

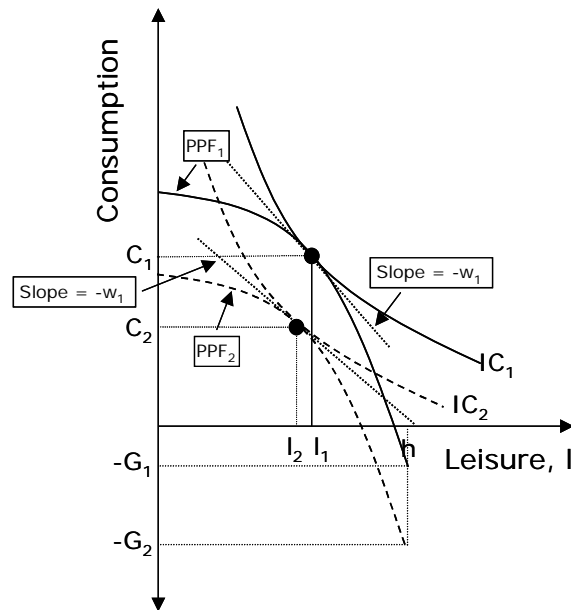
**Midterm Examination
 Answer Key**

1. (34 points) On October 7, 2005, Gannett News Service Reporter Brian Tumulty wrote:

The September unemployment rate ticked upward to 5.1 percent from August's four-year low of 4.9 percent mostly because of Hurricane Katrina, Labor Department officials said Friday. How fast the Gulf Coast area recovers and rebuilds will determine whether employment recovers in the coming month.

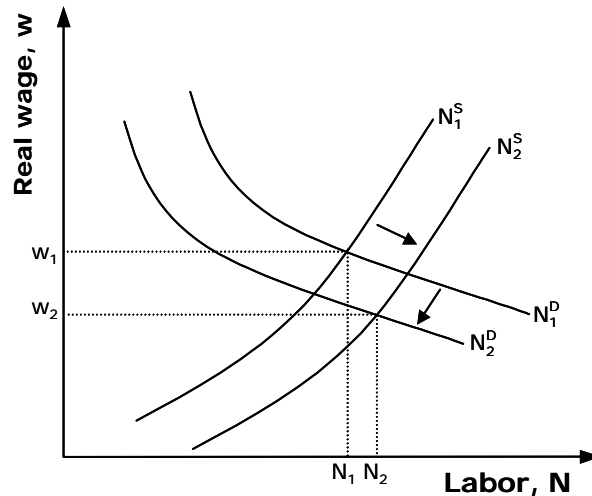
Let's analyze this statement with the one-period macroeconomic model.

- (a) If the Gulf Coast is rebuilt by contractors hired by government, the expenditures can be treated as increase in government spending. Assuming taxes are lump-sum, the PPF will shift down. (Although the rebuilding will eventually increase the capital stock, this effect takes time to accumulate. At the time of the rebuilding, the predominant effect of the rebuilding is a diversion of resources from other uses.) Since consumption and leisure are both normal goods, both will decrease. A decrease in leisure implies an increase in labor, which in turn implies that total output ($Y = C + G$) is higher. Because the marginal product of labor—the real wage—is diminishing, the increase in labor decreases wages.



- (b) We now consider the hurricane and a government-purchased reconstruction together. The hurricane, by destroying the capital stock, reduces the marginal product of labor, and shifts the labor demand curve down and to the left. The

government spending increase has income effects that move the labor supply curve down and to the right. The real wage decreases, while the effect on the quantity of labor depends on the relative magnitudes of the two shifts—in the figure below, labor increases. Consumption, being a normal good, will fall as both the hurricane and the rebuilding effort reduce household wealth. The effect on output is ambiguous: the government spending increase causes labor and thus output to rise, while the reduction in capital causes output to fall.



- (c) The answer to part (b) is consistent with Mr. Tumulty’s discussion. Initially, with the rebuilding effort small, the effects of the capital loss dominate, and unemployment rises (employment falls)—if the labor supply curve is upward-sloping. But once rebuilding starts, equilibrium hours/employment can increase or decrease, depending on the relative sizes of the capital loss and the rebuilding rate. In addition, as the rebuilding continues, capital will grow and the labor demand curve will move up, returning to its initial position. Larger rebuilding efforts will accelerate this reversal and increase the likelihood that unemployment falls.

2. (35 points) Consider a version of the Solow model where total output is given by

$$Y = zK^{0.35}N^{0.65},$$

Assume that $z = 14$, N equals 100, $s = 0.20$, $d = 0.08$, and $n = 0.0$.

- (a) Output per worker is given by

$$y = \frac{Y}{N} = \frac{1}{N}zK^{0.35}N^{0.65} = zK^{0.35}\left(\frac{N^{0.65}}{N}\right) = zK^{0.35}N^{-0.35} = z\left(\frac{K}{N}\right)^{0.35} = zk^{0.35}.$$

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

$$\begin{aligned} s \cdot zf(k^*) &= (n + d)k^*, \\ 0.2 \cdot 14(k^*)^{0.35} &= 0.08k^*, \\ 35 &= (k^*)^{1-0.35} = (k^*)^{0.65}, \\ k^* &= 35^{1/0.65} = 237.405. \end{aligned}$$

The remaining steady state quantities can be calculated as follows

$$\begin{aligned} y^* &= z(k^*)^{0.35} = 14 \cdot 237.405^{0.35} = 94.962, \\ i^* &= s \cdot y^* = 0.2 \cdot 94.962 = 18.99 \\ &= (n+d)k^* = 0.08 \cdot 237.405 = 18.99, \\ c^* &= y^* - i^* = 94.96 - 18.99 = 75.97. \end{aligned}$$

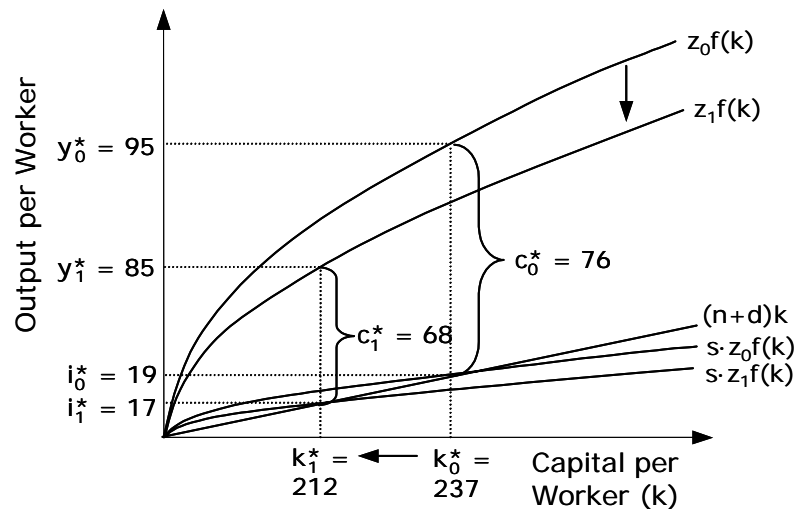
- (c) Now suppose that total factor productivity permanently decreases from 14 to 13. Steady state capital per worker can be derived as follows

$$\begin{aligned} 32.5 &= (k^*)^{0.65}, \\ k^* &= 32.5^{1/0.65} = 211.824. \end{aligned}$$

The remaining steady state quantities can be calculated as follows

$$\begin{aligned} y^* &= z(k^*)^{0.35} = 13 \cdot 211.824^{0.35} = 84.73, \\ i^* &= s \cdot y^* = 0.2 \cdot 84.73 = 16.95 \\ &= (n+d)k^* = 0.08 \cdot 211.824 = 16.95, \\ c^* &= y^* - i^* = 84.73 - 16.95 = 67.78. \end{aligned}$$

- (d) Recalling our answer to part (b), we see that lowering total factor productivity reduces steady state capital, output, investment and consumption. Graphically, both the output and the saving curve shift down, leading to lower values of k^* , y^* , i^* , and c^* . (In the interest of clarity, the graph has not been drawn to scale.)



- (e) Since 150 is below the new steady state per worker capital stock, $k_1^* = 212$, we would see k grow in the period following the hurricane, as capital rises to its new steady state value.

3. (6 points) Next, we consider an endogenous growth model. Output and capital per worker follow

$$\begin{aligned} y &= Ak, \\ k' &= Bk, \end{aligned}$$

If Hurricane Katrina has no effect on B , it will have no effect on the growth rate of capital and output: the gross growth rate is $y'/y = k'/k = B$. But if Hurricane Katrina also lowers k by 50 percent, with A unchanged, capital and output per worker will be 50% lower in perpetuity. Even though output and capital will grow, they grow no more quickly than they would have in the absence of the hurricane, and thus they never recover.

4. (9 points) Let's look at the national accounts.

- (a) Private rebuilding would appear as investment, I , and consumption, C (primarily as purchases of consumer durables). Rebuilding purchased by the government would appear as government consumption, G . (Rebuilding financed by government transfers to private citizens—e.g., FEMA benefits—would be assigned to I or C , as income transfers are not part of G .)
- (b) Recall that national wealth is the sum of domestic physical assets and net foreign assets. Hurricane Katrina obviously reduced domestic physical assets. Over time the rebuilding efforts will replace some of these losses. (This is true even if the government pays—unlike, say, military spending, government investment increases national wealth.) The replacement might not be complete: if the rebuilding efforts displaces other investment in the U.S., or increases overseas borrowing, national wealth will not completely recover.

5. (16 points)

	<u>Year 1</u>	<u>Year 2</u>
Quantity Fast Food (meals)	1,000	400
Quantity Fine Dinners (meals)	200	150
Price Fast Food (\$/meal)	5	15
Price Fine Dinners (\$/meal)	50	75
Nominal GDP (\$)	$1,000 \times 5 +$ $200 \times 50 =$ 15,000	$400 \times 15 +$ $150 \times 75 =$ 17,250
Real GDP Using Year-1 Prices (year-1 \$)	$1,000 \times 5 +$ $200 \times 50 =$ 15,000	$400 \times 5 +$ $150 \times 50 =$ 9,500
Gross Growth Rate	NA	$9.5/15 =$ $0.6\bar{3}$
Real GDP Using Year-2 Prices (year-2 \$)	$1,000 \times 15 +$ $200 \times 75 =$ 30,000	$400 \times 15 +$ $150 \times 75 =$ 17,250
Gross Growth Rate	NA	$17.25/30 =$ 0.575
2-year Geometric Averages	NA	$\sqrt{0.6\bar{3} \times 0.575} =$ 0.60346
Chain-Weighted Real GDP (year-2 \$)	$17,250/0.60346 =$ 28,585	Base Year: 17,250