Business cycle

Lesson on the trade-off between actual and potential GDP

DynaLearn level 4 | Versie 0.9

Summary	
The business cycle refers to short-term fluctuations in economic growth. In this lesson, growth is shown based on the development of the Gross Domestic Product (GDP). The difference between actual GDP and potential GDP is also known as the output gap. Based on the output gap, we can describe the economic phase in which an economy finds itself.	
Given name	
Surname	
Class	
Date	
Comments by teacher	

1. DynaLearn starten

There are several ways to log in. Use one of the two options below. Then check whether the login was successful (see 'Let's check').

Via a code:

1. Go to DynaLearn (https://create.dynalearn.nl/).
2. Click on 'log in with code', at the bottom left.
3. Enter the project code and your (school) email address.
4. Copy the code from the confirmation email received from *dynalearn.nl* (see spam folder if needed) and fill in the other details.
5. Log in to DynaLearn.

By email invitation:

1. Copy the login details from the invitation email received from *dynalearn.nl*.
2. Go to DynaLearn (https://create.dynalearn.nl/).
3. Log in to DynaLearn.

Let's check!
After logging in, you will automatically enter the workspace of the assignment. You can recognize it by the gray question mark on the right side of the screen  . Is the question mark missing? Then first:

- In DynaLearn, click  . Click on 'Select template'.
- Choose 'Business cycle' and press 'Load'.

Save model file and start:

1. Click on  top left. Change the name to ' Business cycle' and click 'Save'.
2. How do you proceed? Follow the steps in this workbook. Note! You can't skip steps. Ask for help if you get stuck. The video function  in Dynalearn shows how a model ingredient can be made. The sources contain content specific information, and the boxes contain a brief explanation about the model ingredient. Put a check mark √ next to the step you performed. This way you keep track of where you left off.

2. Introduction

This lesson covers the following learning objectives:

- You can describe how a deviation of actual GDP (aggregate of demand) from potential GDP (production capacity) leads to changes in the business cycle.
- You can explain how the government can influence the business cycle. This is government policy.
- You can describe two indicators that determine government policy.

1. Read Source 1.

Source 1 – Business cycle development

John Maynard Keynes (1883-1946) is a British economist who developed a theory of how a government should act on changes in the business cycle. In this assignment, we are going to recreate that idea in DynaLearn.

The business cycle refers to short-term fluctuations in economic growth. In this lesson, growth is shown based on the development of the Gross Domestic Product (GDP). The business cycle is defined as the deviation from the current situation (short-term equilibrium) from the trend (long-term equilibrium). The current situation is measured by actual GDP, i.e. the sum of all expenditures. Long-term equilibrium is measured by potential GDP. The difference between actual GDP and potential GDP is also known as the *output gap*. Based on the output gap, we can describe the economic phase in which an economy finds itself. There are three possible situations:

A. *Actual GDP > Potential GDP:* Growth
B. *Actual GDP = Potential GDP:* Long-term equilibrium
C. *Actual GDP < Potential GDP:* Recession

2. We can also *rename* the three situations.
   a. Make use of the internet and fill in the blanks below.

- If the actual GDP *is greater than* the potential GDP, there is more spending than expected. This can also be called …
- If the actual GDP *is equal to* the potential GDP, there is a balance in spending. This can also be called …
- If real GDP *is less than* potential GDP, there is less spending than expected. This can also be called …

3. Base model

The start of the model has already been prepared (see figure 1). Note: If you do not you see a beginning like in figure 1, then go back to chapter 1 at *Just checking!*

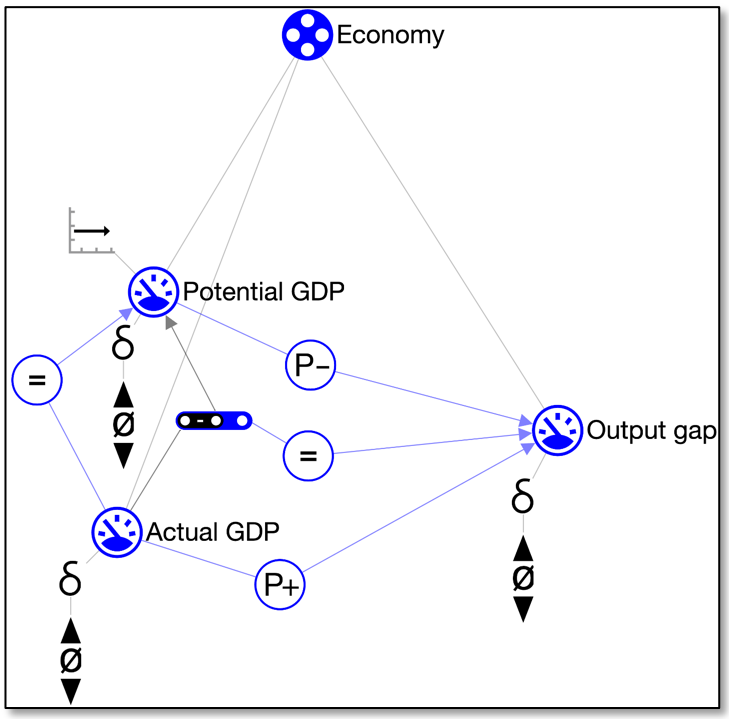


Figure 1. Base model – Initial situation when building the model.

1. Did you forget how the software works? Read Box 1 to 4 to refresh your memory.

2. Read Box 1.

Box 1. Entity and quantity.

An entity is usually a physical thing in a system (e.g., car, human).

A quantity is a measurable property of an entity (e.g., temperature, length).

3. Read Box 2.

Box 2. Change of a quantity.

A quantity can change. This is indicated by δ Ø . The delta symbol (δ) is the mathematical sign for change (also called the derivative). The down arrow (▼) is a decrease, the zero (Ø) is constant and the up arrow (▲) is an increase.

4. Read Box 3.

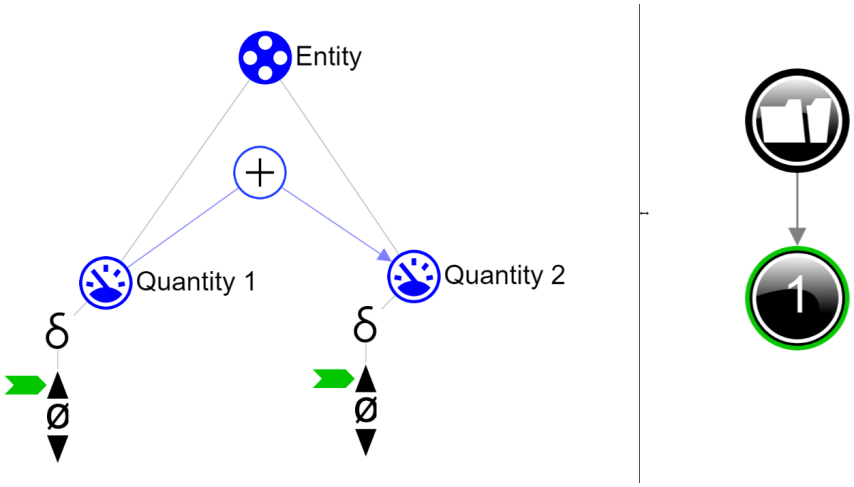
Box 3. Help function

If the explanation mark appears, something is wrong during the simulation. Click on the explanation mark for a hint. Then click on a number, for example 1, to see where the error is in your simulation.

5. Read Box 4.

Box 4. Read the outcome of a simulation.

After starting a simulation (with), a window appears on the right in which the possible states of the system are indicated. There is one possible state in this example .



You can click on the state to view the outcome. The state icon then gets a green circle. In the model, the change for this state is indicated by green arrows . The model shows that in state *Quantity 1* increases and that therefore *Quantity 2* also increases.

The base model (Figure 1) can be used to simulate the three situations mentioned in source 1.

6. Set the initial change of Actual GDP to increase (see →).
   a. Under Actual GDP, click ▲ and choose . It will look like this: 

7. Start the simulation . What happens to the *Output gap*?
   a. Write the result in Table 1.
   b. If you see a blue exclamation mark, read Box 3.

Table 1. Simulation results of the base model.

Change in *Actual GDP*	**What inequality sign do you see appearing? (<, =, >)?**		**Change in *Output gap*?**
	State 1	State 2	
Increases (▲)	…	…	…
Stays steady (Ø)	…	n/a	…
Decreases (▼)	…	…	…

8. Simulate the other two situations as well:
   a. Set the initial change of *Actual GDP* to steady (Ø)
   b. Set the initial change of *Actual GDP* to decrease (▼)

9. Write the results of the simulation in table 1.

4. Business cycle phase

1. Read Box 5.

Box 5. Sum (A + B = C) and Difference (A - B = C).

Sometimes a quantity is *the sum* or *the difference* between two other quantities. This also holds for *Output gap*. We can capture this in a calculation (A-B=C):

Actual GDP – Potential GDP = Output gap

- In the model, we use this function for this purpose. We are now going to represent the result of this calculation using the notion of a quantity space.

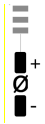
2. Read Box 6.

Box 6. Quantity space.

A newly created quantity does not yet have a quantity space. By adding a quantity space, you can indicate which values a quantity can take on. A quantity space consists of points (●) and intervals (▮).

- A *point value* is only one value. For example, a *boiling point*. A special point is zero, for which there is a separate symbol (Ø) in DynaLearn.
- An *interval* is a set of values. The liquid phase of a substance is an example of an interval. In the case of water, the interval 'liquid' contains all values between 0 °C and 100 °C. The values 0 °C and 100 °C are respectively the 'melting *point*' and the 'boiling *point*' between which the interval 'liquid' is located.

3. Create a quantity space (see →) for the quantity *Output gap* with 0 (Ø, balanced) in the middle, above that an interval **+** (positive, overspending) and below that an interval **–** (negative, underspending). It will then look like this:



4. Read Box 7.

Box 7. Help function.

If the question mark or an ingredient in your model is red, then something is wrong. Click the question mark for a hint. Then click on a number, for example 1 to see where the error is in your model. Only use the question mark if you can't figure it out yourself!

5. Simulate the model with the three initial changes, i.e.:
   - *Actual GDP* decreases (▼), remains steady (Ø), and increases (▲).

6. Write the results of the simulation in Table 2 (below). Cross out wrong answers.

Table 2. Calculation of Output Gap Values

Change *in Actual GDP is …*	**… the value of *Output gap is*** *(in the 'final' state) …*
Increases	– (negative) / 0 (balance, Ø) / + (positive)
Remains steady	– (negative) / 0 (balance, Ø) / + (positive)
Decreases	– (negative) / 0 (balance, Ø) / + (positive)

5. Influence of the government

We are going to add the influence of the government in the model, because the government has influence on the effects of the economy (see also the post below)

1. Read Source 2.

Source 2 – An opinion piece from 2023…

"Especially now, the government needs to start investing"

Unemployment will rise unprecedentedly next year, namely by 200,000 people, according to the latest estimate by the Dutch Bureau for Economic Policy Analysis. An additional concern is that the corona blow will reverberate even longer. It can be learned from previous major crises that unemployment will remain high for a longer period of time, according to the calculations. Over the next 5 years, the damage to the labour market will continue to be considerable.

Important in all of this is the knowledge that additional government spending is more supportive of the economy in the short term than tax cuts. Higher spending leads more quickly and to a greater extent to more domestic output and employment. The lesson of increased spending capacity due to lower costs is that citizens and businesses start hoarding, for example in a savings account. In addition, recent research shows that the so-called 'multiplier', the effect on (structural) GDP development of an increase in government spending, is considerably greater if unemployment in a country is just rising. In other words, stimulus through fiscal policy is more effective at the beginning of the economic downturn. This is exactly the situation the Netherlands is in right now.

2. Source 2 discusses the fact that the government can influence Actual GDP.
   - Cross out the errors in the sentences below:

- By spending more, the government tries to decelerate/keep constant/stimulate the economy, thereby increasing actual GDP (total spending).
- By keeping spending constant, the government tries to decelerate/keep constant/stimulate the economy, keeping the actual GDP (total spending) the same.
- By spending less, the government tries to decelerate/keep constant/stimulate the economy, which reduces actual GDP (total spending).

3. Read Box 8.

Box 8. Agent.

An agent is usually a physical thing with a measurable quantity that affects the system from the outside (e.g., government, sun).

4. Create the **agent** *Government* in the model (see →).

5. Create the **quantity** *Measure* for the **entity** *Government* (see →).

6. Make a quantity space for the **quantity** Measure (→). The quantity space consists of two intervals and one point (zero, Ø). Give the values above and below the zero point the correct names. If necessary, see question 2 above.

7. Read Box 9.

Box 9. An influence relationship.

Some quantities in a system are processes. A process is a quantity that adds or removes something to the system **per unit of time** (e.g. per second, per year).

- Simple examples of processes that **add** something are: (i) water from a tap that flows (L/s) into a bath and (ii) an oven that provides a certain power (J/s) to heat a dish. (iii) the amount of tax paid every year (€/y).
- The outflow (L/s) of water through the drain is an example of a process that **removes** something from the system.

The dependency between a process and another quantity is called an **influence** in DynaLearn (I+ or I-). For this type of relationship, the **value** of the process determines the **change** in the quantity on which an influence is exerted.

Government spending (in the model referred to as *Measure*) can be seen as a process. This process (hence, quantity) has a certain magnitude and affects the Actual GDP.

8. Create the **cause-effect** relationship between *Measure* and *Actual GDP* (→).

9. Click to align everything neatly. Click to make your model fit your screen.

10. Set as initial values (→):

    i. Set the value of *Measure* to Stimulate: Stimulate / Ø / Decelerate

    ii. Create an exogenous influence (→) for *Measure* of the constant type . This indicates that the value of this quantity **does not change**.

10. Start the simulation . What Happens to the *Actual GDP* and the *Output Gap*?
    a. If you see a blue exclamation mark, read Box 3.

11. Run also simulations in which *Measure* remains constant and a simulation in which *Measure* gets value *Decelerate*.

12. Enter the results of the simulation in the table below. Strike out mistakes.

Table 3. Impact of *Measure* on *Actual GDP* and the *Output Gap.*

Measure is:	Actual GDP:	State	Output gap becomes:
Stimulate	Decreases / stays constant/ increases	2	– (negative) / 0 (balance, Ø) / + (positive)
(Ø)	Decreases / stays constant/ increases	1	– (negative) / 0 (balance, Ø) / + (positive)
Decelerate	Decreases / stays constant/ increases	2	– (negative) / 0 (balance, Ø) / + (positive)

6. Influences of the business cycle phase

The phase of the business cycle affects several measurable properties (i.e. quantities) of the economy. We are going to add one of those quantities in the model.

1. Indicate below what the **cause-effect** relationships are. Cross out the errors in the sentences below:

- If actual GDP > potential GDP, then there is an underspending/spending balance/overspending, unemployment will decrease /remain the same/increase. In that case, there is a tight/ample labour market.
- If the actual GDP = potential GDP then there is an underspending/spending balance/overspending, unemployment will decrease/remain the same/increase, this is also called natural or structural unemployment.
- If the actual GDP < potential GDP, then there is an underspending/spending balance/overspending, unemployment will then decrease/remain the same/increase. In that case, there is a tight/ample labour market.

2. Read Source 3.

Source 3 – Output gap as a process.

The influence of the *Output gap* on unemployment works as a process. Regardless of the situation in which the economy (i.e. output gap) finds itself, there is always a certain degree of unemployment, the so-called structural unemployment. However, the state of the economy may affect total unemployment. Also, due to an increase in *Actual GDP*, the demand for labour does not have a direct impact on unemployment. The demand for labour reacts with a delay to the *Output gap*, or business cycle.

3. Create the **quantity** *Unemployment* to the **entity** *Economy*.

4. Create the **cause-effect** relationship between *Output gap* and *Unemployment* (→).

5. Run the simulation for each of the three initial values of *Measure*.

6. Enter the results of the simulation in the table below. Strike out mistakes.

Table 4. Relationship between *Output gap* and *Unemployment.*

If *Output gap* becomes …	**… then for *Unemployment holds …***	**… in state …**
+ (positive)	Decreases / stays the same / increases	2
0 (balanced, Ø)	Decreases / stays the same / increases	1
– (negative)	Decreases / stays the same / increases	2

7. Indicators for the government

1. Read Source 4.

Source 4 –Countercyclical fiscal policy.

We have now seen that unemployment is influenced by the business cycle and that unemployment is one of the indicators for a government to adjust its policy. For example, low unemployment indicates growth, while a high unemployment rate indicates a recession. John Maynard Keynes came up with the idea that the government could weaken the cyclic movement. This is also known as countercyclical fiscal policy. But does it actually work this way, or does the government maintain the cycle itself…?

2. Read Source 5.

Source 5 – Gradual increase in both Actual and Potential GDP.

Note that over the long run, both actual and potential GDP gradually increase, see left in Figure 2. In our model, we assume that growth for actual and potential GDP is equal and remains constant, which allows us to represent the business cycle as shown in Figure 2 on the right.

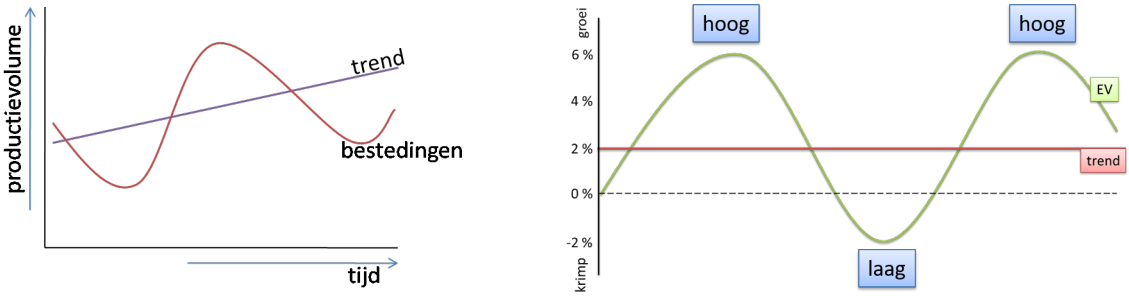


Figure 2 – Effective Demand (EV) is equal to Actual GDP. In times of economic growth, there is overspending, and in times of recession, there is underspending.

3. Create the **cause-effect** relationship between *Unemployment* and *Measure* (→). This relationship is not a process, but a propagation of a change.

4. Click to align everything neatly. Click to make your model fit your screen.

5. Complete the sentences below. Cross out wrong answers.

> If unemployment increases, the government will adjust fiscal policy in which spending decreases/stays the same/increases. This is a proportional/influential relationship.

6. Simulate the model again. Specify the following initial situation:
   - Set the **initial value** of *Measure* to *Stimulate*.
   - Remove the **exogenous influence** that *keeps Measure* on constant.

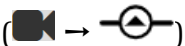
7. The simulation now generates 8 states. Click  (at the bottom of the right-hand window with the states). Do you see that the states are interconnected in a chain? Apparently, a self-repeating pattern has emerged.

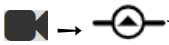
8. Read Box 10.

Box 10. Value history & inequality history of a simulation.

You can use the value history to get an overview the **value** and **change** of a quantity over multiple states.

The inequality history shows the inequality between two quantities over multiple states.

Watch the clip about the value history and the inequality history ().

9. Select all states  , and then: (see ).
   - Show the value history 
   - Show the inequality history 

10. Describe the business cycle in the tables below based on the simulation outcome. Use the **values history** and the **inequality history**. The descriptions of state 2 and 5 have already been given.

Describe the system behaviour in state 1

• Actual GDP ... Potential GDP. Actual GDP ... • Output gap ... • Unemployment ... • Measure ...

Example description of the system behaviour in state 2

• *Actual GDP* > *Potential GDP*. *Actual GDP* increases (▲). The difference thus increases. • *Output gap* → There is *Overspending,* and it is increasing (▲). • *Unemployment* is decreasing (▼). • *Measure* is *Stimulate*, but decreases (▼) (because of countercyclical fiscal policy).

Describe the system behaviour in state 3

• Actual GDP ... Potential GDP. Actual GDP ... • Output gap ... • Unemployment ... • Measure ...

Describe the system behaviour in state 4

• Actual GDP ... Potential GDP. Actual GDP ... • Output gap ... • Unemployment ... • Measure ...

Example description of the system behaviour in state 5

- *Actual GDP* = *Potential GDP*. *Actual GDP* decreases (▼) (becomes smaller in state 6).
- *Output gap* → Is ∅, and decreases (▼) (becomes *Underspending* in state 6).
- *Unemployment* is momentarily stable (∅).
- *Measure* is maximal *decelerating*, steady (∅) (becomes less *decelerating* in state 6).

Describe the system behaviour in state 6

- Actual GDP ... Potential GDP. Actual GDP ...
- Output gap ...
- Unemployment ...
- Measure ...

Describe the system behaviour in state 7

- Actual GDP ... Potential GDP. Actual GDP ...
- Output gap ...
- Unemployment ...
- Measure ...

Describe the system behaviour in state 8

- Actual GDP ... Potential GDP. Actual GDP ...
- Output gap ...
- Unemployment ...
- Measure ...

11. Search the internet for another measurable property of the economy that can also be used by governments as an indicator.

Write the name of the quantity here...

12. Create the **quantity** *Inflation* to the **entity** *Economy.*

13. Create two **cause-effect** relationships between *Inflation* and two other quantities.

14. Click  to align everything neatly. Click  to make your model fit your screen.

15. Simulate the model. Set the **initial value** of *Measure* on *Stimulate.*

16. View the **value history** again by clicking  and  .

17. Finish the sentence below. Cross out the wrong answer. Explain why.

The change in *Unemployment* and *Inflation* do / do not correspond to each other.

Because ...