Macroeconomics, Module 9: An Equilibrium Business Cycle Model

Homework Assignment: Epidemic Effects

(The attached PDF file has better formatting.)

Country W is a developing country that derives all its income from agriculture. In 20X4, it has 10 million farm workers and 4 million machines (tractors, combines, and so forth). The ratio of capital to labor (machines to farm workers) is below the optimal (steady state) ratio. Some farm workers are doing manual labor (plowing or harvesting by hand). The marginal product of capital is high, and the marginal product of labor (the value of the last person hired) is low.

In 20X5, a severe avian flu epidemic kills 20% of the population, spread equally over all age groups. The labor force decreases 20%, but the stock of capital (the machines) is not affected by the epidemic. Workers do not use machines all day, so one machine may suffice for two workers. (Most catastrophes destroy capital more than labor; this scenario is unusual.)

A. What is the effect on the marginal product of labor?
B. What is the effect on the real wage rate?
C. What is the effect on the employment rate?
D. What is the effect on the hours worked per worker?
E. What is the effect on the real rental price?
F. What is the effect on the real interest rate?
G. What is the effect on the investment rate?

For Part A: The epidemic decreases the ratio of workers to capital 20%, so it increases the ratio of capital to workers 25%. Use the concept of capital deepening: as the capital per worker increases, what happens to the marginal product of labor? (In the real world, social problems from the epidemic may decrease labor productivity. Ignore any social problems for the homework assignment.)

For Part B: The real wage rate depends on the marginal product of labor.

For Part C: The values of leisure does not change, but the real wage rate changes. Assume the country has no unemployment benefits that are set as a percentage of the wage rate.

For Part D: Barro assumes that

- *Income effect:* If workers are paid subsistence wages, they may work long hours to pay for food and clothing. As wage levels increase, they can afford some leisure time.
- *Substitution effect:* If workers are paid good wages, they work enough hours that they are indifferent between an additional hour of work and an additional hour of leisure. A higher real wage rate induces them to prefer an additional hour of work.

For most workers, the substitution effect is stronger than the income effect. For your homework assignment, state your assumption about the relative strength of these two effects and the implication for hours worked. No single assumption is always correct.

For Part E: The capital per worker increases, so marginal return per dollar of capital decreases. The homework assignment is worded that capital was insufficient before the epidemic and sufficient after the epidemic. In truth, capital sufficiency does not have a single break point. A higher capital per worker ratio causes a lower marginal return per dollar of capital.

For Part F: Firms borrow money to buy machines, so the real interest rate is the net return on capital. The depreciation rate has not changed, so the net return on capital moves in the same direction as the gross return on capital.

For Part G: How does the new return on capital affect the investment in new capital? Each dollar of capital produces a lower return, so the incentive to acquire more capital changes.

For Part G, you might be tempted to reason that as people are paid more, national savings increases, so net investment also increases. This is true if the interest rate does not change. If the interest rate changes (as in this homework assignment), people's incentive to save also changes.