

Problem Set 4

Due in Lecture on Monday, April 19th. "Box-in" your answers to the algebraic questions.

1. Covered and uncovered interest parity.

1.1 Assume that covered interest parity holds, so $(1+i) = (F/S)(1+i^*)$. Fill in the following grid (carry your answer out to three decimal places), for (a) and (b).

1.2 Assume that uncovered interest parity holds, so $(1+i) = (S^e/S)(1+i^*)$. Fill in the following grid (carry your answer out to three decimal places), for (c) and (d).

	i	i^*	F	S
a.	0.05	0.08	1.20	
b.	0.05		1.20	1.25
	i	i^*	S^e	S
c.		0.08	1.20	1.245
d.	0.06	0.09		1.245

2. Using real data to evaluate PPP and UIP. Consider the table drawn from the *Economist*, April 8th edition, on the attached pages. Answer these questions using equations, and show your work.

2.1 Using the 3 month interest rates, and assuming UIP holds, calculate the expected change in the dollar/pound exchange rate over the next three months. Be sure to state what the rate will be, in annualized terms, and what will be the actual percentage change in the dollar/pound exchange rate.

2.2 Using 10 year bonds, calculate what the implied change in the dollar/pound exchange rate is, over the next ten years.

2.3 Given the empirical evidence on the relationship between exchange rate changes and interest differentials provided in the table in the handout on CIP and UIP, what do you expect to happen to the dollar/pound rate over the next three months, and over the next ten years? Explain.

2.4 Given the inflation rates over the past year, what should have been the rate of change in the US dollar/pound exchange rate if relative purchasing power parity held?

2.5 Interpret the April 8th *Economist* poll of expected inflation rate for 2010 as the expected change from December 2009 to December 2010. What is the expected change in the US dollar/pound over that period if relative PPP holds?

Trade, exchange rates, budget balances and interest rates

	Trade balance*	Current-account balance		Currency units, per \$		Budget balance	Interest rates, %	
	latest 12 months, \$bn	latest 12 months, \$bn	% of GDP 2010 [†]	Apr 7th	year ago	% of GDP 2010 [†]	3-month latest	10-year gov't bonds, latest
United States	-518.8 Jan	-419.9 Q4	-3.2	-	-	-11.1	0.22	3.86
Japan	+61.3 Feb	+157.1 Feb	+3.4	93.7	100	-8.0	0.29	1.39
China	+175.8 Feb	+284.4 Q4	+5.2	6.83	6.84	-2.9	1.94	3.38
Britain	-129.9 Jan	-28.8 Q4	-1.1	0.66	0.68	-13.5	0.67	4.11
Canada	-2.5 Jan	-36.6 Q4	-1.8	1.00	1.24	-3.7	0.29	3.70
Euro area	+35.5 Jan	-67.6 Jan	-0.2	0.75	0.76	-7.2	0.64	3.12
Austria	-5.0 Dec	+7.5 Q3	+1.5	0.75	0.76	-5.0	0.64	3.51
Belgium	+18.2 Dec	+2.7 Dec	-0.2	0.75	0.76	-6.6	0.65	3.58
France	-59.0 Feb	-51.5 Jan	-2.1	0.75	0.76	-8.6	0.64	3.44
Germany	+193.1 Jan	+169.0 Jan	+5.3	0.75	0.76	-5.6	0.64	3.12
Greece	-43.4 Jan	-38.0 Jan	-8.6	0.75	0.76	-9.5	0.64	7.17
Italy	-5.6 Jan	-66.3 Jan	-2.5	0.75	0.76	-5.3	0.64	3.90
Netherlands	+47.0 Jan	+42.8 Q4	+5.3	0.75	0.76	-6.2	0.64	3.36
Spain	-70.4 Jan	-79.9 Jan	-3.8	0.75	0.76	-11.6	0.64	3.87
Czech Republic	+9.0 Feb	-1.4 Jan	-2.1	18.9	20.1	-5.5	1.44	3.89
Denmark	+12.8 Jan	+13.0 Jan	+2.2	5.58	5.63	-5.8	1.30	3.41
Hungary	+6.3 Jan	+0.4 Q4	-2.3	200	223	-4.0	5.47	6.76
Norway	+54.3 Feb	+53.5 Q4	+14.8	5.97	6.71	9.3	2.33	3.77
Poland	-4.4 Jan	-7.2 Jan	-2.8	2.87	3.38	-2.8	4.03	5.59
Russia	+120.8 Jan	+47.5 Q4	+4.2	29.3	33.7	-4.0	8.25	6.06
Sweden	+10.6 Feb	+29.2 Q4	+6.8	7.25	8.29	-3.0	0.22	3.20
Switzerland	+19.9 Feb	+48.2 Q4	+8.7	1.07	1.15	-1.3	0.25	1.82
Turkey	-43.7 Feb	-16.3 Jan	-3.8	1.50	1.59	-5.2	7.39	4.92 [‡]
Australia	-9.5 Feb	-42.4 Q4	-4.4	1.08	1.41	-3.1	4.55	5.85
Hong Kong	-33.1 Feb	+18.4 Q4	+7.1	7.76	7.75	0.8	0.13	2.64
India	-90.5 Feb	-31.5 Q4	-1.0	44.5	50.2	-6.4	3.97	8.16
Indonesia	+21.7 Feb	+10.6 Q4	+1.5	9,053	11,320	-2.1	7.05	5.27 [‡]
Malaysia	+35.2 Jan	+32.0 Q4	+12.7	3.21	3.63	-5.6	2.56	1.57 [‡]
Pakistan	-14.7 Feb	-3.4 Q4	-2.3	83.5	80.6	-5.5	12.30	8.58 [‡]
Singapore	+26.5 Feb	+34.0 Q4	+12.3	1.40	1.52	-2.7	0.50	2.78
South Korea	+41.1 Mar	+40.2 Feb	+3.6	1,121	1,355	-4.1	2.69	4.77
Taiwan	+17.8 Feb	+42.6 Q4	+8.4	31.6	33.9	-3.8	0.91	1.32
Thailand	+14.9 Feb	+16.8 Feb	+4.2	32.3	35.5	-3.7	1.42	3.29
Argentina	+16.6 Feb	+11.3 Q4	+2.4	3.88	3.68	-1.5	11.94	na
Brazil	+23.3 Mar	-28.1 Feb	-2.8	1.76	2.20	-2.4	8.65	6.16 [‡]
Chile	+15.3 Feb	+4.2 Q4	+2.0	517	580	-0.7	0.60	2.25 [‡]
Colombia	+2.1 Jan	-6.1 Q3	-1.4	1,916	2,386	-3.8	3.90	4.93 [‡]
Mexico	-2.7 Feb	-5.2 Q4	-1.7	12.2	13.4	-1.6	4.43	7.35
Venezuela	+19.2 Q4	+8.6 Q4	+5.6	7.05 [§]	6.28 [§]	-3.0	14.50	6.55 [‡]
Egypt	-25.4 Q3	-3.2 Q4	-0.8	5.51	5.62	-9.4	9.67	1.50 [‡]
Israel	-5.4 Feb	+7.2 Q4	+3.1	3.70	4.14	-4.3	1.57	3.91
Saudi Arabia	+212.0 2008	+134.0 2008	+11.3	3.75	3.75	1.7	0.73	na
South Africa	-1.2 Feb	-11.4 Q4	-5.4	7.26	9.16	-6.6	6.58	8.54
MORE COUNTRIES	Data for the countries below are not provided in printed editions of <i>The Economist</i>							
Estonia	-1.1 Jan	+1.0 Jan	+1.5	11.7	11.8	-2.9	1.80	na
Finland	+5.0 Jan	+3.6 Jan	+2.0	0.75	0.76	-4.0	0.64	3.38
Iceland	+0.8 Feb	-0.4 Q4	+0.4	129	127	-7.0	7.88	na
Ireland	+54.7 Jan	-6.5 Q4	-0.8	0.75	0.76	-12.5	0.64	4.48
Latvia	-1.6 Jan	+2.6 Jan	+6.1	0.53	0.54	-6.8	1.59	na
Lithuania	-1.9 Jan	+1.2 Jan	+3.5	2.59	2.61	-6.7	1.73	na
Luxembourg	-5.9 Jan	+3.2 Q3	na	0.75	0.76	-5.4	0.64	na
New Zealand	-0.4 Feb	-7.9 Q4	-4.7	1.41	1.73	-4.3	NA	6.01
Peru	+6.4 Jan	+0.2 Q4	-0.6	2.84	3.11	-1.1	1.25	na
Philippines	-4.6 Jan	+8.6 Dec	+4.8	44.8	48.0	-3.5	4.25	na
Portugal	-26.4 Jan	-23.1 Jan	-7.1	0.75	0.76	-8.5	0.64	4.27
Slovakia	+2.1 Jan	-2.6 Jan	-3.8	22.6	22.8	-5.4	1.35	2.87
Slovenia	-1.4 Jan	-0.3 Jan	-1.7	0.75	0.76	-5.2	0.64	na
Ukraine	-4.7 Q4	-1.8 Q4	-1.0	7.92	8.05	-5.0	7.55	na
Vietnam	-17.5 Mar	-9.2 2008	-7.3	19,055	17,784	-7.9	11.70	5.54

*Merchandise trade only. [†]The Economist poll or Economist Intelligence Unit estimate. [‡]Dollar-denominated bonds. [§]Unofficial exchange rate.

Sources: National statistics offices and central banks; Bloomberg; Thomson Reuters; Bank Leumi le-Israel; Centre for Monitoring Indian Economy; Hong Kong Monetary Authority; JPMorgan; Standard Bank Group; UBS; Westpac.

Output, prices and jobs

% change on year ago

	Gross domestic product				Industrial production latest	Consumer prices			Unemployment rate [‡] , %
	latest	qtr*	2010 [†]	2011 [†]		latest	year ago	2010 [†]	
United States	+0.1 Q4	+5.6	+3.1	+2.9	+1.7 Feb	+2.1 Feb	+0.2	+2.0	9.7 Mar
Japan	-1.0 Q4	+3.8	+1.9	+1.6	+31.3 Feb	-1.1 Feb	-0.1	-1.0	4.9 Feb
China	+10.7 Q4	na	+9.7	+8.2	+12.8 Feb	+2.7 Feb	-1.6	+3.5	9.6 2009
Britain	-3.1 Q4	+1.8	+1.3	+2.1	-0.1 Feb	+3.0 Feb [§]	+3.2	+2.7	7.8 Jan ^{††}
Canada	-1.2 Q4	+5.0	+3.0	+3.0	-1.9 Jan	+1.6 Feb	+1.4	+1.7	8.2 Feb
Euro area	-2.2 Q4	+0.2	+1.2	+1.4	+1.4 Jan	+1.5 Mar	+0.6	+1.3	10.0 Feb
Austria	-1.9 Q4	+1.4	+1.1	+1.4	+4.5 Jan	+0.9 Feb	+1.6	+1.1	5.3 Jan
Belgium	-0.8 Q4	+1.2	+1.3	+1.5	-5.3 Dec	+1.7 Mar	+0.6	+1.3	12.1 Feb ^{††}
France	-0.3 Q4	+2.4	+1.5	+1.6	+3.5 Jan	+1.3 Feb	+0.9	+1.4	10.1 Feb
Germany	-2.4 Q4	nil	+1.6	+1.6	+2.1 Jan	+1.1 Mar	+0.5	+0.9	8.0 Mar
Greece	-2.5 Q4	-3.1	-2.5	-0.7	-3.1 Jan	+2.8 Feb	+1.6	+1.5	10.2 Dec
Italy	-3.0 Q4	-1.2	+0.7	+1.1	+0.1 Jan	+1.4 Mar	+1.2	+1.3	8.3 Q4
Netherlands	-2.2 Q4	+0.9	+1.1	+1.5	+5.3 Jan	+1.0 Mar	+2.0	+0.9	5.7 Feb ^{††}
Spain	-3.1 Q4	-0.6	-0.4	+0.8	-1.9 Feb	+0.8 Feb	+0.7	+1.3	19.0 Feb
Czech Republic	-3.1 Q4	+3.0	+0.9	+2.8	+5.3 Jan	+0.6 Feb	+2.0	+1.6	9.9 Feb
Denmark	-3.4 Q4	+0.9	+1.2	+1.8	-11.5 Jan	+1.9 Feb	+1.9	+1.8	4.1 Feb
Hungary	-4.0 Q4	-1.7	-0.7	+2.8	+5.7 Jan	+5.7 Feb	+3.0	+4.0	11.4 Feb ^{††}
Norway	-1.2 Q4	+0.4	+1.6	+1.8	-3.1 Jan	+3.0 Feb	+2.5	+2.0	3.3 Jan ^{§§}
Poland	+3.1 Q4	na	+2.5	+3.0	+9.2 Feb	+2.9 Feb	+3.3	+2.8	13.0 Feb ^{††}
Russia	-3.8 Q4	na	+3.5	+4.3	+1.9 Feb	+6.4 Mar	+14.0	+7.0	8.6 Feb ^{††}
Sweden	-1.5 Q4	-2.2	+1.9	+2.6	-0.2 Jan	+1.2 Feb	+0.9	+1.4	9.3 Feb ^{††}
Switzerland	+0.6 Q4	+3.0	+1.7	+1.8	-1.1 Q4	+1.4 Mar	-0.4	+0.9	4.1 Mar
Turkey	+6.0 Q4	na	+3.6	+3.8	+12.1 Jan	+9.6 Mar	+7.9	+10.2	13.5 Dec ^{††}
Australia	+2.7 Q4	+3.7	+3.1	+3.4	-3.8 Q3	+2.1 Q4	+3.7	+2.5	5.3 Mar
Hong Kong	+2.6 Q4	+9.5	+4.7	+3.6	-4.9 Q4	+2.8 Feb	+0.8	+2.0	4.6 Feb ^{††}
India	+6.0 Q4	na	+7.7	+8.0	+16.7 Jan	+14.8 Feb	+9.7	+10.7	10.7 2009
Indonesia	+5.4 Q4	na	+5.6	+5.9	+5.0 Jan	+3.4 Mar	+7.9	+5.8	8.1 Feb
Malaysia	+4.5 Q4	na	+5.4	+4.0	+5.0 Feb	+1.2 Feb	+3.7	+1.7	3.6 Q3
Pakistan	+2.0 2009**	na	+2.8	+4.2	+7.5 Jan	+13.0 Feb	+21.1	+11.4	5.2 2008
Singapore	+3.5 Q4	-6.8	+5.1	+5.0	+19.1 Feb	+1.0 Feb	+3.3	+2.2	2.1 Q4
South Korea	+6.0 Q4	+0.7	+5.3	+3.9	+19.1 Feb	+2.3 Mar	+3.9	+2.9	4.4 Feb
Taiwan	+9.2 Q4	na	+4.9	+4.6	+35.2 Feb	+1.3 Mar	-0.1	+1.6	5.7 Feb
Thailand	+5.8 Q4	+15.3	+3.8	+4.4	+30.3 Feb	+3.4 Mar	-0.2	+3.3	0.9 Dec
Argentina	+2.6 Q4	+7.9	+3.1	+2.6	+8.2 Jan	+9.1 Feb ^{***}	+6.8	+10.2	8.4 Q4 ^{††}
Brazil	+4.3 Q4	+8.4	+5.0	+4.5	+18.4 Feb	+4.8 Feb	+5.9	+4.8	7.4 Feb ^{††}
Chile	+2.1 Q4	+5.9	+5.2	+4.5	+0.5 Feb	+0.3 Feb	+5.5	+1.7	8.5 Feb ^{†††}
Colombia	-2.5 Q4	+4.7	+2.5	+3.6	+1.6 Jan	+1.8 Mar	+6.1	+3.0	12.6 Feb ^{††}
Mexico	-2.3 Q4	+8.4	+4.3	+2.7	+3.6 Jan	+4.8 Feb	+6.2	+5.7	5.4 Feb ^{††}
Venezuela	-5.8 Q4	na	-5.6	-1.2	-11.6 Dec	+27.0 Feb	+29.5	+29.7	7.4 Q4 ^{††}
Egypt	+4.9 Q3	na	+5.5	+5.6	+6.7 Q3	+12.8 Feb	+13.5	+10.1	9.4 Q4 ^{††}
Israel	+1.9 Q4	+4.4	+3.2	+3.5	+4.5 Jan	+3.6 Feb	+3.3	+2.0	7.4 Q4
Saudi Arabia	+0.2 2009	na	+3.3	+3.5	na	+4.6 Feb	+6.9	+3.5	na
South Africa	-1.4 Q4	+3.2	+2.8	+3.7	+3.7 Jan	+5.7 Feb	+8.6	+5.9	24.3 Dec ^{††}
MORE COUNTRIES	Data for the countries below are not provided in printed editions of <i>The Economist</i>								
Estonia	-9.5 Q4	na	-1.1	+3.0	+4.8 Feb	+1.7 Mar	+2.0	+0.3	15.5 Q4
Finland	-5.1 Q4	+0.1	+1.5	+1.9	nil Jan	+0.1 Feb	+1.8	+1.0	9.1 Feb
Iceland	-7.0 Q4	+13.9	-0.5	+1.2	+10.1 2008	+8.5 Mar	+15.2	+6.5	9.3 Feb ^{††}
Ireland	-5.1 Q4	-8.7	-2.3	+0.9	+1.9 Jan	-3.2 Feb	-1.7	-0.9	12.6 Feb
Latvia	-16.9 Q4	na	-2.3	+3.0	-16.6 Jan	-4.2 Feb	+9.6	-3.4	22.9 Jan
Lithuania	-12.8 Q4	+1.9	-2.2	+2.9	-4.8 Feb	-0.2 Jan	+9.6	+1.1	13.9 Feb ^{††}
Luxembourg	-2.5 Q3	+17.9	+1.6	+1.3	+29.5 Dec	+1.5 Feb	+1.2	+1.6	6.5 Feb ^{††}
New Zealand	+0.9 Q4	+3.1	+2.7	+3.0	-8.1 Q3	+2.0 Q4	+3.4	+1.7	7.3 Q4
Peru	+3.6 Jan	na	+5.3	+5.1	+0.3 Jan	+0.8 Mar	+4.8	+1.6	10.5 Feb ^{††}
Philippines	+1.8 Q4	+3.5	+3.2	+4.7	+39.4 Jan	+4.2 Feb	+7.3	+4.6	7.3 Q1 ^{††}
Portugal	-1.0 Q4	-0.6	+0.3	+0.3	+2.6 Feb	+0.2 Feb	+0.2	+0.4	10.1 Q4 ^{††}
Slovakia	-2.6 Q4	na	+2.0	+2.8	+19.3 Jan	+0.4 Feb	+3.0	+1.8	13.0 Feb ^{††}
Slovenia	-5.5 Q4	na	+1.2	+2.9	+5.4 Dec	+1.3 Feb	+2.1	+1.9	10.6 Jan ^{††}
Ukraine	-15.9 Q3	na	+2.5	+4.0	+5.6 Feb	+11.5 Feb	+20.9	+10.5	1.9 Feb
Vietnam	+5.8 Q1	na	+6.2	+6.9	-1.3 Feb	+9.5 Mar	+11.2	+10.9	4.7 2008

*% change on previous quarter, annual rate. [†]The Economist poll or Economist Intelligence Unit estimate/forecast. [‡]National definitions. [§]RPI inflation rate 3.0 in February. ^{**}Year ending June. ^{††}Latest 3 months. ^{†††}Not seasonally adjusted. ^{§§}Centred 3-month average. ^{***}Unofficial estimates are higher. Sources: National statistics offices and central banks; Thomson Reuters; Centre for Monitoring Indian Economy; OECD; ECB

The Economist poll of forecasters, April averages (previous month's, if changed)

	Real GDP, % change				Consumer prices		Current account	
	Low/high range		average		% increase		% of GDP	
	2010	2011	2010	2011	2010	2011	2010	2011
Australia	2.1/4.0	2.7/4.6	3.1 (2.9)	3.4	2.5 (2.4)	2.8 (2.7)	-4.4 (-4.0)	-4.2 (-4.4)
Belgium	0.8/1.6	1.1/1.8	1.3 (1.4)	1.5	1.3 (1.2)	1.4 (1.5)	-0.2 (0.4)	0.3 (0.8)
Britain	0.7/2.0	0.9/3.4	1.3	2.1	2.7	1.9	-1.1	-0.8 (-0.7)
Canada	1.6/3.7	1.8/3.6	3.0 (2.7)	3.0	1.7 (1.5)	1.9	-1.8 (-2.3)	-1.6 (-1.5)
France	1.0/2.0	0.9/2.4	1.5 (1.6)	1.6	1.4 (1.3)	1.5 (1.6)	-2.1 (-1.8)	-1.9 (-1.6)
Germany	1.1/2.0	1.2/2.2	1.6	1.6 (1.5)	0.9	1.3 (1.2)	5.3 (5.2)	5.4 (5.3)
Italy	0.4/1.1	0.6/2.1	0.7 (0.9)	1.1 (1.2)	1.3 (1.4)	1.5 (1.6)	-2.5	-2.3 (-2.4)
Japan	1.0/2.8	0.9/2.2	1.9 (1.7)	1.6	-1.0 (-0.9)	-0.2	3.4 (2.8)	3.6 (2.9)
Netherlands	0.7/1.9	1.1/2.4	1.1 (1.2)	1.5	0.9	1.3 (1.1)	5.3 (4.9)	5.5 (5.3)
Spain	-1.0/0.3	0.1/1.5	-0.4 (-0.3)	0.8 (1.0)	1.3 (1.4)	1.4 (1.5)	-3.8 (-4.5)	-3.1 (-3.9)
Sweden	1.2/2.5	1.6/3.6	1.9 (2.2)	2.6 (2.4)	1.4 (1.2)	2.2 (1.9)	6.8 (7.1)	7.1 (7.3)
Switzerland	1.0/2.5	0.9/2.8	1.7 (1.3)	1.8 (1.6)	0.9 (0.7)	1.0	8.7 (7.7)	9.5 (8.2)
United States	2.5/3.8	1.6/4.5	3.1	2.9	2.0 (2.2)	1.6 (1.8)	-3.2	-3.4 (-3.3)
Euro area	0.8/1.6	1.0/2.2	1.2	1.4	1.3 (1.2)	1.4	-0.2 (-0.4)	nil (-0.2)

Sources: BNP Paribas, Citigroup, Commerzbank, Decision Economics, Deutsche Bank, Economist Intelligence Unit, Goldman Sachs, HSBC Securities, KBC Bank, JPMorgan Chase, ING, Morgan Stanley, RBS, Schroders, Scotiabank, Soci t  G n rale, UBS

Economist, April 8, 2010.

3. Flexible price monetary model of exchange rates. Assume $\lambda=5$.

3.1 If the money supply increases by 5% today, and stays 5% higher than it was expected to be, in all future periods, what happens to the nominal exchange rate and nominal interest rate today, and into the future?

3.2 If the money supply expected in period $t+i$ rises by Δm , for $i > 2$ relative to what it was previously expected to be (and is expected to remain lower for all the future thereafter), what would immediately happen to the exchange rate *today*?

3.3 Suppose the fundamentals grow by 0% per annum. Suppose the growth rate increases to 5%. What happens to the exchange rate, if anything, the instant the growth rate changes?

4. Sticky price monetary model of exchange rates.

4.1 Explain what happens if the monetary authority in US decreases the money supply by 5 percent. In your answer, indicate the time paths of M , P , M/P , $r-r^*$, s . Use graphs.

4.2 Suppose θ equals infinity. Redo 4.1.