Exercise 2

The goal of this exercise is for you to demonstrate how the two models of exchange rate determination that we have studied in class can be used to interpret exchange rate movements for your selected country. Also, in predicting the success of a currency depreciation in improving a country’s balance of trade position, we are interested in how additional income is spent on imports or saved, and you will calculate those two terms.

Part one: Retrieving data from the IFS database

Be sure you are logged into Storageserver as yourself. Following the steps detailed in Exercise 1 retrieve the following data for your country and a second country. In most cases let that second country be the United States. If your country is more closely integrated with another country, however (e.g. Senegal and France), then use that alternative country and include its dollar exchange rate on a separate line as well.

- Exchange rate, Country A
- Price level for Country A (preferably wholesale or industrial prices)
- Price level for Country B
- Interest rate for Country A (preferably money market or Treasury bill rate)
- Interest rate for Country B

Save the resulting spreadsheet in your Storageserver space as an Excel spreadsheet.

(Note that on p. 5 of this handout, you are asked to download additional data series for GDP, Household Consumption, Government Consumption, Gross Saving, and Imports of Goods and Services. You can include that information here if you want.)

Part two: Analyzing data within Excel

- Launch Microsoft Excel
- Open the spreadsheet you created in part one:

<table>
<thead>
<tr>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>AUSTRIA</td>
<td>IFS</td>
<td>122 AE ZF...</td>
<td>OFFICIAL RATE</td>
<td>11.62</td>
<td>10.88</td>
<td>10.89</td>
<td>11.35</td>
</tr>
<tr>
<td>3</td>
<td>AUSTRIA</td>
<td>IFS</td>
<td>12230. ZF...</td>
<td>PRICES HOME &amp; IMPORT GOODS</td>
<td>95.43</td>
<td>96.18</td>
<td>99.01</td>
<td>88.79</td>
</tr>
<tr>
<td>4</td>
<td>UNITED STATES</td>
<td>IFS</td>
<td>111B9. ZF...</td>
<td>WHOLESALE PRICES</td>
<td>89.57</td>
<td>91.17</td>
<td>93.29</td>
<td>93.81</td>
</tr>
<tr>
<td>5</td>
<td>AUSTRIA</td>
<td>IFS</td>
<td>122080. ZF...</td>
<td>MONEY MARKET RATE</td>
<td>7.46</td>
<td>8.63</td>
<td>9.10</td>
<td>10.14</td>
</tr>
<tr>
<td>6</td>
<td>UNITED STATES</td>
<td>IFS</td>
<td>111690. ZF...</td>
<td>TREASURY BILL RATE</td>
<td>8.12</td>
<td>7.51</td>
<td>5.41</td>
<td>3.46</td>
</tr>
</tbody>
</table>

First make sure you are working with dollars per unit of A's currency. If your series is given as units of A's currency per dollar, invert that series to give the value of Country A’s currency, as shown in Part III of exercise 1. As a refresher, those steps are repeated, as follows:

- Label a new row "Actual exchange rate for A"

<table>
<thead>
<tr>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>PRICES HOME &amp; IMPORT GOODS</td>
<td>95.43</td>
<td>96.18</td>
<td>99.01</td>
<td>98.79</td>
<td>98.91</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>4</td>
<td>WHOLESALE PRICES</td>
<td>89.57</td>
<td>91.17</td>
<td>93.29</td>
<td>93.81</td>
<td>96.5</td>
<td>86.62</td>
<td>100.0</td>
</tr>
<tr>
<td>5</td>
<td>MONEY MARKET RATE</td>
<td>7.46</td>
<td>8.63</td>
<td>9.10</td>
<td>9.55</td>
<td>7.22</td>
<td>5.03</td>
<td>4.93</td>
</tr>
<tr>
<td>6</td>
<td>TREASURY BILL RATE</td>
<td>8.12</td>
<td>7.51</td>
<td>5.41</td>
<td>3.46</td>
<td>3.02</td>
<td>4.27</td>
<td>5.51</td>
</tr>
</tbody>
</table>

- For the first value of this series, move to that cell (in this case cell H7)
- Type an = sign to tell Excel you are going to enter a formula
- Type 1/ then click in the cell for the first value you hope to transform. In this case, where we are going to transform Austria's Official Rate, the first value is in cell H2.
Exercise 2

• Then press Enter to tell Excel to calculate the rate.

You can ask Excel to repeat a procedure for subsequent columns by filling in the appropriate equation:
• Click in the box into which you entered the first equation.
• Click on the drag handle on the lower right corner of the active cell.

• Drag it across the rest of the row:

• When you let go of the mouse, Excel will invert the rate for each year:

I: Exchange rates based on purchasing power parity

Now we are ready to apply this technique to the first theory, which is purchasing power parity.
• In your spreadsheet, create a new row labeled "Purchasing Power Parity Rate for A"
Exercise 2

- We want to compare the value of the exchange rate in each single year to the value for a constant base year. To make such a comparison in Excel, we will be holding constant that base year as we move from cell to cell.

- For the first value of this series, move to that cell and type in the formula 
  
  \( \frac{(1/SHS2) \times (H4/SHS4) / (H3/SHS3)}{100} \) or 
  
  \( =SHS7^{*}(H4/SHS4)/(H3/SHS3) \)

  Note the dollar signs in the denominator indicate constants, which apply to the year 1989. Also, note that row three gives prices in Country A and row four gives prices in the United States. This calculation says the PPP value of Country A’s currency will rise when US prices rise and fall when A’s prices rise. In other words, for consumers to have the same purchasing power in terms of Austrian and U.S. goods in 1990, the value of the schilling must rise in 1990 if U.S. prices rise more than Austrian prices. Alternatively, we can say by how much the schilling can rise in value without the competitiveness of Austrian goods falling if U.S. prices rise more rapidly than Austrian prices.

- Take the handle on the active box and drag it across the rest of the row.

- Following the same steps create a new entry in row nine to measure the overvaluation of country A’s currency, measured as the actual rate minus the PPP rate, divided by the PPP rate: 
  
  \( =100 \times (H7 - H8)/H8 \)

  We multiply by 100 to express this overvaluation/undervaluation in percentage terms.

- Print a table and graph of the actual exchange rate and the PPP rate.

II. Exchange rates based on interest rates

Our examination of annual interest rates and exchange rates does not yield a cumulative measure of the change in value of the exchange rate over several years compared to some base year, as we calculated above for the PPP model. Instead, our approach will project an annual rate of change in the exchange rate. Consider the gap between the interest rate in Country A and in the United States to predict the decline in the value of A’s currency. For example, if the interest rate in A is 30% and the U.S. interest rate is 5%, investors must expect A’s currency will decline in value by approximately 25%. That is, I can earn 5% by leaving my savings in the U.S. for a year or I can earn 30% by putting my savings in Country A for a year. But at the end of the year when I convert currency A back into U.S. dollars, I will find that they buy 25% fewer dollars. Thus, the equilibrium rate of return is the same in each country. If A’s currency were only to fall by 10%, I would want to take funds out of U.S. dollars and instead acquire assets in Country A.
Exercise 2

To make this calculation more accurate where high interest rates are observed, we use the formula \((i_{US} - i_A) / (1 + i_A)\), which will give a smaller expected rate of decline in A’s currency, only 19% rather than 25%. (See our class handout entitled “Determining the Value of an Exchange Rate.”)

Take the following steps to make this comparison:

- Create a new entry in row ten to represent the interest rate differential between this country and the United States: \( (i_{US} - i_A) / (1 + i_A) \), or \( =(H6 - H5) / (100 + H5) \) where we recognize that the interest rates reported in the IMF statistics are not given in decimal form. That is, they are reported as 7%, not 0.07. Therefore we want 107 in the denominator. Note that the ratio you calculate for row 10 does give an answer in decimal form, and you may want to multiply it by 100.
- Create a new entry in row 11 row to calculate the percentage change in the value of A’s currency. Label this new row “Actual change in value of A’s currency” and in cell I11 the appropriate formula will be \( = (I7 - H7)/H7 \).
- Print a table and graph comparing the percentage change in the exchange rate with the interest rate differential.

The interest differential calculated above often does not give a very accurate measure of the actual change in the exchange rate one year from now, because many other changes influence the rate observed then. Nevertheless, the formula we use does represent an equilibrium condition, based on our expectation today of what the exchange rate will be one year in the future.

Another simple indication of monetary policy is to consider whether the country allowed the real interest rate to become negative. Without making a careful comparison to returns available in other countries, we predict that individuals will try to take funds out of the country when returns are negative. That capital outflow would cause a depreciation of its currency. To see whether this possibility applies to your country, make the following calculations to determine the real interest rate.

- Create a new entry in row 12 to represent the real interest rate in Austria, which for cell I12 we approximate as \( i_1 = I5 - 100*(I3-H3)/H3 \). Because you are comparing the nominal interest rate to the inflation rate, you will not have an entry for the first year, 1989, because there is no way to calculate the inflation rate for that year using the data retrieved.
- Print a table and graph comparing the percentage change in the exchange rate that you used above with the real interest rate.

III. Other Important Economic Variables

Conditions for a successful depreciation in part depend upon the size of a country’s marginal propensity to save (mps) relative to its marginal propensity to import (mpm). For example, our models of a Keynesian economy suggest that a high mpm and a low mps will make a depreciation less successful even if the economy has many idle resources, because extra demand for Country A’s goods will generate more income in A and more spending on imports.
A simple model proposed by the IMF assumes that the mpm can be approximated by dividing Imports of Goods and Services by GDP, both measured in the domestic currency. These entries will occur at the bottom of the IMF table. First, type “=H7/H9” as shown below. Drag this formula across the row.

You can then take the average of these values which you might label in cell T10 and then calculate in T11. Click on the formula paste function button, choose “average” as the function, click OK, and give the range over which to calculate the average as “H11:R11.”

If you want to try some additional ways to measure the mpm, see me for alternatives.

You will note that for Austria two lines have been selected to measure Imports of Goods and Services and GDP. That is because in 1999 Austria adopted the euro as the common currency within the European Monetary Union. The second line, therefore, gives these two values measured in euros for 1999 and subsequent years.
Exercise 2

For some countries you will have a gross saving figure reported, and you can proceed to make an average calculation as you did in the case of imports. For other countries, this value is not reported, and you will have to consider a rough approximation from the national income account data at the end of the IMF file. When output in a country equals income in that country (as will be true if the country receives no net income or transfers from foreigners), then you can approximate saving by subtracting private and government consumption from GDP. That is, \( S = GDP - C - G \). Then, calculate \( S/GDP \) and determine its average value over the period. (This figure will understate saving if the country receives substantial transfers from abroad, but will overstate saving if the country pays substantial income to foreigners.)

For those examining the record of European countries that adopted the Euro in 1999, you will want to calculate the saving propensity from the euro data given on separate lines for the most recent years.
Part three: Interpretation

1. Based on PPP, was there systematic overvaluation or undervaluation of your country’s currency over this period? If the currency was overvalued (undervalued) for nearly all years in the period, perhaps 1989 is not an appropriate year to serve as the base period for comparison; maybe it is an unusual outlier instead.

   Does the overvaluation (undervaluation) of A’s currency reflect a major capital inflow (outflow) into the country? What can you find with respect to the financial account of the balance of payments to substantiate that interpretation?

2. We are interested in whether your country offers a high interest rate to offset expected depreciation of its currency (or the risk of such a depreciation, even if it does not occur during that year). Did your second graph show that as the interest rate differential became more negative (your country offered a relatively higher interest rate than in the US), the value of your country’s currency in fact did fall that year or the next year?

   Of course, we cannot observe the expected depreciation directly, and can only calculate the actual depreciation that occurs. If capital flows are controlled by the government, how will that affect your comparison? If assets in your country are regarded as particularly risky, how may that affect your comparison? Over time there may be a change in the risk premium that investors require in order to buy assets denominated in A’s currency.

   Based on your calculation of real interest rates, do years when the real interest rate in your country falls also happen to be years when your country’s currency falls in value? Is there reason to expect a capital outflow when the real interest rate is less attractive? (Or, does the currency rise in value in spite of a decline in the attractiveness of its real interest rate, a possible sign of a falling risk premium?)

3. What mpm did you find for your country? If a country has a high mpm, explain why it will find income adjustment to a balance of payments deficit less painful than will a country with a low mpm. What mps did you find for your country? If a country has a small mps relative to its mpm, why does that situation suggest that a depreciation that successfully promotes exports nevertheless will not result in much improvement of the trade balance?