Pension

Lesson on pensions and life expectancy.

DynaLearn level 3 | Versie 0.9

Summary	
In this lesson, you will learn about cause-and-effect relationships in a context with interest rates, coverage, retirement benefit, expenditures and life expectancy.	
Given name	
Surname	
Class	
Date	
Comments by teacher	

1 Start DynaLearn

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 'Pensions' and press 'Load'.

Save model file and start:

1. Click on  top left. Change the name to 'Pensions' 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 information about pensions. 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 Interest and coverage

In this lesson, you will learn about cause-and-effect relationships in a context with interest rates, coverage, retirement benefit, expenditures, and life expectancy.

1. Read Source 1.

Source 1. Newspaper: Increasing interest rate may lead to more spending!

Economists know that an interest rate increase by the ECB (European Central Bank) could lead to a decrease in spending because borrowing becomes more expensive. Economist Van Schip also sees another effect. He argues that higher interest rates will also lead households to spend more. And that is good for the Dutch economy. He explains: "My analysis is as follows. The ECB is aiming for higher interest rates. This leads to a rise in interest rates on the wealth market. As a result of this increase, the pension funds will yield more. The pension funds can then (according to the pension rules) increase the retirement benefit. People who see that their pensions are being increased will spend more."

The economist therefore makes a proposal: "I advocate that the ECB raise interest rates again. That will give households the opportunity to spend more."

2. Read Source 2.

Source 2. Summary of pension rules.

The coverage is calculated as follows:

$$\frac{\textit{Current assets of a pension fund}}{\textit{Assets that pension funds must have now in order to be able to pay future pensions}}$$

Depending on the value of the coverage (C), the retirement benefit must be adjusted:

- C > 90% → *increase*: The nominal retirement benefit may be increased.
- C = 90% → *freeze*: The nominal retirement benefit remains unchanged.
- C < 90%[1] → *decrease*: The nominal retirement benefit should be reduced.

[1] *Due to the crisis, the requirement has been temporarily lowered from 100% to 90%.*

3 The base model

The start of the model has already been prepared (see figure 1). Note: if you do not see a beginning like in figure 1, then go back to chapter 1 to Let's check!

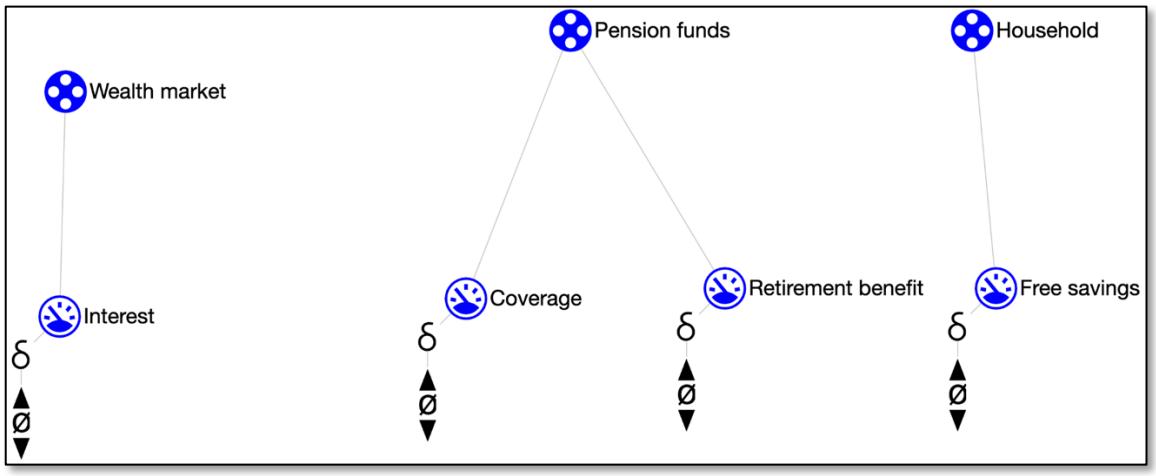


Figure 1. Initial situation when building the model.

1. 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).

2. Read Box 2.

Box 2. Cause-and-effect relationships.

In DynaLearn, there are two types of cause-and-effect relationships:

- Positive relationship ⊕: the quantities change in the same direction (if quantity 1 increases, then quantity 2 increases also)
- Negative relationship ⊖: the quantities change in opposite direction (if quantity 1 increases, then quantity 2 decreases. Or vice versa: if quantity 1 decreases, then quantity 2 increases)

3. There are already *quantities* in the model. Create the 3 dependencies (⊕ or ⊖) between these 4 quantities (see →). Note the direction: cause → effect.

4. Read Box 3.

Box 2. 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. For each relationship, provide an economic explanation as to why it is positive or negative:

1. Relationship between … and… is *positive/negative*, because …
2. Relationship between … and… is *positive/negative*, because …
3. Relationship between … and… is *positive/negative*, because …

6. Read Box 4

Box 4. 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.

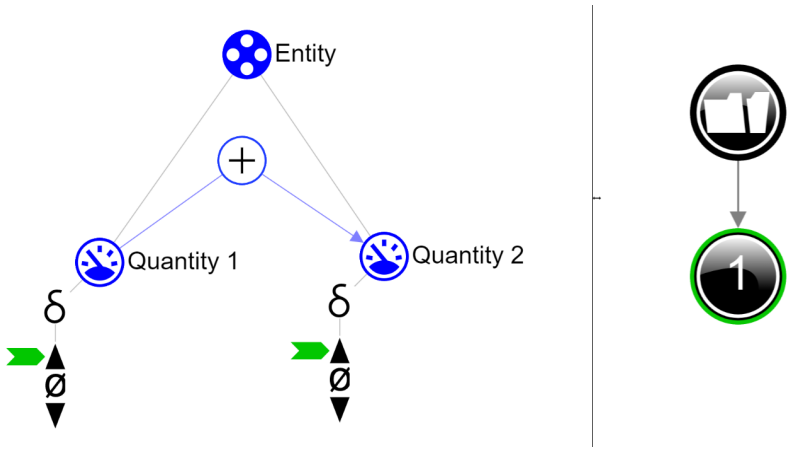
7. You can now run a simulation. To do this, you must first specify an **initial change**. Start with an increase in the **quantity** *Interest* (see →).
   a. Click near quantity *Interest* of entity *Wealth market* on ▲ and choose . It should look like this: δ Ø

8. Start the simulation by clicking (top right of the screen) (see →).

9. Read Box 5.

Box 5. 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 1.



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 1 *Quantity 1* increases and that therefore *Quantity 2* also increases.

10. If the model is correct, you get a 1-step result  .
    a. Click on this result to see how the increase in *Interest* affects other quantities.

11. Read Box 6.

Box 6. 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  , to see where the error is in your simulation.

12. Make the sentences below correct (cross out the wrong options):

If *Interest* increases…

- Then the coverage of the pension funds will *decrease/increase*.
- As a result, the retirement benefit will *decrease/increase*.
- As a result, households' free savings will *decrease/increase.*

4 Coverage

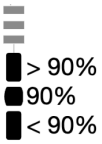
1. Read Box 7.

Box 7. 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 alternating points (●) and intervals (▮).

- A *point value* is only one value. For example, a *boiling point*. A special point is the zero point, 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.

2. Create a quantity space (see →) for the **quantity** *Coverage* of the **entity** *Pension Funds* consisting of an *interval*, *point* and again an *interval*. Source 2 provides information on which values to use according to the pension rules. It will then look like this:



3. Set the **initial value** of the **quantity** *Coverage* to *>90%* (with a)

4. Set the **quantity** *Interest* to decreasing.

5. Start the simulation by clicking .

6. What is the value of the **quantity** *Coverage* in the final state of this simulation? Was this what you expected?

Write your answer here...

5 Keep interest rate decreasing

You can see that the quantity coverage doesnot reach the lowest level. This is because, you have indicated that the interest decreases at the beginning of the simulation, but not yet that the interest decreases permanently during the entire simulation.

1. Read Box 8.

Box 8. An exogenous influence.

If you want a quantity to decrease, remain stable or increase throughout the whole simulation, you must add an external influence (an exogenous influence) to the quantity.

2. Set as initial value:
   a. Create a decreasing exogenous influence  for **quantity** *Interest* (see  → ).
   b. Leave the **initial value** of the **quantity** *Coverage* as in the previous assignment.

3. Start the simulation by clicking .

4. Make the sentences below correct (cross out the wrong options):

If the Interest continues to decrease, the coverage of the pension funds will *increase/decrease*.

In the beginning, the Coverage is <90%/90%/>90% but in the end, it will become <90%/90%/>90%.

6 Retirement benefit

1. Create a **quantity space** (→) for **quantity** *Retire benefit*. Again, use the information in Source 2.

2. Set the **initial value** of the **quantity** *Retire benefit* to *Increase* (with a).

3. Leave the other starting values as in the previous assignment.

4. Start the simulation by clicking .

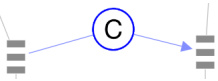
5. The outcome of this simulation may not be what you expected. You see that all kinds of states arise. Click on them and inspect the results. Which states do not correspond to the pension rules in Source 2? Write down the numbers of two states and explain what is wrong with these states.

Write your answer here...

6. Read Box 9.

Box 9. Correspondence.

In a system, it can happen that certain values of different quantities can only occur together. You can then make a **correspondence** between the quantity space of those quantities.

7. Create a **correspondence** of the type directed (see →) between the **quantity space** of *Coverage* and the **quantity space** of *Pension Amount.*
   a. It should now look like this: 

8. Start the simulation by clicking .
   a. How many states are there now?
   b. Do these states align with the pension rules?

Write your answer here...

9. Do you see a blue exclamation mark (right side of the screen)? In that case, read Box 6 for explanation.

7 Policy and life expectancy

We're going to expand the model.

1. Create the **entity** *ECB* (→).
2. Create the **quantity** *Policy* of the **entity** *ECB* (→).
3. Read Source 3.

> **Source 3. From an economics textbook…**
>
> The ECB continuously determines the interest policy. The ECB has several means to ensure that the interest rate in the wealth market is equal to the interest policy.

4. The interest policy has an effect on interest. Create this cause-and-effect relationship between the **quantities** *Policy* and *Interest* (→) (Is positive or negative?).
5. Read Source 4.

> **Source 4. From an e-mail from a pension fund…**
>
> Increasing life expectancy means that people will receive pensions for longer and that pension funds will need more capital to pay all retirement benefits in the future.

6. Create the **quantity** *Life expectancy* of **entity** *Pension funds*.
7. *Life Expectancy* affects *Coverage*. Create this cause-and-effect relationship (→). Is it positive or negative? Use Source 2 and Source 4.
8. Click to align everything neatly. Click to make your model fit on your screen.
9. Explain the two newly created relationships. Give economy-based explanations.

> 1. Relationship between **…** and… is *negative/positive*, because …
> 2. Relationship between **…** and… is *negative/positive*, because …

10. Ensure that the interest policy (**quantity** *Policy*) and Life *Expectancy* increase during the entire simulation . Use an exogenous influence (→) (see Box 8).
11. Leave the initial values of *Coverage* and *Pension Amount* as before (respectively *>90%* and *Increase*).
12. Remove the exogenous influence on **quantity** *Interest* from **entity** *Wealth market*.

13. Start the simulation by clicking .

14. How many possible states are there now? Describe what happens for each **end-state** in the table below. Give economy-based explanations.

End-state	Description
...	
...	
...	
...	
...	

10. Do you see a blue exclamation mark (right side of the screen)? In that case, read Box 6 for explanation.

11. Read Box 11. Your model is finished?

Box 11. Progress bar.

At the bottom of the screen is the *progress bar* (see example below).

For entity it says: 4/4/0, this means: 4 created, 4 needed, 0 error. For quantity it says: 5/17/1: this means: 5 made, 17 needed, 1 error. If all the numbers are green, that type is settled.