Consumption and Investment

Graduate Macroeconomics I
ECON 309 -- Cunningham
Recall that Keynes argues that

\[ C = C_0 + cY, \text{ with } C_0 > 0 \]

and the average propensity to consume (APC = \(C/Y\)) is greater than the marginal propensity to consume (MPC = \(c\)):

\[ C/Y = (C_0 + cY)/Y > c, \text{ or } \]

\[ APC > MPC \]

(1)

(2) Moreover, the APC should not be a constant if \(C_0\) is not zero.

If \(C_0 = 0\), then the consumption function reduces to the absolute income hypothesis—consumption is proportionate to income—which is not consistent with Keynes.
Empirical Verification?

- Keynes’ followers estimated the consumption function for the U.S. using the data from 1929-1941:
  - \( C = 26.5 + 0.75Yd \)
- \( C_0 = 26.5 \text{ billion} > 0 \)
  - \( \text{APC} > \text{MPC} \)
- Increases in consumer spending seemed to be less than increases in disposable income, supporting \( \text{MPC} < 1 \).
Kuznets’ Consumption Data


- Time series estimates of consumption and national income
- Overlapping decades 1879-1938, 5 year steps
- Each estimate is a decade average


- Extended data backward to 1869.
Kuznets’ Study (1)

- Assumptions:
  - Personal taxes and transfer payments are small (in this period)
  - Therefore, it is reasonable to use total income (GNP) as a proxy for disposable income.
  - If a relationship between consumption and disposable income exists, there should also be a relationship between consumption and GNP.
Kuznets’ Study (2)

Results:

- (1946 study) Between 1869-1938, real income expanded to seven (7) times its 1869 level ($9.3 billion to $69 billion).
- But the average propensity to consume ranged between 0.838 and 0.898.
- That is, APC did not vary significantly in the face of vastly expanding income.

Problem!
## Kuznets’ Study (3)

<table>
<thead>
<tr>
<th>Years</th>
<th>Y</th>
<th>C</th>
<th>C/Y</th>
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<tbody>
<tr>
<td>1869-78</td>
<td>9.3</td>
<td>8.1</td>
<td>0.87</td>
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<tr>
<td>1874-83</td>
<td>13.6</td>
<td>11.6</td>
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<td>17.9</td>
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<td>0.85</td>
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<td>1884-93</td>
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<td>17.7</td>
<td>0.84</td>
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<td>24.2</td>
<td>20.2</td>
<td>0.83</td>
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<td>1894-1903</td>
<td>29.8</td>
<td>25.4</td>
<td>0.85</td>
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<tr>
<td>1899-1908</td>
<td>37.3</td>
<td>32.3</td>
<td>0.87</td>
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<tr>
<td>1904-13</td>
<td>45.0</td>
<td>39.1</td>
<td>0.87</td>
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<tr>
<td>1909-18</td>
<td>50.6</td>
<td>44.0</td>
<td>0.87</td>
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<tr>
<td>1914-23</td>
<td>57.3</td>
<td>50.7</td>
<td>0.88</td>
</tr>
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<td>1919-28</td>
<td>69.0</td>
<td>62.0</td>
<td>0.90</td>
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<td>1924-33</td>
<td>73.3</td>
<td>68.9</td>
<td>0.94</td>
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<tr>
<td>1929-38</td>
<td>72.0</td>
<td>71.0</td>
<td>0.99</td>
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</table>
Second Failure

Predictions of post-WWII period are grossly wrong
- Keynesian Theory argues that the average propensity to save (APS) rises with income ($S = S_0 + sY$).
- Higher post-war incomes should imply excess saving.
- Excess saving is more than can be absorbed by investment.
- Therefore the excess saving will result over-investment or hoarding, and therefore in unemployment.
- Will we go straight back to the Depression?
- Comparison of the forecasts with the actual results suggest that:
  - consumption was “under”-predicted
  - saving was “over”-predicted

**IMPLICATION**: major determinants in the behavioral equations must be missing!
<table>
<thead>
<tr>
<th>Estimated equation†</th>
<th>Sample period</th>
<th>1947</th>
<th>1948</th>
<th>1949</th>
<th>1950</th>
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<tbody>
<tr>
<td>(1) ( C = 10.69 + .80Y )</td>
<td>1929–1940</td>
<td>−12.9</td>
<td>−8.8</td>
<td>−12.9</td>
<td>−11.9</td>
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<tr>
<td>(2) ( C^* = 11.45 + .78Y^* )</td>
<td>1929–1940</td>
<td>−11.9</td>
<td>−7.5</td>
<td>−11.0</td>
<td>−9.6</td>
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<tr>
<td>(3) ( pC = 7.77 + .85pY )</td>
<td>1929–1940</td>
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<td>−10.0</td>
<td>−14.0</td>
<td>−12.2</td>
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<tr>
<td>(4) ( s = −10.68 + .20Y )</td>
<td>1929–1940</td>
<td>−13.0</td>
<td>−8.5</td>
<td>−10.8</td>
<td>−9.1</td>
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<tr>
<td>(5) ( S^* = −95.27 + .22Y^* )</td>
<td>1929–1940</td>
<td>−12.0</td>
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<td>−9.2</td>
<td>−7.6</td>
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<tr>
<td>(6) ( pS = −7.89 + .15pY )</td>
<td>1923–1940</td>
<td>−13.9</td>
<td>−9.8</td>
<td>−12.0</td>
<td>−9.7</td>
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<tr>
<td>(7) ( S = −6.61 + .14Y )</td>
<td>1923–1940</td>
<td>−9.7</td>
<td>−4.6</td>
<td>−6.9</td>
<td>−4.6</td>
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<tr>
<td>(8) ( S^* = −85.66 + .21Y^* )</td>
<td>1923–1940</td>
<td>−11.7</td>
<td>−7.1</td>
<td>−8.8</td>
<td>−7.2</td>
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<tr>
<td>(9) ( pS = −6.77 + .14pY )</td>
<td>1923–1940</td>
<td>−12.4</td>
<td>−7.9</td>
<td>−10.1</td>
<td>−7.7</td>
</tr>
</tbody>
</table>

Addendum

Actual nominal consumption

\[
\begin{array}{cccc}
165.6 & 177.5 & 178.8 & 184.2 \\
\end{array}
\]
Reconciliation with Keynes’ Theory? (1)

- Uses per capita Yd and C, and a time trend.
- Argues that the Cons. Function is really Keynesian, but just looks Kuznetsian because of the shifts in the function.
- Says the data points just “happen” to line up to fit Kuznets’ consumption function.
Smithies Result

Smithies estimates yielded the equation:

$$C_t^* = 76.58 + 0.76Y_t^* + 1.15(t-1922)$$

Or equivalently,

$$C_t^* = [76.58 + 1.15(t-1922)] + 0.76Y_t^*$$

Which is of the form $C = C_0 + cY$, the equation of a line.
Reconcilation (2)

Reasons for shifts:
- Migration of people from farms to cities (must buy goods)
- Shift in distribution toward greater equality (poorer save less)
- Rise in the perceived “standard” of living (luxuries become necessities)
- For these reasons each agent (per capita) should increase his or her consumption.
Modigliani gets involved


- When Franco Modigliani (1949) estimates Smithies’ relation over a different time period, the analysis completely breaks down.

- But, Modigliani is hooked...
## More Problems

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption</th>
<th>Personal disposable income</th>
<th>Year</th>
<th>Consumption</th>
<th>Personal disposable income</th>
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<td>1932</td>
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*Entry represents a decrease in a series.

†Entry is not chronologically contiguous with its predecessor.

*Source*: Rebenchmark data furnished to the author by the U.S. Department of Commerce during the first quarter of 1981.
<table>
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<th>Series</th>
<th>Year 1</th>
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<th>3</th>
<th>4</th>
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<th>2</th>
<th>3</th>
<th>4</th>
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<td>336.2*</td>
<td>336.5</td>
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</tr>
</tbody>
</table>

*Entry represents a decrease or a constancy in a series.
†Entry is not chronologically contiguous with its predecessor.
Source: See Table 5.4.
Habit Persistence Theory

- Note: Duesenberry and Modigliani both presented similar results at the Econometric Society Meeting of 1947.
- Duesenberry (1947) noted that in 1935 dissaving grew as a percentage of income.
  - Dissaving was greater in 1935 than in the relatively prosperous year 1941.
  - Why? Households must sacrifice saving to “defend” (attempt to maintain) their standard of living.
- Duesenberry and Modigliani can reconcile the short-run and long-run consumption functions, but cannot explain the negative relationship between current income and consumption that sometimes occurs.
Duesenberry’s Habit Persistence

Duesenberry assumes that the consumers defend their highest level of consumption. Thus:

\[
\frac{S_t}{Y_t} = F \left( \frac{Y_t}{Y_{\text{peak}}} \right)
\]

For no other reason than simplicity, he assumes linearity.

\[
\frac{S_t}{Y_t} = a + b \left( \frac{Y_t}{Y_{\text{peak}}} \right)
\]
More Duesenberry

\[
\frac{C_t}{Y_t} = (1-a) - b \left[ \frac{Y_t}{Y_{peak}} \right]
\]

So that

\[
C_t = \left\{ 1 - a - b \left[ \frac{Y_t}{Y_{peak}} \right] \right\} Y_t
\]

If \( Y \) grows steadily, then

\[
\frac{Y_t}{Y_{peak}} = \frac{Y_t}{Y_{t-1}} = k, \text{ and}
\]

\[
C_t = (1-a-bk)Y_t, \text{ or}
\]

\[
C_t = \lambda Y_t, \text{ with } \lambda = (1-a-bk)
\]

Note: \( Y_t = S_t + C_t \)

so

\[
1 = \frac{S_t}{Y_t} + \frac{C_t}{Y_t}
\]

and

\[
S_t = 1 - \frac{C_t}{Y_t}
\]

Kuznet’s Result
Dusesenberry’s “Ratchet Effect”
Brown’s Habit Persistence


Brown tries:  
\[ C_t = a_0 + a_1 Y_t + a_2 C_{\text{peak}} \]

and

\[ C_t = a_0 + a_1 Y_t + a_2 C_{t-1} \]

He finds the second specification slightly superior and more easily consistent with the downward shifts. (Econometric tests.)
Hamburger and Wealth Theories

- **Hamburger (1951, 1954, 1955)**
- Argues an alternative explanation for sluggishness ties consumer response formally to intertemporal utility maximization.
- Household ties current consumption to a lifetime plan of consumption:
  \[ u_t = u_t(c_t, c_{t+1}, c_{t+2}, \ldots, c_{t+i}) \]
- Wealth arises from property wealth and human wealth (investments and income).
- Households consume less under an estate motive.
- Explains habit persistence rigorously.
Life Cycle Hypothesis (LCH)

- Franco Modigliani, Albert Ando, and Richard Bloomberg
- Assumes that each representative agent will die, and knows:
  - when he/she will die, how many periods $T$
    he/she will live, and
  - How much his/her life-time income will be.
- The consumer smooths consumption expenditure over his/her life, spending $1/T$
  of his/her life-time income each period.
The consumption function implied by this logic is:

$$C_t = \frac{1}{T} \left[ Y_t^1 + (N - 1)\bar{Y}^{1e} + A_t \right]$$

with the aggregate estimable consumption function look like this:

$$C_t = b_1 Y_t^1 + b_2 \bar{Y}^{1e} + b_3 A_t$$
Income and Consumption—LCH
Testing the LCH

- If the function form looks like this:
  \[ C_t = b_1 Y_t^1 + b_2 Y_t^{1e} + b_3 A_t \]

- Ando and Modigliani argue that expected future labor income is proportional to current income, so that the function can be reduced to:
  \[ C_t = (b_1 + b_2 \beta) Y_t^1 + b_3 A_t \]

- When they estimate this function, they get:
  \[ C_t = 0.72 Y_t^1 + 0.06 A_t \]
Criticisms of LCH

- The households, at all times, have a definite, conscious vision of:
  - The family’s future size and composition, including the life expectancy of each member,
  - The entire lifetime profile of the labor income of each member—after the applicable taxes,
  - The present and future extent and terms of any credit available, and
  - The future emergencies, opportunities, and social pressures which might affect its consumption spending.

- It does not take into account liquidity constraints.
Policy Implications of LCH

- Changes in current income have a strong effect on current consumption only if they affect expected lifetime income.
- In Q2 1975, a one-time tax rebate of $8 billion was paid out to taxpayers to stimulate AD.
  - The rebate had little effect.
- Maybe George W. hadn’t heard about this?
- The only way there can be a significant effect is if there is a strong liquidity constraint operating.
- This has implications for monetary policy.
Permanent Income Hypothesis (PIH)


- Assumptions:
  - Perfect certainty about:
    - Future receipts
    - Future interest rates
    - Future prices, etc.
  - People save to reduce fluctuations in expenditures
  - People are immortal (or leave bequests)

- Individual’s utility function:
  \[ u = u(c, c_1) \]
  where \( c \) is current period consumption and \( c_1 \) is next period consumption.
Assume positive but diminishing returns and positive cross partials. Also assume that $u$ is homogeneous of degree one.

The budget constraint is:

$$c + \frac{1}{1+r}c_1 = q + \frac{1}{1+r}q = w_e$$

Where $q, q_1$ are planned real receipts from human and nonhuman wealth in each period, and $w_e$ is expected wealth.

Optimization yields:

$$c = i_A(r)w_e$$
$$c_1 = i_B(r)w_e$$
This implies that consumption depends upon income only if the income affects expected wealth. Therefore, changes in income need not affect current consumption.

We may view $y_p = rw_e$ as permanent income—what really affects the consumption decision.

\[ c = c_p + c_T \]
\[ y = y_p + y_T \]
Where is has permanent (p) and transitory (T) components. For each individual agent:

\[ c_P = k(r,v,x)y_P \]

Where

- \( r \) = rate of return
- \( v \) = the ratio of human to nonhuman wealth (permanent income)
- \( x \) = demographics

By summing across individuals (aggregating), we have:

\[ C_P = \kappa Y_P \], that permanent consumption is proportional to permanent income.
PIH, Continued

When reduced to a estimable form, this becomes:

\[ c_t = \kappa a_0 Y_t + \lambda c_{t-1} + \theta_t \]

Which looks remarkably like the Brown (1952) result.

The result can explain the unusual changes in MPC due to changes in income:

If income changes, individuals tend to decrease saving (or dissave) to maintain a more uniform spending pattern over their lives.
Individuals update adaptively their estimates of permanent income based on changes in current income. That is, \textit{they learn}.

\[
Y_t^p = Y_{t-1}^p + j(Y_t - Y_{t-1}^p), \quad 0 < j < 1
\]

The result is that changes to current income have little effect on current consumption unless the individual believes that the changes has long-term consequences.
Investment Spending

● Investment is the change in the capital stock

  - $I_{n,t} = K_t - K_{t-1} = \text{Net Investment}$
  - $I_{g,t} = K_t - K_{t-1} - \delta K_t = \text{Gross Investment}$
    $(\delta K_t \text{ is depreciation})$
  - $I = I(r,E) = I(r)$

● What about the expectations term?
The Accelerator Model (1)

- Attempts to capture some measure of current business conditions (growth of the economy or lack of it), and use that to explain the level of investment.
Accelerator Model (2)

- The desired capital stock is proportional to the level of output:
  \[ K^d_t = \alpha Y_t \]

- Investment is the process of moving from the current level of capital to a desired level:
  \[ I_{n,t} = K^d_t - K_{t-1} \]

- We assume that whatever the capital stock ended up being last period was the level of capital that businesses actually wanted:
  \[ K_{t-1} = K^d_{t-1} = \alpha Y_{t-1} \]
Accelerator Model (3)

- This allows us to rewrite:
  \[ I_{n,t} = K_t^d - K_{t-1} \]

- As
  \[ I_{n,t} = K_t^d - K_{t-1} = \alpha Y_t - \alpha Y_{t-1} = \alpha (Y_t - Y_{t-1}) \]
  \[ I_{n,t} = \alpha \Delta Y_t \]

- Thus investment is related to the rate of change in output.
  - If the economy is growing rapidly, then investment grows rapidly.
  - If the economy is not growing, then investment slows, and net investment (after depreciation) may actually be negative.
Accelerator Model (4)

- As a result of adjustment costs and practical time-to-build considerations, the entire adjustment to the desired capital stock may not be done in one period. The firms may only finance a partial adjustment.

- Let $\lambda$ be the fraction of the gap between the desired and actual capital stock that the firms pursue. This leads to:

$$I_{n,t} = \lambda(K_t^d - K_{t-1}), \ 0 < \lambda < 1.$$  

- Or, equivalently,

$$I_{n,t} = \lambda(\alpha Y_t - K_{t-1})$$  

- This is referred to as the flexible accelerator model of investment.
Cost of Capital Approach

- MEC all over again?
- Recall that Keynes argued that business decision makers compare the expected revenue stream from the new capital to the cost of capital.
- The user cost of capital is the total cost to the firm of employing an additional unit of capital for one period.
  - The new capital might be funded by borrowing, selling stock shares, retained earnings, etc.
Cost of Capital Approach (2)

- This suggests an investment function of the form:
  \[ I_{n,t} = I(Y_t, CC_t, K_{t-1}) \]
- If a firm invested its retained earnings or monies raised by selling stock shares, it could earn the current interest rate. So this must be the opportunity cost we are looking for.
- Investment must be related to this interest rate—specifically, to the real interest rate \( \phi \), where:
  \[ \phi = r - \dot{p}^e \]
Cost of Capital Approach (3)

- Part of the user cost of capital is the depreciation rate $\delta$.
- So $CC = \phi + \delta = r - \dot{p} + \delta$.
- But some government programs provide subsidies to firms for purchasing capital. For example, the gov’t may offer investment tax credits. If the portion paid by government is $\tau$, then the effective cost of capital to the firm is:
  \[ CC = (1 - \tau)(r - \dot{p} + \delta). \]
- This leads to an investment function of the form:
  \[ I_{n,t} = I(Y_t, r_t, \dot{p}_t^e, \tau_t, K_{t-1}) \]