Answer Key to Problem Set # 2
Econ 333-11,
Spring 2001

Q1. For each variable, calculate the annual growth rate for each year, and then take average over appropriate years. I show calculations only for GNP.

Year	Y=GNP	g_Y
1779	286.5	
1780	330.8	0.154625
1781	348	0.051995
1782	366.8	0.054023
1783	366.8	0
1784	400	0.090513
1785	421.7	0.05425
1786	444	0.052881
1787	449.7	0.012838
1788	448	-0.00378
1789	487.9	0.089063
av. 1779-84		0.070231
av. 1785-89		0.03775

Q.2

a) The growth accounting equation is:

$$r_Y = r_A + \eta_{FK} \cdot r_K + \eta_{FL} \cdot r_L$$

where r_Y = growth rate of output
r_A = TFP growth rate
r_K = growth rate of capital
r_L = growth rate of labor
η_{FK} = output elasticity of capital
η_{FL} = output elasticity of labor

This can be also written as (assuming each factor earns its marginal product),

$$r_Y = r_A + s_K \cdot r_K + s_L \cdot r_L$$

where s_K = share of income earned by capital
s_L = share of income earned by labor

b) Using the above equation

r_Y = 0.02 + 0.3*0.07 + 0.7*0.03 = 0.062

c) Growth rate of per capita income $r_{pci} = r_Y - r_L$ = 0.062 - 0.03 = 0.032

(NOTE: the growth rate of per capita income pci = Y/L is NOT r_Y / r_L)

d) If capital grows at 10%,

r_Y = 0.02 + 0.3*0.1 + 0.7*0.03 = 0.071

r_{pci} = 0.071 - 0.03 = 0.041

e) the government can encourage savings by
- increasing the interest rate
- reducing taxes on capital gains
- reducing income taxes (increases disposable income)
- increasing sales taxes (reduces consumption)
- stabilizing the investment climate (reduce risks, interest rate volatility, inflation etc.)
- encouraging foreign capital flows (relax capital controls etc.)

f) components of effective labor (E) are

- number of hours of labor (L)
- productivity of each hour of labor (b)

That is, E = b L

Effective labor can be increased by increasing L or e.

Ways of increasing L
- encourage population growth (incentives to have kids, migration etc.)
- rural to urban migration (e.g. two sector models)
- raising wages and benefits
- lowering unemployment benefits, welfare etc.
- tax cuts (effect is not clear. Works only if the substitution effect dominates)

- improve labor force participation (better roads, public transport, child care etc.)

Ways of increasing b, the productivity level of a worker:

- Improve education (invest in schools etc.)
- Improve job skills (on-the-job training)
- Improve health conditions
- Introduce good work incentive schemes (bonuses, stock options etc.)

g) Components of capital investment are a) private investment, b) government investment and c)

c) foreign investment (net imports).

Private capital can be mobilized by encouraging private savings as discussed in part c. The govt. can also give private firms tax incentives to invest. Government investment can be improved by raising taxes or borrowing. But government investment usually tends to crowd out private sector investment by raising interest rates. The third way of increasing investment is by attracting foreign capital, either as direct investment or as portfolio investment. This can be done by raising interest rates, lowering investment risks and lowering the exchange rate.

h) Total factor productivity includes technology, scale economies, management etc. Government policies that address TFP growth include

- investment in basic sciences and management studies (universities)
- promoting research and development (tax incentives)
- strengthening intellectual property rights (patents)
- promoting competitiveness (trade policies, antitrust laws etc)
- promoting international technology transfers (multinationals, collaborations)
- improving infrastructure (highways, ports, internet, telecommunications)

Q3.

a) In the developing country, Korea, a large part of growth came from growth in labor

Reasons:

higher population growth
structural change from agriculture to manufacturing (labor surplus was absorbed)
large advances in human capital (education, health, skills)

The developed countries cannot depend on labor growth because they have completed the demographic transition (low population growth) and the structural change (excess labor is absorbed already). In addition, the scope for improving human capital is also limited because health, education etc. is already very high.

b) The main source of growth in Japan was TFP growth. Policies the US can adopt to foster TFP growth includes tax incentives to firms that invest in R&D, direct investment in research centers and universities, strengthening the patent system, increasing competitiveness (breaking up monopolies, reducing tariffs etc.). The US can also increase capital investment by encouraging savings, foreign capital flows etc. The scope for increasing labor is rather limited.