

Practice Problem Set #1 – Solutions

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Chapter 3

2. a. $Y=Z$ (for equilibrium in the goods market)
 $Y=C+I+G$ (where the usual closed-economy definition of Z has been inserted)
 $Y=(160+0.6Y_D)+150+150$ (inserting the given information for each component)
 $Y=160+0.6(Y-100)+150+150$ (because $Y_D=Y-T$ by definition and $T=100$ is given)
 $0.4Y=400$ (subtracting $0.6Y$ from both sides and adding terms up on the right)
 $Y^*=400/0.4=1000$.
- b. $Y_D=Y-T=1000-100=900$.
- c. $C=160+0.6(900)=700$.
3. a. Equilibrium output is 1000, as in the previous question. Total demand= $C+I+G=700+150+150=1000$. Total demand equals production. We used this equilibrium condition to solve for output.
- b. There are a couple of different ways of doing this. First, you could start with the equilibrium condition and go through the whole calculation over again, like in 2a but with the new level of G . Second, you can use your intuition regarding the multiplier to find a shortcut. The expression for the multiplier when consumption is a linear function of disposable income and all other variables are exogenous is $1/(1-c_1)$, which tells us how much equilibrium output will increase by if exogenous spending increases by \$1. In this case, $c_1=0.6$ (from the consumption function) and exogenous spending changes by -40 (because G falls from its initial value of 150 to 110). Therefore, output will *fall* by 40 times the multiplier $=40/(1-.6)=100$. So, equilibrium output is now 900 (i.e. the initial equilibrium level of 1000 minus the change we just calculated). Total demand= $C+I+G=160+0.6(800)+150+110=900$. Again, total demand equals production.
- c. Private saving= $Y-C-T=900-(160+0.6(800))-100=160$. Public saving $=T-G=-10$. Total saving (or “national saving”) equals private plus public saving, or 150. Total saving equals investment. This statement is mathematically equivalent to the equilibrium condition, total demand equals production. In other words, there is an alternative (and equivalent) equilibrium condition: total saving equals investment.
4. a. Y increases by $1/(1-c_1)$.
- b. Y decreases by $c_1/(1-c_1)$.
- c. The answers differ because spending affects demand directly, but taxes only affect demand indirectly through consumption (and the marginal propensity to consume, of course, is less than one).

- d. The change in Y equals $1/(1-c_1) - c_1/(1-c_1)=1$. Balanced budget changes in G and T are not macroeconomically neutral. (Macroeconomic neutrality in this case would require the simultaneous increase in G and T by one dollar to lead to a change in Y of zero.)
- e. There's an unfortunate typo in the way this part is written in the book. It asks you how c_1 affects your answer to part (a), but what it really means to ask is how c_1 affects your answer to part (d). Let's answer both. i. The higher is the marginal propensity to consume, the larger is the standard multiplier $1/(1-c_1)$. This makes sense because when c_1 is higher, a greater proportion of additional income is spent on consumption goods, thus pushing demand higher than it otherwise would in the second round following an initial increase in exogenous spending, leading to higher income again, and so on until the new equilibrium is reached. ii. The marginal propensity to consume has no effect on the balanced budget multiplier (which was calculated above as 1) because the balanced budget tax increase effectively aborts the multiplier process. Y and T both increase by one unit, so disposable income, and hence consumption, do not change. More specifically, the one-unit increase in G pushes up Y by one unit directly, but there are no further-round indirect increases in Y because the one-unit direct change in Y and the one-unit increase in T combine to produce no net change in C .
5. a. $Y=Z$ (for equilibrium, as usual)
 $Y=C+I+G$
 $Y=(c_0+c_1Y_D)+I+G$
 $Y=c_0+c_1[Y-(t_0+t_1Y)]+I+G$
 $Y(1-c_1+c_1t_1)=c_0-c_1t_0+I+G$
 $Y^*=[1/(1-c_1+c_1t_1)][c_0-c_1t_0+I+G]$.
- b. The multiplier is $1/(1-c_1+c_1t_1)$, which is less than the standard multiplier of $1/(1-c_1)$, which this multiplier would collapse to if t_1 were zero and taxes hence did not respond to income. (The presence of the positive term in the denominator makes the denominator larger and hence the overall multiplier smaller.) So the economy responds less to changes in autonomous spending when t_1 is positive. After a positive change in autonomous spending, the increase in total taxes (because of the increase in income) tends to lessen the subsequent increases in output (since consumption depends on disposable income as usual, but increases in disposable income are moderated by the automatic increase in taxes). Likewise, after a negative change in autonomous spending, the fall in total taxes tends to lessen the decrease in output.
- c. Because of the automatic response of taxes to the state of the economy in this case (i.e. the absolute tax burden is higher when income is higher and lower when income is lower), the economy responds less to changes in autonomous spending than in the case where taxes are independent of income. Since output tends to vary less (or in other words, to be more stable), fiscal policy is called an automatic stabilizer. ("Fiscal policy" typically refers to both government spending and taxation. However, government spending is being held constant throughout this problem, so it's ok to use "fiscal policy" and "tax policy" synonymously in this case, which the problem does.)

6. a. $Y^* = [1/(1-c_1+c_1t_1)][c_0-c_1t_0+I+G]$, as calculated above.
- b. $T = t_0 + t_1[1/(1-c_1+c_1t_1)][c_0-c_1t_0+I+G]$. (This can be simplified more, but it's not illuminating. These first two parts really aren't very useful.)
- c. Both Y and T decrease, by $1/(1-c_1+c_1t_1)$ and $t_1/(1-c_1+c_1t_1)$ respectively.
- d. If G is cut, Y will decrease even more. A balanced budget requirement amplifies the effect of the decline in c_0 . Therefore, such a requirement is destabilizing. (In fact, there is a potential for this to start a policy spiral, if the balanced budget requirement is taken seriously enough. The initial drop in autonomous consumption causes output to fall through the usual multiplier mechanism, but this causes taxes to fall, which policy makers will have to respond to with a cut in spending, which will in turn induce a further decline in output, again through the multiplier process. This much we've discussed already. But because of this further decline in output, taxes will fall yet again, requiring another drop in spending by policy makers if the budget is to be exactly balanced, inducing another drop in output. And on and on. Because t_1 has been assumed to be less than 1, this spiral will eventually converge to a much lower level of output and a balanced budget rather than spin out of control, as taxes fall by less than the drop in output after each spending change, so that the spending cut required for a balanced budget is getting smaller at each policy change.)

8. a. $Y = C + I + G$
 $Y = [1/(1-c_1-b_1)][c_0-c_1T+b_0+G]$.

(Note that, in moving from 2a to 5a to here, the mathematical solutions have gotten more terse. As you get more practice, you'll be able to do more steps in your head and give much more parsimonious answers than what was given above for 2a. On the other hand, you'll probably want to show more steps than have been shown here for the present problem, for the sake of being careful and so that others can follow your work.)

- b. Including the b_1Y term in the investment equation increases the multiplier, which in this case is given by $1/(1-c_1-b_1)$, which is greater than the standard multiplier of $1/(1-c_1)$ (because the subtraction of the extra term in the denominator makes the denominator smaller and hence the overall multiplier larger). Increases in autonomous spending now create a multiplier effect through two channels: consumption and investment. For the multiplier to be positive, the condition $c_1+b_1 < 1$ is required. (This condition ensures the stability – and sensibility – of the model. If it did not hold, any positive shock to autonomous expenditure would set off an exploding spiral of expanding output, which is clearly not an accurate reflection of reality. This would happen because, if the condition did not hold, any increase in income would induce a second-round increase in consumption and investment that would be larger than the initial income increase, leading to an even larger third-round income increase and so on forever. In slightly more technical language, there would be “divergence”. The condition ensures the opposite – namely, convergence – which is a desirable property for most models to exhibit for a lot of reasons.)

- c. Output increases by the change in b_0 times the multiplier. Investment increases by the change in b_0 plus b_1 times the change in output. These are the overall changes, which can be broken down into their step-by-step changes: the initial change in business confidence leads to a direct increase in output, which induces an additional indirect increase in investment and an indirect increase in consumption, which push output higher again, and so on until the economy converges to its new equilibrium. Since investment increases, and total saving equals investment, saving must also increase. Where does this increased saving come from? The increase in output leads to an increase in disposable income and hence an indirect increase in consumption, but this increase in consumption is less than the increase in disposable income (because $c_1 < 1$ in general), so private saving (which is defined as the difference between disposable income and consumption) also increases. (Public saving does not change because T and G are both being held fixed throughout. So the change in total – or national – saving is just equal to the change in private saving in this case.)
9. a. Output will fall. (Specifically, if c_0 falls by 1, output will fall by $1/(1-c_1-b_1)$.)
- b. Since output falls, investment will also fall (specifically, by $b_1/(1-c_1-b_1)$ if the drop in c_0 was by 1). Public saving will not change (because public saving is defined as $T-G$, and both variables are assumed to be constant and thus don't change). Private saving will fall, since investment falls, and investment equals saving. (See the answer to 8c for an explanation of the underlying mechanism.) Since output and consumer confidence fall, consumption will also fall. (If the initial drop in c_0 was by 1, overall consumption would drop by $c_1/(1-c_1-b_1)$ indirectly plus the direct drop of 1. Private saving will change by the change in output minus the change in consumption, by the definition of saving and the fact that taxes are constant throughout. So the drop in saving if the drop in c_0 was by 1 would be $\{1/(1-c_1-b_1) - [1+c_1/(1-c_1-b_1)]\}$, which, as you can check, simplifies to $b_1/(1-c_1-b_1)$, which is the same as the change in investment, as we would expect.)
- c. Output, investment, consumption and private saving would have risen.
- d. Clearly this logic is faulty. When output is low, what is needed is an *increase* in spending. This will lead to an increase in output, and therefore – somewhat paradoxically if the increased spending comes from an attempt to save less – to an increase in private saving. (If you're curious, however, note that with a linear consumption function, the private saving *rate* – defined as private saving divided by output – will fall when c_0 rises.)

Keynes argued during the Great Depression that increased spending was necessary to boost output, but that this would have to be effected through government spending because consumers were hoarding their reduced incomes and trying to save “too much”. Suggesting that consumers should be saving less was a bit of a heretical notion at the time, since thrift was thought of as a great virtue, and indeed, we will see later in the course that higher saving rates are associated with higher standards of living in the long run. Nonetheless, it is now well understood that an increase in saving can have negative consequences in the short run irrespective of whatever benefits there might be in the long run. (Keynes also argued that “in the long run, we are all dead.”)

Chapter 5

5. Firms deciding how to use their own funds will compare the return on bonds to the return on investment. When the interest rate on bonds increases, bonds become more attractive, and firms are more likely to use their funds to purchase bonds, rather than to finance investment projects. Put another way, firms with lots of cash on hand will choose to lend that cash out rather than invest it in machinery as long as the interest rate return from lending is high enough to compensate for the forgone higher future profits that could be earned if the new machinery were invested in instead. Thus, for firms with no cash on hand, the interest rate reflects the cost of borrowing, while for firms with lots of cash on hand, the interest rate reflects the opportunity cost of not lending. Either way it is a cost, and when that cost rises, all firms will want to invest less.