

Problem Set 4

Due in Lecture on Monday, April 20th. "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	0.09	1.20	
b.	0.05		1.20	1.30
	i	i^*	S^e	S
c.		0.09	1.20	1.25
d.	0.05	0.09		1.30

2. Using real data to evaluate PPP and UIP. Consider the table drawn from the *Economist*, April 10th 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/euro 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/euro 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/euro rate over the next three months, and over the next ten years (use the German 10 year rate as a proxy for the Euro area rate)? Explain.

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

2.5 Interpret the April 10th *Economist* poll of expected inflation rate for 2009 as the expected change from December 2008 to December 2009. What is the expected change in the US dollar/euro over that period if relative PPP holds?

Trade, exchange rates, budget balances and interest rates

	Trade balance* latest 12 months, \$bn	Current-account balance		Currency units, per \$		Budget balance % of GDP 2009†	Interest rates, %	
		latest 12 months, \$bn	% of GDP 2009†	Apr 8th	year ago		3-month latest	10-year gov't bonds, latest
United States	-797.1 Jan	-673.3 Q4	-3.3	-	-	-13.7	0.50	2.90
Japan	+28.5 Jan	+131.8 Feb	+1.5	101	103	-5.6	0.54	1.42
China	+311.5 Feb	+400.7 Q2	+6.1	6.84	7.00	-3.6	1.22	3.36
Britain	-167.7 Jan	-44.6 Q4	-1.7	0.68	0.51	-11.3	1.63	3.44
Canada	+41.6 Jan	+11.3 Q4	-2.0	1.24	1.02	-2.8	0.39	3.08
Euro area	-53.8 Jan	-90.2 Jan	-1.0	0.75	0.64	-5.3	1.50	3.23
Austria	-3.5 Jan	+16.8 Q3	+1.5	0.75	0.64	-3.4	1.45	4.12
Belgium	+8.2 Jan	-12.1 Dec	-1.4	0.75	0.64	-3.6	1.47	4.02
France	-79.9 Feb	-56.8 Jan	-2.2	0.75	0.64	-6.3	1.45	3.73
Germany	+234.6 Feb	+224.3 Jan	+4.5	0.75	0.64	-3.9	1.45	3.22
Greece	-65.0 Dec	-49.9 Jan	-12.6	0.75	0.64	-4.9	1.45	5.66
Italy	-18.4 Jan	-73.1 Jan	-2.6	0.75	0.64	-4.3	1.45	4.44
Netherlands	+51.7 Jan	+65.3 Q4	+5.9	0.75	0.64	-1.3	1.45	3.86
Spain	-131.7 Jan	-145.2 Jan	-7.5	0.75	0.64	-7.4	1.45	4.14
Czech Republic	+3.5 Feb	-7.3 Jan	-2.3	20.0	16.0	-3.0	2.46	5.67
Denmark	+6.7 Jan	+6.8 Jan	+1.0	5.61	4.75	-2.0	4.50	3.80
Hungary	-0.4 Jan	-13.0 Q4	-3.7	224	161	-2.7	9.83	10.50
Norway	+73.7 Feb	+83.4 Q4	+10.9	6.66	5.06	10.6	2.99	3.89
Poland	-23.1 Jan	-28.1 Jan	-4.9	3.38	2.20	-2.2	4.16	6.09
Russia	+170.8 Jan	+98.9 Q4	-2.2	33.6	23.6	-8.0	13.00	10.60
Sweden	+14.3 Feb	+40.3 Q4	+7.3	8.17	5.97	-3.3	0.25	3.23
Switzerland	+18.4 Feb	+53.3 Q4	+7.5	1.14	1.01	-2.0	0.40	2.20
Turkey	-60.8 Feb	-37.2 Jan	-3.4	1.60	1.29	-4.2	11.61	7.69‡
Australia	+2.2 Feb	-44.1 Q4	-5.2	1.40	1.08	-3.1	3.08	4.61
Hong Kong	-25.1 Feb	+30.6 Q4	+9.1	7.75	7.79	-4.5	0.90	2.02
India	-113.3 Feb	-37.5 Q4	-3.7	50.1	40.0	-7.2	4.49	7.51
Indonesia	+7.2 Feb	+0.6 Q4	-0.4	11,320	9,195	-2.9	9.27	9.26‡
Malaysia	+42.1 Feb	+39.1 Q4	+7.8	3.59	3.19	-6.6	2.09	3.38‡
Pakistan	-19.7 Feb	-15.3 Q4	-5.8	80.5	63.1	-6.4	12.77	19.89‡
Singapore	+14.7 Feb	+27.1 Q4	+15.4	1.51	1.38	-4.1	0.56	1.94
South Korea	-2.8 Mar	+0.7 Feb	+1.2	1,324	976	-3.5	2.41	5.05
Taiwan	+9.8 Mar	+25.0 Q4	+7.9	33.6	30.5	-5.0	0.90	1.44
Thailand	+6.1 Feb	+4.5 Feb	+1.4	35.4	31.7	-4.7	1.72	2.79
Argentina	+13.1 Feb	+7.6 Q4	-0.5	3.67	3.16	-0.8	14.44	na
Brazil	+25.0 Mar	-25.7 Feb	-2.0	2.23	1.70	-1.9	11.16	6.16‡
Chile	+7.6 Feb	-3.4 Q4	-3.4	582	437	-3.5	2.64	3.89‡
Colombia	+2.1 Feb	-6.8 Q4	-4.0	2,417	1,813	-3.3	7.91	6.82‡
Mexico	-16.0 Feb	-2.4 Q4	-3.4	13.6	10.6	-3.2	6.24	7.61
Venezuela	+39.2 Q4	+39.2 Q4	+0.1	6.28	3,708	-5.3	17.25	6.55‡
Egypt	-26.8 Q4	-1.3 Q4	-0.5	5.62	5.45	-7.0	10.47	3.58‡
Israel	-12.8 Feb	+1.6 Q4	+1.9	4.14	3.61	-5.0	0.59	3.37
Saudi Arabia	+197.4 2008	+124.0 2008	-8.0	3.75	3.75	-8.7	1.15	na
South Africa	-8.0 Feb	-21.0 Q4	-7.0	9.15	7.79	-3.3	8.85	8.53
MORE COUNTRIES	Data for the countries below are not provided in printed editions of <i>The Economist</i>							
Estonia	-3.4 Jan	-1.9 Jan	-6.2	11.8	9.96	-3.4	6.67	na
Finland	+8.8 Jan	+4.8 Jan	+2.4	0.75	0.64	-4.1	1.42	3.84
Iceland	+0.2 Mar	-5.6 Q4	+0.5	127	72.5	-9.5	15.50	na
Ireland	+44.3 Jan	-12.7 Q4	-1.7	0.75	0.64	-12.4	1.45	5.24
Latvia	-6.1 Jan	-4.0 Jan	-5.0	0.53	0.44	-6.0	10.35	na
Lithuania	-6.6 Jan	-5.6 Jan	-7.5	2.60	2.20	-2.5	7.08	na
Luxembourg	-7.9 Dec	+3.0 Q4	na	0.75	0.64	-3.9	1.45	na
New Zealand	-3.5 Feb	-11.3 Q4	-6.3	1.73	1.26	-6.3	3.65	5.22
Peru	+2.2 Feb	-4.2 Q4	-3.9	3.11	2.69	-1.8	6.00	na
Philippines	-7.6 Jan	+4.2 Dec	+2.9	47.8	41.8	-2.6	4.50	na
Portugal	-34.0 Dec	-29.0 Jan	-9.4	0.75	0.64	-4.7	1.45	4.58
Slovakia	-1.5 Jan	-7.0 Jan	-4.8	22.7	20.7	-2.8	1.35	4.63
Slovenia	-4.5 Jan	-3.1 Dec	-4.3	0.75	0.64	-3.4	1.45	na
Ukraine	-16.9 Q4	-12.9 Q4	-3.8	8.05	5.01	-1.0	19.10	na
Vietnam	-12.2 Feb	-7.0 2007	-7.2	17,750	16,109	-8.4	8.30	8.04

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

Output, prices and jobs

% change on year ago

	Gross domestic product				Industrial production latest	Consumer prices			Unemployment rate [†] , %
	latest	qtr [*]	2009 [†]	2010 [†]		latest	year ago	2009 [†]	
United States	-0.8 Q4	-6.3	-2.7	+1.4	-11.8 Feb	+0.2 Feb	+4.0	-0.8	8.5 Mar
Japan	-4.3 Q4	-12.1	-6.5	+0.4	-38.4 Feb	-0.1 Feb	+1.0	-1.0	4.4 Feb
China	+6.8 Q4	na	+6.0	+7.0	+3.8 Jan-Feb	-1.6 Feb	+8.7	-0.2	9.0 2008
Britain	-2.0 Q4	-5.9	-3.5	+0.3	-12.5 Feb	+3.2 Feb [§]	+2.5	+1.2	6.5 Jan ^{††}
Canada	-0.7 Q4	-3.4	-1.9	+1.6	-7.8 Jan	+1.4 Feb	+1.8	+0.6	7.7 Feb
Euro area	-1.5 Q4	-6.2	-3.4	+0.2	-17.3 Jan	+0.6 Mar	+3.6	+0.4	8.5 Feb
Austria	+0.5 Q4	-0.8	-2.0	+0.3	-6.5 Jan	+1.3 Feb	+3.2	+0.6	4.5 Feb
Belgium	-0.8 Q4	-6.5	-2.7	+0.3	-17.9 Jan	+0.6 Mar	+4.4	+0.7	11.2 Feb ^{††}
France	-1.1 Q4	-4.4	-2.7	+0.3	-13.8 Jan	+0.9 Feb	+2.8	+0.3	8.6 Feb
Germany	-1.7 Q4	-8.2	-4.3	+0.3	-19.2 Jan	+0.5 Mar	+3.1	+0.3	8.1 Mar
Greece	+2.4 Q4	+1.2	-3.4	-0.4	-10.2 Jan	+1.6 Feb	+4.4	+0.9	7.8 Dec
Italy	-2.9 Q4	-7.5	-3.7	+0.1	-16.7 Jan	+1.2 Mar	+3.3	+0.8	6.9 Q4
Netherlands	-0.6 Q4	-3.8	-2.7	+0.5	-13.3 Dec	+2.0 Feb	+2.2	+0.9	4.1 Feb ^{††}
Spain	-0.7 Q4	-3.8	-3.1	-0.5	-23.9 Feb	+0.7 Feb	+4.4	+0.3	15.5 Feb
Czech Republic	+0.7 Q4	-3.7	-2.0	+1.6	-23.3 Jan	+2.0 Feb	+7.5	+1.8	7.4 Feb
Denmark	-3.7 Q4	-7.3	-3.1	+0.5	-11.3 Feb ^{†††}	+1.9 Feb	+3.1	+1.1	2.5 Feb
Hungary	+2.0 Q4	-3.9	-3.0	+0.4	-25.4 Feb	+3.0 Feb	+6.9	+2.9	9.1 Feb ^{††}
Norway	+0.8 Q4	+5.6	-1.2	+0.5	-5.1 Feb	+2.5 Feb	+3.7	+1.7	3.1 Jan ^{**}
Poland	+2.9 Q4	na	+0.7	+2.2	-14.3 Feb	+3.3 Feb	+4.2	+3.0	10.9 Feb ^{††}
Russia	+1.2 Q4	na	-3.0	+2.0	-13.2 Feb	+14.0 Mar	+13.3	+13.5	8.5 Feb ^{††}
Sweden	-4.9 Q4	-9.3	-3.6	+0.7	-22.9 Jan	+0.9 Feb	+3.1	-0.1	8.0 Feb ^{††}
Switzerland	-0.1 Q4	-1.2	-2.3	+0.1	-6.0 Q4	-0.4 Mar	+2.6	-0.2	3.1 Feb
Turkey	-6.2 Q4	na	-2.0	+1.5	-21.3 Jan	+7.9 Mar	+9.2	+7.8	12.3 Q4 ^{††}
Australia	+0.3 Q4	-2.1	-0.8	+1.6	+3.8 Q3	+3.7 Q4	+3.0	+2.1	5.2 Feb
Hong Kong	-2.5 Q4	-7.8	-5.9	-0.2	-10.3 Q4	+0.8 Feb	+6.3	+1.1	5.0 Feb ^{††}
India	+5.3 Q4	na	+5.0	+6.4	-0.5 Jan	+9.6 Feb	+5.5	+5.4	6.8 2008
Indonesia	+5.2 Q4	na	-1.3	+0.6	-6.1 Jan	+7.9 Mar	+6.3	+3.9	8.4 Aug
Malaysia	+0.1 Q4	na	-0.3	+2.8	-20.2 Jan ^{†††}	+3.7 Feb	+2.7	+1.1	3.0 Q4
Pakistan	+5.8 2008 ^{**}	na	+1.2	+3.2	-8.9 Jan	+21.1 Feb	+11.3	+10.1	5.6 2007
Singapore	-4.2 Q4	-16.4	-7.5	+1.9	-22.4 Feb	+1.9 Feb	+6.5	+0.9	2.6 Q4
South Korea	-3.4 Q4	-20.8	-5.9	+0.3	-10.3 Feb	+3.9 Mar	+3.9	-0.6	3.5 Feb
Taiwan	-8.4 Q4	na	-6.5	+0.1	-27.1 Feb	-0.1 Mar	+3.9	-1.0	5.6 Feb
Thailand	-4.3 Q4	-22.2	-4.4	+1.8	-19.8 Feb	-0.2 Mar	+5.3	-1.2	2.4 Jan
Argentina	+4.9 Q4	-1.2	-2.8	+1.5	-14.0 Feb	+6.8 Feb	+8.4	+6.4	7.3 Q4 ^{††}
Brazil	+1.3 Q4	-13.6	-1.5	+2.7	-17.0 Feb	+5.9 Feb	+4.6	+4.4	8.5 Feb ^{††}
Chile	+0.2 Q4	-8.3	+0.4	+2.3	-11.5 Feb	+5.0 Mar	+8.5	+3.7	8.5 Feb ^{††††}
Colombia	-0.7 Q4	-4.1	-1.0	+1.5	-10.7 Jan	+6.1 Mar	+5.9	+5.0	12.5 Feb ^{††}
Mexico	-1.6 Q4	-10.3	-2.6	+1.4	-11.1 Jan	+6.0 Mar	+4.3	+4.8	5.3 Feb ^{††}
Venezuela	+3.2 Q4	na	-5.0	-5.4	-25.4 Dec	+28.6 Mar	+29.1	+30.1	6.3 Q4 ^{††}
Egypt	+5.9 Q3	na	+3.8	+3.9	+7.3 Q3	+13.5 Feb	+12.1	+8.1	8.8 Q4 ^{††}
Israel	+1.2 Q4	-0.5	+0.4	+2.6	-4.1 Jan	+3.4 Feb	+3.6	+1.8	6.3 Q4
Saudi Arabia	+4.2 2008	na	+0.4	+3.3	na	+6.9 Feb	+7.4	+4.3	na
South Africa	+1.0 Q4	-1.8	-0.8	+3.1	-11.1 Jan	+8.6 Feb	+9.8	+6.0	21.9 Dec ^{††}
MORE COUNTRIES Data for the countries below are not provided in printed editions of <i>The Economist</i>									
Estonia	-9.7 Q4	na	-8.0	-1.5	-32.7 Feb	+2.0 Mar	+10.9	+1.0	8.6 Jan
Finland	-2.4 Q4	-5.0	-2.8	+0.5	-19.5 Jan ^{†††}	+1.7 Feb	+3.7	+0.7	7.1 Feb
Iceland	-1.3 Q4	-3.6	-12.4	-0.9	+0.4 2007	+15.2 Mar	+8.7	+12.5	6.6 Jan ^{††}
Ireland	-7.5 Q4	-25.7	-4.8	-1.4	-0.8 Jan	-1.7 Feb	+4.8	-0.7	11.0 Mar
Latvia	-10.3 Q4	na	-12.0	-2.0	-24.2 Feb	+9.6 Feb	+16.7	+3.0	12.3 Jan
Lithuania	-2.2 Q4	-5.5	-8.0	-2.5	na	+8.7 Feb	+10.7	+4.2	9.5 Mar ^{††}
Luxembourg	-0.3 Q3	-5.5	-2.9	-0.2	-24.1 Dec	+1.2 Feb	+3.1	+0.5	5.6 Feb ^{††}
New Zealand	-2.3 Q4	-2.3	-3.2	+0.5	-0.5 Q3	+3.4 Q4	+3.2	+1.6	4.6 Q4
Peru	+3.2 Jan	na	+3.0	+4.0	-2.7 Jan	+4.8 Mar	+5.5	+4.7	9.4 Feb ^{††}
Philippines	+4.5 Q4	+4.1	-0.6	+1.6	-19.9 Jan	+6.4 Mar	+6.4	+1.9	7.7 Q3 ^{††}
Portugal	-1.8 Q4	-6.2	-3.5	-0.4	-19.1 Jan	+0.2 Feb	+2.9	-1.0	7.8 Q4 ^{††}
Slovakia	+2.5 Q4	na	+2.0	+2.8	-27.0 Jan	+3.1 Feb	+4.0	+2.8	9.7 Feb ^{††}
Slovenia	-0.8 Q4	na	+0.4	+1.2	-17.4 Jan	+1.8 Mar	+6.9	+2.0	7.8 Jan ^{††}
Ukraine	+6.9 Q3	na	-6.0	+2.0	-31.6 Feb	+18.1 Mar	+26.2	+16.3	3.2 Feb
Vietnam	+5.5 Q4	na	+0.3	+1.1	+14.5 Feb	+14.8 Feb	+15.7	+4.3	4.6 2007

*% change on previous quarter, annual rate. †The Economist poll or Economist Intelligence Unit estimate/forecast. ‡National definitions. §RPI inflation

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

	Real GDP, % change				Consumer prices % increase		Current account % of GDP	
	Low/high range		average		2009	2010	2009	2010
	2009	2010	2009	2010				
Australia	-1.6/0.1	0.5/3.1	-0.8 (-0.3)	1.6	2.1	2.3 (2.2)	-5.2 (-5.3)	-5.7 (-5.3)
Belgium	-3.2/-1.5	-1.0/1.2	-2.7 (-1.8)	0.3 (0.9)	0.7 (1.1)	1.5 (1.8)	-1.4 (0.7)	-1.6 (0.7)
Britain	-4.5/-2.3	-1.1/1.7	-3.5 (-3.1)	0.3 (0.5)	1.2 (1.0)	1.7	-1.7 (-2.0)	-1.2 (-1.4)
Canada	-3.0/0.1	nil/2.6	-1.9 (-1.5)	1.6 (1.7)	0.6 (0.5)	1.5 (1.9)	-2.0 (-1.1)	-1.2 (-0.3)
France	-3.4/-1.4	-0.6/1.1	-2.7 (-1.9)	0.3 (0.7)	0.3 (0.4)	1.2 (1.4)	-2.2	-2.5
Germany	-5.4/-2.7	-0.7/1.1	-4.3 (-3.2)	0.3 (0.8)	0.3 (0.4)	0.9 (1.1)	4.5 (5.3)	4.3 (4.9)
Italy	-4.8/-1.9	-0.9/0.8	-3.7 (-2.7)	0.1 (0.5)	0.8 (1.0)	1.4 (1.7)	-2.6 (-2.0)	-2.5 (-2.0)
Japan	-8.7/-4.5	-1.9/1.6	-6.5 (-5.3)	0.4 (0.5)	-1.0 (-0.8)	-0.3 (-0.2)	1.5 (2.0)	1.6 (2.0)
Netherlands	-4.1/-1.5	-0.9/1.3	-2.7 (-1.9)	0.5 (0.8)	0.9 (0.7)	1.0 (1.3)	5.9 (6.2)	5.3 (4.4)
Spain	-3.6/-1.8	-1.9/0.7	-3.1 (-2.5)	-0.5 (0.0)	0.3 (0.6)	1.4 (2.0)	-7.5 (-7.8)	-6.7 (-7.2)
Sweden	-4.9/-1.8	-0.3/1.6	-3.6 (-2.2)	0.7 (0.9)	-0.1	1.0 (1.2)	7.3 (6.7)	7.3 (6.4)
Switzerland	-3.5/-0.9	-1.5/1.0	-2.3 (-1.6)	0.1 (0.7)	-0.2 (-0.1)	0.6 (0.7)	7.5 (8.7)	7.5 (9.2)
United States	-3.9/-1.6	-0.2/2.5	-2.7 (-2.2)	1.4 (1.9)	-0.8 (-0.6)	1.2 (1.5)	-3.3	-3.4
Euro area	-4.3/-2.0	-0.7/0.8	-3.4 (-2.4)	0.2 (0.7)	0.4 (0.6)	1.1 (1.3)	-1.0 (-0.8)	-0.9 (-0.7)

Sources: BNP Paribas, Citigroup, Decision Economics, Deutsche Bank, Economist Intelligence Unit, Goldman Sachs, HSBC Securities, KBC Bank, JPMorgan Chase, Morgan Stanley, RBS, Scotiabank, UBS

Economist, April 10, 2009.

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

3.1 If the money supply increases by 3% today, and stays 3% 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 $t+i$ falls 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 2% per annum. Suppose the growth rate *decreases* by 3%. 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 increases the money supply by 3 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.