Instructions

Today you will participate in an experiment in economic decision making. We have provided instructions that explain what your role in the experiment is going to be, what you will be required to do, and how you are going to be rewarded for your decisions. Please read these instructions carefully.

Your earnings depend on your decisions and the decisions of the other participants. There is a show up fee of $15. From now on until the end of the experiment you are not allowed to communicate with each other. If you have any questions, please raise your hand and one of the instructors will answer your question in private.

The rules are equal for all the participants.

Experimental Economy

The experiment consists of 180 experimental periods and will last approximately two hours. You and all other participants in the experiment are assigned the role of investors. In each experimental period you are given a fixed amount of domestic francs with which you must decide where to invest in order to earn the greatest return. This amount will remain the same during the entire experiment. There are two markets where you may invest: (1) in the domestic, or home market, or, (2) in the foreign, or emerging market. Investments made in the domestic market earn a *safe* rate of return that is constant. Money invested in the foreign market earns a rate of return that *fluctuates*, but is generally higher than that of the domestic market. How the foreign rate of return is determined and what causes its fluctuations is explained below.

In each period, you are given 68.8 francs, the domestic currency, with which to invest in each period. When you decide to invest in the foreign market, you must purchase foreign currency. Once this investment is retired, you sell this currency and buy the francs.

Let us call D_t the *total* investment made in the emerging economy in the current time period, t. This value is the sum of all the investments the participants of this experiment make in the foreign market. All investments last for one experimental period. We will call the sum of all the investments made in the foreign market last period D_{t-1}. Each franc invested last period in the foreign market yields $(1 + r_{t-1})$ gross today. Because these investments are now finished, the participants that hold them will need to convert this amount of foreign currency into domestic, for a total value of $(1 + r_{t-1})D_{t-1}$. At the same time, the amount of D_t is being invested in this foreign market and these investors require foreign currency to make their

investments. The difference between these two amounts is an excess demand or supply of francs. The foreign central bank covers this excess demand of francs with the reserves of francs that it holds. The foreign central bank has total control over the amount of foreign currency in the market. Thus, it can meet excess demand for foreign currency by increasing or decreasing its supply.

At time period t, the foreign central bank has an amount of francs in reserves equal to R_t. Therefore, once we account for covering the excess supply of or demand for francs described above, we can calculate the change in these reserves. This period's reserves level is equal to:

$$R_t = R_{t-1} + D_t - (1 + r_{t-1})D_{t-1}. \tag{1}$$

In other words, the new reserves level is equal to last period's reserves level plus the excess supply of or demand for francs.

The foreign central bank has an objective of not letting the level of reserves fall below a given threshold level, H. This level does not change throughout the duration of the experiment. However, you do not know what H is equal to.

The foreign central bank meets its objective in the following way. If the sum of the previous period's reserves, R_{t-1}, and the current period's investment into the foreign market, D_t, minus the outflow of francs due to the repayment of the previous period investment and its return, $(1 + r_{t-1})D_{t-1}$ falls below the threshold level H, i.e. if

$$R_{t-1} + D_t - (1 + r_{t-1})D_{t-1} < H \tag{2}$$

then the value of the foreign currency falls. We will call a percentage decrease in its value a *devaluation* and denote it by δ_t. The extent of devaluation is determined in the following way:

$$\delta_t = \frac{H - R_t}{D_t} \tag{3}$$

or, using the above equation for R_t

$$\delta_t = \frac{[H + (1 + r_{t-1})D_{t-1} - R_{t-1} - D_t]}{D_t} \tag{4}$$

where H refers to the threshold below which a devaluation occurs. When a devaluation occurs, money invested in the foreign market earns only $(1 + r_t)/(1 + \delta_t)$ rather than $(1 + r_t)$. The

larger the shortfall in reserves, the larger the devaluation, and the larger the decrease in the return earned in the foreign market.

This means that the larger the shortfall in reserves, the larger the decrease in the return earned in the foreign market.

Devaluations will continue in every period of the experiment until reserve levels are again above the threshold level. Once reserve levels move above the threshold, the devaluation stops.

Any questions?

Your Investment Decision

You want to invest where you will earn the highest return. Generally, you will earn more in the foreign market, but *you do not want your money in the foreign market when a devaluation occurs!* In the domestic market you will earn 1.001666 francs for every franc invested there; a somewhat low rate of return, but it is guaranteed. In the emerging market you will earn more, unless a devaluation occurs, in which case you may earn substantially less.

You, the investor, must decide on the likelihood of a devaluation. That is, you must decide on what you think the chances are that a shortfall in reserves will occur resulting in devaluation.

Each period, you will be asked to enter your assessment of this likelihood. You must enter an assessment (a number between 0.0 and 100.0) that represents your assessment of how likely a devaluation is. This assessment is much like that reported in weather forecasts. You make a forecast on the probability of devaluation, rather than the chance of sun or showers. This assessment is divided by ten and converted into a percentage value. We will refer to this value as π. For example, if your assessment in any period is 55, this number is then divided by 10, and converted to a percentage value yielding a π for that period of 0.055.

In every period, a gross rate of return in the foreign market is determined by the following equation:

$$1 + r_t = (1 + r_d)\Pi_{i=1}^{n}(1 + \pi_t^i)^{1/n} \tag{5}$$

where $(1 + r_d)$ is the domestic gross rate of return (1.001666), n is the number of investors, $\Pi_{i=1}^{n}(1+\pi_t^i)^{1/n}$ is the geometric mean of the investors' probability assessments after converting them into π's.

If we refer to the geometric mean as $(1 + \pi_t^m)$ for any given experimental period t, this equation may be simplified to

$$1 + r_t = (1 + r_d)(1 + \pi_t^m) \tag{6}$$

Notice that the larger the mean value of π, the larger the foreign return.

Immediately after you and the other investors enter your assessments, the computer will calculate this gross rate of return.

Given your assessment, your 68.8 francs will be invested optimally; either wholly in the domestic market, or wholly in the foreign market.

That is, given your value of π and the geometric mean of all investors' converted assessments $(1 + \pi^m)$ in any given experimental period, you will invest all of your francs in the domestic market if:

$$(1 + \pi) > (1 + \pi^m). \tag{7}$$

You will invest all of your francs in the foreign market if:

$$(1 + \pi) < (1 + \pi^m). \tag{8}$$

If this holds with equality, your assessment is equal to the geometric mean of all investors' assessments. If this occurs, and your assessment is greater than 50, you will invest wholly in the domestic market. Alternatively, if your assessment is less than 50, you will invest wholly in the foreign market. Finally, if your assessment equals the mean assessment, and it equals 50, you will invest half your wealth in the domestic, and half in the foreign market.

Once the computer determines the investors' investment flows, total foreign investment, D_t, is calculated. This is simply the sum of each participant's money that is invested in the foreign market. Using this value in conjunction with last period's D_{t-1} and $(1 + r_{t-1})$, the new level of reserves is calculated (see above). If a shortfall exists, the gross rate of return is divided by $(1 + \delta_t)$.

Importantly, remember that the foreign rate of return is determined by the (geometric) mean assessment of the probability of devaluation. If your assessment is *lower* than the mean, you are going to have your money invested in the foreign market. Conversely, if your assessment is *higher* than the mean, your money will be invested in the domestic market, where it is safe.

Take a moment here to think about this. It is important to understand that it is your assessment relative to the mean assessment that determines where your money is invested, not the level of this assessment. Although your assessment may be quite high, if the other investors in this experiment have assessments higher than yours, you will likely have your money invested in the foreign market.

You will make this assessment every period for the length of the experiment, which is **180** periods. At the beginning of every period, you have **20** seconds to reach a decision regarding your probability belief. At the end of each period, you have **10** seconds to view the results of that period and your earnings. All the information that is displayed on your computer screen is described below.

Payment

You are given $15 as a *show-up* fee. In addition, you will be paid an amount of money that depends on how well you do in this experiment. This amount is determined in the following way.

In each period, you will receive a payoff that is equal to the number of francs that you earn in excess of 68.8 francs that you invest in each period. For example, if you invest in the domestic market in a period you will earn $(1.00166 * 68.8) - 68.8 = 0.11$ francs in that period. If you invest in the foreign market, you earn the amount of francs equal to $(1 + r_t)68.8 - 68.8$. Finally, if you invest in the foreign market and a devaluation occurs, you earn the amount of francs equal $[(1 + r_t)/(1 + \delta_t)]68.8 - 68.8$ *only if this amount is positive.* If devaluation leads to an ex post negative return, your payoff for that period is zero.

Your total *investment* earnings are computed as the sum of your per period payoffs. In each time period, in addition to your per period payoff, you will be given information on your cumulative earnings up to that time.

At the end of the experiment, your total investment earnings, measured in experimental francs, are converted into dollars, using a conversion factor of 0.2, and added to your $15 show-up fee.

Information available on the screen

During the *decision* stage of the period, while you are thinking about your assessment and entering it, the following information will be displayed on your computer screen:

[i] The equation governing the change in reserve levels,

$$R(t) = R(t-1) + D(t) - [1 + r(t-1)] * D(t-1)$$

[ii] The initial conditions:

- Initial Foreign Investment, $D(0)$
- Initial Foreign Return, $1 + r(0)$
- Gross Domestic Return = 1.001666

Reporting of variables

During the *decision* stage, the table with the following historical data up to the current period will be displayed on your computer screen:

Period	Foreign Return	Total Foreign Investment	Devaluation	Your Investment Amount
1	$1 + r(1)$	$D(1)$	$1 + \delta(1)$	68.8
2	$1 + r(2)$	$D(2)$	$1 + \delta(2)$	68.8
3	$1 + r(3)$	$D(3)$	$1 + \delta(3)$	68.8
...	$1 + r(...)$	$D(...)$	$1 + \delta(...)$	68.8
$t-1$	$1 + r(t-1)$	$D(t-1)$	$1 + \delta(t-1)$	68.8

Notice, if there was no devaluation, the value reported under the heading *Devaluation* is "1". It is the amount you divide foreign return by to get ex post return.

When you are viewing the results, i.e. during the *reporting of results* stage, the same table and historical data are available, but updated to include the current period variables.

In addition, during the *reporting of results* stage the following information is reported on your computer screen pertaining to the current period:

- Your investment amount= 68.8 francs
- The value of this investment at the end of the period
- Amount you invested in the foreign market
- Amount you invested in the domestic market,
- Riskless gross domestic return = 1.001666
- Return earned in the foreign market AFTER devaluation,
- Your earnings in the current period
- Your cumulative earnings

Any questions

Now is a great time to ask for clarification on anything in these instructions that is unclear. Good-luck.