



Lifelong Learning Programme



Country: CZ + NO

Schools: Gymnazium Teplice and Raelingen videregående skole

Software: Geogebra, Excel

Subject: Mathematics

Topic: Financial Mathematics

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Cooperation duration: 18 th August 2014 – 30 th September 2014

Theory: Linear functions, exponential functions, logarithmical functions and equations, equations and functions of higher degrees, sequences, series, regresion analyses.

Table of Contents

The Goal of the Cooperation 3

Comparison of Salaries and House Prices in the Czech Republic and Norway 3

Buying a Flat? 4

Buying a Flat in Cash 5

Buying a Flat on Mortgage..... 7

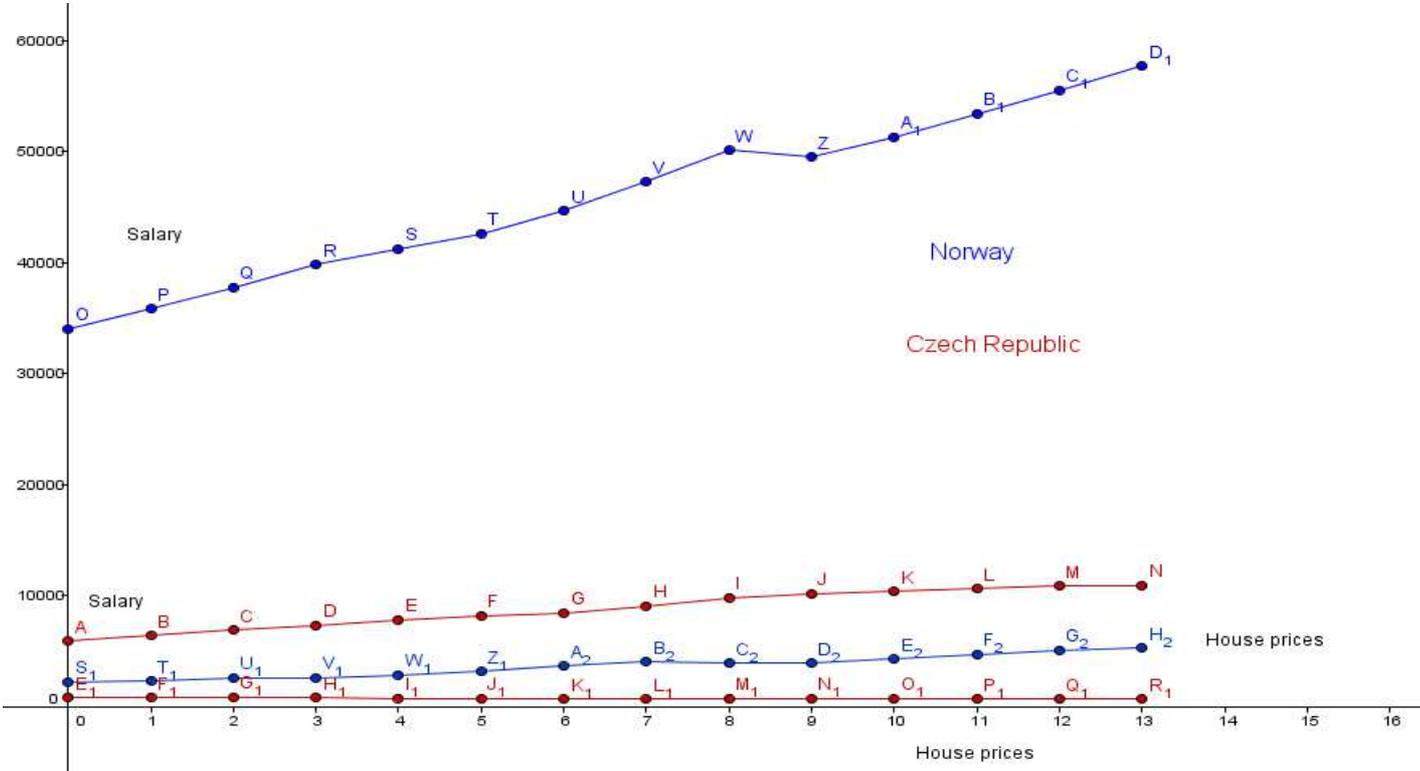
New car in cash 8

Conclusion..... 9

The Goal of the Cooperation

During our project meeting we worked with software Geogebra to create graphs that show the difference between Norway and the Czech Republic when it comes to salary and house prices. We were also calculating the period of time that a Norwegian and a Czech couple needs to save for a 100m² flat in Oslo and Prague and for a Czech car Škoda Octavia.

Comparison of Salaries and House Prices in the Czech Republic and Norway



In this model, the blue graphs represent figures about Norwegian salaries and house prices. The red graphs represent figures about Czech salaries and house prices. The top blue one shows the average salary for a Norwegian per year, and the top red one shows the average salary for a Czech person per year. We can see that an average salary a year is much higher in Norway. A Norwegian citizen earns about five times more a year than a Czech citizen does.

The bottom blue graph shows the average Norwegian house price per one square meter, and the bottom red graph shows the average Czech house price for the same. If we compare the house prices to the salary, we can assume that it would be easier to buy a house in Norway, rather than in the Czech Republic. For the Czechs, the salary graph is much closer

to the house price graph than it is for Norwegians, making it harder for Czechs to afford flats. In the following chapters we are going to verify our theory through calculations.

Buying a Flat?

We decided to compare living conditions in both countries by making a model situation. A couple lives in the capital city in a rented flat and they would like to own their own flat. They decide to save all the money they do not necessarily need. In our theory they will be spending only on rent, energies, food and communication charges. Culture, clothes, holiday expenses, a car, etc. are not included. How long would it take for them to save for their own flat?

In the following chart we used statistical figures of both countries and we found out that a Norwegian couple could use more than 6000 EURO per month to save up for buying the same thing, a flat in cash whereas a Czech couple would have less than 1000 EURO per month to save for

Average monthly income of a Norwegian and a Czech couple and their necessary expenses

	Norway		Czech Republic	
Salary	81,532.00 NOK	9,998.13 €	49,612.00 Kč	1,786.21 €
Rent	12,000.00 NOK	1,471.54 €	12,000.00 Kč	432.04 €
Energy	3,200.00 NOK	392.41 €	2,314.00 Kč	83.31 €
Food	15,000.00 NOK	1,839.42 €	8,000.00 Kč	288.03 €
Communications	1,000.00 NOK	122.63 €	769.00 Kč	27.69 €
Credit		6,172.13 €		955.14 €

Buying a Flat in Cash

It's obvious that Norwegians are able to save much bigger amount of money than Czechs. Prices of properties in Norway are higher than in the Czech Republic. Nevertheless, Norwegians – concerning their average salaries – are able to buy a flat in cash within a shorter period of time. Czechs would have to save much longer to afford a flat of the same size.

The following table shows the period of time a couple would have to save to be able to buy a flat of a size of about 100 square meters. In both countries we consider an average interest rate p.a. after tax (approximately 2%). The result of our calculations: a Norwegian couple might buy a flat within less than 5 years, whereas a Czech couple could do the same after about 11 years.

Calculation

Czech Republic:

Credit ... $S = 955,14 \text{ €}$... average interest rate 2%

P ... price of the flat ... $P = 144\,014,4 \text{ €}$ $q = 1 + \frac{2}{12 \cdot 100} \doteq 1,0016667$

t ... time

$$P = S \cdot \frac{q^t - 1}{q - 1}$$

$$q^t = \frac{S + P \cdot q - P}{S}$$

$$t = \log_q \frac{S + P \cdot q - P}{S} = \frac{\log \frac{S + P \cdot q - P}{S}}{\log q}$$

$$t \doteq 134,6 \text{ months} \doteq 11,2 \text{ years}$$

Norway:

Credit ... $S = 6\,172,13 \text{ €}$... average interest rate 2%

P ... price of the flat ... $P = 367\,884,79 \text{ €}$ $q = 1 + \frac{2}{12 \cdot 100} \doteq 1,0016667$

t ... time

$$t = \log_q \frac{S+P \cdot q - P}{S} = \frac{\log \frac{S+P \cdot q - P}{S}}{\log q}$$

$t \doteq 56,9 \text{ months} \doteq 4,7 \text{ years}$

The Period of Time to Buy a Flat in Cash

	Norway		Czech Republic	
New flat :	3,000,000.00 NOK	367,884.79 €	4,000,000.00 Kč	144,014.40 €
-app. 100 m2				
Interest rate:		0.02		0.02
Minimal time (months):		56.90		134.60
Years:		4.74		11.22

A curiosity that comes out of our calculations shows that if a Norwegian couple liked to buy a flat in Prague, it would take them about 2 years to save for it. Czechs could afford to buy a flat in Oslo after about 30 years. It's clear that economic situations in both countries are different.

Buying a Flat on Mortgage

And what would happen if we took a mortgage for the flat? How long would we have to pay for it?

On average it would take about 5,5 years for Norwegians and approximately 15 years for Czechs to pay for the loan.

Calculation

Czech Republic:

$$u = 2,69 \% \quad q \doteq 1,0022417$$

$$n = \log_q \frac{S}{S + D - D \cdot q} = \frac{\log \frac{S}{S + D - D \cdot q}}{\log q}$$

$$n \doteq 184,2 \text{ months} \doteq 15,4 \text{ years}$$

Norway:

$$u = 3,5 \% \quad q \doteq 1,0029167$$

$$n \doteq 65,6 \text{ months} \doteq 5,5 \text{ years}$$

The Period of Time to Buy a Flat on Mortgage

	Norway		Czech Republic	
Interest rate:		3.50%		2.69%
Months:		65.6		184.2
Years:		5.5		15.4

New car in cash

It would end quite similarly if the couples wanted to buy a car. For comparison, we chose car Škoda Octavia, which is sold in both countries.

Calculation

Czech Republic:

$$u = 2 \% \qquad q = 1 + \frac{2}{12 \cdot 100} \doteq 1,0016667$$

$$n = \log_q \frac{S + P \cdot q - P}{S} = \frac{\log \frac{S + P \cdot q - P}{S}}{\log q}$$

$$n \doteq 12,49 \text{ months} \doteq 1,04 \text{ years}$$

Norway:

$$u = 2 \% \qquad q \doteq 1,0016667$$

$$n \doteq 4,84 \text{ months} \doteq 0,40 \text{ years}$$

Buying new car in cash

	Norway		Czech Republic	
New car :	242,800.00 NOK	29,975.30 €	334,900.00 Kč	12,046.80 €
Škoda Octavia				
Interest rate:		2%		2%
Quotient:		1.0016667		1.0016667
Minimal time (months):		4.84		12.49
Years:		0.40		1.04

Norwegians could save for it in half a year; Czechs would need twice that time to do that. That's a reason Norwegians can usually afford better cars.

Conclusion

The aim of our project work was to think about economic situation of common Czech and Norwegian young people. Participating students shared data, cooperated and calculated the numbers that helped them to imagine real life economic situations in both countries. Czech young couples have a more difficult financial start of their life than Norwegians. Our hypothesis has been true and the charts below show it.