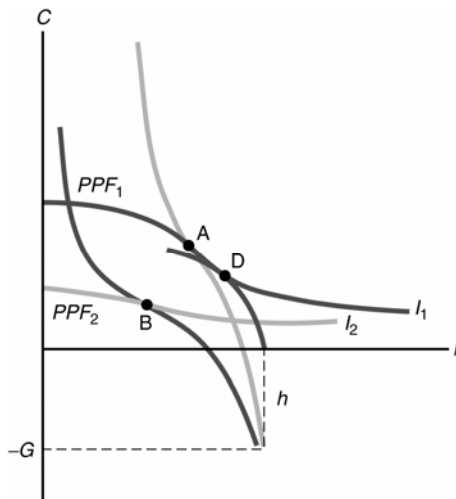


**Econ 402**  
**Fall 2007**

**Problem Set #4**  
**Suggested solutions**

3. The only impact effect of this disturbance is to lower the capital stock. Therefore, the production possibility frontier shifts down and the marginal product of labor falls (*PPF* is flatter).

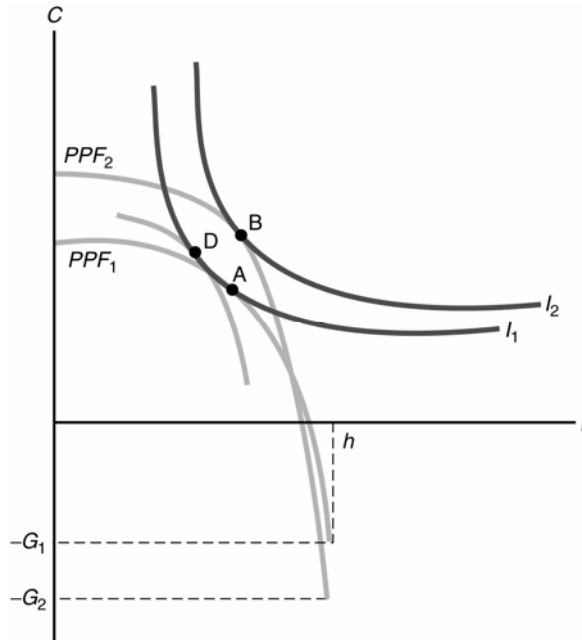
- (a) The reduction in the capital stock is depicted in the figure below. The economy starts at point A on  $PPF_1$ . The reduction in the capital stock shifts the production possibilities frontier to  $PPF_2$ . Because  $PPF_2$  is flatter, there is a substitution effect that moves the consumer to point D. The consumer consumes less of the consumption good and consumes more leisure. Less leisure also means that the consumer works more. Because the production possibilities frontier shifts down, there is also an income effect. The income effect implies less consumption and less leisure (more work). On net, consumption must fall, but leisure could decrease, remain the same, or increase, depending on the relative strengths of the income and substitution effect. The real wage must also fall. To see this, we must remember that, in equilibrium, the real wage must equal the marginal rate of substitution. The substitution effect implies a lower marginal rate of substitution. The income effect is a parallel shift in the production possibilities frontier. As the income effect increases the amount of employment, marginal product of labor must fall from point D to point B. This reinforces the reduction in the marginal rate of substitution from point A to point D.



- (b) Changes in the capital stock are not likely candidates for the source of the typical business cycle. While it is easy to construct examples of precipitous declines in capital, it is more difficult to imagine sudden increases in the capital stock. The capital stock usually trends upward, and this upward trend is important for economic growth. However, the amount of new capital generated by a higher level of investment over the course of a few quarters, of a few years, is very small in comparison to the existing stock of capital. On the other hand, a natural disaster that decreases the stock of capital implies lower output and consumption, and also implies lower real wages, which are all features of the typical business cycle contraction.

6. Production-enhancing aspects of government spending.

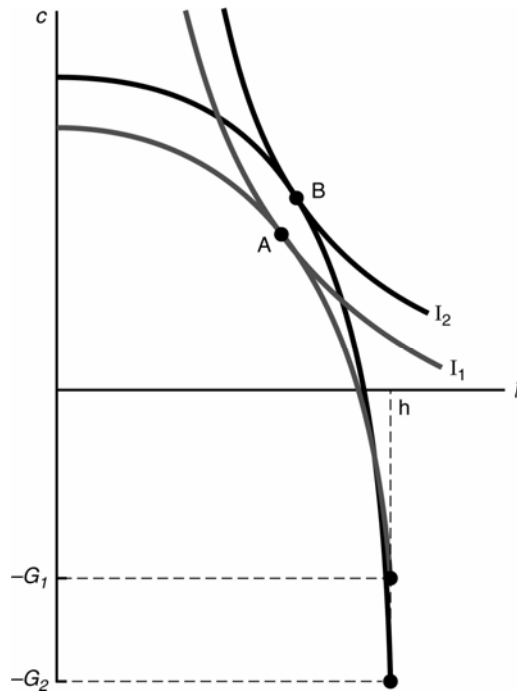
The increase in government spending in this example has two separate effects on the production possibilities frontier. First, the increase in government spending from  $G_1$  to  $G_2$  implies a parallel downward shift in the production possibilities frontier. Second, the productive nature of government spending is equivalent to an increase in total factor productivity that shifts the production possibilities frontier upward and increases its slope. The figure below draws the original production possibilities frontier as  $PPF_1$  and the new production possibilities frontier as  $PPF_2$ . If the production-enhancing aspects of the increase in government spending are large enough, representative consumer utility could rise, as in this figure.



There are three effects at work in this example. First, there is a negative income effect from the increase in taxes needed to pay for the increased government spending. This effect tends to lower both consumption and leisure. Second, there is a substitution effect due to the productive effect of the increase in  $G$ , which is drawn as the movement from point A to point D. This effect tends to increase both consumption and leisure. Third, there is a positive income effect from the increase in  $G$  on productivity. This effect tends to increase both consumption and leisure. In the figure above, the movement from point D to point B is the net effect of the two income effects. In general, consumption may rise or fall, and leisure may rise or fall. The overall effect on output is the same as in any increase in total factor productivity. Output surely rises.

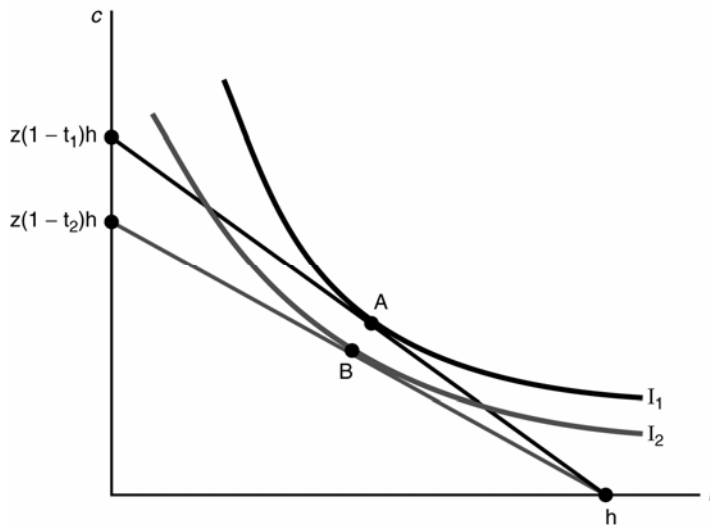
The fact that government spending make firms more productive is similar to adding  $G$  to the production function. There are now two effects to an increase in government expenses: the standard crowding out of consumption, and now also an efficiency effect on production.

- (a) The figure below illustrates a particular situation where the welfare of the household is improved, as illustrated by a shift to the north-east of the indifference curve. The equilibrium shifts from A to B as the  $PPF$  is lowered by the additional government expenses but is also getting steeper thanks to the same government expenses.



- (b) From previous results, we know that output increases with the increase in government expenses. This is now reinforced as  $G$  increases production efficiency. Regarding consumption and leisure, without this new effect, we obtained that an increase in  $G$  lead to a negative income effect and thus to decreases in both consumption and leisure. But as the real wage went down, there was also a substitution effect leading to an additional decrease in consumption and increase in leisure. The new effect on the production function adds opposite effects: a positive income effect and a wage increase, thus possibly reversing, or not, anything that was concluded without the impact of  $G$  on production.

7. We need to analyze each case separately. Start with the good equilibrium. As government expenses increase, more tax revenue needs to be raised, and thus the tax rate needs to be increased. As shown in the figure below, this tilts down the linear *PPF*. The new equilibrium leads to a lower indifference curve. This leads to a negative income effect and a lower wage (remember, it is  $z(1 - t)$ ), thus a substitution effect. The income effect lowers consumption and leisure, the substitution effect decreases consumption and increases leisure. All in all, consumption is lower and leisure is higher, as we know that the substitution effect dominates the income effect. This means that the labor supply is reduced, and thus equilibrium labor and output.



The story is different in the bad equilibrium. To increase tax revenue, one needs to reduce the tax rate. Then all the changes discussed above are exactly in the opposite direction.