ECON 410: PROBLEM SET # 2

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1. Suppose you want to save $100 in a bank which promises you 15 % interest rate per annum and a continuous compounding.

   (a) How much money will you have at the end of 5th year, 10th year and 20th year. (show your calculations)

   (b) Suppose the price of gold today is $50 per ounce and the price of gold is growing exponentially at the rate of 5% per annum. How much gold can you buy at the end of 5th year, 10th year, and 20th year with the money you have accumulated in your bank.

   (c) You have the choice of saving your $100 in the bank or buying gold with it to hide under your carpet, which one would you prefer? Why?

   (d) Repeat (c) when the price of gold is growing exponentially at the rate of 20% per annum.

2. Suppose you have US$100 and you want to invest in foreign exchange markets (i.e., you want to buy a mix of foreign currencies and keep under your pillow). Exchange rate of India on April 26, 1989 is 14.50 means $1 is equivalent to 14.50 units of Indian currency, i.e., rupee on that date. Exchange rates of various countries are growing exponentially over time at the rates (also known as the inflation rate of the exchange rate) as shown below. Each country promises continuous compounding of its interest the rate that is given below.

Country	interest rate	rate of inflation in exchange rate	exchange rate (to-day)
1. India	25	10	14.20
2. Mexico	40	30	3500
3. Japan	10	-2	4500
4. Brazil	120	300	2300
5. U.S.	12	0	1

   Ultimately you want to bring your money back to the U.S. How much of which currency would you buy? Why?

3. 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 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 govenment policies that will be most effective in improving the total factor productivity of an economy.

4. In 1994, China has per capita income of US$530, total population 1.19 billion, and its average exponential growth rate during 1985-1994 is 7.8 percent per annum. In 1994, India has per capita income of US$320, total population 0.913 billion, and its average exponential growth rate of per capita income during 1985-1994 is 2.9 per annum. The US has per capita income of $25,880, total population 0.260 billion in 1994, and the average exponential growth rate of per capita income during 1985-1994 is 1.3 percent per annum

   (a) When in future China and India will have the 1994 US standard of living as measured by per capita income?

   (b) Which year China will overtake US in terms of per capita income? Which year India will overtake US in terms of per capita income?

(c) Suppose India's population is growing exponentially at the rate of 2.0 percent per year, and China's population is growing exponentially at the rate of 1.2 percent per year. When in future, India will have larger population than China? At what exponential rate the GNP of China and India are growing over time?

5. Examine the relevant tables of my notes (check table 5 of my notes) and answer the following questions:

   (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. Explain the main structural differences for the factor that you identify in these tables, and give a mechanism how it is possible to have high growth of this factor in a less developed country (Korea) but not so possible in developed 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 rates?

Answer Key Problem set#2

Probelm #1: 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#2 Suppose the excnage 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 begining, 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 varous 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.