

Macroeconomic Time Series: The Consumption Function

This unit has two prerequisites:

- § You should install gretl on your computer.
- § You should read the two extracts from Keynes's *General Theory*, available from the class home page.

1 Installing gretl

1. Go to the course website:
<http://ricardo.ecn.wfu.edu/ecn201/>
Under "Basic resources," click on the "here" of "Local Windows download here." When prompted, save the file `gretl_install.exe` to your desktop.
2. Go to the desktop and double-click on `gretl_install.exe`. You'll be asked various questions about the installation. It is safe to accept the default choices (by pressing "OK" or hitting the Enter key). When the installer has finished running, you may delete `gretl_install.exe`; you have no more use for it.
3. There should now be a gretl icon on your desktop, which you can use to start the program. We'll use it shortly.

2 Reading Keynes

The extracts are from two chapters of Keynes's *General Theory*, Chapter 4, "Choice of Units" and Chapter 8, "The Propensity to Consume". Keynes was the most influential economist of the 20th century and the founder of the branch of the subject now known as macroeconomics. Here are some brief notes on what to look for in your reading.

Choice of Units

What's of interest here is Keynes's posing of a sort of data question that should probably be asked more often. That is, are such-and-such data really meaningful? Do they in fact measure what they are supposed to measure? When we see numbers presented to, say, 6 significant digits, is the implied precision appropriate or does it go beyond what can reasonably be claimed, given how the data were constructed?

In modern macroeconomic discussions, two key variables that are bandied around a lot are "real GDP" and "the price level." We quite often see long time-series given for these variables. But in this chapter Keynes argues that neither of these measures are well-defined outside of the short run. Apparently most macroeconomists these days think that Keynes was overly scrupulous, yet his arguments deserve attention. Think back to introductory macro. How *do* we define "real output of the US economy" when the mix of products is changing year by year (and changing quite radically decade by decade)?

Keynes comes down in favor of two macroeconomic measures that, he claims, are less "fuzzy" than real output and the price level, namely sums of money and sums of labor-time.

Question: How might one criticize Keynes's idea that "hours of labor" constitute a unit of measure that is truly homogeneous over time?

Propensity to Consume

The part of this discussion that we're most interested in is section III (pages 12–14). Here Keynes sets out what he claims is a “fundamental psychological law,” namely the people are disposed to “increase their consumption as their income increases, but not by as much as the increase in their income,” or in other words that the marginal propensity to consume is “positive and less than unity”. He also suggests that when real income increases, an increased *proportion* of income will be saved (not just an increased *amount*).

You should also look into section II: although Keynes emphasizes income as the primary “objective factor” governing the level of consumption, in section II he spells out various additional factors which may play a role. Among these he seems to give most weight to factor (3), “windfall changes in capital values.”

3 Keynes and the Data

OK, now it's time to try to match Keynes's theory up with the data. Note, however, that we will not follow Keynes in working in terms of “wage-units.” Rather, we will work in terms of the now-standard “real” values of consumption and income—but bearing in mind Keynes's comments on the limitations of such data.

1. Start gretl. Under the File menu, select **Browse databases**, on database server.
2. You'll now see a window displaying the various databases on the Economics department server. Take a look at what's available for future reference.
3. Select the `fedst1` database (St Louis Federal Reserve Bank). Click the **Install** button below to place a copy of this database on your computer.
4. Open the `fedst1` database. (From now on, you'll be able to find this database under **File, Browse databases, gretl native**—you don't have to go back to the server each time).
5. There are several hundred series in this database. We're looking for suitable measures of disposable income and consumption. Hint: for our purposes here, a good keyword to search on is “personal”. Start a search by clicking the **Find** menu item, continue by clicking **Find next**.
6. Once you've found suitable series for consumption and income, the next step is to import them into gretl's workspace. You can do this in any of three ways: drag the series from the database window to the main gretl window; highlight the series and select **Import** from the **Series** menu in the database window; or right-click and select “**Import**” from the pop-up menu.
7. The names of the imported series are a bit cryptic. For graphing, it would be nice to have more comprehensible labels. Select the income variable in the gretl main window and right-click. Select “**Edit attributes**” from the pop-up menu. Give the variable a “display name” of “income”. Do the same for the consumption variable, giving it a display name of “consumption”.
8. Now select both variables (you can do this with a mouse drag); right-click and select “**Time series plot**”. Think about what you see. Does it look to be compatible with what Keynes said? Is there anything else noteworthy about the graph?
Note that you can click on the graph window for a menu that lets you do various things, including zooming and copying the graph to the clipboard (from where you can put it into Word).
9. Now let's take a different view. At the foot of the main gretl window there's a toolbar. Click on the little graph icon to define an *X-Y* scatter plot. Which variable should go on the *X* axis and which on the *Y*? Once you've figured that, create the plot.

You'll notice that when gretl draws the scatter it automatically adds a “line of best fit” (actually, it does this only if the straight line of best fit provides a reasonably good fit to the scatter). Comment on the degree of fit in this case.

10. In this plot, we can't see if the line of best fit has a positive, zero or negative Y-intercept.¹ Click on the graph for the pop-up menu and select "Edit". Click on the "X-axis" tab and set the minimum to 0. Click "Apply" and get the dialog box out of the way. Any comments?

At this point it might be nice to put some numbers to the line of best fit that was shown on the consumption-income scatter plot. Here's how:

1. From gretl's Model menu, select Ordinary Least Squares. Select the consumption variable as dependent (double-clicking on the variable name is a shortcut for this action). Select the income variable as the independent (right-clicking on the variable name is a shortcut). Click "OK".
2. Whoa! There's a bunch of statistics in the window that appears. We'll concentrate on just a few of them.

§ The COEFFICIENT column in effect shows the equation of the line. The coefficient for const is the Y-intercept, and the coefficient for the income variable is the slope (in this example, the marginal propensity to consume). Think about these numbers, and comment.

§ At the right-hand end of the rows in the coefficient table are some "stars". These indicate "statistical significance". Roughly, if a variable has two or three stars at the end of its row, that's saying you'd be very unlikely to get a measured coefficient like the one shown, if the true effect were zero. In other words, we can be confident the true coefficient is not zero. In this case we can be confident, it seems, (a) that the true intercept is not zero, and (b) that there really is an upward-sloping relationship between income and consumption ("really", that is, as opposed to this just being a "luck of the draw" effect in the sample we're looking at).

4 The average propensity to consume

What's the deal with the intercept of the consumption function? Take literally, it seems to mean "the level of consumption that would take place if disposable income were zero." Viewed in this way, it doesn't seem to make sense that the intercept should be anything other than zero. For each individual household, if income is zero they can't keep on consuming for very long (they could for a short while by running down past saving), so a positive intercept seems to be out. But a negative intercept seems even worse. Negative consumption would have to mean selling off, not buying, consumer goods. This could not go on for long either. Then consider the fact that the macroeconomic consumption function is an *aggregate* relationship. Particular households might have an income of zero from time to time, but could aggregate disposable income ever be zero? That would mean that the economy had completely imploded, in which case all bets would be off regarding consumer behavior.

To make sense of the intercept, don't think of it as predicted consumption when income is zero. Its mathematical role is to allow for the possibility that *the fraction of income that people consume is not constant, but varies with the level of income.*

In general, the consumption function can be written as $C = a + bY$ where a is the intercept and b the slope. The slope is also known as the *marginal propensity to consume* (MPC for short), and it represents the fraction that consumers will spend out of any increment to their income. The *average propensity to consume* (APC for short), on the other hand, is the ratio

$$C/Y = \frac{a + bY}{Y} = \frac{a}{Y} + b$$

Suppose a is positive. That means that the APC is greater than the MPC. As Y increases, a/Y falls, so the APC also falls. Now consider a negative a . That would mean that the APC is less than the MPC, but it increases as income rises. The tables below illustrate this idea. The two functions are calibrated to give the same level of consumption (and an APC of 91 percent) out of an income of 5000. Notice how the function with $a > 0$, on the left, shows a decline in the APC as income rises, while the one on the right with $a < 0$ shows the APC rising with income.

¹Note that the x axis does not start at zero.

$C = 300 + .85Y$			$C = -300 + .97Y$		
Y	C	$C/Y = \text{APC}$	Y	C	$C/Y = \text{APC}$
2000	2000	1.000	2000	1640	0.820
3000	2850	0.950	3000	2610	0.870
4000	3700	0.925	4000	3580	0.895
5000	4550	0.910	5000	4550	0.910
6000	5400	0.900	6000	5520	0.920
7000	6250	0.893	7000	6490	0.927
8000	7100	0.888	8000	7460	0.933

Keynes was concerned with the possibility that the APC would fall with rising income. This would imply an increasing “gap” by which consumption falls short of income as the economy grows. If the economy is not to fall into under-employment, this gap must be plugged by investment spending. Keynes was worried that it would become progressively harder to find enough profitable investment opportunities to plug the increasing gap. Investment would have to increase as a percentage of GDP, but would there be sufficient incentive for this to occur? If not, a rich economy would have a perennial tendency towards unemployment.

On the other hand, if the intercept of the consumption function is negative, and hence the APC *rises* with increasing income, the problem that Keynes perceived seems less worrisome.

Is it really the case that the U.S. consumption function has a negative intercept, so that the APC increases with income, contrary to Keynes’s fears? If one doubts this, what alternative hypothesis might one propose? Recall that Keynes did not say income was the only factor governing consumption—he specifically mentioned changes in wealth as another factor. In the assignment to follow we will explore this possibility.