Economics 501: Macroeconomics
Fall 2008
Professor Jones

Midterm Examination
Answer Key

1. (32 points) Consider a version of the Solow model where total output is given by

$$Y = zK^{0.36}N^{0.64},$$

Assume that $z = 11$, N equals 200, $s = 0.15$, $d = 0.08$, and $n = 0.02$.

(a) Output per worker is given by

$$y = \frac{Y}{N} = \frac{1}{N}zK^{0.36}N^{0.64} = zK^{0.36}\left(\frac{N}{N}^{0.64}\right) = zK^{0.36}N^{-0.36} = z\left(\frac{K}{N}\right)^{0.36} = zk^{0.36}.$$

(b) Steady state capital per worker can be derived as follows

$$\begin{aligned} s \cdot zf\left(k^*\right) &= \left(n+d\right)k^*, \\ 0.15 \cdot 11\left(k^*\right)^{0.36} &= 0.1k^*, \\ 16.5 &= \left(k^*\right)^{1-0.36} = \left(k^*\right)^{0.64}, \\ k^* &= 16.5^{1/0.64} = 79.858. \end{aligned}$$

The remaining steady state quantities can be calculated as follows

$$\begin{aligned} y^* &= z\left(k^*\right)^{0.36} = 11 \cdot 79.858^{0.36} = 53.2387 \\ i^* &= s \cdot y^* = 0.15 \cdot 53.2387 = 7.9858 \\ &= \left(n+d\right)k^* = 0.1 \cdot 79.858 = 7.9858, \\ c^* &= y^* - i^* = 53.2387 - 7.9858 = 45.2529. \end{aligned}$$

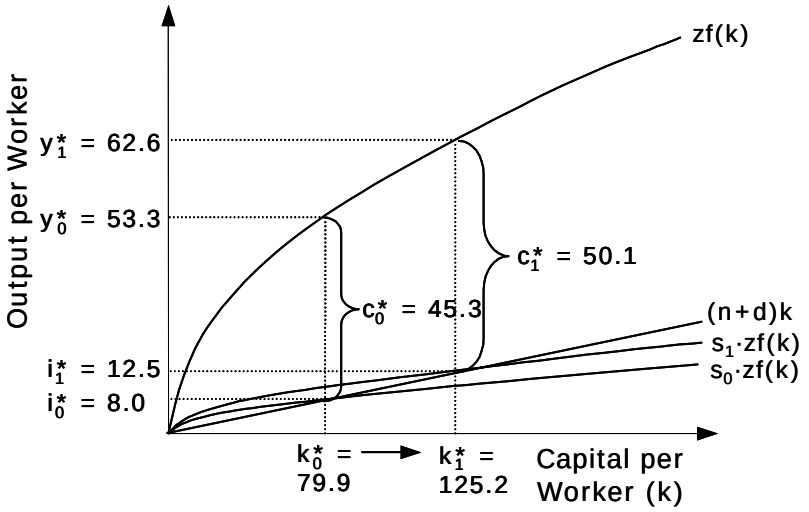
(c) Now suppose that the savings rate permanently increases from 15 to 20 percent. Steady state capital per worker can be derived as follows

$$\begin{aligned} 22 &= \left(k^*\right)^{0.64}, \\ k^* &= \left(22\right)^{1/0.64} = 125.180. \end{aligned}$$

The remaining steady state quantities can be calculated as follows

$$\begin{aligned} y^* &= z\left(k^*\right)^{0.36} = 11 \cdot 125.180^{0.36} = 62.590, \\ i^* &= s \cdot y^* = 0.2 \cdot 62.590 = 12.518 \\ &= \left(n+d\right)k^* = 0.1 \cdot 125.180 = 12.518, \\ c^* &= y^* - i^* = 62.590 - 12.518 = 50.072. \end{aligned}$$

(d) Recalling our answer to part (b), we see that increasing the saving rate increases steady state capital, output, investment and consumption. Graphically, we see that a higher savings rate rotates the saving curve counterclockwise, leading to a higher value of k^*, which in turn leads to higher values of y^*, i^* and c^*. (In the interest of clarity, the graph has not been drawn to scale.)



2. (15 points) Consider an endogenous growth model where output per worker is given by

$$y = Ak,$$

with $A = 0.7551$. Capital per worker follows

$$k'(1+n) = sy + (1-d)k,$$

with $d = 0.08$, and $n = 0.2$.

(a) Rearranging the preceding equation yields

$$\begin{aligned} \frac{k'}{k}(1+n) &= s\frac{y}{k} + (1-d) = s\frac{Ak}{k} + (1-d) \\ &= 1 - d + sA, \end{aligned}$$

so that

$$G_k = \frac{k'}{k} = \frac{1-d+sA}{1+n}.$$

(b) With $s = 0.15$, the gross per worker growth rate is $[1 - 0.08 + 0.15 \cdot 0.7551]/1.02 = 1.033265/1.02 \approx 1.013$, for a net growth rate of 1.3% per year.

(c) If s increases from 0.15 to 0.2, the growth rate is $[1 - 0.08 + 0.2 \cdot 0.7551]/1.02 = 1.07102/1.02 \approx 1.05$, for a net growth rate of 5% per year.

(d) In this model, increasing the savings rate from 15 to 20 percent permanently increases the economy's balanced growth rate, so that in the long run consumption will be higher than before. On the other hand, the increase in the saving rate will redirect output from consumption to investment, so that in the short-run, before the economy has grown very much, consumption will drop. The net effect on a consumer's overall well-being is unclear.

3. (5 points) It follows from the uses-of-saving identity that private saving will fund domestic investment, government borrowing, or the current account:

$$\begin{aligned} S_p &= I - S_g + CA \\ \Rightarrow\ S_p - I &= -S_g + CA = D + CA. \end{aligned}$$

It follows that if private saving increases and investment decreases, either government saving must decrease (the deficit must increase) or the current account balance must increase.

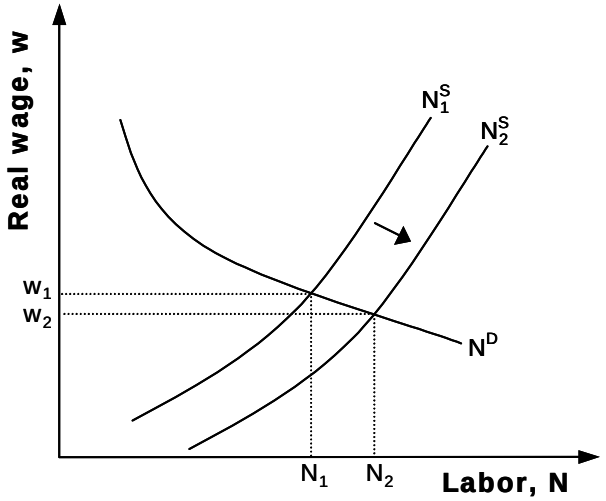
4. (21 points)

	2007	2008
Quantity Peanut Butter (billions of jars)	15	20
Quantity Caviar (billions of cans)	2	1
Price Peanut Butter ($/jar)	3	3.5
Price Caviar ($/can)	25	15
Nominal GDP ($billions)	$3\times15+25\times2=95$	$3.5\times20+15\times1=85$
Real GDP Using Year-2007 Prices (billions of year-2007 $)	$3\times15+25\times2=95$	$3\times20+25\times1=85$
Gross Growth Rate	NA	$85/95=0.8947$
Real GDP Using Year-2008 Prices (billions of year-2008 $)	$3.5\times15+15\times2=82.5$	$3.5\times20+15\times1=85$
Gross Growth Rate	NA	$85/82.5=1.\overline{03}$
2-year Geometric Averages	NA	$\sqrt{0.8947\times1.0303}=0.9601$
Chain-Weighted Real GDP (billions of year-2008 $)	$85/0.9601=88.5324$	Base Year: 85
Chain-Weighted GDP Deflator	$(95/88.5324)\times100=107.31$	$(85/85)\times100=100$
Inflation per Deflator	NA	$100/107.31-1=-6.81\%$

5. (19 points) In the past 6 months, the Dow Jones Industrial Average, an index of stock prices, has fallen from 13,000 to around 8,400.

   (a) Because a decrease in stock prices reduces the consumer's financial resources, it is analogous to an increase in (unproductive) government spending which increases the consumer's (lump-sum) tax burden.

(b) Building on the analogy in part (a), the stock price drop has an income effect that shifts the labor supply curve down and to the right. Because there is no change in physical capital or productivity, the labor demand curve is unchanged. Labor hours increase and wages fall. The increase in labor hours leads to an increase in output. What happens to consumption is unclear. If we interpret the model strictly, higher output must lead to higher consumption, as there is no change in government spending. On the other hand, the labor supply effect of lower stock prices is predicated on the assumption that lower stock prices reduce the consumer's purchasing power, implying that consumption should fall. This contradiction arises because the static model does not allow for saving or wealth.



6. (8points) The Emergency Economic Stabilization Act of 2008, better known as the "financial sector bailout", authorized the U.S. Department of the Treasury to purchase unsound assets from financial firms. Because these are purchases of existing assets, they would not appear in the national accounts, as GDP consists only of new goods and services. Any expenses in administering the program, however, would appear as government expendtitures, G.