Keynesian Model Practice

Here are some practice problems using the Keynesian model. Note that $\bar{C}$ is autonomous consumption and c is the marginal propensity to consume. Tax rate is t so that total taxes are tY. The marginal propensity to import is m and transfers are T_r.

1. Let $I = 20, \bar{C} = 10$ and the $c = 0.8$. Compute Y and C. *Solution:* Solve $Y = C + I$ and $C = \bar{C} + cY$ simultaneously (isolate and substitute) to obtain $Y = 150, C = 130$.

2. Let $I = 100, \bar{C} = 34$ and the $c = 0.75$ (marginal propensity to consume). Compute Y and C. *Solution:* $Y = 536, C = 436$.

3. In the previous problem calculate household savings. *Solution:* $S = Y - C = 536 - 436 = 100$, or from $S = I, S = 100$.

4. Let $I = 150, \bar{C} = 34$ and the $c = 0.75$ (marginal propensity to consume). Compute Y and C. *Solution:* $Y = 736, C = 586$.

5. In the previous problem compute income using the multiplier. *Solution:* $Y = \mu \Delta I$, where $\mu = 1/(1 - c) = 4$ so the change in Y is the multiplier times the change in I. $\Delta Y = 4(50) = 200$. The new level of $Y = 536 + 200 = 736$.

6. In the previous problem, if consumption increases to 600, while production remains at 736, compute the change in inventories. *Solution:* $Y = 736 - 600 - 150 = -14$. Inventories *fall* by 14. This will cause output to rise in the next period.

7. For the SAM given in table 1, let the $mpc = 0.67$. Compute $\bar{C}$ to calibrate the consumption function to the SAM. *Solution:* Household income is 50 with consumption at 40.5. Autonomous consumption is then $\bar{C} = 40.5 - 0.67(50) = 7$.

8. Using the $\bar{C} = 7$ from the previous problem, show that the solution for the Keynesian model is given in the SAM. *Solution:* Solve the system

$$\begin{aligned} Y &= C + I \\ Y &= \bar{C} + cY \end{aligned}$$

simultaneously for Y, C. This should give

$$\begin{aligned} Y &= C + 9.5 \\ C &= 7 + 0.67Y \end{aligned}$$

or, substituting the second equation into the first $Y = 7 + 0.67Y + 9.5$ or $Y = 50$. Thus, $C = 7 + 0.67(50) = 40.5$. Savings is $Y - C = 50 - 40.5 = 9.5$

9. Let $I = 20, \bar{C} = 10$, $G = 15$ with $c = 0.8$ and the tax rate $t = 0.2$ Compute Y and C and government savings, S_g, (the negative of the deficit). *Solution:* $Y = 125, C = 90, S_g = 10$.

10. Let $I = 20, \bar{C} = 10$. $G = 25$ and $c = 0.8$ and the tax rate $t = 0.2$ Compute Y and C and the new government savings. *Solution:* $Y = 152.8, C = 107.8, S_g = 5.6$.

11. In the previous problem government spending went up by 10. Compute the change in GDP using the multiplier $1/[1 - (1 + t)c]$. *Note that the multiplier is different with taxes in the model. Solution:* $\mu = 2.78$, so $\Delta Y = 2.778(25 - 15) = 27.8$. The new level of $Y = 138.9 + 27.8 = 152.8$, the same as calculated directly.

Table 1: A Social Accounting Matrix

	Firms	Household	Invest	Total
Firms		40.5	9.5	50
HH	40.5			40.5
Savings		9.5		9.5
Total	50	50	9.5	

Source: made-up numbers.

Table 2: A Social Accounting Matrix

	Firms	Household	Invest	Govt	Net Exports	Total
Firms		99.6	20	25	-4.6	140
HHolds	140					140
Savings		12.4		3	4.6	20
Govt		28				28
Foreign						0
Total	140	140	20	28	0	

Source: made-up numbers.

12. The level of government spending went up by 10, but government savings fell by only 4.4. Why is this? *Solution:* Think about what has happened to total tax revenues.

13. Let imports be mY with the marginal propensity to import $m = 0.14$. Exports are $E = 12$, $I = 20, \bar{C} = 10$. $G = 25$ and $c = 0.8$ and the tax rate $t = 0.2$. Compute Y and C, S_g and foreign savings (the current account deficit), S^*. *Solution:* $Y = 134, C = 95.8, S_g = 1.8, S^* = 6.8$.

14. In the previous problem raise exports to 15. Compute Y and C and the new government savings and foreign savings. *Solution:* $Y = 140, C = 99.6, S_g = 3, S^* = 4.6$.

15. In the previous problem exports went up by 3. Compute the change in GDP using the multiplier $\mu = 1/[1 - (1 + t)c + m]$. *Note that the multiplier is different with taxes and imports in the model. Solution:* $\mu = 2$, so $\Delta Y = 2(3) = 6$. The new level of $Y = 134 + 6 = 140$, the same as calculated directly. Note that you can also use the multiplier to calculate the change in consumption, government savings and the level of foreign savings.

16. Write out a new SAM for the previous problem. *Solution:* The SAM is table 2.

17. In the SAM of table 3, let the marginal propensity to consume be 0.7 and the marginal propensity to import be 0.1. Note that transfers to households are 80. Compute the level of Y, C, S_g, S^* and show that they agree with the SAM.

    Solution: We must figure out the tax rate, which is 180/1200 =0.15. Net exports are -30 so this must mean $Nx = E - mY$ or $E - 0.1(1120) = -30$ so that E = 82. Disposable income is $Y_d = (1 - t)(Y + T_r) = (1 - 0.15)(1200) = 1020$. Thus $\bar{C} = C - cY_d = 800 - 0.7(1020) = 86$. To solve this model, write

$$Y = C + I + G + E - mY$$
$$C = \bar{C} + (1 - t)(Y + T_r)$$

Table 3: A Social Accounting Matrix

	Firms	Household	Invest	Govt	Net Exports	Total
Firms		800	200	150	-30	1120
HHolds	1120			80		1200
Savings		220		-50	30	200
Govt		180				180
Foreign						0
Total	1120	1200	200	180	0	

Source: made-up numbers.

Substituting the second equation into the first and then putting in the data from the SAM.

$$\begin{aligned} Y &= 86 + 0.7(1 - .15)(Y + 80) + 200 + 150 + 82 - 0.1Y \\ 0.505Y &= 86 + 47.6 + 432 \\ Y &= 1120 \\ C &= 86 + 0.7(1 - 0.15)(1200) = 800 \end{aligned}$$

18. Now calibrate the Solow model to this SAM. The capital output ratio is 3 and $\beta = 0.4$. Let $A = 1$. Compute the capacity utilization ratio. *Solution:* The capital stock is $3(1120) = 3360$. The share of labor is 0.6 so that labor is $0.6(1120) = 672$. The capital-labor ratio, $k = 3360/672 = 5$. Per worker income is then $y = Ak^{\beta}$=$5^{0.4} = 1.9$, but the actual per worker income of the SAM is $1120/672 = 1.67$. Thus $u = [1.67(672)]/[1.9(672)](1.67/1.9) = 0.875$.

19. Now increase transfers by 10 and recalculate the new levels of Y, C, S_g and S^*. *Solution:* $Y = 1131.8, C = 813, S_g = -56.7, S^* = 31.2$.

20. In the last question, what happens to capacity utilization? *Solution:* Capacity remains the same but demand has increased. Income per worker rises to 1131.8/672 =1.68/1.9=0.885.