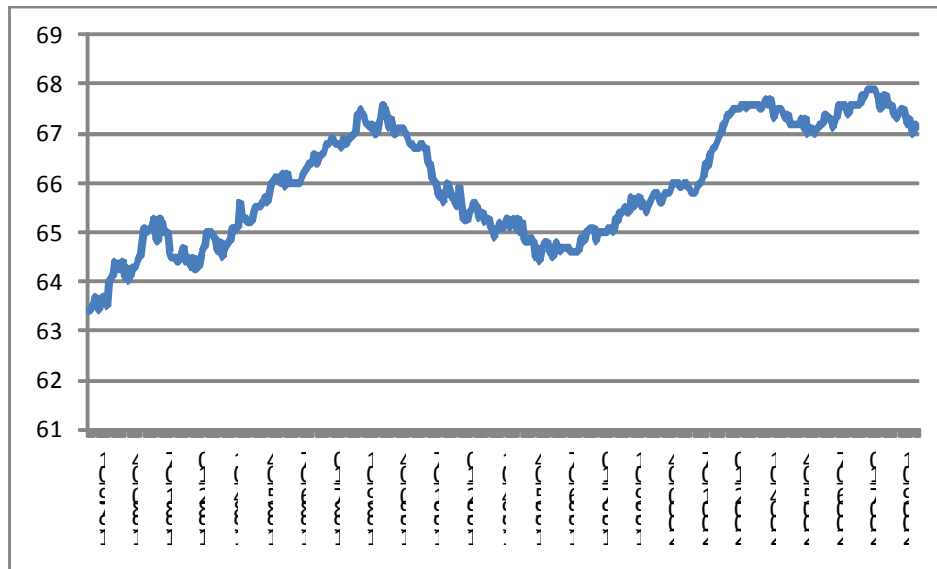


ECON 222
Macroeconomic Theory I
Winter Term 2009/10

Assignment 1 - ANSWER KEY

Question 1: Some Canadian Macroeconomic Data (30 Marks)

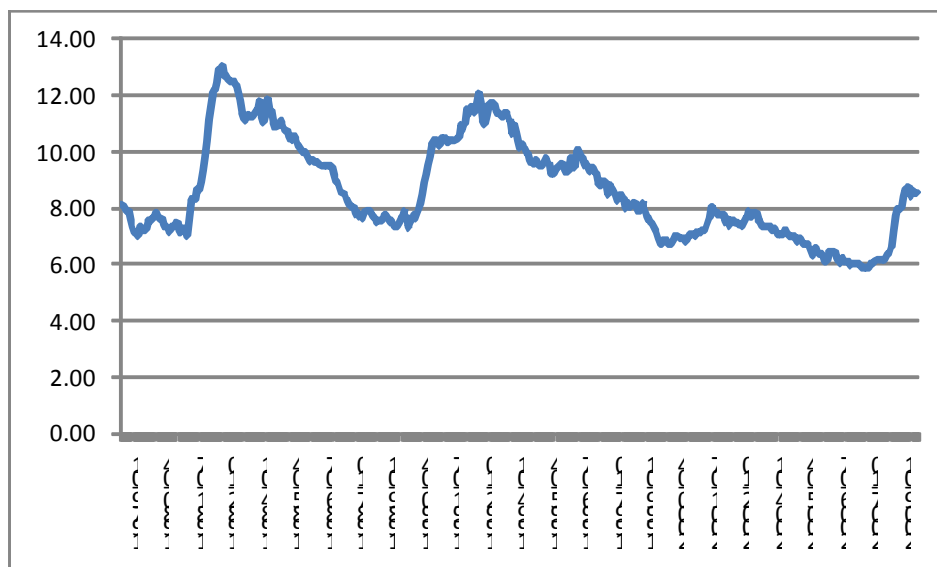
- a) The time series is plotted in figure (1). There are some interesting patterns:
- 1) The participation rate has been increasing by four percentage points over the last 30 years;
 - 2) The participation rate has been fluctuating when considering both short time periods (comparing different months) and long ones (comparing different decades).
 - 3) We can divide the sample in four different phases: in the early 80's there was a long term increase, which was followed by a sharp and long lasting decrease, which started in the early 90's. From '96 the participation rate has bounced back, with a sharp increase in 2002 and a more stable behaviour since then.
 - 4) Immigration waves and a higher likelihood for women to participate in the labor market can help explaining these patterns.



Canadian Participation Rate (1979-2009)

- b) The Canadian unemployment rate is plotted in figure (2). In the early 80's the unemployment rate had a sharp increase followed by a rather fast decrease. It plateaued at the 8.00% level for two years and it increased abruptly and quite steadily for five years. From 1993 to 2008 the unemployment rate decreased by six percentage points. The series is quite volatile, that is there are several sudden changes from one month to the next.

The current crisis still does not show an unemployment rate which is substantially different from the recent Canadian economic experience.



c) The average unemployment rates for the years 1979, 1989, 1999, 2009 are reported in table 1.

d) See table 2 below. The population growth rate seem to have slowed down over time, unlike GDP. We need to realize that one variable is a stock (population), while the other one is a flow (GDP). Hence, for the first one we need to take the average, while for the GDP we need to add up the income for the four quarters in order to get the GDP in one year.

e) See table 3 below. GDP per capita in year 2008 is just the ratio $\frac{GDP_{2008}}{Pop_{2008}}$.

Question 2: Employment, Output, Productivity and Inflation (20 Marks)

a. Nominal GDP is just the dollar value of production in a year at prices in the same year. Nominal GDP was \$200,000 in the base year and \$171,300 in 2009. It decreased by 14.35%.

b. Real GDP is calculated by finding the value of production in each year at base-year prices. Real GDP is \$200,000 in 2008 (being the base year) and \$201,500 in 2009. It increased by 0.75%.

c. The GDP deflator is the ratio of nominal GDP to real GDP. In the base year, nominal GDP equals real GDP, so the GDP deflator is 1. In 2009 it is 0.85, so the price level fell by 14.99%.

d. The growth rate of average labour productivity was equal to 0.75%. The increase in productivity in the TV's industry more than offsets the decrease in productivity in the Computers one. In 2008 the average labour productivity was $\frac{200,000}{1000+500} = 133.\bar{3}$, and in 2009 $\frac{201,500}{1100+400} = 134.\bar{3}$.

Question 3: National Accounting (20 Marks)

(a) $S = Y + NFP - C - G = 2000 + 100 - 1400 - 200 = 500$

(b) $S_p = PDI - C = 200$; and $INT = PDI - Y - NFP + T - TR = 10$

(c) $NGI = T - TR - INT = 500$

(d) $GNP = GDP + NFP = 2100$

$$(e) \quad NX = Y - C - I - G = 240$$

(f) $INT = 10$

(c) $CA = NX + NFP = 340$

Question 4: The Aggregate Production Function (30 Marks)

The expressions we are looking for are as follows:

Part 1)

$$\begin{aligned} MPK &= \alpha K^{\alpha-1} (AN)^{\beta} \\ MPN &= \beta AK^{\alpha} (AN)^{\beta-1} + \beta A (AN)^{\beta-1} L^{\gamma} = \beta A (AN)^{\beta-1} (K^{\alpha} + L^{\gamma}) \\ MPL &= \gamma (AN)^{\beta} L^{\gamma-1} \end{aligned}$$

Part 2)

a) As we can see from figure (3), the marginal productivity of labor is decreasing, but the rate at which it decreases diminishes with N . That is, the MPN is a convex function.

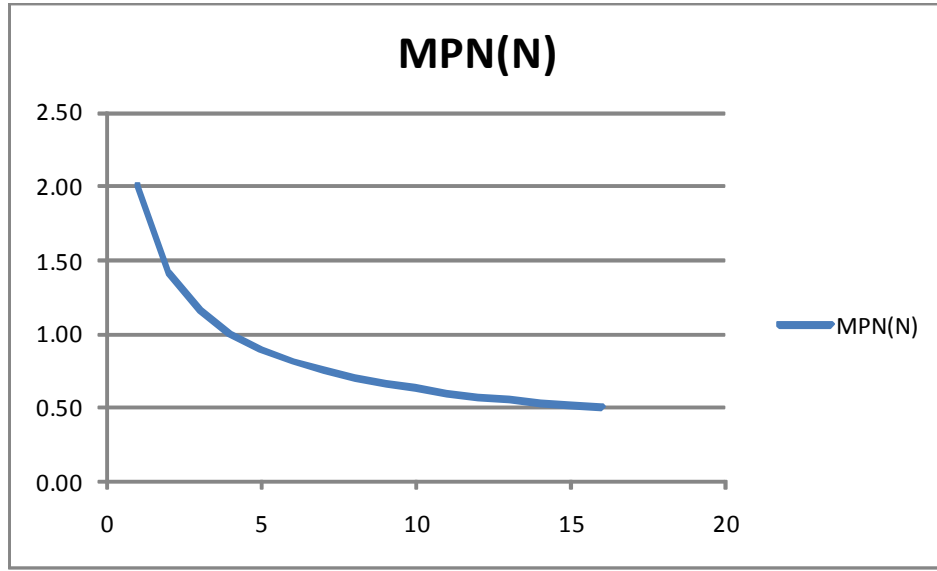


Figure - Marginal Product of Labor

b) When the real wage paid to labour is $w = 1$ the level of employment in the economy is $N = 4$. To get this result we need to impose that the labor market is in equilibrium, that is that the price of labor is equal to its marginal product:

$$\begin{aligned} w &= MPN(N) \rightarrow 1 = \beta A (AN)^{\beta-1} (K^{\alpha} + L^{\gamma}) = \frac{1}{2} (\sqrt{9} + 1) N^{-\frac{1}{2}} \\ 1 &= 2N^{-\frac{1}{2}} \rightarrow N^{\frac{1}{2}} = 2 \rightarrow N = 4 \end{aligned}$$

An increase in the efficiency of labour leads to an increase in the demand for workers, since they have become more productive. If $A = 4$ we get that the level of employment in the economy is $N = 16$

$$\begin{aligned} w &= MPN(N) \rightarrow 1 = \beta A (AN)^{\beta-1} (K^{\alpha} + L^{\gamma}) = \frac{1}{2} 2 (\sqrt{9} + 1) N^{-\frac{1}{2}} = 4N^{-\frac{1}{2}} \\ 1 &= 4N^{-\frac{1}{2}} \rightarrow N^{\frac{1}{2}} = 4 \rightarrow N = 16 \end{aligned}$$

c) We need to study the behaviour of the derivative of the MPN :

$$\frac{\partial MP_N(N)}{\partial N} = \beta(\beta - 1) A^2 (AN)^{\beta-2} (K^\alpha + L^\gamma) = \beta(\beta - 1) \frac{A^2 (K^\alpha + L^\gamma)}{(AN)^{2-\beta}}$$

This quantity is negative, since $\beta > 0$, $(\beta - 1) < 0$, and $\frac{A^2(K^\alpha + L^\gamma)}{(AN)^{2-\beta}} > 0$. Again, we get a decreasing marginal product of labor.

d) Table 2 report the requested values. Production is increasing monotonically in the quantity of inputs. Notice that the labor input is essential to production. Namely, if labor is not used ($N = 0$) we don't get any output, irrespective of the quantity of capital. The capital input, however, is not essential: as long as some labor is used, we get some positive output.

<i>Year</i>	<i>Unemployment Rate (%)</i>
1879	7.50
1989	7.53
1999	7.57
2009	8.28

Table 1: Question 1, Part1

<i>Year</i>	<i>Population</i>	<i>Pop. Growth rate</i>	<i>GDP Growth rate</i>
1988	26,751,474	—	—
1998	30,123,875	12.61%	24.09%
2008	33,275,717	10.46%	31.71%

Table 2: Question 1, Part2

<i>Year</i>	<i>GDP Per Capita Growth rate</i>	<i>GDP Per Capita</i>
1988	—	\$29,917
1998	10.20%	\$32,968
2008	19.24%	\$39,310

Table 3: Question 1, Part2

	<i>K=0</i>	<i>K=1</i>	<i>K=2</i>	<i>K=4</i>	<i>K=16</i>
<i>N=0</i>	0	0	0	0	0
<i>N=1</i>	1.62	3.25	4.17	5.62	11.47
<i>N=2</i>	2.07	4.14	5.32	7.17	14.62
<i>N=4</i>	2.64	5.28	6.78	9.14	18.64
<i>N=16</i>	4.29	8.57	11.01	14.84	30.28

Table 4: Question 4, Part2