Econ 352 - A Two-Period Model: The Consumption-Savings Decision and Credit Markets

(See Williamson Ch. 9)

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Introduction

- We've seen some one-period models of Macro
- Can think about the "consumption-leisure" or "intratemporal" tradeoff
- But one-period model...what about future? No savings.
- Having isolated the consumption-leisure tradeoff, we turn to the "intertemporal" tradeoff: consume today vs consume tomorrow
- Just as the wage was a key driver of the intratemporal decision, the real interest rate will be a key driver of the intertemporal

Two-Period Model

- Note: while we'll do a two-period model, not much changes when we shift to a 200-period model
- Assume N consumers, with real income today y and real income tomorrow y', lump-sum taxes today t, and lump-sum taxes tomorrow of t'. Letting savings between periods be s, the first period's budget constraint is:

$$c + s = y - t$$

- The next period, savings recieve interest rate r (so total assets are now $(1 + r)s$, and the person consumes everything. Their budget constraint is:

$$c' = y' - t' + (1 + r)s$$

- Note that both equations have savings (s) linking them...really the consumer just faces one full lifetime budget constraint

Lifetime Budget Constraint-I

- Solving for s in the second-period:

$$s = \frac{c' - y' + t'}{1 + r}$$

- And plugging into the first period's budget constraint: $c + s = y - t$, we get:

$$c + \frac{c'}{1 + r} = y + \frac{y'}{1 + r} - t - \frac{t'}{1 + r}$$

- We call this the "lifetime budget constraint" because it's the total of all the income you have to spend over your whole lifetime

Lifetime Budget Constraint-II

- Lifetime budget constraint:

$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - t - \frac{t'}{1+r}$$

- The budget constraint is in terms of "today's dollars" but we could put it in terms of tomorrow's dollars by multiplying by $(1+r)$:

$$(1+r)c + c' = (1+r)y + y' - (1+r)t - t'$$

- What both are saying is that (when $r > 0$) money today is "more valuable." Increasing c by one today costs me $1 + r$ c' tomorrow. Decreasing c' by one tomorrow only increases c by $\frac{1}{1+r}$. Similarly with income!

- If the budget constraint doesn't make sense, let's give some examples

Lifetime Budget Constraint: Examples

- Let's say $y = y' = 1$, $r = 0.5$ (50% interest rate) and $t = t' = 0$ for simplicity.
- Then we have:

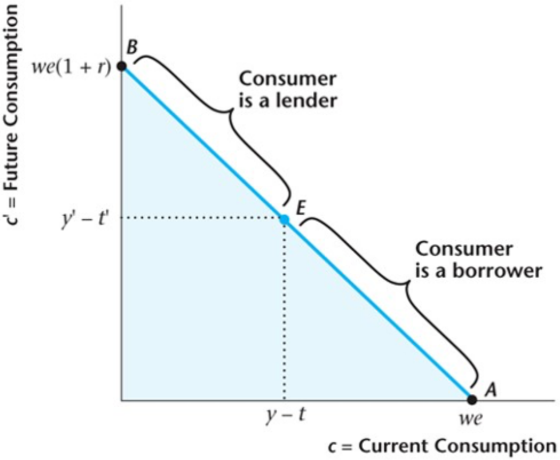
$$c + \frac{c'}{1.5} = 1 + \frac{1}{1+0.5} - 0 - \frac{0}{1+0.5}$$

- Or:

$$c = \frac{5}{3} - \frac{2}{3}c'$$

- If I spent all my money on today $c' = 0$, I could consume \$5/3. This makes sense: eat my \$1 of income today, take out a loan of \$0.66, and eat that too. Then when the second period rolls around, I owe \$1, and have \$1 in income, which I use to pay off my debt.
- If I spend all my money on tomorrow, $c = 0$, and I could consume \$2.5. How? I save my \$1 of income today, and it becomes \$1.5 tomorrow, when added to my \$1 of income tomorrow, allows me to buy \$2.5 worth of stuff tomorrow.

Consumer's Lifetime Budget Constraint

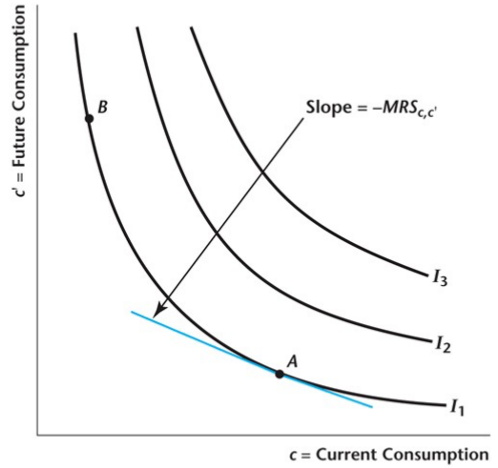


We have the B.C., now we need preference

Consumer preferences

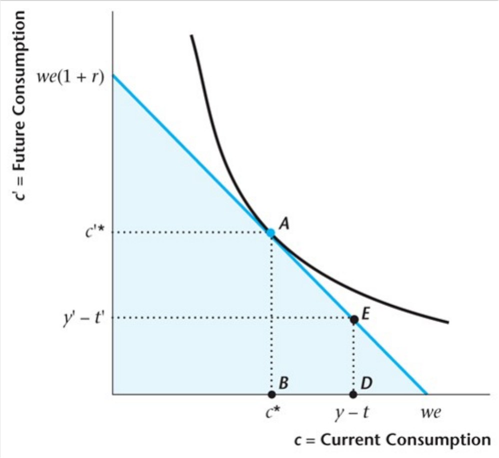
- Consumers always like more c and more c'
- The consumer likes variety. Roughly, $c = c' = 1$ is preferred to $c = 1.99$ and $c' = 0.01$.
- Both c and c' are normal goods: when lifetime wealth increases, we expect both to increase
- With this, we can graph indifference curves!

Consumer's Lifetime Budget Constraint



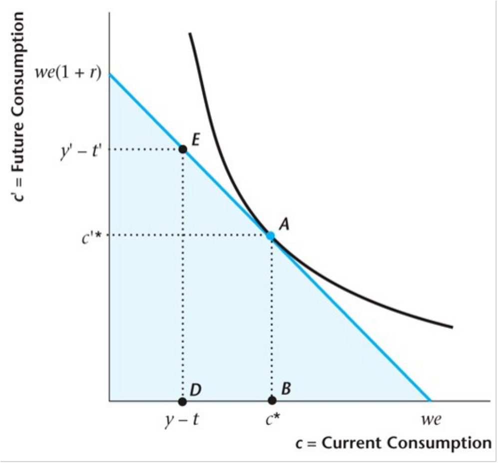
Just as in the wage example, we will always consume where $MRS = MRT$, in this case: $MRS_{c,c'} = 1 + r$

Lenders Consume Less today than Endowment



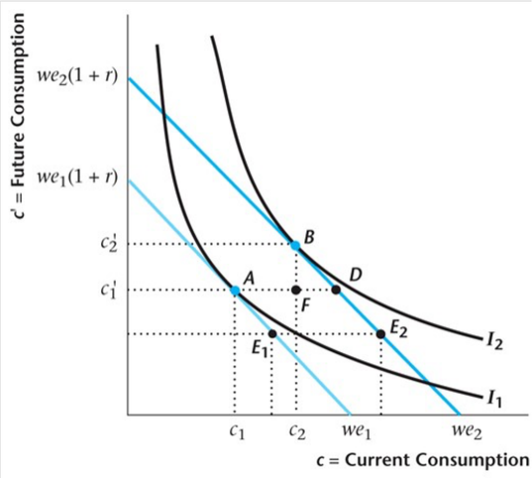
$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - t - \frac{t'}{1+r}$$

Borrowers Consume More today than Endowment



$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - t - \frac{t'}{1+r}$$

When lifetime today increases, we consume more of all normal goods



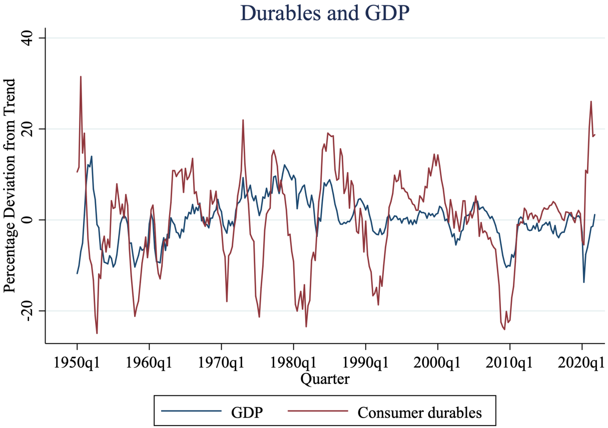
$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - t - \frac{t'}{1+r}$$

note you can't tell if it was y or y' that increased! Testable

Predictions

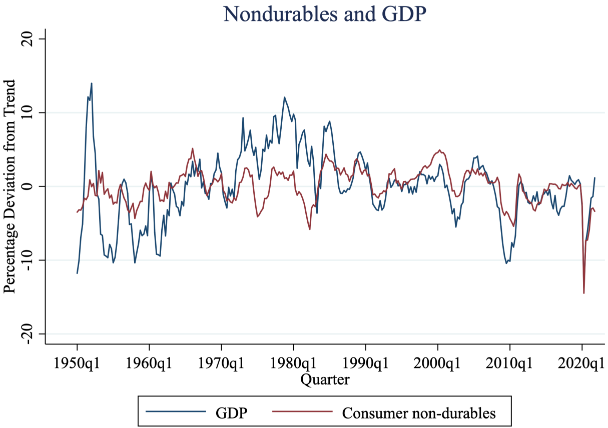
- If consumers like to smooth, we predict consumption should be smooth relative to income
- We can test this with our GDP/consumption graph
- But first note that durables should probably be with investment
- Let's take a look

Durables and GDP



Durables, a form of investment/saving, are volatile

Durables and GDP

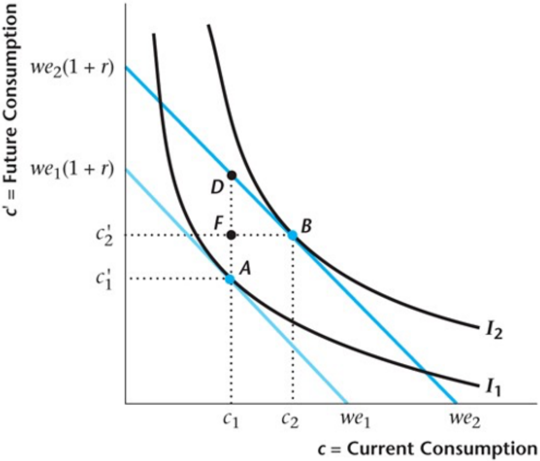


Nondurable consumption is less than half as volatile than GDP.
Still, there is excess variablility...

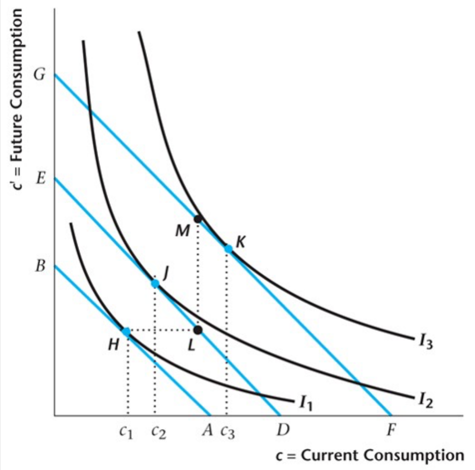
Excess Variability

- Perhaps there are imperfections in the credit market?
- Or consumers are trying to smooth (borrow when times are bad) and this raises interest rates, causing less smoothing in equilibrium

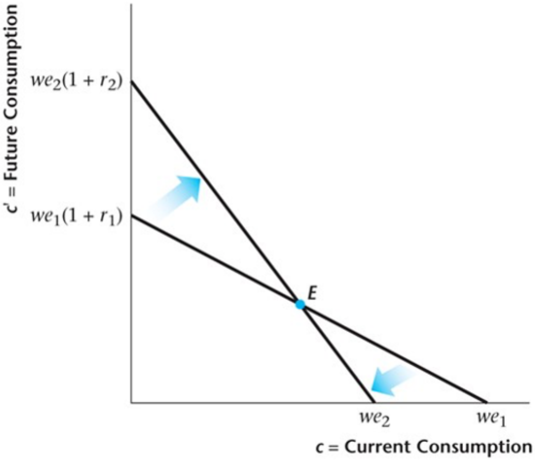
Increase in future income has same effect on lifetime income as increase in current income!



Temporary vs permanent changes!



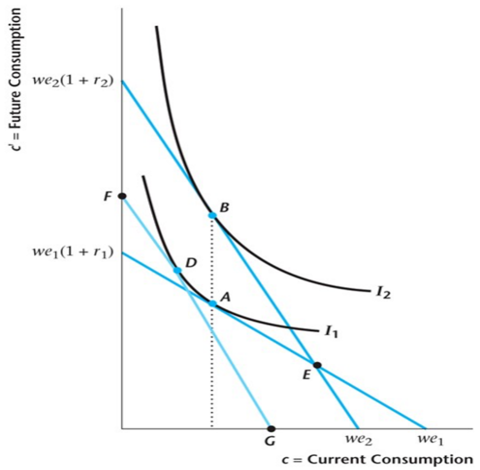
Changes in the real interest rate



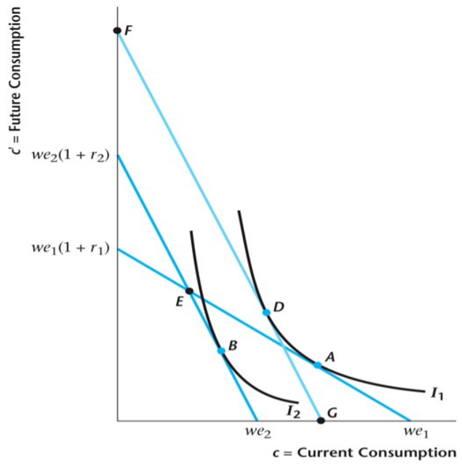
Changes in the real interest rate

- Thinking about income and substitution effects of a rise in real interest rates
- Borrower:
  - income effect: poorer, so $c \downarrow$, $c' \downarrow$
  - substitution effect: consumption tomorrow "cheaper", so $c \downarrow$, $c' \uparrow$
- Lender:
  - income effect: richer, so $c \uparrow$, $c' \uparrow$
  - substitution effect: consumption tomorrow "cheaper", so $c \downarrow$, $c' \uparrow$
- Unclear what happens to borrower c', but $c \downarrow$. Unclear what happens to lender c, but $c' \uparrow$. For both, $c'/c \uparrow$

Changes in the real interest rate: lender



Changes in the real interest rate: borrower



Government Budget Constraint

- We have the household, now we need a government which can spend on G, tax T and borrow B:

$$G = T + B$$

$$G + (1+r)B = T'$$

- Combining the two, we have the government's net present value budget constraint:

$$G + \frac{G}{1+r} = T + \frac{T'}{1+r}$$

- With this we can combine with the household to get an equilibrium

Equilibrium

1. Each consumer chooses optimal first and second period consumption, given y, y', and r (HH BC holds)

2. The government present-value budget constraint holds

3. The credit market clears

Equilibrium in Math

- Aggregate private savings must equal government bond holdings in closed economy with no capital:

$$S^P = B$$

- Total spending is done by households or government:

$$Y = C + G$$

- Note that we can derive the second from the first and the private BC:

$$S^P = Y - C - T$$

$$B = G - T$$

- Plugging in:

$$Y - C - T = G - T$$

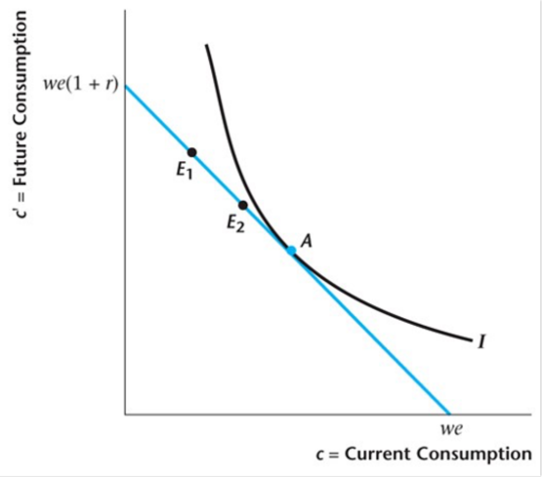
$$Y = C + G$$

- Yay.

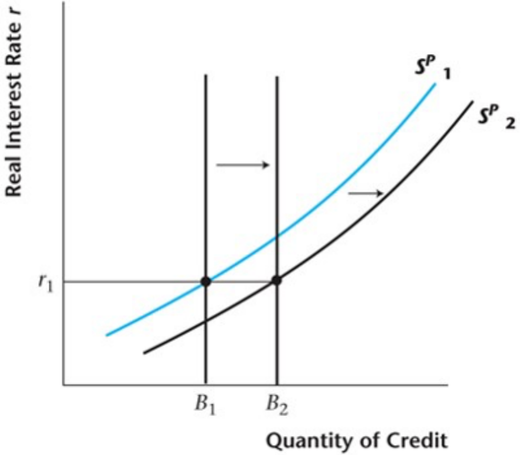
Ricardian Equivalence

- If this seems foolish, get ready for a wild prediction!
- Our model up until now predicts that a lump-sum tax cut with no fall in government savings will not change consumer behavior in the model
- Take the total tax burden for N consumers:
$$G + \frac{G'}{1+r} = Nt + \frac{Nt'}{1+r}$$
- Or:
$$t + \frac{t'}{1+r} = \frac{1}{N}\left[G + \frac{G'}{1+r}\right]$$
- Which we can plug into the consumer's budget constraint:
$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - \frac{1}{N}\left[G + \frac{G'}{1+r}\right]$$
- Implication: the household doesn't care about when taxation takes place, it only cares about total government spending!
- If we cut all (lump sum!) taxes today and put them to tomorrow, or vice versa, c and c' shouldn't change!

Ricardian Equivalence: no change in BC, just endowment



Ricardian Equivalence: credit markets



Ricardian Equivalence and the Burden of Government Debt

We made some assumptions

- Taxes are not redistributional (between people or across generations)
- Taxes are lump sum/non-distortionary
- Credit markets are perfect

The point is not that Ricardian Equivalence holds perfectly, but that intertemporal shifts in taxes are filtered through household intertemporal budget constraints

Federal Government Debt as a Percent of GDP

We made some assumptions