ECON 333: PROBLEM SET # 2

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1. A country's real GNP and population are given below for the period 1779-1789.

Year	GNP	Population
1779	286.5	151.7
1780	330.8	154.3
1781	348.0	156.9
1782	366.8	159.6
1783	366.8	162.4
1784	400.0	165.3
1785	421.7	168.2
1786	444.0	171.3
1787	449.7	174.1
1788	448.0	177.1
1789	487.9	180.8

   Calculate the annual average growth rates of GNP, population, and per capita income during 1779-1784 and 1785-1789 and also for the period 1779-1789.

2. An empirical investigation of a certain country reveals that during the period 1950-1989 its stock of capital and the labor force are exponentially growing at the annual rates 7% and 3% respectively. National income statistics of the country show that the average income shares of capital and labor during the period are .3 and .7 respectively. Assume that capital and labor are the only factors of production, the total productivity is growing at the rate 2% per year, and GNP at time t is given by the production function $Y(t) = A(t)F(K(t), L(t)$, and F exhibits constant returns to scale.

   (a) Write down the formula for growth in output in terms of the growth in capital and labor (Just write the formula,, you do not have to derive it).

   (b) At what rate the GNP is growing during the period.

   (c) What is the exponential growth rate in per capita income (assume that each person supplies one unit of labor)?

   (d) The new supply side economic policy regime encourages higher savings rate. It is expected that as a response to the new policy the capital will grow at the rate of 10% per annum. What will be the new growth rates for GNP and per capita income of the economy?

   (e) Suggest at least three government policies that may encourage one to save more. Explain why you think so.

   (f) What are the components of "effective" labour hours? Suggest government policies that can increase effective labor hours of the economy through each of these components.

   (g) What are the components of total capital investment in an economy? Suggest policies that can increase each of these components and hence the growth in capital of the economy.

   (h) What are the various ways the economy can have higher total factor productivity (TFP) growth? Suggest government policies that will be most effective in improving the total factor productivity of an economy.

3. Examine the table to answer the following questions:

Sources of growth	Japan:1953-1971	Korea:1963-1982	U.S:1948-1973
Output growth	8.81	8.13	3.79
Contribution of			
gr. in labor	1.85	3.31	1.42
gr. in capital	2.10	1.58	0.71
gr. in TFP	4.86	3.24	1.66

Source: Kim and Park [1985].

Table 1: Growth accounting for Korea, Japan and the U.S.

(a) In the light of growth experiences a developing country (Korea) and two developed countries (US and Japan), what could be attributed to the main source of high growth in the developing country. What kind of structural differences between the less developing countries (such as in Korea) and developed countries (such as US and Japan) we can attribute to that will be consistent with the observed sources of growth? (Think about one of the indicators we talked about while discussing the structural differences between developed and developing countries).

(b) What are the main sources for Japan's higher growth than the that of the US. In the light of another fast growing developed country's experience, what policies would you recommend for the US to improve its growth rate?

Answer Key Problem set#2

Problem 1:

OBS	YEAR	GNP	Y	POP	$g˙P$	PCY	$g˙PCY$
1	1779	286.5	.	151.7	.	1.88860	.
2	1780	330.8	0.15462	154.3	0.017139	2.14388	0.13517
3	1781	348.0	0.05200	156.9	0.016850	2.21797	0.03456
4	1782	366.8	0.05402	159.6	0.017208	2.29825	0.03619
5	1783	366.8	0.00000	162.4	0.017544	2.25862	-0.01724
6	1784	400.0	0.09051	165.3	0.017857	2.41984	0.07138
7	1785	421.7	0.05425	168.2	0.017544	2.50713	0.03607
8	1786	444.0	0.05288	171.3	0.018430	2.59194	0.03383
9	1787	449.7	0.01284	174.1	0.016346	2.58300	-0.00345
10	1788	448.0	-0.00378	177.1	0.017231	2.52964	-0.02066
11	1789	487.9	0.08906	180.8	0.020892	2.69856	0.06678

For period 1779-1784 average linear growth rates are:

Variable	Mean
g˙Y	0.0702311
g˙P	0.0173198
g˙PCY	0.0520125

For period 1785-1789 average linear growth rates are:

Variable	Mean
g˙Y	0.0378
g˙P	0.0182
g˙PCY	0.0191

For period 1779-1789 average linear growth rates are:

Variable	Mean
g˙Y	0.0556407
g˙P	0.0177042
g˙PCY	0.0372631

Note: the above growth rates are not in percentage. You multiply each grwoth rate with 100 to get percentage.

Probelm #**??**: Interest rate $r = .15$. At the end of period t, we will have $100e^{.15t}$.

(a) at the end of 5 years, we will have $\$100e^{.15\times 5} = 211.70$ similarly do for other

periods.

(b) At $t = 0$, price of gold is \$50 per ounce, and I have \$100, so at $t = 0$, I can buy 2 ounce of gold. At t, the price of gold will be $50e^{.05t}$, and my money in the bank will be $100e^{.15t}$. So at time t I can buy $\frac{100e^{.15t}}{50e^{.05t}} = 2e^{(.15-.05)t} = 2e^{.10t}$ ounces of gold. So at $t = 5$, I will have 3.30 ounces of gold. Similarly, do for the other periods

(c) I will prefer to keep my money at the bank, since when my money is at the bank, at any time t, I can convert it into gold, and I will have $2e^{.1t}$ ounces of gold, which is larger than the 2 ounce of gold that I will have in period t if I purchased gold in time $t = 0$ and hide it under my carpet.

(d) In this case, I will rather hold gold.

Problem#**??** Suppose the exchange rate is $E(t)$ (local currency /dollar). Suppose I invest my \$100 in this country which promises me interest rate of r in local currency. In the beginning, at $t = 0$, I will have $E(0) \times 100$ units of local currency, and thus at the end of period t I will have $(E(0) \times 100)e^{rt}$. Suppose the inflation in the exchange rate is r_e then the exchange rate at time t is given by $E(t) = E(0)e^{r_e t}$. So when I convert this local currency back to dollar at the end of period t, I will have

$$\frac{(E(0) \times 100)e^{rt}}{E(0)e^{r_e t}} = 100e^{r-r_e t} \text{ dollars}$$

let us call $r - r_e$ to be dollar interest rate. That is my 100 dollars will be growing at the rate of $r - r_e$ (in dollars) in this country. When we calculate this dollar interest rates for various countries, we find the following

Country	$r - r_e$
India	.15
Mexico	.10
Japan	.12
Brazil	-1.80
US	.12

So I will choose India.

Answers to other questions are similar.

Problem #**??**

(a) Doubling up time T corresponding to a grwoth rate r is given by the formula: $T = \frac{\ln 2}{r}$. See the table below for calculations

(b) Let T be the time it takes for a country with gorwth rate r and with initial level of per capita income y_0 to attain the current US standard of living $\bar{y} = \$15,390$, then T is given by $T = \frac{\ln(\bar{y}/y_0)}{r}$. Calculations of T for various countries are in the following table.

(c) Let T be the time in future when a country with grwoth rate r and initial per capital income y_0 will catch-up with the per capita income. Then T must satisfy:

$$y_0 e^{rT} = 115390e^{0.017T} \text{ which implies } T = \frac{\ln(15390/y_0)}{r - 0.017}$$

the calulations of T for various countries are shown in the following table.

Country	T of (a)	T of (b)	T of (c)
India	43.32	255.05	never
Indonesia	14.14	68.36	104.68
Phillipines	26.66	121.12	349.91
Malaysia	16.50	48.82	82.02
Korea	10.50	30.10	40.55
Hong Kong	11.18	14.33	19.74
Japan	14.74	7.87	12.33
US	40.77	-	-