Chapter 6

- Start putting macroeconomy together
  - Build model of household so we can think about behavior
- Need markets, choices, tradeoffs, Budget constraints

Four markets

- Goods market (Y, P, C, I)
- Labor market (L, w)
- Rental market (K, R)
- Bond market (B, i)

Income

$/hour hours

Wage income: $W \cdot L$

Rental income: $R K - \delta P K$

R: $/machine hour; K: machine hours; $\delta P K$: Replacement cost in dollars

Interest income: $i B$

i: interest; B: last-pd dollars of bonds

Profit from firms: $\Pi = Y - wL - RK$

Total nominal income $= \Pi + wL + \left(\frac{R}{P} - \delta\right) PK + iB$

PK: $ val of machines

"net profit" income

$\frac{R}{P}$: net return

Nominal

Expenditures / Assets

- Consumption, PC
- Savings
  - Money $\circ$ ΔM ∈ (assume $\Delta M = 0$ for now)
  - Capital $\circ$ $P\Delta K$
  - Bonds $\circ$ ΔB

) two ways of saving... what must be true?

$$i = \frac{R}{\rho} - \delta$$

otherwise arbitrage

i: what I get if I spend $1 on bonds

$\frac{R}{\rho}$: what I get if I spend $1 on capital

δ

Nominal

Household Budget constraint

Total Nominal Inc = Total Nominal Exp

replaced $(\frac{R}{P} - \delta = i)$

$$\Pi + WL + i(B + PK) = PC + \Delta B + P\Delta K$$

savings/wealth — cons — savings

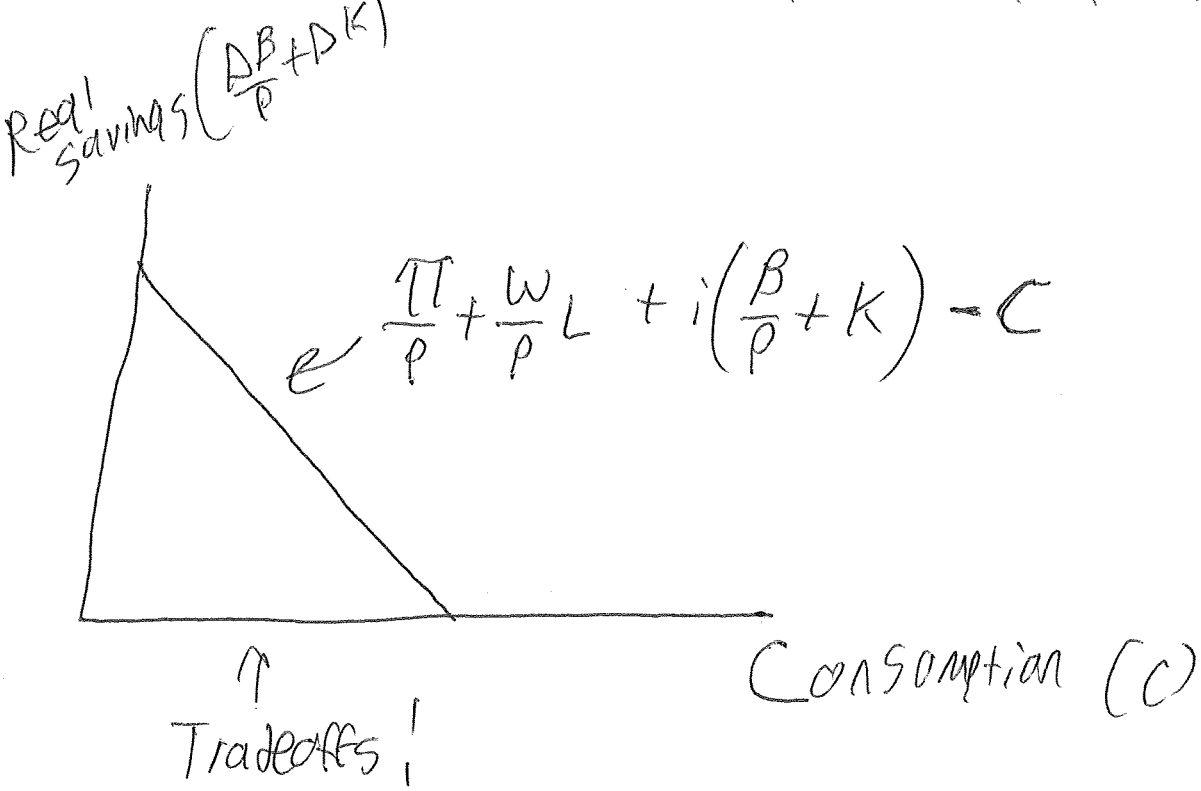
net inc

How make it real? Divide by P

$$\frac{\Pi}{P} + \frac{W}{P}L + i\left(\frac{B}{P} + K\right) = C + \frac{\Delta B}{P} + \Delta K$$

real profits — real wage — real bonds — real capital

Important tradeoff consumption today vs saving (cons in future)



what happens when Π increases? Shifts out.

Now derive multi-period B.C.

Real BCs

$$C + \frac{\Delta B}{P} + \Delta K = \frac{\Pi}{P} + \frac{w}{P}L + i\left(\frac{B}{P} + K\right)$$

net savings = 0, from profit max + CRS

$$C_1 + \frac{\Delta B_1}{P} + \Delta K_1 = \frac{w}{P}L_1 + i\left(\frac{B_0}{P} + K_0\right)$$

$$\frac{B_1 - B_0}{P} + K_1 - K_0$$

$$C_1 + \frac{B_1}{P} - \frac{B_0}{P} + \frac{K_1}{P} - \frac{K_0}{P} = \frac{w}{P}L_1 + i\left(\frac{B_0}{P} + K_0\right)$$

$$C_1 + \frac{B_1}{P} + \frac{K_1}{P} = \frac{w}{P}L_1 + (1+i)\left(\frac{B_0}{P} + K_0\right) \qquad \text{BC in pd 1}$$

gross savings

gross capital income

But advance 1 period

$$C_2 + \frac{B_2}{P} + K_2 = \frac{w}{P}L_2 + (1+i)\left(\frac{B_1}{P} + K_1\right) \qquad \text{BC in pd 2}$$

We can combine to get pd 1 + pd 2 BC "NPV" BC

$$\frac{C_2}{1+i} + \frac{\frac{B_2}{P}}{1+i} + \frac{K_2}{1+i} - \frac{\frac{w}{P}L_2}{1+i} = \frac{B_1}{P_1} + K_1$$

"two-period BC"

$$\Rightarrow \boxed{C_1 + \frac{C_2}{1+i} + \frac{\frac{B_2}{P}}{1+i} + \frac{K_2}{1+i} = \frac{w}{P}L_1 + \frac{\frac{w}{P}L_2}{1+i} + (1+i)\left(\frac{B_0}{P} + K_0\right)}$$

But!

$$\frac{B_2}{P} + K_2 = \frac{C_3}{1+i} + \frac{B_3/P}{1+i} + \frac{K_3}{1+i} - \frac{w}{P}L_3$$

$$\Rightarrow C_1 + \frac{C_2}{1+i} + \frac{C_3}{(1+i)^2} + \frac{B_3/P}{(1+i)^2} + \frac{K_2}{(1+i)^2} = \frac{w}{P}L_1 + \frac{\frac{w}{P}L_2}{1+i} + \frac{w/P\,L_3}{(1+i)^3} + (1+i)\left(\frac{B_0}{P} + K_0\right)$$

Do this forever, get the "many-year BC"

$$\boxed{\sum_{t=1}^{\infty} \frac{C_t}{(1+i)^{t-1}} = \sum_{t=1}^{\infty} \frac{\frac{w}{P}L_1}{(1+i)^{t-1}} + (1+i)\left(\frac{B_0}{P} + K_0\right)}$$

- Forget about savings, it's just accounting
- Really? what you eat (in NPV) is what you earn (in NPV), plus what you started with

Lets think clearly about the tradeoffs now

(8)

Trevor's simple B.C.:

$$C_1 + S_{1\to 2} = w_1 L_1 + V_1$$

↑ cons ↑ saving ↑ lab inc ↑ prop inc

$$C_2 = w_2 L_2 + V_2 + (1+i) S_{1\to 2}$$

$$S_{1\to 2} = \frac{C_2}{1+i} - \frac{w_2 L_2}{1+i} - \frac{V_2}{1+i}$$

Two-period B.C.

$$C_1 + \frac{C_2}{1+i} = w_1 L_1 + \frac{w_2 L_2}{1+i} + V_1 + \frac{V_2}{1+i}$$

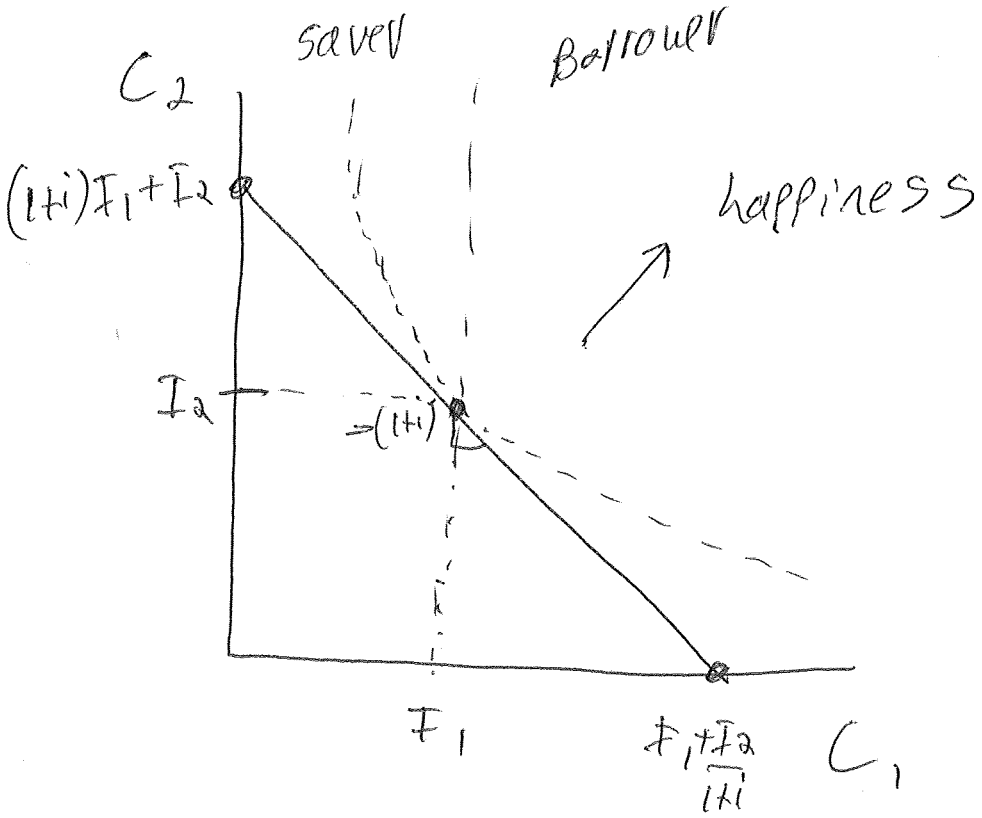
Three questions:

- How much work vs consume?
- when consume?
- when work?

simplify the "when consume" question

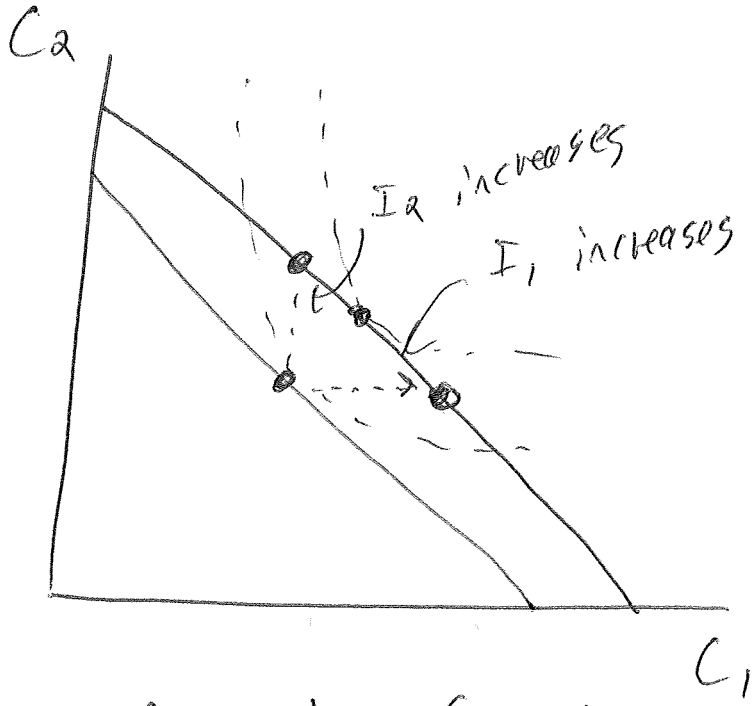
$$w_t h_t + V_t = I_t \leftarrow \text{fixed}$$

$$C_1 + \frac{C_2}{1+i} = I_1 + \frac{I_2}{1+i} \Rightarrow C_2 = (1+i)I_1 + I_2 - (1+i)C_1$$



- define curve of equal happiness "isoutility curve"

- what happens when I_1 increases by \$1.?
- what happens when I_2 increases by \$1 (1x)?

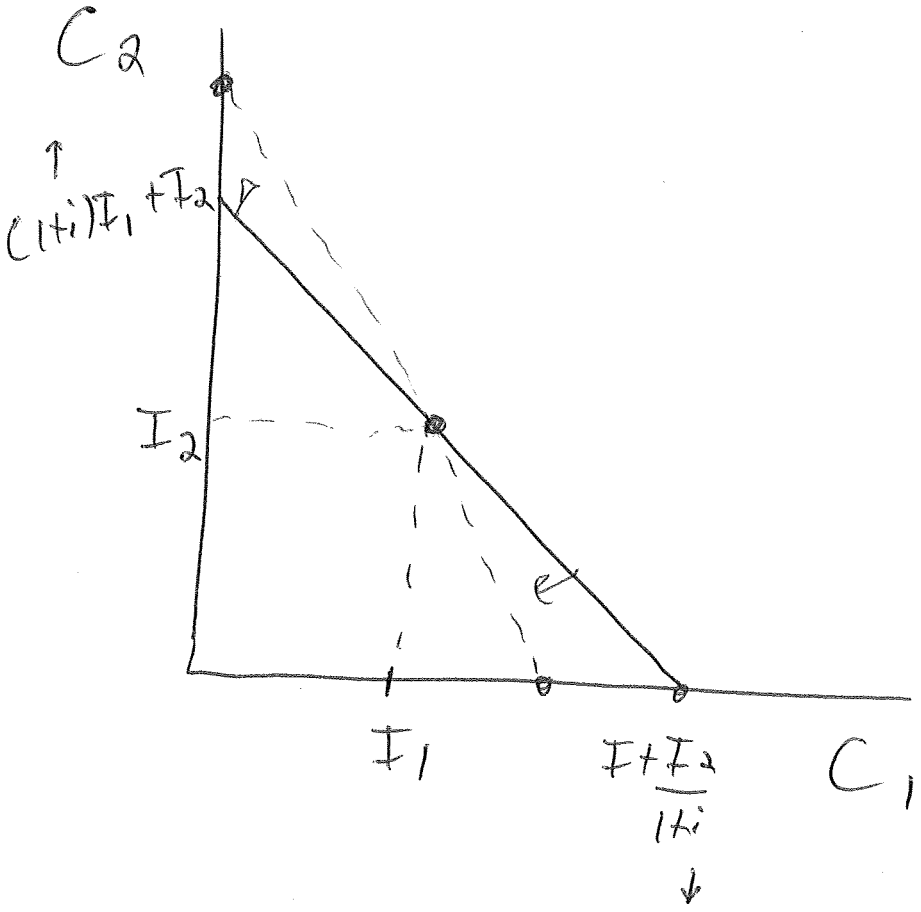


- what happens to C_1 when I_1 incr.? I_2 incr.
- what happens to C_2 when I_2 incr.? I_1 incr.?

Points All same (Doesn't matter when you get your money!)

- want to smooth consumption

- what happens when interest rates rise?



↓

when richer, consume more

- Income effect: ~~get saver, ric~~ of everything, (C_1↑, C_2↑)
- Substitution effect: when something is expensive, do less of it! (when i↑, C_1↓, C_2↑)

if

Saver (inc r)	C_1	C_2	$\frac{C_2}{C_1}$
Income effect	↑	↑	(-)
substitution effect	↓	↑	↑
total	? (small)	↑	↑

Borrower (inc b)	C_1	C_2	$\frac{C_2}{C_1}$
Income effect	↓	↓	(-)
sub effect	↓	↑	↑
total	↓	? (small)	↑

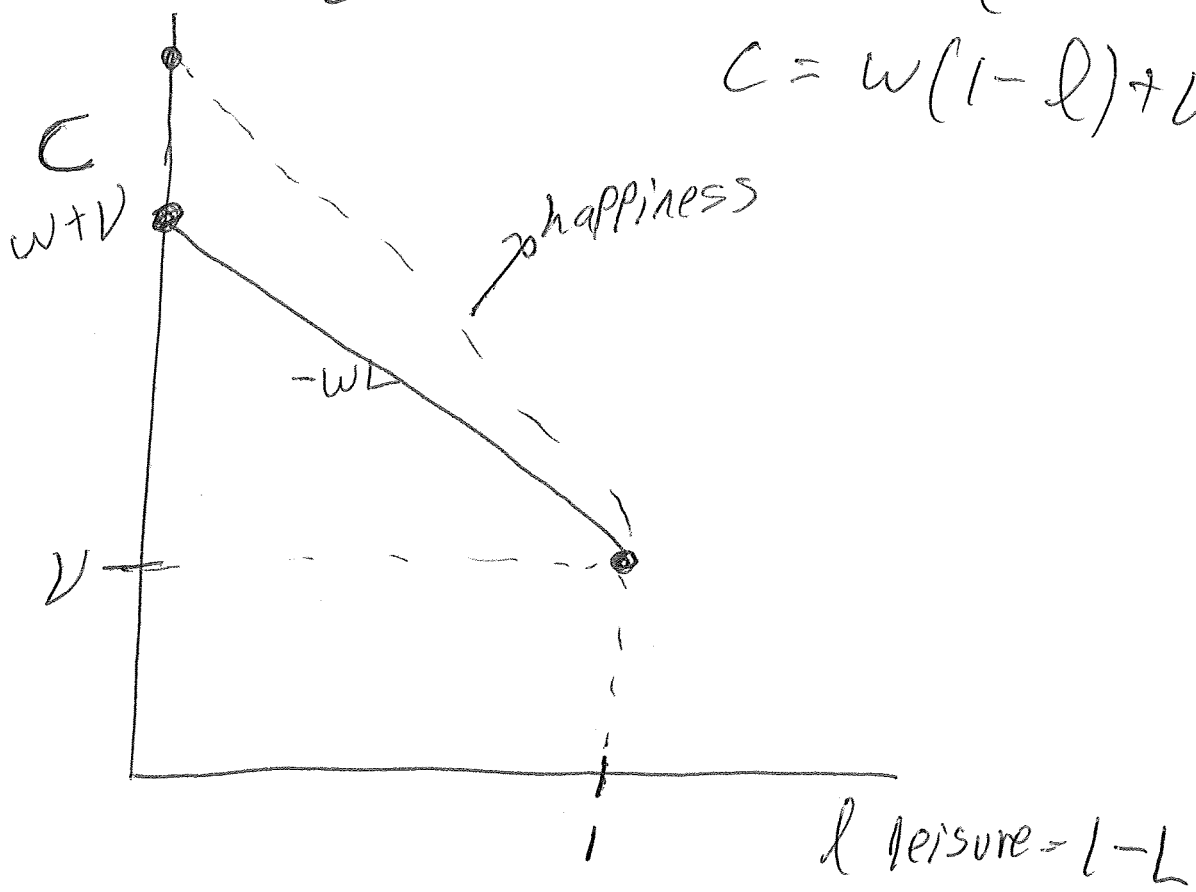
So, if Borrower, definitely consume less now, probably consume less tomorrow

if Saver, definitely consume more tomorrow.

Next question: How much work vs. consume?

$C = wL + V$ or ~~$C = w(1-l)$~~

$C = w(1-l) + V$

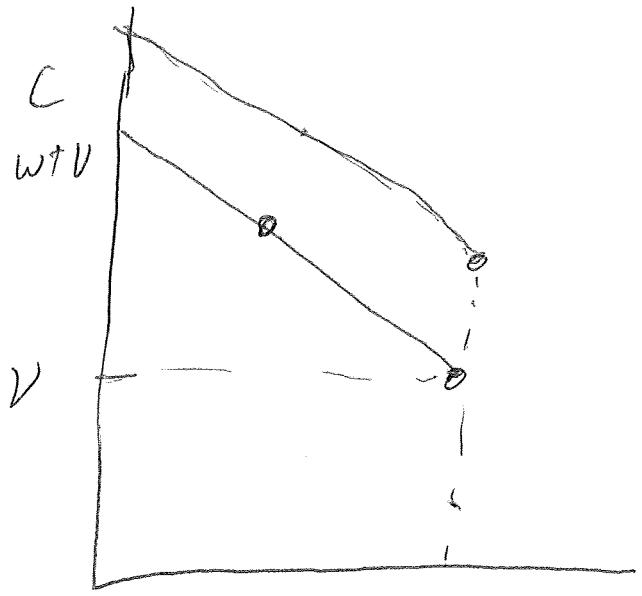


what happens when w ↑

- Income effect: consume more C and l, work less
- Substitution effect: consume more C, less l, work more.
- Result: unclear, largely balance.

How

What happens when $\bar{V}$ increases?



- Income effect ⇒ work less
- Sub effect ⇒ not present
- Result ⇒ work less

when work?

$$C_1 + \frac{C_2}{1+i} = w_1 L_1 + \frac{w_2 L_2}{1+i}$$

ASSUME $i = 0$, $C_1 = C_2$

$$2C = w_1 L_1 + w_2 L_2$$

$$C = \underline{w_1^* L_1} + \underline{w_2^* L_2}$$

- ~~Two countervailing effects:~~
  - when $w\uparrow$, total effect unclear bc inc and sub offset
  - But if $w_1 \uparrow$, w_2 o, then work more in pd 1, less in pd 2 (intertemporal substitution of labor) Income effect watered down, all substitution effect

Last class

One-period real budget constraint

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P} L + i\left(\frac{B}{P} + K\right) \quad \text{or} \quad C + S^{(1+i)} = wL + S$$

Two-period real budget constraint

$$C_1 + \frac{C_2}{1+i} + \frac{\frac{B_0}{P}}{1+i} + K_2 = \frac{w}{P} L_1 + \frac{\frac{w}{P} L_2}{1+i} + (1+i)\left(\frac{B_0}{P} + K_0\right)$$

or

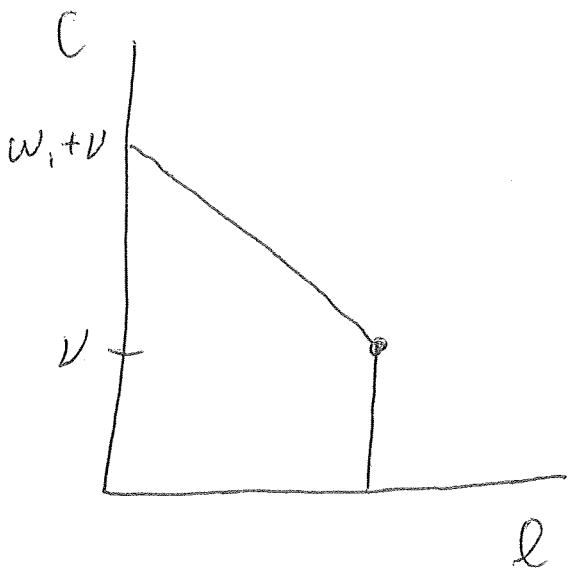
$$C_1 + \frac{C_2}{1+r} + \frac{S_{2\to 3}}{1+r} = w_1 L_1 + \frac{w_2 L_2}{1+r} + (1+r)(S_0)$$

Three Questions

- How much to work & consume over lifetime
- ~~How much~~ when to work
- When to consume?

- Two basic principles
  - ~~When~~ Income effect: when you are richer, do more of all normal goods
  - Substitution effect: when something is relatively expensive, do less of it.

One-period C vs. ℓ tradeoff



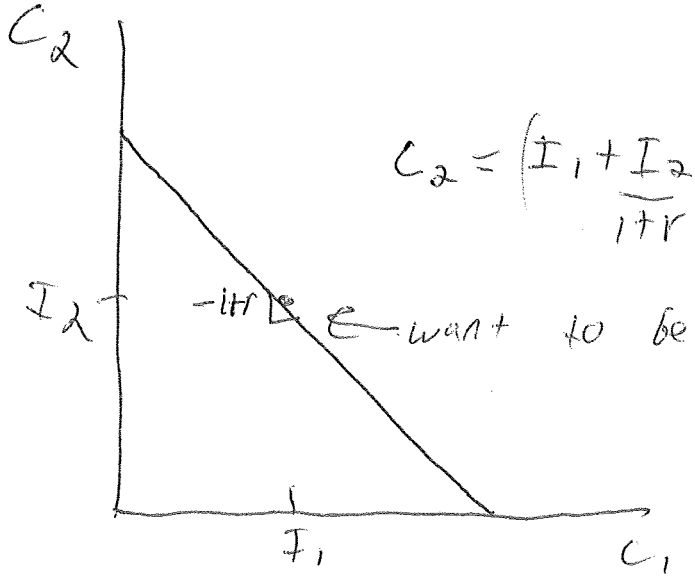
can change v (pure income effect)

or w (inc & sub effects)

Now, when to consume?

$$C_1 + \frac{C_2}{1+r} = w_1 L_1 + \frac{w_2 L_2}{1+r} + (1+r)S_0$$

$$\Rightarrow \quad C_1 + \frac{C_2}{1+r} = I_1 + \frac{I_2}{1+r}$$



$$C_2 = \left(I_1 + \frac{I_2}{1+r} - C_1\right)(1+r)$$

← want to be in middle

Make table

- Important doesn't matter when get money!

- Does matter r (i in barro)
  - ~~$\frac{C_2}{C_1}$~~ incr in r by 0.5% Big!

Two concepts: MPC out of predicted permanent I

- Prediction: higher interest rates mean less consumption today, more tomorrow

  = 1% increase in $r \Rightarrow$ C_1 ↓ 0.5% ← percentage points

  - 1% increase in $r \Rightarrow \frac{C_2}{C_1} - 1 \uparrow + 0.33$

  - Hypothesis survives!

- Prediction: get tons of money today, increase consumption by a little. (not 100%)

  1957 = Israeli citizens get about 1-years income bonus

  - Spent about 20% of it in first year, much on ~~goo~~ multiyear consumption goods.

  1951 = In 1951, WWII vets got 4% annual income ($175) bonus and spent about $61, or 35%.

  - Hypothesis survives!

- Prediction: get tons of money ~~tomorrow~~ in Q4, ~~increase consumption today~~ smooth cons.

  - Alaskans get $8000/person each year in 4th Q
  - Smooth cons. even with variations
  - When getting tax refunds, nondurable consumption increases by 10%

- when do people work?

$$C = w_1 L_1 + \frac{w_2 L_2}{1+r}$$

- under when $w_1 \uparrow$, $w_2 \uparrow$, unclear, L_1 & L_2 change little, b/c income $\uparrow$, sub $\downarrow$.

- But what if just $w_1 \uparrow$? Then inc effect small, sub big!

- Intertemporal substitution: make hay when sun shines

- Big: A 1% change in $w \uparrow$ L by 0.75%!