

Fr., 12. 12. 1997, 9:00 Uhr	Gain 1. Game
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Welcome to a strategic experiment

The Euro is coming — what means to Euro to us? The latter may very much depend on the policy of the future european central bank. In the following game we analyse how the policy of a central bank determines inflation and saving behaviour of market participants.

This strategy-experiment is sponsored by various research foundations, among other the german research foundation. Similar experiments have already been carried out in Barcelona and Florence.

The instructions are simple, and when you consider them carefully, decide reasonable, and when you are able to put yourself into the role of the other participants you will win a considerable amount of cash money that will payed to you at the end of the game. You will in any case receive a minimal gain of 10 DM. On average you should win more.

This introduction is divided into two parts. A short text that we currently reading, and practical exercises, where you will train certain moves at the terminal. After each part you have the opportunity to ask questions.

After the introduction we will play several times a game at the terminal. The single games are independent. In each game you can win money. At the end you will be payed the sum of the gain from each game.

Instruction

Each game is a simulated very simple market, that represents the european currency union. In this market you can buy and sell “chips”. The “currency” that you use in this market will be called SFB-Euro. This currency will only be used to buy and sell chips. It has no other purpose. At the end of the game you will be payed in DM. We explain now how the market operates, and how the gain that you take home is determined.

Tasks during the game and payoffs

Each game consists of several rounds. In some of these rounds you will be “entering the market”. This means that in the following round, you will “leave the market”. After having left the market you will either immediately or after some rounds reenter the market. You have no influence whatsoever on the timing of these entries and exits — it is determined randomly. E.g. it may be that in the first period you do not enter the market, but instead in the second, in the third period you leave, you stay out in the fourth, and reenter in the fifth, etc. The computer will always tell you whether you enter, leave or you are out of the market. You have no influence on this issue. In any case you will enter the market several times.

Each time when you enter the market you will receive 750 chips. You may “consume” all of these chips, or “sell” some of these (i.e. you type the number of chips that you want to “sell” in the terminal). In return for the sold chips you receive money (in SFB-Euro). The amount of SFB-Euros you receive is dependent on the behaviour of the other participants. Details will be explained below.

In the subsequent round you will leave the market again. In each round where you leave the market you will again receive chips. But when you leave it is only 125. Additionally you own the SFB-Euros that you received from trading chips when you entered the market. These SFB-Euros will be traded to the current market price into chips. Again you consume all chips you possess altogether.

After having left the market you may reenter in one of the subsequent rounds. Again you receive then 750 Chips. In no case you possess then still chips from a previous visit of the market. The single visits of the market are completely independent.

For simplicity we call the decision to sell chips in the entry period “selling”. We call it selling, since you transfer a part of your wealth from one round (the entry) to the next one (the exit) — you do the same with you savings book.

The purpose of “saving” is to distribute consumption chips as evenly as possibly among the entry and the exit period. You will earn a lot of money at the end of the game when you have consumed in *both* round a similar amount of chips. You will earn less, when you consume much in one of the two rounds, and little in the other. To be precise: The amount of money that you earn is proportional to the *product* of the amount of chips that you consume in both periods. In the appendix we give the precise formula that is used to determine your payoff. But you need not care about this — the computer will automatically calculate what you have earned in the respective entry and exit periods. The computer will also help you to determine the amount of chips that you should sell. We only give the formula to give you the opportunity to control us.

In addition to these selling decisions we also ask you to give in those period where do *not* enter the market a *recommendation* of how many chips you would sell if you were in the situation to enter the market. The recommendation you give has neither influence on the market nor on your payoff. Still it is not bad to carefully ponder this decision — you may gain this way experience that helps you when you enter the market next time.

Inflation and Referenda over Monetary Policy in the European Currency Union

Let us summarise: Since you receive a lot of chips in the entry rounds (750), and only a few in the exit round (125), it is not reasonable to sell all 750 chips in the entry round. It is also a bad idea to trade all 750 chips in the entry round against SFB-Euros. In the latter case you will have a lot of chips in the exit period, but none in the entry period. The best thing is to sell only a part of your chips in the entry period. The problem is *how many* chips you sell optimally, and this problem becomes a little bit difficult, since there is inflation. We will explain below how you use the computer to solve this problem.

The problem becomes even more difficult, since in the european market from our game the central bank of the european union is printing fresh SFB-Euros to sell chips. What the EU is doing with these chips is of no interest to you. The important thing is: The more SFB-Euros are printed, the higher are prices and inflation.

The course of the game determines the bank that has the role of the central bank of the european union, i.e. which bank is printing the SFB-Euros. You have to bank to choose from. The "European Commission" or the "Bundesbank". These Bank follow (in our game) a fixed rule and does not deviate from this rule. To give you the opportunity to check our calculations we have written the respective rules in the appendix. Knowing this rule is, however, not necessary to make a huge gain in the game. You will have a specialised calculator during the game that you may use to determine the optimal amount of chips to sell. This calculator knows the current monetary policy of the EU and takes it into consideration.

Which of the two banks ("European Commission" or "Bundesbank") determines the monetary policy is determined during the first round of each game. All participants of a game (this who enter the market during the first round as well as all other participants) will be invited to vote on the bank. The result of the voting process determines in some games the bank, in other games voting has no influence. In such a game the bank is already predetermined (there will be at most two games where your votes have no influence). We will not tell you in which games your vote has no influence.

Exercises at the terminal

To give you the opportunity to get used to the software that we will be using in the game, we do some exercises after all participants have read the instructions. Please note that during the exercise you do not play against the other participants but against a computer program.

During the exercise you can not gain any money. Still you should go carefully through the exercises, to prepare for the subsequent games where you have the opportunity to gain money. A good knowledge of the rules of the game is an important prerequisite for a high gain.

Sit down in front of a terminal. Check whether your chair has a suitable height. Change the height if necessary. Does your monitor have the right angle for you. Take into consideration that the game takes a while and that you may want to have good working conditions.

The screen is divided horizontally. The top part shows a window where you can make your selling decision. Further you may vote there for a bank.

Exercise 1 Find out whether you enter the market during the first round. Compare your result with your neighbour. Fill in the result in the next line:

I enter, I do not enter

In the lower part of the screen you can forecast which regime wins the election in the first round.

Exercise 2 Click on "European Commission" (in the *lower* part of the screen)

Now you receive a little graph. The graph consists of two coordinate systems, one for inflation, one for sold chips. Each coordination system contains a blue vertical bar. You can click into this bar. You can make different forecasts clicking into different positions of this bar.

Exercise 3 Click into the diagram for inflation and make the forecast that in round 1 inflation will be 100%.

Now the blue bar move a little bit to the right. This means, that the next forecast will be for round 2.

Exercise 4 Click again into the diagram for inflation, and make the forecast that also in round 2 inflation will be 100%.

Now a little table appears to the right. In this table you find your forecast for the next two rounds. In particular you find in this table the optimal amount of chips to sell in the first round.

Exercise 5 How many chips should you sell? Compare the result with your neighbour.

chips to sell

The same number is also indicated on top of the graph.

Exercise 6 Clear your forecast by pressing the button "clear forecast".

Now you will be asked again, which bank might win the election.

Exercise 7 Click on "Bundesbank".

Again you receive the picture with the two coordinate systems.

Exercise 8 Forecast that in each of the next two rounds 250 chips will be sold on average. How many chips should you sell in this case. Compare your result with your neighbour.

chips to sell

Exercise 9 Did you find out, that the optimal amount to sell is indicated with a little cross in the diagram?

Yes, I found out

Exercise 10 Clear your forecast.

Exercise 11 Make a forecast that "Bundesbank" wins the election and 250 chips will be sold on average in the next round and 300 chips in the subsequent round. How many chips should you sell in this case. Compare your result with your neighbour.

chips to be sold

Did you realize that when clicking into the diagram for sold chips the diagram for inflation changes as well. Both values are connected. When you know the number of sold chips you can derive the inflation and vice versa.

Exercise 12 You just made a forecast for sold chips. Use the table at the right to determine what this means for inflation in round 1 and 2.

Inflation in round 1: inflation in round 2:

Exercise 13 Clear your forecast.

Exercise 14 Make another forecast that die "Bundesbank" wins the election. Make then a forecast for inflation with the values that you derived in exercise 11 as a result of your savings forecast. How much should you sell now:

chips to be sold

The result should be very similar to the one you derived in exercise 11.

Let us now look at the *upper half* of the screen.

Exercise 15 Fill in any arbitrary number of chips, that you wish to sell and vote either for "European Commission" or "Bundesbank".

Confirm your decision with "Yes" and proceed to the next round.

Now you are in round 2.

Exercise 16 Do you enter the market in this round?

I do enter, I do not enter

You have a new graph in the lower half of the screen.

Exercise 17 Derive from the graph inflation and sold chips(per head) in the first round.

Inflation: Sold chips:

Exercise 18 Did you realize that both values are also shown in the upper left table?

I did

Exercise 19 Now make a forecast that in the next two rounds the number of sold chips (per head) will be the same as in the first round. How much should you sell in this case?

chips to be sold:

Exercise 20 Clear this forecast and make a forecast that Inflation in the next two rounds is the same as it was in the first round. How many chips should you sell in this case?

chips to be sold:

Exercise 21 Make another forecast and decide then how many chipsto sell. Fill in this number and move to the next period.

Exercise 22 Do you enter the market in this round?

I do enter, I do not enter

Now you see the past 2 rounds in the graph.

Exercise 23 *How will inflation and sold chips develop in the future? Forecast the future development of inflation. How many chips should you sell, given your forecast?*

chips to be sold:

Exercise 24 *Forecast the future development of sold chips. How many chips should you sell?*

chips to be sold:

Exercise 25 *Make more forecasts for inflation or sold chips*

if you wish. Decide how many chips you sell and proceed to the next round.

Now you see the past three rounds in the graph.

Exercise 26 *Make any forecast. Decide how many chips you sell and proceed to the next round.*

You see now the past four rounds in the graph.

Exercise 27 *Make any forecast. Decide how many chips you sell and proceed to the next round.*

You see now the past five rounds in the graph.

Look for a moment at the table in the upper left corner. In some rounds you entered the market and have sold chips. The number of sold chips can be found in the line previous to the last line of the table. Please note that the table shows only those rounds where you *entered* the market.

In the last line of the table you find the gain that you achieved when you entered the market. Please note that the gain of a period can only be calculated at the end of the subsequent period.

Exercise 28 *What is your total gain so far?*

Total gain in round 6:

In this table you also find a line that displays the maximal possible gain in the respective round.

Exercise 29 *What is the maximal gain that you could have achieved so far? (This requires some manual calculation. When doing these calculations please note that you can only archive any gain in those periods where you enter the market.*

Maximal possible gain up to round 6:

You have a slightly smaller gain, since your savings were sometimes too high and sometimes too low. Only when your foresight is perfect you could achieve the maximal possible gain. Still, you can obtain a result that is very close to the maximal gain, when you make good forecasts of the development of the economy, i.e. of the behaviour of your competitors.

Exercise 30 *Play some more rounds and try to make good forecasts and good selling decisions.*

You have now done the exercised to get used to the game and the software. In the next game your selling decisions *count* four your gain.

If you still have questions concerning the game you should ask them now.

Appendix

In the following we describe the formulas that are used by the computer to derive your gain and your best decisions. You do not need these formulas. We still show the formulas to give you the opportunity to control us.

Gain

The payoff in DM for each market entry and exit is calculated as follows:

$$\lambda(750 - S) \left(125 + S \frac{p_t}{p_{t+1}} \right) - \nu$$

Here is...

S the number of chips that you sell when entering the market,

λ and ν are two constants that will be communicated to you at the beginning of the game.

$(750 - S)$ the amount of chips that you will consume when entering the market — your initial endowment 750 chips, minus the amount S chips that you sell.

$(125 + Sp_t/p_{t+1})$ the amount of chips that you consume when leaving the market — your endowment 125 in the exit period, plus the value of your savings, taking into account the inflation.

p_t/p_{t+1} the relation between the market price p_t in round t — this is the round when you enter the market — and the market price p_{t+1} in round $t + 1$ — the round when you leave the market.

Intuitively you can explain the above formula as follows.

If there is a lot of inflation (p_t/p_{t+1} is huge), you should only sell a small number of chips; if there is only little inflation, you should better sell a lot.

The amount of inflation will be determined through the behaviour of all participants of the game. When in the period where you enter the market those who enter the market together with you sell a lot of chips the price for chips decreases, and you receive only a small number of SFB-Euros.

When in the round where you *leave* the market those who *enter* in this period sell a lot, the price for chips will be low which means that you can buy a lot of chips for those SFB-Euros that you possess.

The market price p_t

In each round t the market price p_t is the price where the value of the per capita supply of chips equals the per capita demand of money. The per capita supply of chips is the average amount of sold chips for all participants that enter the market. In round t we

call this amount s_t . The per capita supply of money is composed of two parts: The amount of SFB-Euros, that those players who are leaving the market right now possess (since they sold chips in round $t - 1$ they have now SFB-Euros), and the SFB-Euros, that are printed by the EU-Administration.

The amount of SFB-Euros per head that own players who are leaving the market is denoted with $p_{t-1}s_{t-1}$. Here p_{t-1} is the market price of the previous round, and s_{t-1} the average sold amount of chips in the previous round.

The amount of SFB-Euros, that is printed by the EU-Administration depends on whether "European Commission" or "Bundesbank" determine the monetary policy.

- If "European Commission" determines the monetary policy in each round the amount of SFB-Euros present in the economy will be increased by 1.27414 .
- If "Bundesbank" determines the monetary policy the amount of newly printed SFB-Euros is such that the Administration can buy 130.46875 chips per participant in the market..
- If "European Commission" determines the monetary policy the money supply is $(1 + 1.27414)p_{t-1}s_{t-1}$; and the market market price is determined such that $p_t s_t = (1 + 1.27414)p_{t-1}s_{t-1}$.
- If "Bundesbank" determines the monetary policy the money supply is $p_t 130.46875 + p_{t-1}s_{t-1}$; and the market price is determined such that $p_t s_t = p_t n + p_{t-1}s_{t-1}$.

Optimal amount of sold chips

When you enter the market in round t then the amount of chips that you sell to maximise your gain is given as

$$s = \frac{1}{2} \left(750 - \frac{p_{t+1}}{p_t} 125 \right)$$

Please note that at time t when you have to determine the amount of chips to sell, none of the prices p_t and p_{t+1} is known. However, you can click into one of the two diagrams to translate your expectations about the ratio p_{t+1}/p_t into an amount of chips to sell. The result can be found in the table.

Please notice that the rate of inflation is defined as $(p_{t+1} - p_t)/p_t$. I.e. an inflation rate of 10% is equivalent to a price ratio of 1.10.

Since inflation can be translated into selling behaviour (The formal relation is $p_{t+1}/p_t = (1 + 1.27414)s_t/s_{t+1}$ when "European Commission" determines the monetary policy and $p_{t+1}/p_t = s_t/(s_{t+1} - 130.46875)$ when "Bundesbank" determines the monetary policy) you can describe your expectations either as expected inflation or as expected per capita sold amount of chips.