TOPIC 3

Consumption, Saving and Investment
Goals for Today’s Class – Start Modeling Aggregate Demand (AD)

• What drives business investment decisions?

• What drives household consumption?

• Does consumption theory accurately match the data?

• What theories of consumption seem to match the data?

• What role can the government play in shaping spending?

• Should a distinction be made between unexpected and expected changes and permanent and temporary changes?

• What is the link between consumption and savings?
Part I: Investment
Decomposing The 2008 Recession

<table>
<thead>
<tr>
<th></th>
<th>Y</th>
<th>C</th>
<th>I</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 GDP Share</td>
<td>1.000</td>
<td>0.671</td>
<td>0.168</td>
<td>0.197</td>
</tr>
<tr>
<td>% Δ 2007:4-2009:2</td>
<td>-2.6%</td>
<td>-2.6%</td>
<td>-38.3%</td>
<td>+5.0%</td>
</tr>
<tr>
<td>Approximate Contribution</td>
<td>-1.7 pp</td>
<td>-0.6 pp</td>
<td>+0.1 pp</td>
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</table>
• Firms optimize the amount of capital to have (just like they optimize the amount of labor to hire).

• **How does capital evolve?** \( K_{t+1} = (1-\delta) K_t + I_t \)
  - where \( K_{t+1} \) represents capital in the next period, \( \delta \) represents a depreciation rate, \( K_t \) represents capital today and \( I_t \) represents investment so capital is increased tomorrow by investing today less depreciation

• **Remember:** For the optimal amount of labor, firms equate the MPN (labor productivity) with the real wage (cost of an additional unit of labor).

• **For the optimal amount of capital, firms equate the MPK (per period benefit of one more unit of capital) with the per period cost of an additional unit of capital.**

• What is the cost of an additional unit of capital?
User Cost of Capital

- User Cost of Capital (cost of purchasing one more unit of capital)
  - Capital is long-lived-- so user costs include not only current, but future costs

- Real Interest Rate (cost of Funds). Firms usually have to borrow to buy equipment. If you do not borrow and instead use retained earnings, you give up the interest payments you would have received if you invested that money instead of buying new equipment. (Assume borrowing rates = lending rates = r = real interest rate).

- Real Purchase Price of capital (how much the equipment costs) \(\text{Symbol } = p(K)\)

- Depreciation Rate on the Capital (how long the capital lasts) (Percent that depreciates, on average, per year) \(\text{Symbol } = \delta\)

- Maintenance Rate - How much will it cost (per unit price) to maintain the equipment. \(\text{Symbol } = \text{mm}\)

- User Cost (per period) = \(\text{UC } = r \times p(K) + \delta \times p(K) + \text{mm} \times p(K)\) \(\text{interest rate is key!}\)
• First order condition from profit maximization:

\[ P \times \text{MPK}_f = p(K)[r + \delta + \text{mm}] \]

• Benefits of investing are more output tomorrow – so, it is the future MPK that is important. P is the price of output, p(K) is the price of capital. If P = p(K), then:

\[ \text{MPK}_f = r + \delta + \text{mm} = \text{per dollar user cost} \]

• Rationale: Investment decisions today have effects on the capital stock tomorrow. It takes time to build, install, train workers, etc. This is especially true with large expenditures (buildings, structures, assembly lines, etc).

• If User Cost of Capital > MPK\(_f\), then MPK\(_f\) must rise (capital must fall - ie, investment must be lower today).

• If User Cost of Capital < MPK\(_f\), then MPK\(_f\) must fall (capital must rise - ie, investment must increase).
Investment Continued: Let’s Prove the Identity Graphically

Capital Stock Curve

Key: As \( r \) increases, User Cost Shifts Up, desired future capital stock, \( K^f \), falls!
Investment (I) and real interest rates (r)

**Investment Demand Curve (ID)**

From Cobb-Douglas: \(0.3 A^f (N^f/K^f)^{0.7} = r + \delta + mm\)

Key: As (r) increases, desired capital stock falls, investment slows

Reading: Notes 5 from the supplemental notes.
Investment takes time to plan and tends to be ‘irreversible’ (costly to change if you over/under invest).

**Implications:**

- **Investment returns are uncertain (returns are in the future - which is unknown).**
  - As economic uncertainty increases, investment decisions can become delayed.

- Firms - like individuals - are forward-looking. If interest rates fall today, I may not invest today because I believe interest rates can be even lower tomorrow.

- **Firms, like individuals, may be liquidity constrained.** (The role of banks in the economy may be important). Liquidity constrained means that the firm is unable to have access to financial markets – or they have access, but the cost of funds is prohibitive!

- Tax policy can affect investment decisions (investment tax credit…).

Readings: 39-40
Investment and The Banking System

• Banks are important because firms rely on them to finance their investment projects!

• When banks stop lending (for whatever reason), this will have a real effect on economic activity because it directly affects firms (and consumers).

• We refer to the inability to undertake optimal economic activity because of a lack of financing as resulting in a binding “liquidity constraint”.

• Banks match borrowers with savers in an efficient way. If that link breaks down, firm financing will dry up (affecting their ability to undertake optimal investment projects).

• The health of the banking system affects the real economy (not just the banks!)
Part II: Consumption
Forecasts are still pretty pessimistic given the depth of the recession.
Real Consumption Growth vs Real GDP Growth: 1970Q1 – 2017Q1

Source: U.S. Bureau of Economic Analysis
fred.stlouisfed.org
Real Consumption Growth: 1970Q1 – 2017Q1

Big consumption boom after prior big recessions

Source: U.S. Bureau of Economic Analysis
fred.stlouisfed.org
Real Consumption Growth: 1970Q1 – 2017Q1

Small consumption boom after recent recession

Source: U.S. Bureau of Economic Analysis
fred.stlouisfed.org
Real Consumption Growth During 2000s: 2000Q1 – 2016Q2
LEVERAGE VS. DE-LEVERAGING

HOUSEHOLD SAVING RATE OVER TIME

Increase in Household Leverage

Source: U.S. Bureau of Economic Analysis
fred.stlouisfed.org
LEVERAGE VS. DE-LEVERAGING

HOUSEHOLD SAVING RATE OVER TIME

Household Deleveraging

Source: U.S. Bureau of Economic Analysis
fred.stlouisfed.org
Consumer Confidence: 1978M1 – 2017M8

Low Consumer Confidence

Source: University of Michigan
fred.stlouisfed.org
“Old School” Model of Consumption: Keynesian Consumption

• Keynesian Consumers (named for theories of John Maynard Keynes)

\[ C = a + b \cdot Y_d \] (ignoring Taxes and Transfers: \( Y_d = Y \))

- \( a \) = ‘subsistence’ level of Consumption
- \( b \) = marginal propensity to consume = MPC

**Key:** Consumption is based solely on current income.

Based on *cross-country* and *long run time* series data:

\[ a \sim 0 \text{ and } \text{MPC} = \frac{\Delta C}{\Delta Y} \sim 0.90 \]

Problem: In Micro Data (*household data*) over short term, MPC \( << 0.90 \)

People run a regression: \( \Delta C = \beta_0 + \beta_1 \Delta Y + \text{error} \) (using household data) \( \beta_1 \) around 0.40!

• Keynesian consumption function does not seem to match short run (household) data (although it does match long run (country level) data).
Old School Consumption?

• Drawbacks to Keynesian Consumption Functions (aside from not matching data):
  – Does not Include Expectations "<<this is important!>>"
  – Does not Distinguish Between Different Types of Income (one-time increase vs. permanent increase)
  – Does not allow for the role of interest rates
  – Does not result from optimizing household behavior

• Is there another theory which allows us to look at household Consumption Behavior?

• Yes - Lifecycle/Permanent Income Hypothesis!
Permanent Income Hypothesis (PIH)

- Milton Friedman/Franco Modigliani:
  - Consumers like Smooth Consumption
  - Optimize ‘lifetime’ utility (over consumption and leisure)

  - Today, you plan your consumption based upon what you observe today and what you expect to happen tomorrow!

  - **Constraint:**  \( PVLC = PVLR \) (**PVLC = present value of lifetime consumption**).

  - They like to smooth ‘marginal utility’ across seasons, business cycles and life cycles.

  - Think about it: Retirement, Job Loss, Summer Vacations, etc.

  - Does much better at matching data – (although not perfect)
• Assume households maximize $U(C, C_f)$ in a two period model (1,2) (ignore their dependence on leisure for this example - makes it simpler).

$U(.) = \ln(C) + \beta \ln (C_f)$  
(log utility - for simplification, $\beta$ = Discount Factor - i.e., how much you like eating today versus tomorrow)

$C_f = (Y + Wealth_0 - C) (1 + r) + Y_f$  
(Budget Constraint; $Wealth_0$ = Initial Wealth)

or

$C + C_f/(1+r) = Wealth_0 + Y + Y_f/(1+r)$  
(I just re-wrote the above constraint)

Do some simple optimization:

maximize $U(.)$ subject to budget constraint.
An Example (continued)

- Maximize Utility (See supplemental consumption notes for detail): We get……

\[ \frac{\partial U(C)}{\partial C} = \frac{1}{C} - \beta (1+r) \left( \frac{1}{C_f} \right) = 0 \]

<<Process: a) Use budget constraint and substitute out \( C_f \) from utility function (utility function is only a function of \( C \) now (not \( C \) and \( C_f \)).
b) Take derivative of utility function with respect to \( C \)
c) Set derivative equal to zero (this is how we maximize)
d) Substitute \( C_f \) back into the second term using the budget constraint. >>

- For our example, assume that \( \beta = 1 \) and \( r = 0 \) (for simplicity, not realism)
- Solution: \( C = C_f \) (Households want equal levels of consumption each period).

- Suppose: \( Y = 1 \), \( Y_f = 9 \), \( Wealth_0 = 0 \): What is Optimal \( C \), \( C_f \)?
- We know that \( C \) is smoothed over time (optimizing behavior)
- We also know that \( C_f = (Wealth_0 + Y - C) (1 + r) + Y_f \) (budget constraint)

- Solve, we get \( C = (Wealth_0 + Y + Y_f)/2 = PVLR/LL = 5 \); \( LL = \text{length of life} \)
### An Example Continued

<table>
<thead>
<tr>
<th>Period</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumption</strong></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td><strong>Savings</strong></td>
<td>-4</td>
<td>4</td>
</tr>
</tbody>
</table>

• Expected Income Increases are already included in Today’s consumption plan:
  
  – **Only news today (about today or the future) affects our consumption plan!!!!**
  – The fact that income rises from 1 to 9 between periods 1 and 2 is already included in my consumption plan.

• Unexpected News about income, life spans, etc **WILL** affect consumption decisions.
Unexpected Increase in Transitory Income

• Example: Suppose today I find out that my income will increase by $2 (in period 1). What is the new consumption plan associated with this transitory (temporary) increase in Y?

• $C = C_f = 6$ <<<still smooth consumption across periods>>>

• $S_1 = -3, \ S_2 = 3$

• Consumption increases by a little today (and in future), saving increases today!
  
  – Saving increases today so consumption tomorrow will be higher (transfer some of the transitory income shock towards the future)

• $MPC = \Delta C \ (\text{today}) / \Delta Y \ (\text{today}) = 1/\text{LL} = (\text{in this example}) = \frac{1}{2} = 0.5$
Example:

Suppose today I find out that my income will permanently increase by $2 (in both period 1 and period 2). What is the new consumption plan associated with this permanent increase in $Y$?

- $C = C_f = 7$
- $S_1 = -4, S_2 = 4$

Consumption increases more today (and in future) than compared with the case of a transitory income shock, and saving remains constant!

- $MPC = \Delta C \ (today) / \Delta Y \ (today) = 1 = (in \ all \ examples) = 2/2 = 1$
  - With permanent changes in income, consumption and income move 1 for 1.
Unexpected One Time Permanent Increase in Initial Wealth (Wealth_0)

• Example:

• Suppose today I find out that my initial wealth increased by $2 (i.e., wealth increased prior to period 1). For simplicity, you can think of it as a one-time unexpected stock market gain. For simplicity, lets suppose that the increase in wealth was permanent. (Stocks increase and are expected to stay high).

• What is the new consumption plan associated with this unexpected increase in H_0?

• C = C_f = 6

• S_1 = -5 (Y - C), S_2 = 3 (increase in PVLR due to wealth = 2)

• Consumption increases today (and in future), and saving falls.

• Unexpected one time (but permanent) increases in wealth are identical to unexpected one time (but transitory) changes in income.
Some Evidence Consistent with PIH Behavior

- Business Cycles are likely to be associated with large *temporary* shocks to income.
  
  - We find consumption to be more stable than income over the business cycle.
  - And the saving rate jumps during recessions.
  - So, \( C \neq 0.9Y \).

- **Micro studies find the MPC out of income changes to be much less than 0.9 (C does not track Y one-for-one)**

- **Micro Studies (including mine) find a MPC out of changes in wealth of about 0.05. (Unexpected capital gains in housing/securities are like one-time increases in income).**

- Household consumption responds more to permanent shocks to income.

- **A must read: Notes #6**
- Reading list #36-38
- Supplemental Notes 6, 7 and “Notes Extra”.

In contrast to the predictions of the PIH, consumption does vary a lot with temporary income changes:

- Suppose a household earns $60,000 (on average) over 40 working years.
- Total earnings over working years = $2.4 million (do not worry about discounting)
- Suppose in a recession, that head of household loses his/her job for 1 year and because of transfers (unemployment insurance, severance?) only earns $20,000 that year.
- That household’s lifetime income only declined by 1.66% ($40,000/$2.4 million) because of recession.
- Being unemployed --- even for one full year out of a lifetime --- does not affect lifetime income all that much!
- According to the PIH, consumption should not respond that much….(household should spread that $40,000 over 40 years. Consumption should, at most, decline only $1,000/year).
- If you prepared for the possibility of job loss, consumption really shouldn’t change at all (just draw down savings).

If the PIH theory is true, aggregate consumption should not respond that much during recessions (1. recessions have little effect on our lifetime incomes and 2. we should prepare for recessions and as a result, have savings to buffer our lower income).
Real Consumption Growth: 1970Q1 – 2017Q1

Small consumption boom after recent recession

Source: U.S. Bureau of Economic Analysis
fred.stlouisfed.org
Consumption During Recessions

• BUT Consumption falls during recessions
  – Not a prediction of the standard permanent income hypothesis.

• If households were smoothing consumption, they should realize that lifetime income has not changed that much because of job loss.

• Furthermore, they should have saved to prepare for a recession (we all know that recessions sometimes happen)!

• During recessions, consumption behavior looks more Keynesian than PIH…..

• Why do I say this? Well, Keynesian behavior says C is a function of only current Y.
  
  i.e., $C = a + b Y_d$

• As current Y falls (as in a recession), current C falls. However, data shows that C falls only by about 40% of the Y fall. That implies $b$ is 0.40. But, this doesn’t match long-term response of consumption to income changes.
Refinements to Consumption Theory

- These are refinements to consumption theory that we will not spend much time on (there is a whole consumption literature modeling consumption behavior more thoroughly).

  - **Liquidity Constraints** «Let’s talk about this»
    - Due to borrowing constraints, households may not be able to smooth income shocks

  - **Uncertainty (Precautionary Savings)**

    - Little is known about preferences (time preference rates - $\beta$ and risk aversion).
    - Bequests explain a large portion of wealth accumulation
    - Large variation in wealth accumulations across individuals (we will discuss this more).
    - Life Cycle Shocks.

    - Home production (including shopping for bargains)
Refinement of PIH Theory (part 1): Liquidity Constraints

**Formal Definition…**

- Liquidity Constraints refer to the fact that sometimes a household (or a firm) optimally wants to borrow to smooth consumption (or for investment), but lenders are unwilling to lend to that household.

  - Why will lenders refuse to lend?
    - Lender may not believe that the household will pay them back.
    - Lender cannot distinguish between households who want to borrow to smooth consumption from those who want to borrow and then default.

- In recessions, in order to smooth consumption, households who receive a negative income shock either have to draw down saving or borrow. If they are prevented from borrowing, households will have no choice but to cut their consumption. As a result, C will fall during recessions.

- **Liquidity constraints make households look Keynesian** when income falls (C falls when Y falls – for those with no savings and who cannot borrow).

- **However, when Y is high, households look like PIH households** – nothing prevents them from saving. If Y is temporarily high, households would want to save some of that income. Liquidity constraints prevent borrowing NOT saving….
**Consumption and Interest Rates**

**Assume households are net savers** *(Reading: see Notes 7 for discussion of net borrowers).*

- **Substitution effect:**
  Higher r lowers C. Think of people saving more to reap the higher return, or people borrowing less b/c it is more expensive. Higher interest rate today, makes saving more beneficial (price of future consumption falls). Households will switch away from consumption today (i.e., C today falls, C tomorrow increases, and S today increases)

- **Income effect:**
  Higher r raises C today. For every dollar saved, you get higher income (if you are a net saver). When richer, you buy more of the things you like. What do you like? Consumption today and consumption tomorrow. As a result, you can save less and get more of both. (C today increases, C tomorrow increases, and S today falls)

- **Evidence:**
  Some studies find the substitution effect stronger, others find they are the same. My belief is that higher r has little, if any, effect on current consumption

**What if households are net borrowers?** - Income effect is opposite. Higher interest rates make households poorer (they have to pay higher interest payments!) Income effect will say that $C$ today will fall, $C$ tomorrow will fall and $S$ today will increase.
Consumption and Income Taxes

Reading: Notes 7 for full details…

From micro…. assume households maximize $U(C, L)$. Where $U(.)$ is a utility function, $C$ is consumption and $L$ is the fraction of time spent on leisure (Leisure is Not Working). Households are made happier by consuming more and working less (all else equal…i.e., holding lifetime resources fixed).

From micro, we also know that:

$\frac{\text{MU}_C}{P_C} = \frac{\text{MU}_L}{P_L}$, where MU = marginal utility and P equals prices.

This is the equilibrium condition that exists for all utility optimization over two goods.

We also know that the budget constraint has to hold:

$P_C \cdot C = W \cdot (1-t) \cdot (1 – L)$, where $(1-L)$ is the fraction of time worked, $t$ is the income tax rate and $W$ is the Wage.
Suppose income taxes fall..... What has to happen to consumption and leisure????

**Income Effect (Equation 2 on previous slide)**

When income taxes fall – equation 2 says that, all else equal, households will be richer [i.e., \((W(1-t))\) will increase].

- When households are richer, they will buy more of the things they like.
- What do households like?....... C and L.

So, according to income effect, C and L will increase when income taxes fall.

**Substitution Effect (Equation 1 on previous slide)**

When income taxes fall, equation 1 says that, all else equal, after tax wages will increase [i.e., \((W(1-t))\) will increase].

- As the price of leisure increases, \(MUL\) must increase AND/OR \(MUC\) must fall.
- As leisure falls, \(MUL\) increases (law of diminishing marginal utility of L).
- As C increases, \(MUC\) must fall (”

So, according to substitution effect, C will increase and L will fall when income taxes fall.

Putting two effects together:  Effect on L is ambiguous.  C will definitely increase!
Summary: What affects consumption

- Current Income (Both PIH and Keynesian Theories)
- Expectations of Future Income (Only PIH theory)

- Wealth
- Temporary vs. Permanent Changes
- Tax Policy
- Interest rates (slightly)

- Preferences ($\beta$)

- The magnitude of the results depend on whether consumers follow Keynesian or PIH consumption rules and whether or not liquidity constraints exist!!!!

- In our Government Policy Lecture, we will talk about Social Security Systems and Consumer’s Expectations of Tax Changes
Foreshadowing: Modeling Demand

PVLR

- $C(\text{today}) = C(y, y^f, \text{wealth}, \text{taxes}, \text{liquidity constraints}, \text{consumption rules}, \text{expectations})$.
  - We will assume that $r$ does not affect $C$!

- $I(\text{today}) = I(r, A, \text{expectations}, \text{investment taxes})$

- We are moving towards a model of Aggregate Demand:

  $Y = C(.) + I(.) + G + NX$  \hspace{1cm} (We will get to NX later in the course)