Assignment 4 **Economics 222, Fall 2006**
Due: Drop Box 2^{nd} floor Dunning Hall by noon Nov. 24th, 2006
Maximum Group Size: 4 people

A Long and Involved IS-LM-FE Numerical Example

Our first task is to solve for the 'general equilibrium' values in Kazakhstan's economy. There are 3 markets to consider: labour; goods; and assets. Later we will see how shocks affect the economy. Read through the entire question to plan your attack before you attempt it.

Labour Market (FE line):

Production uses only labour. The production function is:

$$Y = A(100N - N^2).$$

Aggregate labour supply, where w is the real wage, is:

$$N^s = \frac{w}{10.82}.$$

Full-employment output, the FE line: $\overline{Y} = 720$. Productivity: $A = 1$. From the labour market, we will want to solve for the real wage, w^*, and number of workers, N^*.

Goods Market (IS curve):

$$C^d = 100 + 0.9(Y - T) - 2000r$$

$$I^d = 50 - 4000r$$

$$G = 150$$

$$T = 120$$

From the goods market, we will derive the IS curve to find consumption, C, and investment, I. Government spending, G, and taxes, T, are taken as given.

Asset Market (LM curve):

$$\frac{M^s}{P} = 0.8Y - 500(r + \pi^e).$$

Suppose $\pi^e = 0.01$ and that this does not change. The central bank of Kazakhstan issues $M^S = 561$. From the asset market, we will derive the LM curve to find the price level, P.

Question 1: Derive and then use the IS-LM-FE curves to find the long-run values of Y, r, P, C, I, N, and w. (20 marks)

Question 2: Draw the IS-LM-FE figures to explain how a (permanent unanticipated) negative productivity shock, ($\downarrow A$) impacts all of these variables in the system. You may assume, as in the math to follow, that labour supply doesn't respond. (15 marks)

Question 3: Now numerically find the effects of a fall in productivity to $A = 0.9$ on all of these variables to confirm your predictions. Then compare to question 1. (15 marks)

Question 4: Now let's start out with our benchmark model from Question 1. Starting from this equilibrium, show with IS-LM-FE figures what happens in the short-run and the long-run when the central bank increases the money supply. (15 marks)

Question 5: Now confirm your findings numerically *for short-run and the long-run*, if Borat, the governor of the central bank of Kazakhstan, increases the money supply to $M^s = 580$. Solve for the variables relating to the goods and asset markets (Y, r, P, C, I), ignore the labour market. (15 marks)

Question 6: **McParity:** Read the Economist article "McCurrencies" (attached below). (20 marks)

a) The Big Mac Index uses the concept of purchasing power parity (PPP). Define and explain PPP. (6 marks)

b) Explain 3 limitations of the Big Mac Index (as highlighted in the article). (6 marks)

c) Average prices tend to be lower in poorer countries. Why? (4 marks)

d) If you could costlessly move yourself and your Big Macs to and from any two countries in the world to *arbitrage*, where would you buy and where would you sell? (4 marks)

Economist.com FINANCE & ECONOMICS
ECONOMICS FOCUS
PRINTABLE PAGE VIEW SPONSORED BY

Economics focus

McCurrencies

May 25th 2006
From The Economist print edition

Happy 20th birthday to our Big Mac index

The hamburger standard

	Big Mac prices		Implied PPP* of the dollar	Actual dollar exchange rate May 22nd	Under (–)/ over (+) valuation against the dollar, %
	in local currency	in dollars			
United States†	$3.10	3.10	–	–	–
Argentina	Peso 7.00	2.29	2.26	3.06	-26
Australia	A$3.25	2.44	1.05	1.33	-21
Brazil	Real 6.40	2.78	2.06	2.30	-10
Britain	£1.94	3.65	1.60‡	1.88‡	+18
Canada	C$3.52	3.14	1.14	1.12	+1
Chile	Peso 1,560	2.94	503	530	-5
China	Yuan 10.5	1.31	3.39	8.03	-58
Czech Republic	Koruna 59.05	2.67	19.0	22.1	-14
Denmark	DKr27.75	4.77	8.95	5.82	+54
Egypt	Pound 9.50	1.65	3.06	5.77	-47
Euro area§	€2.94	3.77	1.05**	1.28**	+22
Hong Kong	HK$12	1.55	3.87	7.75	-50
Hungary	Forint 560	2.71	181	206	-12
Indonesia	Rupiah 14,600	1.57	4,710	9,325	-49
Japan	¥250	2.23	80.6	112	-28
Malaysia	Ringgit 5.50	1.52	1.77	3.63	-51
Mexico	Peso 29.00	2.57	9.35	11.3	-17
New Zealand	NZ$4.45	2.75	1.44	1.62	-11
Peru	New Sol 9.50	2.91	3.06	3.26	-6
Philippines	Peso 85.00	1.62	27.4	52.6	-48
Poland	Zloty 6.50	2.10	2.10	3.10	-32
Russia	Rouble 48.00	1.77	15.5	27.1	-43
Singapore	S$3.60	2.27	1.16	1.59	-27
South Africa	Rand 13.95	2.11	4.50	6.60	-32
South Korea	Won 2,500	2.62	806	952	-15
Sweden	SKr33.00	4.53	10.6	7.28	+46
Switzerland	SFr6.30	5.21	2.03	1.21	+68
Taiwan	NT$75.00	2.33	24.2	32.1	-25
Thailand	Baht 60.00	1.56	19.4	38.4	-50
Turkey	Lire 4.20	2.72	1.35	1.54	-12
Venezuela	Bolivar 5,701	2.17	1,839	2,630	-30
Aruba	Florin 4.95	2.77	1.60	1.79	-11
Bulgaria	Lev 2.99	1.94	0.96	1.54	-37
Colombia	Peso 6,500	2.60	2,097	2,504	-16
Costa Rica	Colon 1,130	2.22	365	510	-28
Croatia	Kuna 15.0	2.62	4.84	5.72	-15

Dominican Rep	Peso 60.0	1.84	19.4	32.6	-41
Estonia	Kroon 29.5	2.40	9.52	12.3	-23
Fiji	Fiji $4.65	2.69	1.50	1.73	-13
Georgia	Lari 4.15	2.31	1.34	1.80	-26
Guatemala	Quetzal 17.25	2.27	5.56	7.59	-27
Honduras	Lempira 35.95	1.90	11.6	18.9	-39
Iceland	Kronur 459	6.37	148	72.0	+106
Latvia	Lats 1.35	2.47	0.44	0.55	-20
Lithuania	Litas 6.50	2.41	2.10	2.69	-22
Macau	Pataca 11.1	1.39	3.59	7.99	-55
Moldova	Leu 23.0	1.75	7.42	13.2	-44
Morocco	Dirham 24.5	2.82	7.92	8.71	-9
Norway	Kroner 43.0	7.05	13.9	6.10	+127
Pakistan	Rupee 130	2.16	41.9	60.1	-30
Paraguay	Guarani 9,000	1.63	2,903	5,505	-47
Saudi Arabia	Riyal 9.00	2.40	2.90	3.75	-23
Slovakia	Koruna 58.0	1.97	18.7	29.5	-37
Slovenia	Tolar 520	2.76	168	189	-11
Sri Lanka	Rupee 190	1.85	61.3	103	-40
Ukraine	Hryvna 8.50	1.68	2.74	5.05	-46
UAE	Dirham 9.00	2.45	2.90	3.67	-21
Uruguay	Peso 42.3	1.77	13.6	23.9	-43

*Purchasing-power parity: local price divided by price in United States

Sources: McDonald's; *The Economist* †Average of New York, Chicago, Atlanta and San Francisco ‡Dollars per pound §Weighted average of prices in euro area **Dollars per euro

WHEN our economics editor invented the Big Mac index in 1986 as a light-hearted introduction to exchange-rate theory, little did she think that 20 years later she would still be munching her way, a little less sylph-like, around the world. As burgernomics enters its third decade, the Big Mac index is widely used and abused around the globe. It is time to take stock of what burgers do and do not tell you about exchange rates.

The Economist's Big Mac index is based on one of the oldest concepts in international economics: the theory of purchasing-power parity (PPP), which argues that in the long run, exchange rates should move towards levels that would equalise the prices of an identical basket of goods and services in any two countries. Our "basket" is a McDonald's Big Mac, produced in around 120 countries. The Big Mac PPP is the exchange rate that would leave burgers costing the same in America as elsewhere. Thus a Big Mac in China costs 10.5 yuan, against an average price in four American cities of $3.10 (see the first column of the table). To make the two prices equal would require an exchange rate of 3.39 yuan to the dollar, compared with a market rate of 8.03. In other words, the yuan is 58% "undervalued" against the dollar. To put it another way, converted into dollars at market rates the Chinese burger is the cheapest in the table.

In contrast, using the same method, the euro and sterling are overvalued against the dollar, by 22% and 18% respectively; the Swiss and Swedish currencies are even more overvalued. On the other hand, despite its recent climb, the yen appears to be 28% undervalued, with a PPP of only ¥81 to the dollar. Note that all emerging-market currencies also look too cheap.

The index was never intended to be a precise predictor of currency movements, simply a take-away guide to whether currencies are at their "correct" long-run level. Curiously, however, burgernomics has an impressive record in predicting exchange rates: currencies that show up as overvalued often tend to weaken in later years. But you must always remember the Big Mac's limitations. Burgers cannot sensibly be traded across borders and prices are distorted by differences in taxes and the cost of non-tradable inputs, such as rents.

Despite our frequent health warnings, some American politicians are fond of citing the Big Mac index rather too freely when it suits their cause—most notably in their demands for a big appreciation of the Chinese currency in order to reduce America's huge trade deficit. But the cheapness of a Big Mac in

China does not really prove that the yuan is being held far below its fair-market value. Purchasing-power parity is a long-run concept. It signals where exchange rates are eventually heading, but it says little about today's market-equilibrium exchange rate that would make the prices of tradable goods equal. A burger is a product of both traded and non-traded inputs.

An idea to relish

It is quite natural for average prices to be lower in poorer countries than in developed ones. Although the prices of tradable things should be similar, non-tradable services will be cheaper because of lower wages. PPPs are therefore a more reliable way to convert GDP per head into dollars than market exchange rates, because cheaper prices mean that money goes further. This is also why every poor country has an implied PPP exchange rate that is higher than today's market rate, making them all appear undervalued. Both theory and practice show that as countries get richer and their productivity rises, their real exchange rates appreciate. But this does not mean that a currency needs to rise massively today. Jonathan Anderson, chief economist at UBS in Hong Kong, reckons that the yuan is now only 10-15% below its fair-market value.

Even over the long run, adjustment towards PPP need not come from a shift in exchange rates; relative prices can change instead. For example, since 1995, when the yen was overvalued by 100% according to the Big Mac index, the local price of Japanese burgers has dropped by one-third. In the same period, American burgers have become one-third dearer. Similarly, the yuan's future real appreciation could come through faster inflation in China than in the United States.

The Big Mac index is most useful for assessing the exchange rates of countries with similar incomes per head. Thus, among emerging markets, the yuan does indeed look undervalued, while the currencies of Brazil, Turkey, Hungary and the Czech Republic look overvalued. Economists would be unwise to exclude Big Macs from their diet, but Super Size servings would equally be a mistake.