Problem Set 1 · Main macroeconomic variables

1. For every period t, calculate: (i) nominal GDP; (ii) real GDP at constant prices of period $t = 2$; (iii) the corresponding GDP deflator; (iv) the rates of growth of both nominal GDP and real GDP; and (v) the inflation rate associated with the GDP deflator.

t	p_1	q_1	p_2	q_2	p_3	q_3
1	5	1	6	4	0	0
2	6	2	3	3	1	2
3	5	3	5	2	2	4
4	3	4	9	1	3	6

2. Suppose that, between period t and period $t + 1$, the production of all goods remains constant. Is it possible for real GDP to increase from t to $t + 1$?

3. <u>Rule of 70</u>. If a variable grows at g percent per year, it doubles approximately every $70/g$ years. Compute how many years are roughly necessary for a variable growing at the following rates to double.

rate (%)	years	rate (%)	years	rate (%)	years
0.1		3		7	
0.5		4		10	
1		5		50	
2		6		100	

4. The GDP of an economy is 1000. The GDP of a second economy is 20. (i) If the first economy grows every year a 2% and the second one a 12%, how many years are roughly necessary for the GDP of the second economy to catch up the GDP of the first one? (ii) If the first economy grows at 5% per year, what is the smallest growth rate that allows the second economy to catch up the first one in 10 years?

5. Consider two periods of an economy with two goods. Find the prices and the quantities of the goods so that from period 1 to period 2 nominal GDP falls and, simultaneously, real GDP raises.

6. What can be inferred from having a nominal GDP larger than the real GDP?

7. (i) Explain the differences between the GDP deflator and the CPI. (ii) What is the difference between real GNP and CPI?

8. Imagine an economy where only two goods are produced, good 1 and good 2. The basket of goods of the representative consumer consists of 1 unit of good 2 and 2 units of good 3, which is an imported good. Given the table below, find: (i) for each period, the GDP deflator with base level 100; (ii) for each period, and also with base level 100, the CPI; (iii) the inflation rates associated with the GDP deflator; and (iv) the inflation rates associated with the CPI.

period	p_1	q_1	p_2	q_2	p_3	q_3
1	5	100	1	400	6	100
2	4	100	2	300	7	200
3	3	100	3	200	6	150
4	2	100	2	100	8	300
5	1	100	1	300	7	250

9. What happens to the GDP deflator if nominal GDP and real GDP are both increased twofold?

10. Is a negative CPI possible? If so, what would a negative CPI mean?

11. Is it possible that, at the same time, the GDP deflator raises and the CPI falls? If so, why?

12. Is it possible that, at the same time, the participation rate raises and the unemployment rate falls? If so, why?

13. Explain the differences between frictional unemployment and structural unemployment. Suggest examples of both.

14. Consider Figure 1. (i) Is it accidental that the curves cross in 1986? (ii) What information furnishes the fact that nominal GDP is above real GDP after 1986? (iii) And the fact that nominal GDP is below real GDP before 1986? (iv) What could be inferred if the labels of the curves were mutually exchanged?
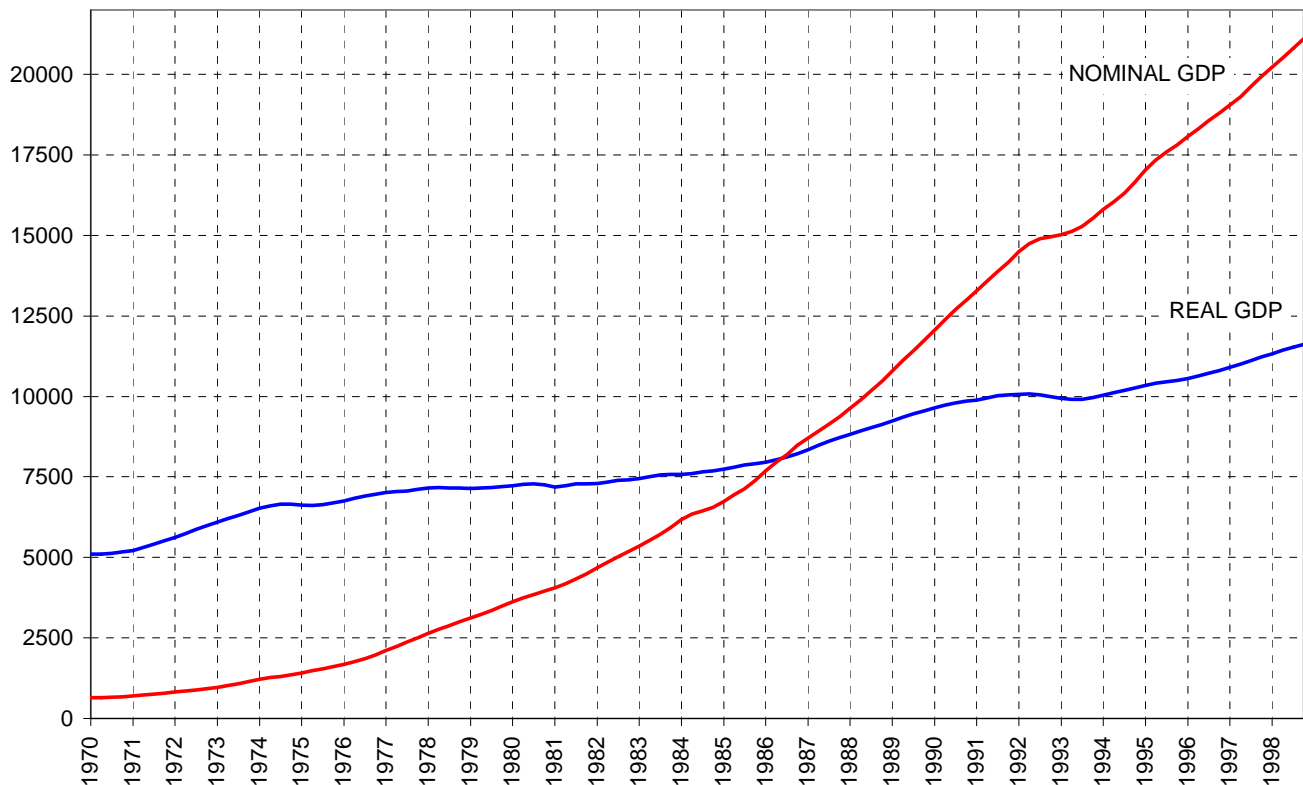

Figure 1. Real GDP and nominal GDP, Spain, quarterly data, 1970-1998
Base 1986, billions of pesetas · http://www.ine.es/daco/daco42/daco4214/cntrb86.xls

15. Suppose that both unemployment and the total population of working age remain constant. If the female unemployment rate falls, what happens to the male unemployment rate and to the number of unemployed men?

16. (i) Can it be that the nominal GDP of an economy grows faster than the nominal GDP of a second economy and, simultaneously, that the real GDP per capita of the second economy grows faster than the real GDP of the first economy? (ii) What if "nominal" were replaced by "real"?

17. For any given variable v, let g_v designate the rate of change of v. (i) Compute the relative error that arises when, in the first table, the correct rate of change of the variable $z = xy$ is approximated by the rule $g_z \approx g_x + g_y$. (ii) Do the same in the second table when the correct rate of change of the variable $z = x/y$ is approximated by the rule $g_z \approx g_x - g_y$.

case	g_x	g_y	value of g_z using the rule	correct value of g_z	relative error (%)
1	1%	1%			
2	1%	10%			
3	1%	100%			
4	10%	-20%			
5	10%	20%			
6	0%	100%			

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2	1%	10%			
3	1%	100%			
4	10%	-20%			
5	10%	20%			
6	0%	100%			

18. Complete as much as possible of the following table.

case	growth rate of the nominal GDP	inflation rate associated with the GDP deflator	population growth rate	growth rate of the real GDP per capita
1	positive	positive	positive	
2		negative	positive	zero
3	negative		negative	positive
4			zero	zero
5	zero	negatie	positive	
6		zero	negative	negative
7	zero	positive	zero	
8		positive		positive

19. (i) If nominal GDP and real GDP both fall at the same rate, what is the value of the GDP deflator? (ii) And the inflation rate that corresponds to the GDP deflator? (iii) And the inflation rate associated with the CPI?

20. [Difficult] For any given variable v, let g_v designate the rate of change of v. (i) Prove that if $z = xy$, then $(1 + g_z) = (1 + g_x)(1 + g_y)$. (ii) Show that, for small values of the rates of change, $g_z \approx g_x + g_y$. (iii) Using the previous results, demonstrate that $z = x/y$ implies $(1 + g_z) = (1 + g_x)/(1 + g_y)$ and that, for sufficiently small values, $g_z \approx g_x - g_y$.

21. Using Figure 2, make a rough estimate of the number of years that, in 2008, Latin America, Asia, Africa, and China lagged behind Spain in terms of real GDP per capita.

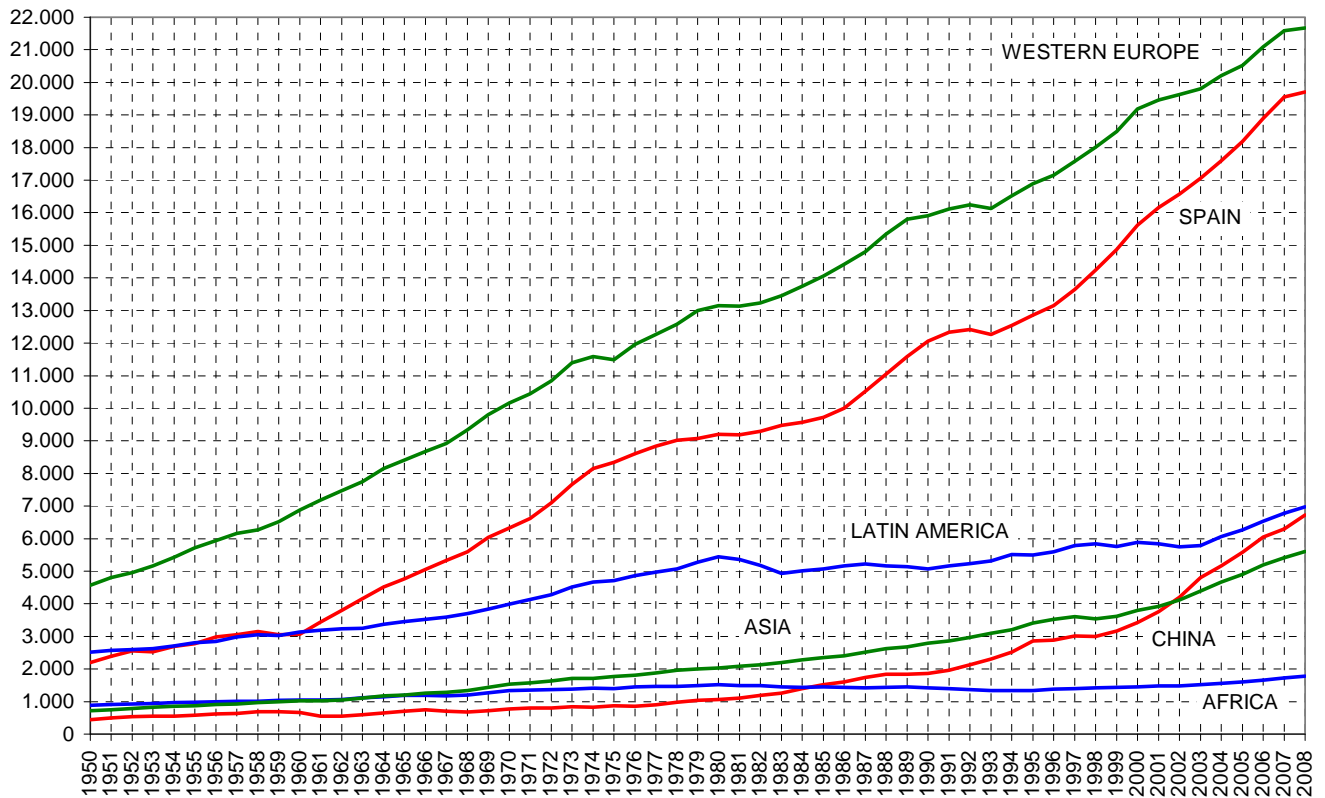**22.** Indicate in Figure 3 periods of inflation, deflation, disinflation, and hyperinflation.

Figure 2. Real GDP per capita, 1950-2008
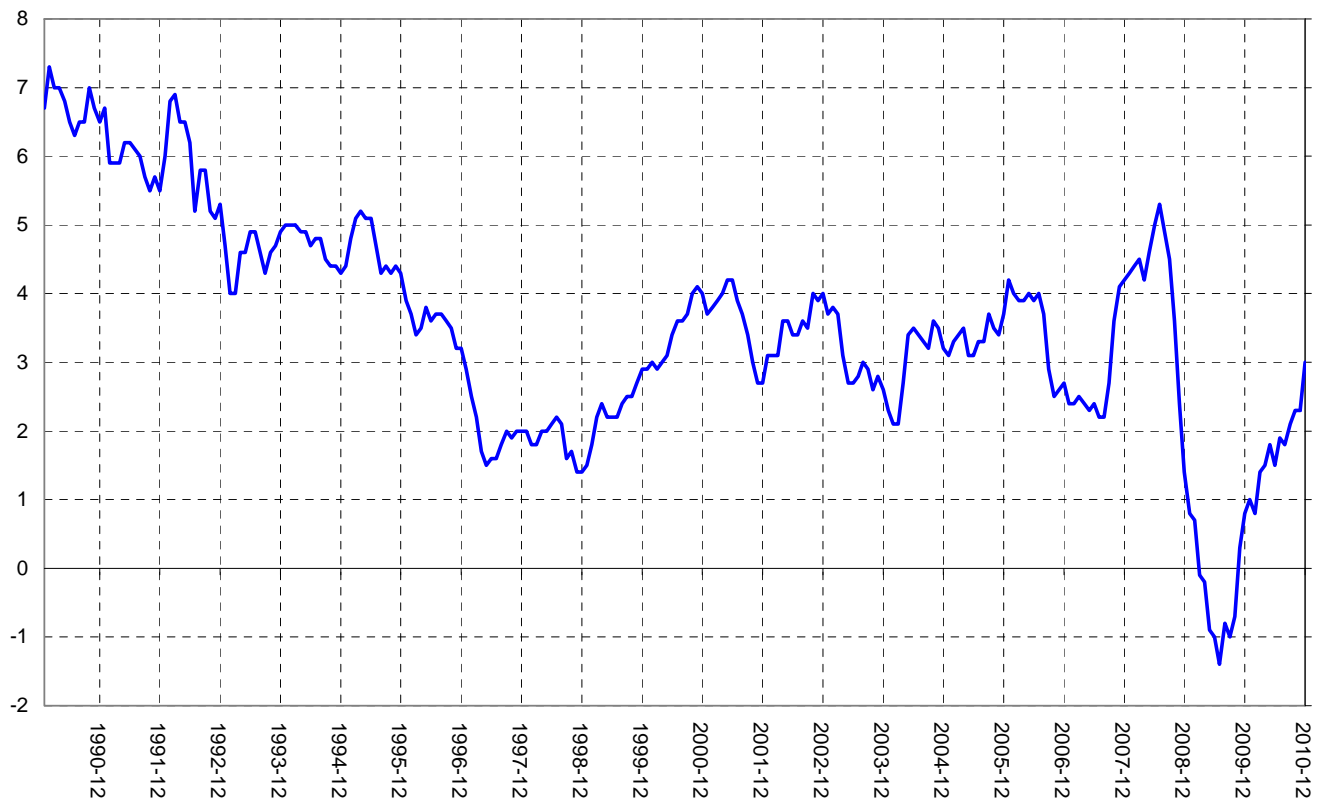http://www.ggdc.net/maddison/Historical_Statistics/horizontal-file_02-2010.xls

Figure 3. Annual inflation rate, Spain, monthly basis, 1990-2010
http://www.ine.es/jaxiBD/tabla.do?per=01&type=db&divi=IPC&idtab=105