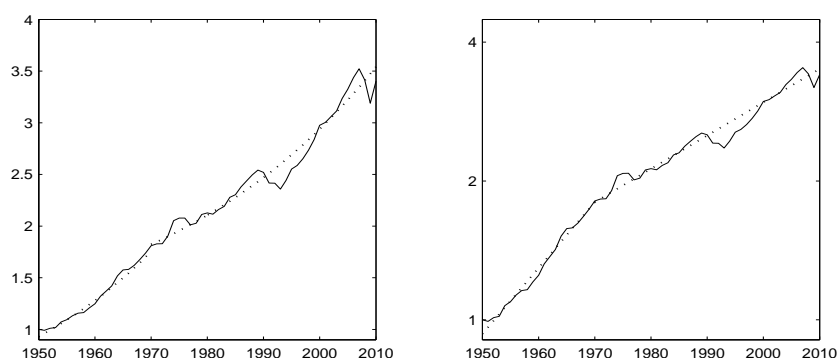


Figure 2: Real GDP in Sweden since 1950, relative to 1950. The dotted line shows an estimate of the trend—with a break in 1970—and the right-hand figure has a logarithmic scale on the y-axis. The trend is for growth at 3 percent per year, then 2.5 percent per year. Source: Lund University School of Economics and Management.

- 6.2 Consider Figure 2.
- (a) The left-hand panel seems to show constant growth, while the right-hand panel shows declining growth. Which is the better guide?
- (b) The left-hand panel seems to show that the drop in GDP after 2008 was bigger than the drop after 1990, whereas the right-hand panel seems to show that they are equally large. Which is the better guide?
- 6.3 Aggregate investment is strongly procyclical, while unemployment is countercyclical. Explain what this means. (Note: The terms are not defined in the book, use google or other sources.)

7 The business cycle 2: A very simple Keynesian model

- 7.1 Assume a closed economy where the only input into production is labour, and there is no public sector. There are two types of economic agent, workers and retirees.
- (a) Draw a picture of the circular flow of money in this economy. Show consumption, saving/investment and wages. What is GDP?
- (b) Is there capital in this economy? Is there investment?
- (c) One agent-type has positive saving, the second type has negative savings. What type is which?

- (d) What happens to firms' inventory investment if one group's savings exceeds the other's negative savings? What could the consequence of this be?
- (e) Suggest mechanisms by which this imbalance could be smoothed out.

7.2 The year is 1400. Assume an economy with 10 identical producers / consumers, and a single product, milk. There is full employment, 10 liters of milk are produced and consumed per day. The milk costs 10 USD per liter. There is an unlimited amount of money (through credit). Every night the workers get paid, and then buy milk. The company has a stock of milk; it is not necessarily today's production that is consumed.

A certain Monday night one person decides to save his money instead of consuming milk.

- (a) Show the circular flow of money; show also the flow of goods and services.
- (b) Show the bank's balance sheet on Tuesday morning given that it looks like this on Monday morning.

<i>Assets (USD)</i>		<i>Liabilities (USD)</i>	
<i>Monday</i>			
Reserves	100	Deposits (f)	100
Loans	0		
Total	100	Total	100

The firm decides, on Tuesday, to reduce production (and the labour force) in accordance with the lower demand. Those who do not get paid may not borrow money; they have to stop consuming.

- (c) Show the new circular flow of money.
- (d) How does it look on Wednesday, and beyond?
- (e) On his birthday the person who saved money decides to withdraw it and buy an extra liter. What happens?

7.3 The year is 1500. Assume an economy with 30 people, of whom 20 are working and 10 have retired. There is one commodity, milk. There is full employment, and 40 liters of milk are produced and consumed per day. Milk costs 5 SEK per liter. There is an unlimited amount of money (through credit). The salary level is 10 SEK per day.

Each day, during the day, the retirees withdraw 6 SEK from their savings and buy milk. Those who work get paid 10 crowns; they save three of them, and use the rest to buy milk. For simplicity, we assume that the interest rate is zero.

- (a) Show the circular flow of money and goods / services. What is GDP (SEK per day)?
- (b) The balance sheet of the bank on Monday morning is shown below. How does it look on Tuesday morning (after Monday's transactions are completed)?

<i>Assets (SEK)</i>		<i>Liabilities (SEK)</i>	
<i>Monday</i>			
Reserves	1000	Deposits (pen)	10000
Loans (firms)	19000	Deposits (wkrs)	10000
Total	20000	Total	20000

On Tuesday, all those who work decide to save 4 crowns instead of 3. The company produces as usual.

- (c) Show the circular flow of money and goods / services on Tuesday. What is GDP?

The company's milk inventory increases by 4 liters. The company decides, on Wednesday, to reduce production (and the labor force) in accordance with the lower demand. Meanwhile, those who work return to saving 30 per cent of their income. The unemployed spend / save nothing.

- (d) Show the new circular flow of money. What is GDP (SEK / day)?
- (e) Show the circular flow on Thursday. What is GDP (SEK / day)?
- (f) On his birthday (much later) the person who saved extra decides to withdraw the money and buy an extra liter. What happens? Bonus question: What's the overall effect of the savings decision on GDP, in SEK?

7.4 Assume that the following applies to the closed economies, Asien and Besien.

Both	Asien	Besien
$C_0 = 400$ tSEK per year	$t = 25$ percent	$t = 50$ percent
$MPC = 0,8$	$T = 625$ tSEK per year	$T = 1250$ tSEK per year
$I = 100$ tSEK per year		
$G = 0$ tSEK per year		

Here C_0 is autonomous consumption, MPC is the marginal propensity to consume, I is the real investment in equilibrium, G is public consumption, t is the rate of income tax, and T are transfers from central government to households.

- When $GDP = GDP$ equilibrium (and inventory investments are zero), we know that Y is equal to $MPC [(1 - t)Y + T] + C_0 + G + I$. Show this with the help of a picture of the circular flow.
- Calculate equilibrium GDP for each country.
- Calculate the multiplier for each country.

Assume that both countries initially have a GDP level that is equal to GDP equilibrium and then they are affected by a disturbance in aggregate demand such that C_0 decreases temporarily (for one year) by 50 thousand SEK.

- What will be the total decline in GDP as a result of the disruption, in each country?
- Explain the meaning of automatic stabilizers. Does a large public sector lead to larger or smaller economic fluctuations?

- 7.5
- Explain why investment I normally falls more (in percentage terms) than consumption C during a downturn in economic activity.
 - Compare to what happens in an economy without money when households become worried about the future and reduce their consumption.

- 7.6 Assume an economy with 100 workers. Each worker needs one machine in order to be productive. The workers are employed by competitive firms, each of which owns 10 machines and employs 10 workers. Eight of the firms produce consumption goods, and 2 produce new machines. These two firms, with 10 employees each, produce 5 machines each per year (10 machines per year altogether).

Each year, 10 percent of machines break down irreparably (depreciation). In a normal year that means that 10 machines depreciate, and therefore 10 new machines must be bought, and the economy is in long-run equilibrium. For simplicity we assume that machines used in year n are also made in year n .

Now assume that year 1 was a normal year, but in year 2 consumers reduce their purchases of consumption goods by 2 percent. This means that producers of consumption goods decide to reduce their production in year 3 by 2 percent, and they lay off 2 percent of their workers.

- How many machines do the producers of consumption goods buy in year 1? And how many do the producers of machines keep back from their own production?
- How many machines do the producers of consumption goods buy in year 2? And how many do the producers of machines keep back from their own production?
- How many machines do the producers of consumption goods buy in year 3?
- Assume that the producers of machines predict demand in year 3 accurately. How many machines do they make in year 3, and of these how many do they keep?
- Use the model to help explain why investment is more volatile than consumption in real economies.

- 7.7 Assume an economy with households, firms, a financial sector, a central bank, and a government. The government taxes income and uses the money to pay for services such as health care and education. The role of the central bank is to determine the interest rate in the economy.

Households become worried about the future and cut their consumption.

- Explain how this can lead to an economic downturn.

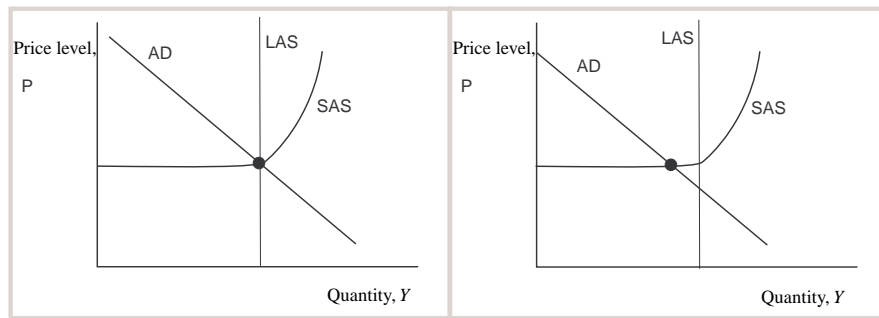


Figure 3: $AD-AS$ model with booms: (a) the economy is in equilibrium; (b) recession. The black dots show the price level and GDP, where AD and SAS meet.

- (b) Discuss what the government and central bank can do to speed up recovery from the downturn.
- (c) In real economies, monetary policy is used much more actively than fiscal policy to manage the business cycle. Why?

8 The business cycle 3: A model of the medium term with inflation

- 8.1 Assume an economy with a single product, widgets, produced using labour alone. There are 100 working-age adults in the economy, each of whom can produce one widget per day, and everyone works in widget production. (All adults are in the labour force, and there is no unemployment.) There are also 50 retirees in the economy, and workers save a proportion of their wages to build up savings, while retirees live off their savings. The economy starts in a long-run equilibrium with zero net savings, zero investment, and zero inflation.

Now assume that the short-run supply curve is similar to that illustrated in Figure 3, and that the citizens of the economy become more optimistic about the future and decide to save less and consume more. Describe what happens over time according to the $AD-AS$ model assuming that wages are *sticky*, that is that they change slowly in response to changed circumstances.

- 8.2 Assume an economy in equilibrium which is suddenly hit by a negative demand shock, such that the demand curve shifts to the left. Use $AD-AS$ model to answer the following questions.
- (a) Show the short-term impact on GDP (and hence unemployment) and inflation.
 - (b) Show the effect in the medium term if the state does nothing and the high unemployment leads to a downward pressure on wages.
 - (c) Show the effect in the medium term if the state tries to neutralize the shock with expansionary policy.
- 8.3 (a) An economy, A, has long had stable inflation at 2 percent per year. Suddenly the government implements a more expansionary policy that leads to a sharp increase in AD . Explain the effect on inflation, GDP and unemployment in the short and medium term.
- (b) Another economy, B, has long had high and volatile inflation, which is, however, currently at 2 percent per year. Suddenly the government implements a more expansionary policy that leads to a sharp increase in AD . Explain the effect on inflation, GDP and unemployment in the short and medium term, compared to in economy A.
- 8.4 Assume a country where technological development means that labour productivity rises. Illustrate what happens with LAS curve with time. Explain briefly!

- 8.5 Assume an economy with zero growth (there is no technological progress) in which prices and wages both grow at 2 percent per year, while unemployment is stable at 5 percent. The government is not happy; it wants higher GDP and lower unemployment. To achieve this it decides to reduce interest rates and raise spending. Furthermore, it is determined to achieve its goals.

Describe, step-by-step, what is likely to happen. Use economic reasoning (such as a model economy), and cite evidence from real economies.

- 8.6 Assume an economy in which the government controls both monetary policy (the interest rate) and fiscal policy (the government budget). The government claims that it hates inflation, but market agents are not convinced; they think that the government hates unemployment, and isn't too bothered about inflation as long as it is no higher than 10 percent. The inflation rate is currently 10 percent, and the interest rate is 13 percent.
- (a) What is likely to happen if the government announces that from now on inflation will be 2 percent, and consequently that it plans to reduce interest rates to 5 percent so that the real interest rate remains at 3 percent? Explain carefully.
 - (b) What is likely to happen if the government announces that it has created an independent central bank whose sole aim, set down in law, is to keep the rate of inflation as close as possible to 2 percent? Explain the difference.

- 8.7 The central bank controls the short-run interest rate. This question is about how the *long-run* interest rate is determined.

The date is May 29. Assume you hold, among other assets, 10000 bonds giving 50 EUR in payment at the end of each year, in perpetuity. You are happy with your investments at the moment. However, you are suddenly convinced that the central bank is going to lower the short-run interest rate on June 1, and moreover that it will signal a lower interest rate path in the future than the one previously announced. These events are not expected by the financial markets.

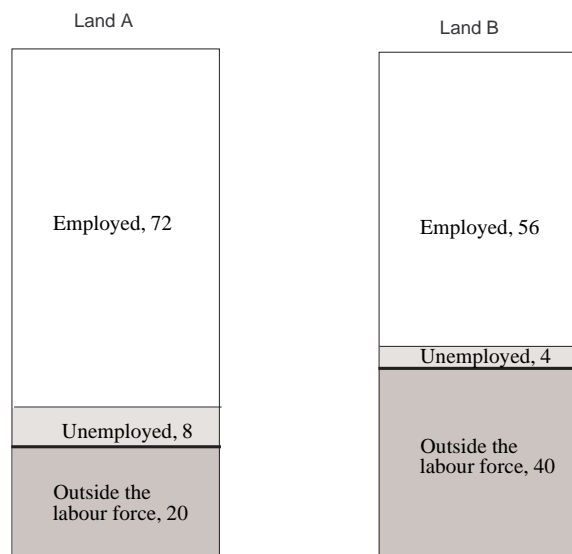
- (a) What do you do with your bonds, or any of your other assets, when you get your new beliefs? Explain!
 - (b) Assume instead that you are not alone in your insight: the entire market has the same insight as you, on 29 May. What happens?
- 8.8 Assume that you own a hundredth of a business, and the market believes that the company—if it is well run—will deliver benefits totaling 100000 SEK annually in perpetuity to their owners. You are thinking of selling your share when you retire and living on it.
- (a) What is the value of your share of the company if the interest rate is fixed at 5 percent per year in perpetuity?
 - (b) What is the value if interest rates rise to 10 percent?
 - (c) What is the impact of such a rate increase on your prioritization between consumption and saving? Explain!

- 8.9 –We cannot promise spending when there is no money, said Finance Minister Anders.

Prime Minister Fredrik however is confused. Should the government not run a deficit during a recession? Help him sort this out! Is Anders right? Is Fredrik right? What should Fredrik do?

9 Unemployment: Definitions and Data

- 9.1 Two countries, A and B, have 100 working-age adults each. Their economies are in long-run equilibrium, and the occupations of the working-age adults are distributed as below.



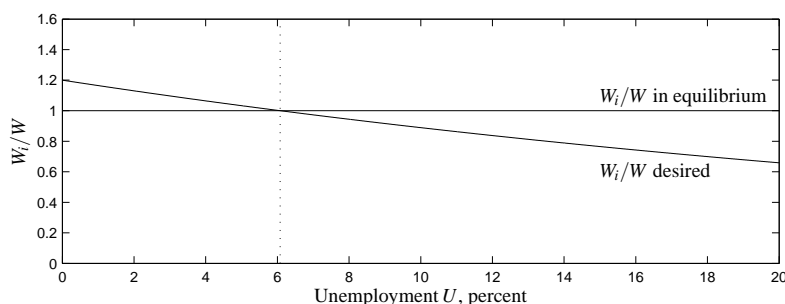
- (a) i. What is the level of unemployment in each country, as a percentage?
 ii. Every person who is employed produces goods with a value of 1000 SEK per year. What is the level of GDP per capita in each country?
- (b) Discuss briefly the following statement: ‘The labour market in Country A works better than in Country B, because more jobs are created in A than in B.’

10 Unemployment: Explanations and Policy

- 10.1 Assume an economy without money in which the citizens decide collectively what each person should do, to best contribute to the common good.
- (a) Discuss whether factors such as technological progress and immigration are likely to create unemployment in such an economy.
- (b) Are government policies to encourage business activity likely to reduce unemployment in such an economy?
- (c) Is there any reason to suppose that these conclusions change in a market economy?
- 10.2 Explain the concept of voluntary unemployment, and use the *AD-AS* model to explain why voluntary unemployment might fall in a boom.
- 10.3 Assume a modern economy with inflation at a steady 2 percent and a central bank whose job it is to keep it that way. There are 10000 people in the labour market, of whom 9500 have jobs and 500 are unemployed. Of those with jobs, 300 work in what remains of the steel industry, of whom 200 have very specialized skills and high wages. However, the steel industry in this economy is dying due to cheaper competition from abroad, and on 1 January 2015 the last factory closes. The reservation wages of all the former workers in the factory are close to the wages they received before its closure.

Discuss the likely evolution of the economy over the next two years, including the actions of the central bank and changes in the rate of unemployment.

- 10.4 Assume an economy of 100 similar firms, and 100000 people in the labor force. In an equilibrium with full employment each firm employs 1000 people and pays everyone 10 SEK per day. But if unemployment is zero then each of the firms would like to pay 20 percent higher wages than the other firms, in order to attract and retain staff. The higher the unemployment rate, the less each firm wants to pay in relation to the others. The relationship between the firms’ desired relative wage level, W_i/W , and the unemployment rate U , is shown in the figure below.



- (a) Why does the curve for “ W_i/W desired” slope downwards?
 (b) What will the unemployment rate U be in long-run equilibrium? Explain.
 (c) What can we say about inflation in such an equilibrium?
 (d) Suggest policies which might reduce equilibrium unemployment.
- 10.5 Assume an economy in which the central bank sets the interest rate in order to hold the inflation rate at 2 percent per year, and firm profits are higher the lower is the real interest rate. When the interest rate is low, profits are high, and new firms try to enter. A firm which chooses to enter offers wages to ensure that there is at least one applicant per job. There are 200 workers. If a job offers a normal wage—in line with other jobs—then 1 out of every 10 unemployed workers chooses to apply. On the other hand, if a job offers above-normal wages then 1 out of every 5 unemployed workers choose to apply, as well as workers who are already in jobs.
- (a) What is the NAI rate of unemployment? Explain.
 (b) Assume that 3 workers are unemployed, the inflation rate is 2 percent, and the base rate of interest is 4 percent. Profits are at normal levels and there is no net entry of firms. What does the central bank do next? Explain.
 (c) The government wants to reduce the NAI rate of unemployment. What sort of actions might it take? Explain. (Note that you need to state assumptions about the existing situation.)
- 10.6 Assume an economy in which trade unions are able to influence wages for everyone in the economy, including non-members. However, the higher the rate of unemployment, the stronger the incentive is for unions to restrain their wages demands. Labour productivity in the economy increases by 2 percent per year, and the central bank has the task of keeping the rate of inflation at or close to 2 percent per year. In 2015 the inflation rate is 2 percent and the rate of unemployment is 4 percent. Meanwhile the unions and employers agree wage increases averaging 6 percent.
- Describe what is likely to happen over the next few months and years.
- 10.7 Assume an economy in which trade unions are able to influence wages for everyone in the economy, including non-members. However, the higher the rate of unemployment, the stronger the incentive is for unions to restrain their wages demands.
- Compare the likely equilibrium rate of unemployment in the following three cases. Explain carefully.
- The unions only represent a very small proportion of the workforce and have little or no power to set wages.
 - There are many unions which compete for members and bargain separately over wages.
 - The unions get together and bargain collectively over wages.
- 10.8 Assume an economy in which trade unions are able to influence wages for everyone in the economy, including non-members. However, the higher the rate of unemployment, the stronger the incentive is for unions to restrain their wages demands.
- (a) Show, using a figure with real wage on the vertical axis and jobs on the horizontal, how a prolonged recession (case of AD to the left) can create more outsiders in an economy, i.e. individuals outside the wage bargaining process and the trade unions.
 (b) Explain why—when there are many outsiders—inflationary pressure is likely to be higher at any given level of unemployment.

(c) Could this be relevant to Sweden? Is there any evidence for that?

10.9 Assume two economies, each with 1000 workers and a central bank which holds inflation to 2 percent per year. Everything about the economies—the skills of the workers, the level of unemployment benefits, the institutions (how the economy is managed), etc.—is identical, except in one respect: in economy 1, agents' preferences are such that workers are terrified of unemployment, whereas in economy 2 workers are much more relaxed about the risk of losing their jobs. What differences can be observed between the economies according to the 'reserve army' model?

10.10 In Sweden, around 6000 people are employed in the mining industry in 2015. Imagine an alternative reality in which Swedish minerals ran out in 1965. Which of the following statements is nearest to the truth? Explain your choice.

- i There would be approximately 6000 fewer people employed in Sweden in 2015, in total, in the alternative reality, and hence unemployment would be higher by 6000.
- ii There would be an even greater shortfall in employment in the alternative reality in 2015, because many of the other workers necessary to support the mining communities (in schools, hospitals, etc.) would also be without jobs.
- iii The level of unemployment in 2015 would be the same in the alternative reality as it is in the real Sweden.

11 Open economies

11.1 On April 27, 2002, The Economist published its "Big Mac Index" and noted that the US dollar was overvalued. Among other things, it presented the following figures.

Country	Price	Price (USD)	Implied PPP rate	Actual exchange rate 2002-04-23	Overvaluation percent
USA	2.49 USD	2.49	-	-	-
Euro area	2.67 EUR	2.37	0.93 USD / EUR	0.89 USD / EUR	-5
Sweden	26 SEK	2.52		10.3 SEK / USD	+ 1

- (a) What is the PPP exchange rate between the SEK and the USD is implied by the prices?
- (b) What was the exchange rate between the SEK and the EUR?
- (c) Was the Swedish crown, on this basis, over- or undervalued against the euro? By how much?

11.2 The year is 1980. The souvenir donkey industry in Spain is on its knees. You make a plan to import donkeys redesigned to Dala Horses. You buy donkeys with pesetas and sell them in Sweden for crowns.

- (a) How are your profits affected by the changes below?
 - i. The nominal exchange rate is unchanged, but prices are rising faster in Sweden than in Spain.
 - ii. The nominal exchange rate is unchanged, but prices rise more slowly in Sweden than in Spain.
 - iii. The crown depreciates (more per ESP), and the prices are unchanged both in Sweden and in Spain.
- (b) When foreign goods become cheaper, and import business benefits, is that called a real appreciation or depreciation of the currency?

11.3 (a) If the government has a budget deficit while private net lending is zero, what can you say about the current account?
 (b) The US has a negative current account balance, while China has a positive balance and large net exports to the US. Explain in terms of the countries' net financial savings, with the help of a picture of the circular flow.

11.4 Assume that the global economy consists of two countries with identical GDP of 2000 SEK per year. However, there are net exports from country A to country B worth 200 SEK per year. Explain by using an image of the circular flow how this can be possible.

- 11.5 Assume an open economy with a floating exchange rate that is heading into a recession caused by a sharp reduction in real investment in the private sector. The government responds by lowering short-term interest rates in the economy, as well as signalling that interest rates will remain low for a significant period of time.
- Explain the effect on the exchange rate according to simple theory.
 - Explain the effect on net exports in this case.
 - Is the effect of interest rate change is greater or less than it would have been if the economy had been closed? [Is multiplier is higher or lower than if the economy had been closed?]
- 11.6 Assume a country, in 2007, with GDP of 100 million EUR per year, and a government debt of 100 million EUR. The government budget is in balance; it draws in 40 million EUR per year in taxes and spend them on government consumption (38 million) and interest on the government debt, which is 2 million EUR per year since the interest rate is 2 per cent per year. The loans on the government debt are renewed on an annual basis.
- Assume now that the economy enters a major crisis in 2008 such that the GDP drops to 80 million EUR per year. Government consumption increases due to the necessary increases in social welfare to 43 million, while revenue drops to 35 million. The interest rate (set at the beginning of the year) is still 2 percent, and the interest cost is 2 million.
- The crisis continues, and in 2009 GDP is again 80 million, while government revenue is again 35 million and public consumption is 43 million. Market agents are concerned, and no one is willing to lend money to the country without real interest rate increases to 10 percent. The new rate applies to the entire government debt.
- What is the government deficit in 2008?
 - What is the government debt at the beginning of 2009?
 - What is the government deficit in 2009?
 - What is the government debt at the beginning of 2010?
 - What solutions are available if the country is in the common European currency, the euro? What are the options if the country is *not* in the euro, or if it is able to withdraw?
- 11.7 Households in the UK owns assets worth 7×10^9 GBP net, while the total return on assets within the UK economy is about 0.4×10^9 GBP per year.
- Assume that all UK assets owned by UK households. What is the yield in percent per year in that case?
 - Who might own the assets if not households?
- 11.8 Assume a small country—GDP = 2000 million EUR per year—which is part of a monetary union with several major countries. Assume that 30 percent of consumption and investment is domestically produced, and 70 percent is imported. The government budget is in balance, and the current account balance is zero.
- The government is not satisfied with the pace of economic growth, and increases G to 100 million EUR per year. What happens in the short term with the following quantities, according to Keynes: (i) imports; (ii) exports; (iii) aggregate demand; and (iv) the current account balance?
 - What happens in the medium term as a result of the expansionary fiscal policy?
 - Assume the country decides to leave the union and allow the exchange rate to float freely. The government continues to pursue expansionary policies, and inflation is 6 percent per year, while inflation in the RoW¹ is 2 percent per year. What happens as a result of this policy?
- 11.9 Assume a small island economy (3 million inhabitants) whose GDP per capita is 50 percent of USA's GDP per capita. The country exports agricultural products, and imports some hi-tech products. Imports are strictly controlled, and the rules ensure that most products (including cars and computers) are assembled at home from imported parts. There are restrictions on taking capital out of the country, and the exchange rate is fixed relative to the dollar. Unemployment is 2 percent.

1. RoW = rest of the world.

Discuss possible short and long-run effects on (a) GDP and (b) unemployment if the country removes all barriers to trade and lets the exchange rate float freely.

- 11.10 Assume a country with 60 million inhabitants whose GDP per capita is 50 percent of USA's GDP per capita. Unemployment is 8 percent and the growth rate of GDP per capita has averaged 2.0 percent over the last 10 years. The exchange rate floats freely.

A new government comes in and introduces a range of measures which it says will increase competitiveness and therefore lead to a fall in unemployment. These measures include weakening rules regarding environmental protection, removing barriers to trade, and funding research.

Discuss the likely effect of these measures.

Late additions

4 Economic growth 2: Capital accumulation and technology adoption

The following question replaces question 4.3.

4.3* Assume an economy in which there are people and machines, and each machine needs one person to operate it. Machines last for one period (corresponding to 10 years), at which point they fall apart irreparably and must be replaced by new machines. In period 1 there are 100 people and 100 (new) machines. Of these, 75 people—each with a machine—work on the production of consumer goods, while 25 people—each with a machine—work on the manufacture of the next-generation machines. All workers command the same wage, which is 30 crowns per period in period 1. Payments to capital owners in period 1 are 2000 crowns in total.

- (a) Draw the circular flow, and fill in wage payments, payments to capital owners, consumption, and investment. What is GDP?

Now assume that the 25 workers producing machines complete exactly 100 machines in period 1, that are ready for use in period 2. Furthermore, these machines are 25 percent more productive than machines from period 1, and that consumption, investment, wages, and payments to capital all grow by 25 percent each period.

- (b) What is GDP in period 2? And what are total payments to capital owners?
(c) What is the interest rate per period? And the interest rate per year?

7 The business cycle 2: A very simple Keynesian model

7.6* Assume an economy with 100 workers. Each worker needs one machine in order to be productive. The workers are employed by competitive firms, each of which owns 10 machines and employs 10 workers. Eight of the firms produce consumption goods, and 2 produce new machines. These two firms, with 10 employees each, produce 5 machines each per year (10 machines per year altogether).

At the end of each year, 10 percent of machines break down irreparably (depreciation). In a normal year that means that 10 machines depreciate, and therefore 10 new machines must be bought at the start of the following year, and the economy is in long-run equilibrium.

Now assume that year 1 was a normal year, but in year 2 consumers reduce their purchases of consumption goods by 2 percent. This means that producers of consumption goods decide to reduce their production in year 3 by 2 percent, and they lay off 2 percent of their workers.

- (a) How many machines (made in year 0) do the producers of consumption goods buy at the start of year 1? And how many do the producers of machines keep back from their own production?
(b) How many machines (made in year 1) do the producers of consumption goods buy at the start of year 2? And how many do the producers of machines keep back from their own production?
(c) How many machines (made in year 2) do the producers of consumption goods buy at the start of year 3? And how many do the machine producers have left altogether, to use in year 3?
(d) How many machines do the producers of machines make in year 3, assuming that they expect demand for machines in future years to be equal to demand in year 3, and that they want to have sufficient capacity to meet that demand? Of those they make, how many do they keep?
(e) By what percentage does investment fall in year 3?

- 7.8 Assume an economy with four individuals of different ages. Each individual works for 30 years and is then a pensioner for 30 years. At birth, agents borrow money, buy a house and start work. At retirement, agents have paid off their loan and accumulated some financial assets. They sell the house and move to a flat, subsequently living off their savings. GDP per capita is 625 SEK per year.

The current situation is as follows. The ages of the four individuals are 0, 15, 30, and 45 respectively. The new-born worker has just bought a house for 1000 SEK, and has a debt of 1000 SEK with the bank. The 15-year-old has an identical house, and a remaining debt of 250 SEK. The 30-year-old has just bought a flat for 500 SEK, and has financial assets worth 1000 SEK. And the 45-year-old has an identical flat and savings of 250 SEK.

- (a) What is the total level of household debt in the economy, as a proportion of total GDP?
- (b) Assume that the interest rate declines. What is the effect on consumption C in this economy? Explain.
- (c) Assume that households become more optimistic about future incomes. What is the effect on C ? Explain.