

MACROECONOMICS

73-240

LECTURE 17

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Plan for This Lecture

Goal: Understand optimal (micro!) savings decision of the representative household

- Recap the two period model: the household
 - Inter-temporal budget constraints
 - Optimality
- Fiscal Policy and Ricardian Equivalence
- Constrained Household

Guess what we will talk about today

top Washington Post

Trump advisers exploring tax proposal that would lower 'middle class' rate to 15 percent

Weeks before the 2018 midterms, Trump suddenly floated a 10 percent tax cut for the middle class, saying he was working on a "very major tax ...

In-Depth · 5 days ago



CNBC

Trump advisor Kudlow teases middle class tax cut as 2020 campaign heats up

President Donald Trump's top economic advisor, Larry Kudlow, hinted at a middle-class tax cut Tuesday as the president searches for an edge ...

5 days ago



W Yahoo News

Trump Eyes New Middle-Class Tax Cut – and a Massive Break for the Rich

President Trump's economic advisers are considering whether he should make the promise of a middle-class tax cut a central element of his ...

4 days ago



TWO PERIOD MODEL: THE GOVERNMENT

GOAL: UNDERSTAND EQUILIBRIUM EFFECTS OF TAX POLICY

The Dynamic Government

- Government spends and taxes in two periods
- NEW: now it can borrow and save!
- Budget constraint today

$$G = T + B$$

- Budget constraint tomorrow

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

- Life-time budget

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

Equilibrium in the Endowment Economy

- Only 2 agents in the endowment economy: Households and Govt
- Equilibrium requires:
 - Households optimally choose (c, c') to maximize their utility subject to lifetime budget constraint
 - Govt balances its lifetime budget
 - Markets clear:
 - Goods
 - Assets

$$Y = C + G$$

$$S = B$$

The Stimulative Impact of Tax Cuts

Questions we will ask:

- Conditional on constant $G + \frac{G'}{1+r}$ (no change in govt spending plans), does a tax cut today *stimulate* consumption spending?
 - Does the tax uniformly impact households of different types?
 - Does it depend on the type of tax levied?

Small note: because we are looking at an *endowment* economy where y, y' are exogenous, impact can only be on consumption and savings, if any. Some results we establish here will carry over to the *production* economy where y is endogenous

RICARDIAN EQUIVALENCE

Ricardian Equivalence

Main idea:

- **When** markets are perfectly competitive, there exists no frictions and taxes are non-distortionary ...
- the timing of taxes does not affect consumption patterns if government spending plans, i.e. G, G' , are unchanged.

Ricardian Equivalence: In words

Suppose the government today lowers T by 100\$ and raises B by 100\$ but doesn't change its government spending plans.

- If $r = 3\%$, tomorrow the government owes 103\$ taxes tomorrow go up by 103\$.
- Household has two course of actions:
 - ① Keep same spending on C , today save 100\$, tomorrow earn 103\$ and use to pay increased taxes.
 - ② Spend today the extra 100\$, today save 0\$, tomorrow lower consumption by 103\$ to pay for taxes.
- What would the household do?

Ricardian Equivalence

- Punchline: the timing of taxes is irrelevant
- Key equation: lifetime budget constraint (in today's \$)

$$\underbrace{c + \frac{c'}{1+r}}_{\text{present value of consumption}} = \underbrace{y + \frac{y'}{1+r}}_{\text{...of income}} - \underbrace{\left(t + \frac{t'}{1+r}\right)}_{\text{...of taxes}}$$

Let $T = t$ (assuming size of population equal 1, otherwise let $T = N \cdot t$)

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

substituting in consumer lifetime budget (since $t = T$)

$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - \left(G + \frac{G'}{1+r}\right)$$

r constant \implies changes in t and t' don't matter

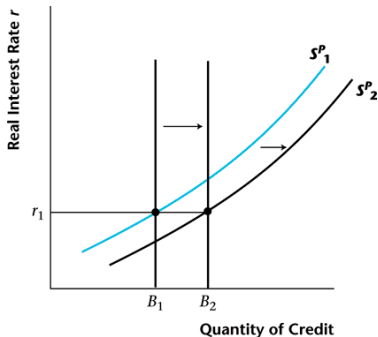
Ricardian Equivalence

- Suppose current taxes change by Δt and future taxes change by $-\frac{\Delta t}{1+r}$
- Now, think about equilibrium conditions (all these things occur simultaneously):
 - Life-time Budget constraint of Gov't: unchanged
 - Life-time budget constraint of HH: unchanged
 - \Rightarrow Optimal consumption plan of household: unchanged. $C = Y - G$ unchanged.
 - The only variable responding to the change in T today is $S = Y - C - T$
 - But since $T = G - B \implies \Delta S = \Delta Y - \Delta C - (\Delta G - \Delta B) = \Delta B$.
 S increases by same amount as B . Credit market still clears at r .

Only effect of change in taxes is a change in private savings

Ricardian Equivalence: Credit Markets

- Does r change?
No: since demand and supply of assets cancels out
- Think about the previous example



Note: S^P is private demand for saving

Cutting taxes without cutting government spending

- No stimulative effect from temporary tax cut in period 1.
- When government announces temporary tax cut $t \downarrow$ but does not change lifetime spending (G, G') , households anticipate $t' \uparrow$.
- Since people eventually have to pay back more taxes so that govt can pay back its debt \Rightarrow No effect on permanent income!
- Hence no change in consumption
- Instead Household responds to tax cut today by saving more today.
- Additional saving invested in government bond

Tax Rebates of 2008

- Economic Stimulus Act of 2008 signed by President George W. Bush
- 2/3 of the \$ 152 bn bill = economic stimulus payments to households.
- Between May and July 2008, HHs received \$300-\$1,200 tax rebate checks
- Unexpected, transitory addition to *current* income
- Survey of Consumers: ask households what they will do with the rebate.

Tax Rebates of 2008

- What did HHs plan to do with their rebate?

Intended Disposition of Tax Rebate	Percentage of Respondents Receiving Rebates
Mostly Spend	19.9
Mostly Save	31.8
Mostly pay off debt	48.2

Source: Shapiro and Slemrod, “Did the 2008 Tax Rebates Stimulate Spending,” *American Economic Review*, 1999.

Tax Rebates of 2008

- Plans to spend increased with age

Table 2. Spending the 2008 Rebate, By Age

Age Group	Percent Mostly Spending
29 or less	11.7%
30-39	14.2%
40-49	16.9%
50-64	19.9%
Age 64 or less	17.0%
Age 65 or over	28.4%

Source: Shapiro and Slemrod, "Did the 2008 Tax Rebates Stimulate Spending," *American Economic Review*, 1999.

Tax Rebates of 2008

- Possible evidence of Ricardian equivalence?



Source: Shapiro and Slemrod, "Did the 2008 Tax Rebates Stimulate Spending," *American Economic Review*, 1999.

Note: Graph does not report the amount saved from the rebate.

Ricardian Equivalence: Important Assumptions

Some important assumptions are required for Ricardian Equivalence to hold:

- ➊ Taxes are equal for all household types (everybody pays the same tax)
- ➋ Debt repaid while you are alive
- ➌ Lump sum taxes
- ➍ Credit markets **without frictions**

WHAT IF THE HOUSEHOLD FACES BORROWING CONSTRAINTS?

A Household with a No-Borrowing Constraint.

- One borrowing constraint we can think of is if households could not borrow at all, i.e.

$$s \geq 0$$

- In this case, this is like a HH who has no access to credit.
- Do we still get Ricardian Equivalence?

A Household with a No-Borrowing Constraint.

- Notice that if a household's optimal decision is to save today, he is not affected by the borrowing constraints since, $s^* > 0$.
- The constraint only affects households who would like to be borrowers.

A Household with a No-Borrowing Constraint.

- Suppose $y' - t' > y - t$ and $\beta = \frac{1}{1+r}$. Find the household's optimal c and s today if there was no borrowing constraint.
- Suppose $y' - t' > y - t$ and $\beta = \frac{1}{1+r}$. Find the household's optimal c and s today if households cannot borrow i.e. $s \geq 0$.

A Household with a No-Borrowing Constraint.

- If there are no borrowing constraints, we solve the usual problem:

$$\max_{c, c'} U(c, c')$$

s.t.

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

- From the optimality condition, and knowing that $\beta = \frac{1}{1+r}$, we have:

$$c = c'$$

- Plug into lifetime budget constraint:

$$c^* = \frac{(1+r)(y-t) + y' - t'}{2+r}$$

- Use first period budget constraint to find s

$$s^* = y - t - c^* = \frac{(y-t) - (y' - t')}{2+r} < 0$$

since $y - t < y' - t'$

A Household who cannot borrow

- We have just seen that for a household with $y - t < y' - t'$ and $\beta = \frac{1}{1+r}$, the household would like to borrow, $s^* < 0$, and therefore $c^* > y - t$.
- Suppose now, the household cannot borrow, savings are constrained to be $s \geq 0$. What is c^* and s^* in this environment?

A Household who cannot borrow

- HH would like to borrow and have $c^* > y - t$, but now he is not allowed to borrow.
- Best he can do: $s = 0$.
- Which implies: $c = y - t$, $c' = y' - t'$.

A Household who cannot borrow and a tax cut today.

- Suppose again the household would like to borrow but is not allowed to. And suppose now there is a tax cut today: $t \downarrow$, and no change in govt spending.
- Again, govt budget constraint must balance

$$G = T + B$$

- $T \downarrow \implies B \uparrow$.

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

- which further implies $T' \uparrow$, tax increases tomorrow to finance tax cut today

A Household who cannot borrow and a tax cut today.

- Let the lower tax today be given by \hat{t} and the higher tax tomorrow be given by \hat{t}' , where $\hat{t} < t$ and $\hat{t}' > t'$.

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

- Assume still that despite the tax change, $y' - \hat{t}' > y - \hat{t}$, and $\beta = \frac{1}{1+r}$ and household not allowed to borrow.
- We know that above implies $s^* = 0$,

$$c^* = y - \hat{t}$$

Which implies that

$$\Delta c^* = \Delta t$$

Consumption responds to the tax!

A Household who cannot borrow and a tax cut today.

- Punchline: Ricardian Equivalence does not hold if there are credit market frictions!

Households and Differential Access to Credit

Define $y^{disp} = y - t$

- Households with differential access to credit will exhibit different marginal propensities to consume (MPC), $\frac{\partial c}{\partial y^{disp}}$.
- With *no borrowing constraints*, previous example showed that:

$$\frac{dc}{dy^{disp}} = \frac{1+r}{2+r} < 1$$

- If household is **borrowing** constrained and wants to borrow:

$$\frac{dc}{dy^{disp}} = 1$$

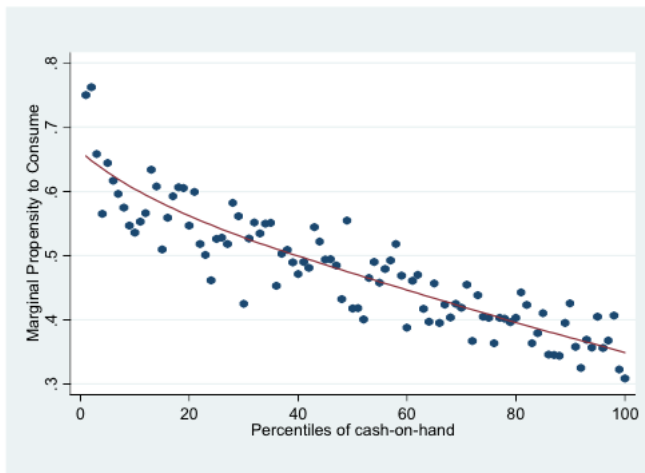
If you had to use lump-sum taxes, which segment of the population would you target to stimulate spending with a tax cut?

Households and Differential Access to Credit

- Model says that households with differential access to credit will exhibit different MPCs, $\frac{\partial c}{\partial y^{disp}}$.
- Does this show up in the data?

Households and Differential Access to Credit

Define cash-on-hand as: sum of household disposable income and financial wealth, net of consumer debt.



WHAT IF THERE ARE DISTORTIONARY TAXES?

Ricardian Equivalence: Assumptions

- ① Question: will Ricardian Equivalence still hold if we have distortionary taxes?
- ② Example of distortionary tax? proportional tax on consumption expenditures

Government budget constraint

- 1 1st period budget constraint:

$$G = tC + B$$

- 2 2nd period budget constraint:

$$G' + (1 + r)B = t'C'$$

- 3 Life time budget constraint:

$$G + \frac{G'}{1 + r} = tC + \frac{t'C'}{1 + r}$$

Household problem

- ① Maximize utility by choosing (c, c')

$$\max_{c, c'} U(c, c') = u(c) + \beta u(c')$$

s.t.

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

Observe no lump-sum taxes. Here only taxes are proportional taxes on (c, c') .

Household problem

- ① Setting up Lagrangian, taking first order conditions, we get two optimality conditions

- Affordability

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

- Desirability $MRS_{c,c'} = \text{opportunity cost of } c \text{ today}$

$$\frac{u'(c)}{\beta u'(c')} = \frac{1+t}{1+t'}(1+r)$$

- observe that the relative price of consuming today is affected by the ratio of taxes!

$$u'(c) = (1+r)\beta u'(c') \frac{1+t}{1+t'}$$

- Change in ratio of taxes will affect marginal benefit vs. marginal cost of consumption today.

- ② Try solving for c when $U(c, c') = \ln c + \beta \ln c'$

USING OUR MODEL TO UNDERSTAND THE 2007 HOUSING CRISIS

Question:

- We have seen that when there are credit frictions present, Ricardian Equivalence need not hold
- But we could ask: why are there credit frictions?

Credit Frictions

- One Possibility: Bank does not know if you have the **willingness** to repay the loan
 - We call this a problem of **Moral Hazard**
 - Here, the bank knows the individual can repay the loan
 - But can't prevent the individual from running away with the money
- Here the credit friction stems from the bank's unwillingness to lend since it cannot control the individual's actions

Credit Frictions

- A **Credit Friction** is : any type of obstacle, either technological or institutional that prevents an optimal level of trade in the credit market.

- Tackling Moral Hazard:
 - If defaulting on a loan is costless, borrowers will have a great incentive to always default!
 - Bank wants to create an incentive to ensure that the borrower does not default
 - One way to do so: make the household pledge collateral towards a loan
 - If the borrower does not repay, bank takes the collateral that was pledged.

Households and Borrowing Constraints

- Rather than a no-borrowing constraint, we usually think that households can get access to loans by pledging collateral
- **Collateral:** An asset owned by the borrower that the lender has a right to seize if the borrower defaults on the loan.

Households and Borrowing Constraints

- One asset a household usually uses as collateral to borrow against is the value of his house.
- Let pH be the value of a house, where p is the housing price level and H represents housing units
- Note that housing is an **illiquid** asset.
(it takes time to find a buyer for a house and to convert the house into current consumption)

Households and Housing Collateral

- It takes time to sell your house
- We will model this ‘time to sell’ as that you can only receive the value of your house in the second period.

$$c + s = y - t$$

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

- Notice pH is the value you get from selling your house in the second period.

Households and Housing Collateral

- Use second period budget constraint and make s subject of equation:

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

- Stick into first period budget constraint to get lifetime budget constraint:

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

Households and Housing Collateral

- How much is a bank willing to lend if a household pledges his house as collateral?

- Bank will lend up to the amount of the collateral:

$$s \geq -\frac{pH}{1+r}$$

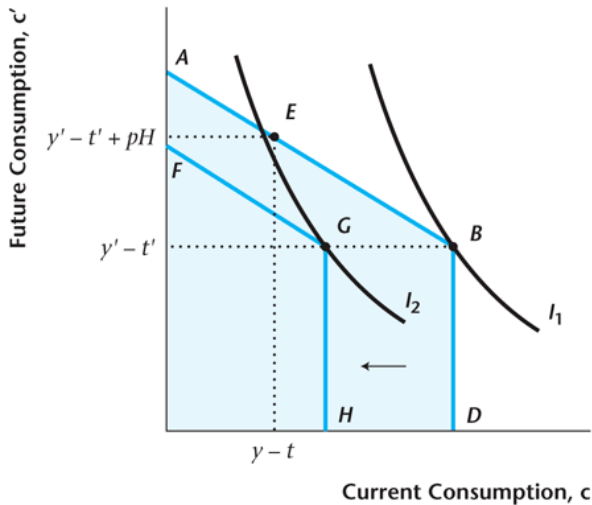
remember negative savings is positive borrowing!

- The above equation represents the collateral constraint of the household.
- A household that wants to borrow up to the maximum has

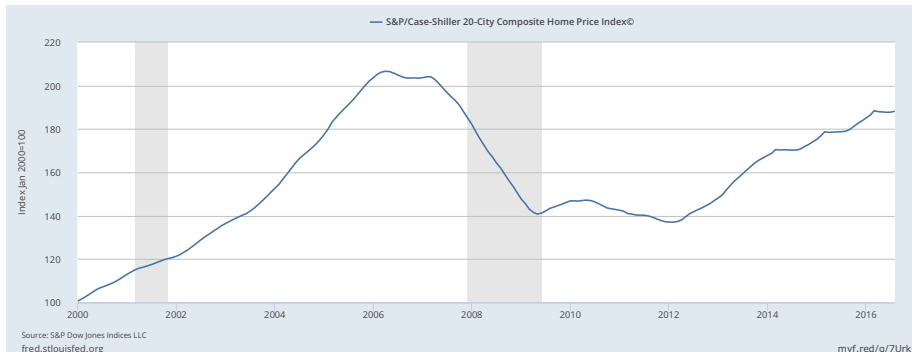
$$c^{max} = y - t + \frac{pH}{1+r}$$

- Graphically, what does the household's budget constraint look like?

Households and Housing Collateral



What happened to Housing Prices?



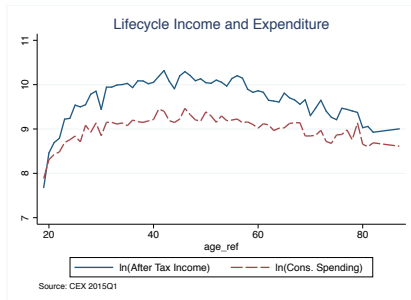
- Housing prices fell dramatically during Great Recession.

SUMMARY

Summary

A model to:

- rationalize the (non-constant) gap between consumption and income
- understand why consumption is smooth(er) over the lifetime than income
- Hence: a model where HHs choose how much to consume and save.



Summary

We used our model to:

- understand how temporary changes in income affect consumption (MPC)
- showed that permanent income (present value of wealth) mattered more for consumption
- showed how changes in r affect c and c'
 - substitution effect vs.
 - income effect (different for saver vs. borrower)
- Showed how taxes affect consumption spending