

### Problem Set 4 Answers

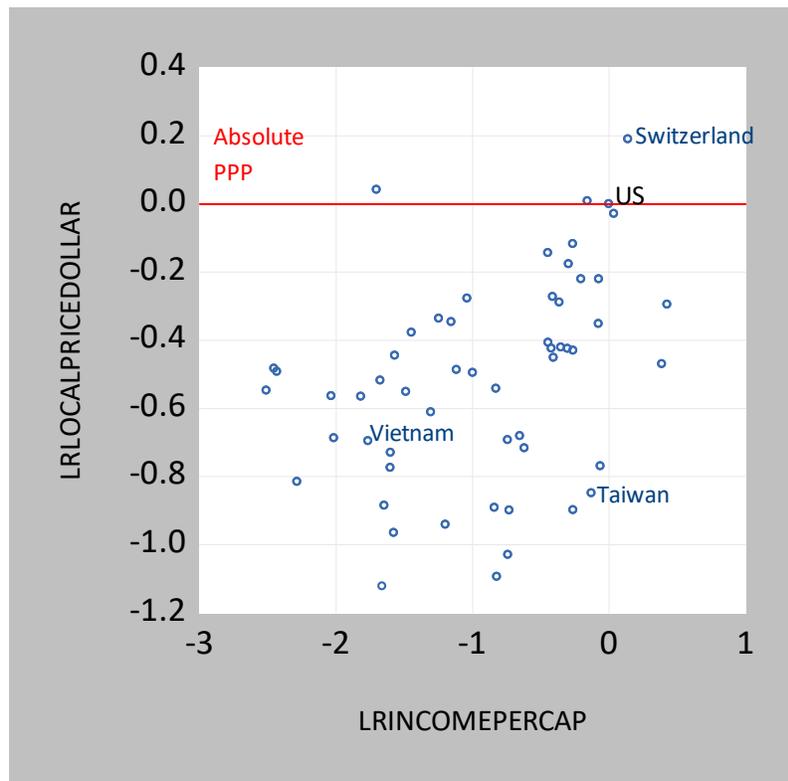
Due **5PM** on Monday, April 26th. Be sure to put your name on your problem set. Put “boxes” around your answers to the algebraic questions.

#### 1. Exchange rate misalignment, purchasing power parity and the Penn Effect

Download the file: [http://www.ssc.wisc.edu/~mchinn/bigmacdata\\_jul2020.xls](http://www.ssc.wisc.edu/~mchinn/bigmacdata_jul2020.xls)

Data on Big Mac prices from July 2020 are contained in the file; Column C is price in local currency, column D is the exchange rate expressed as local currency per USD, and column B is per capita GDP in 2017 International Dollars, so figures are directly comparable across countries.

- 1.1 The latest US Treasury report put Taiwan, Vietnam, and Switzerland on the watch list. Calculate the percent misalignment (in log terms) for these three countries, using Purchasing Power Parity, using the US as benchmark.



1	-0.35197	
2	-0.48682	
3	-0.22086	
4	-0.89854	
5	-0.43037	
6	-0.37778	
7	-0.11755	
8	0.19013	Switzerland
9	-0.49562	
10	-0.61132	
11	-0.55133	
12	-0.34622	
13	-0.40689	
14	-0.22039	
15	-0.77401	
16	-0.1765	
17	-0.28889	
18	-0.56365	
19	-0.76961	
20	-0.48274	
21	-0.54236	
22	-0.68083	
23	-0.88551	
24	-0.81531	
25	-0.14352	
26	-0.56541	
27	-0.45147	
28	-0.42126	
29	-0.42415	
30	0.041572	
31	-0.44507	
32	-0.72969	
33	-0.94086	
34	-0.89119	
35	-0.49206	
36	-0.0286	
37	-0.27241	
38	-0.6924	
39	-0.5473	
40	-0.51767	
41	-0.68687	
42	-0.71638	
43	-0.46953	
44	-0.89897	

45 -1.09376  
 46 -0.4252  
 47 -0.29484  
 48 0.008012  
 49 -0.33652  
 50 -1.02951  
 51 -0.84847 Taiwan  
 52 -0.96532  
 53 -0.27725  
 54 0 US  
 55 -0.69585 Vietnam  
 56 -1.12199

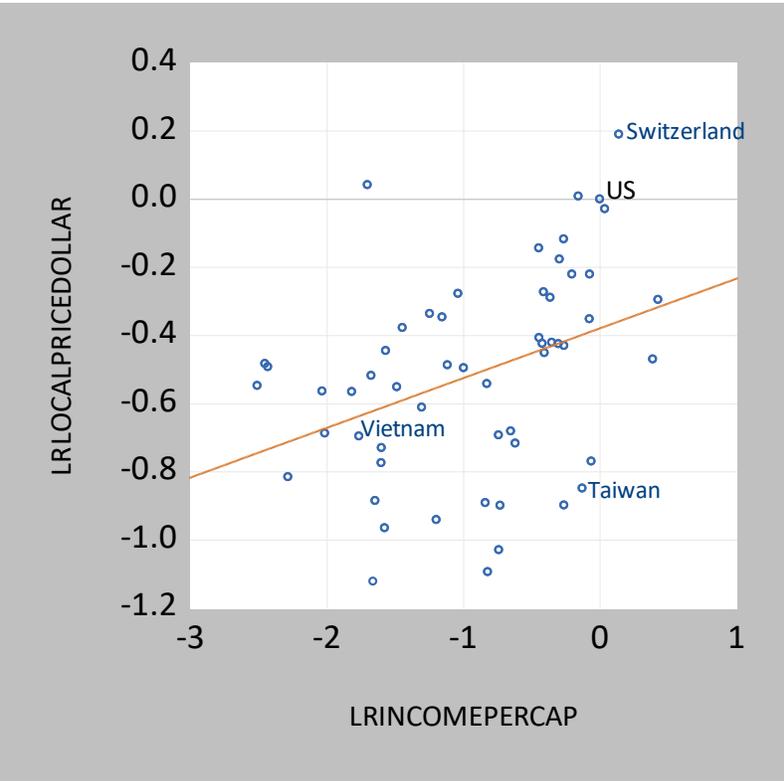
1.2 Calculate the percent misalignment (in log terms) for Taiwan, Vietnam, and Switzerland, using the Penn effect, using the US as benchmark. In order to estimate this, run a regression:

$$p_i = \alpha + \beta y_i + u_i$$

Where  $p_i$  is the log of the dollar price of a Big Mac in country  $i$  divided the dollar price of a Big Mac in the US, and  $y_i$  is the log of country  $i$  per capita income divided by US per capita income (both expressed in 2017 International Dollars). The misalignments are then the residuals from the regression.

Dependent Variable: LRLOCALPRICEDOLLAR  
 Method: Least Squares  
 Date: 04/29/21 Time: 17:25  
 Sample: 1 56  
 Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.378607	0.059156	-6.400166	0.0000
LRINCOMEPCAP	0.145868	0.049656	2.937591	0.0049
R-squared	0.137786	Mean dependent var		-0.512123
Adjusted R-squared	0.121819	S.D. dependent var		0.302361
S.E. of regression	0.283347	Akaike info criterion		0.350769
Sum squared resid	4.335405	Schwarz criterion		0.423103
Log likelihood	-7.821532	Hannan-Quinn criter.		0.378813
F-statistic	8.629443	Durbin-Watson stat		1.416348
Prob(F-statistic)	0.004855			



- 1 0.037777
- 2 0.054738
- 3 0.187599
- 4 -0.48162
- 5 -0.01345
- 6 0.211937
- 7 0.299511
- 8 0.54846 Switzerland
- 9 0.028622
- 10 -0.04231
- 11 0.044299
- 12 0.200791
- 13 0.036701
- 14 0.168915
- 15 -0.16186
- 16 0.245091
- 17 0.14265
- 18 0.111701
- 19 -0.38175
- 20 0.253856
- 21 -0.04302

22	-0.20707	
23	-0.26674	
24	-0.10355	
25	0.300329	
26	0.078243	
27	-0.01362	
28	0.008627	
29	0.015861	
30	0.668418	
31	0.162317	
32	-0.11778	
33	-0.38744	
34	-0.39019	
35	0.241217	
36	0.344624	
37	0.16624	
38	-0.20547	
39	0.197544	
40	0.105352	
41	-0.0143	
42	-0.24729	
43	-0.14757	
44	-0.41371	
45	-0.5954	
46	-0.0023	
47	0.021687	
48	0.409671	
49	0.223884	
50	-0.54294	
51	-0.451	Taiwan
52	-0.35677	
53	0.252771	
54	0.378607	US
55	-0.05996	Vietnam
56	-0.50094	

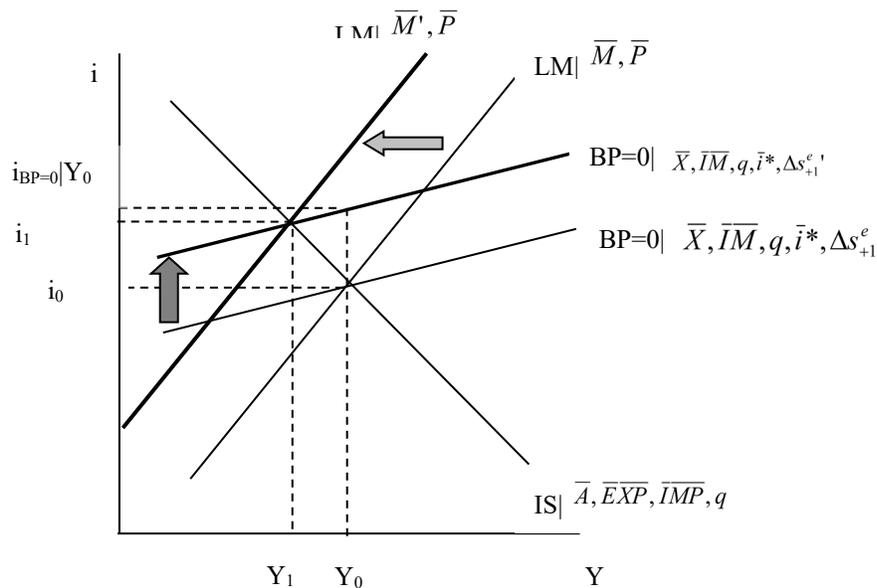
2. Consider a small open economy with a fixed exchange rate, and imperfect capital mobility. Suppose the financial capital account behaves as follows.

$$FA = \overline{FA} + \kappa(i - i^* - \Delta s_{+1}^e)$$

- 2.1 To begin with everyone believes the peg is perfectly credible, so expected depreciation is zero. Then, with an election of a new government, people believe that there is a 50-50

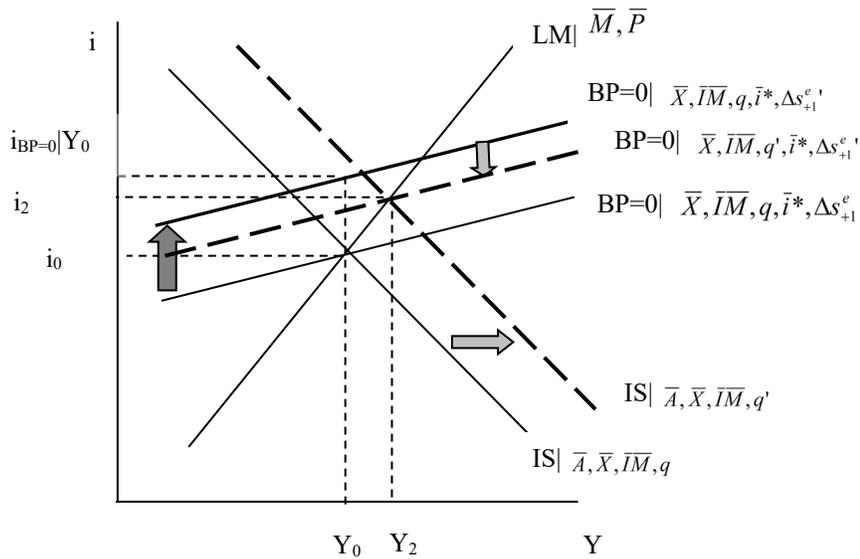
chance of a 20% depreciation. Interpret the impact on the economy using an IS-LM-BP=0 graph; assume the central bank sterilizes.

The BP=0 line shifts up. The interest rate is now below that consistent with external balance. Either reserves will decline and the monetary authority has to sterilize the outflow (so we stay at  $Y_0, i_0$ ), or the money base will endogenously shrink, so the LM is shifted back (gray arrow).

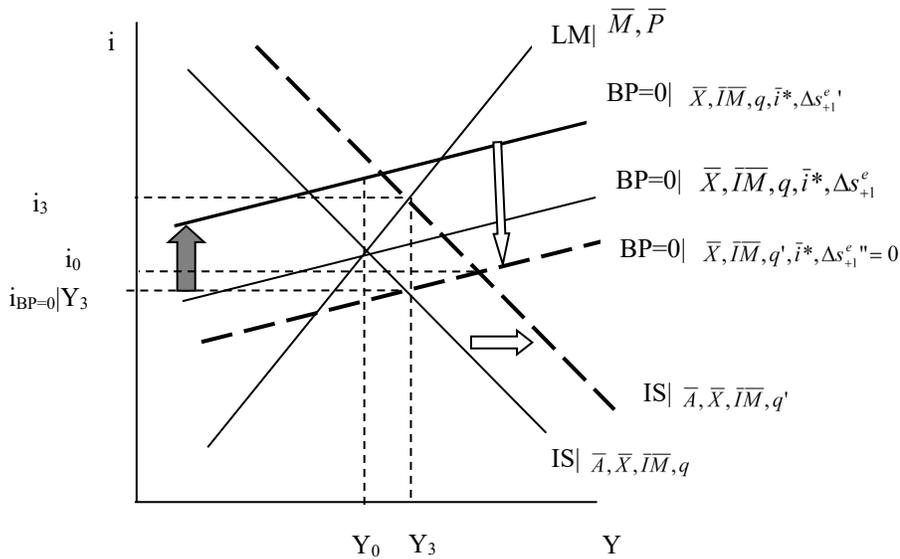


2.2 Should the government devalue the currency or raise interest rates? Explain your answer using IS-LM-BP=0 graphs.

In the standard Mundell-Fleming model, an interest rate defense results in the picture shown in the answer to 2.1 (LM shifted back), except reserves will not be depleted. A devaluation (if it doesn't affect expectations) has the following impact (shown by gray arrows).



The devaluation shifts out the IS curve and down the BP=0 curve. If the devaluation is sufficient to reduce expected depreciation to zero, then the following occurs (white arrows):



The BP=0 curve shifts down relative to the original BP=0 curve, because now expected depreciation is zero **and** the exchange rate has been devalued. The IS shifts out as  $q$  rises to  $q'$ .

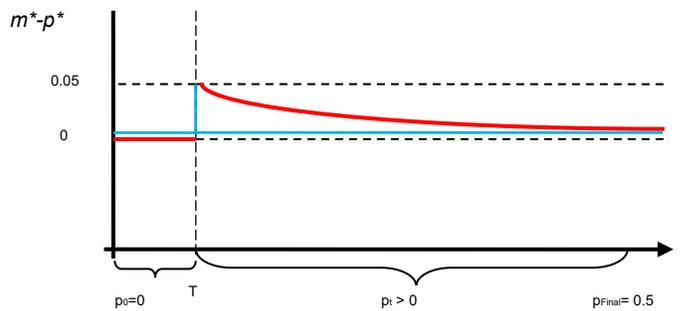
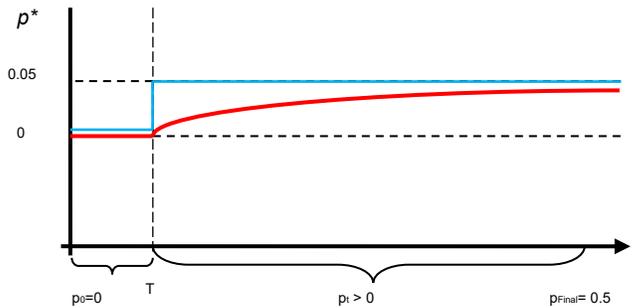
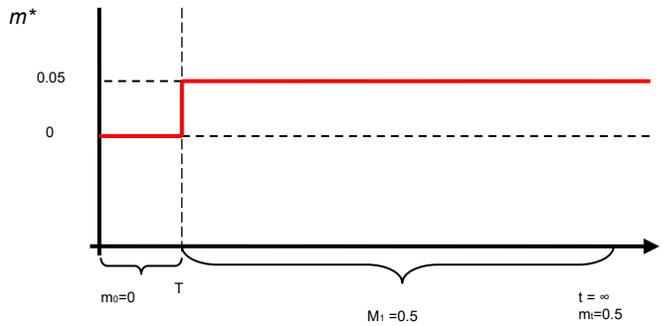
2.3 How does your answer change if the country (firms, the government) has a big outstanding debt borrowed in US dollars?

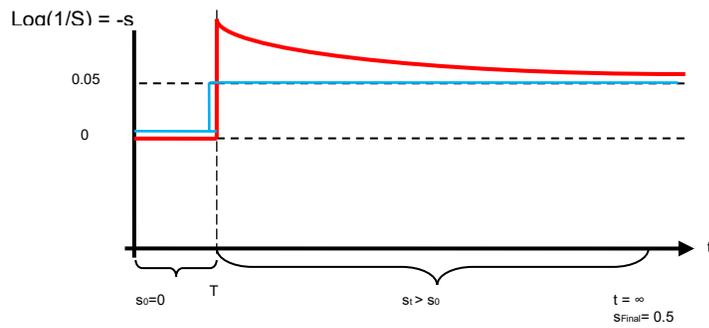
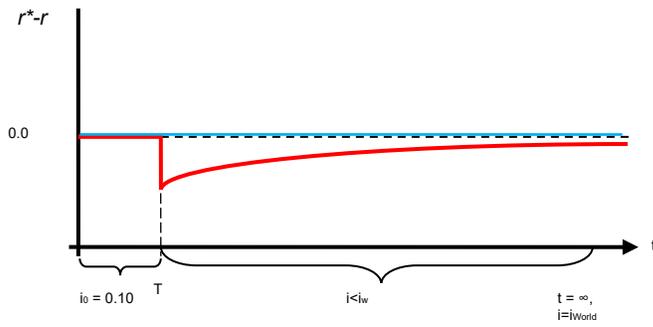
If the country has a large outstanding debt in dollars (the foreign currency), a devaluation will have balance sheet effects, possibly throwing the government and/or the firms into insolvency/bankruptcy, thereby offsetting the positive flow effects of devaluation shown in answers to 2.1 and 2.2.

### 3. Sticky price monetary model of exchange rates.

3.1 Explain what happens if the monetary authority in the euro area increases the money supply by 5 percent. In your answer, indicate the time paths of  $M^*$ ,  $P^*$ ,  $M^*/P^*$ ,  $r^*-r$ ,  $1/S$ . Use graphs.

5% increase in money supply in euro area (denoted by \*) means  $m^*$  increases from 0 to 0.05. If prices were perfectly flexible, the blue line would apply for  $p^*$ ,  $m^*-p^*$ ,  $r^*-r$ ,  $-s$  ( $= s^*$ ). With sticky prices, one has overshooting, so the red line applies.





3.2 Suppose  $\theta$  falls from 10 to 0.5. Redo 3.1.

A shrinking  $\theta$  means prices are even more sticky, i.e., adjust even more slowly. That means the drop in the euro area interest rate would be bigger and more protracted, and the overshooting of the exchange rate bigger and more protracted.