# Consumption and Investment

Graduate Macroeconomics I

ECON 309 -- Cunningham

# Keynesian Theory

**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):**

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

**(1)** $$\text{APC} > \text{MPC}$$

**(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 billion > 0**
  - **APC > MPC**
- **Increases in consumer spending seemed to be less than increases in disposable income, supporting MPC < 1.**

# Kuznets' Consumption Data

**Kuznets, Simon. *Uses of National Income in Peace and War*, Occasional Paper 6. NY: NBER, 1942.**

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

**Kuznets, Simon. *National Product Since 1869*. NY: NBER, 1946.**

- **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)

| *Years* | *Y* | *C* | *C/Y* |
|---|---|---|---|
| 1869-78 | 9.3 | 8.1 | 0.87 |
| 1874-83 | 13.6 | 11.6 | 0.85 |
| 1879-88 | 17.9 | 15.3 | 0.85 |
| 1884-93 | 21.0 | 17.7 | 0.84 |
| 1889-98 | 24.2 | 20.2 | 0.83 |
| 1894-1903 | 29.8 | 25.4 | 0.85 |
| 1899-1908 | 37.3 | 32.3 | 0.87 |
| 1904-13 | 45.0 | 39.1 | 0.87 |
| 1909-18 | 50.6 | 44.0 | 0.87 |
| 1914-23 | 57.3 | 50.7 | 0.88 |
| 1919-28 | 69.0 | 62.0 | 0.90 |
| 1924-33 | 73.3 | 68.9 | 0.94 |
| 1929-38 | 72.0 | 71.0 | 0.99 |

# Second Failure

**Predictions of post-WWII period are grossly wrong**

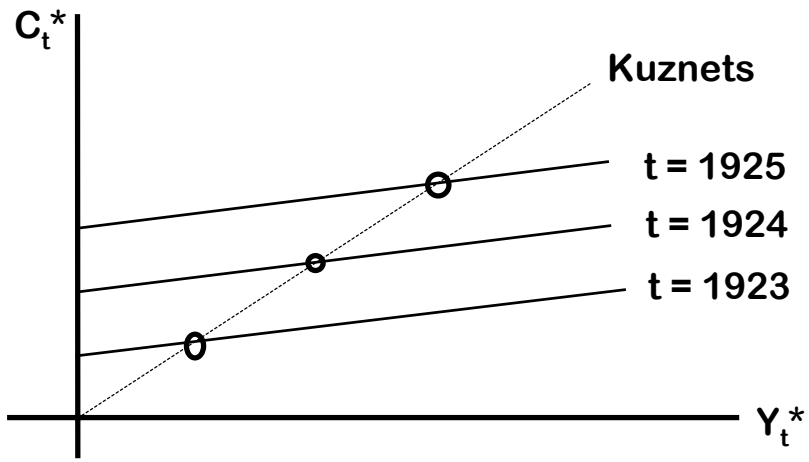
- **Keynesian Theory argues that the average propensity to save (APS) rises with income ($S = S_0 + sY$).**
- **Higher post-war incomes should imply excess saving.**
- **Excess saving is more than can be absorbed by investment.**
- **Therefore the excess saving will result over-investment or hoarding, 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!**

| Estimated equation† | Sample period | Year to which the forecast error applies | | | |
|---|---|---|---|---|---|
| | | 1947 | 1948 | 1949 | 1950 |
| (1) $C = 10.69 + .80Y$ | 1929–1940 | −12.9 | −8.8 | −12.9 | −11.9 |
| (2) $C^* = 11.45 + .78Y^*$ | 1929–1940 | −11.9 | −7.5 | −11.0 | −9.6 |
| (3) $pC = 7.77 + .85pY$ | 1929–1940 | −13.8 | −10.0 | −14.0 | −12.2 |
| (4) $S = -10.68 + .20Y$ | 1929–1940 | −13.0 | −8.5 | −10.8 | −9.1 |
| (5) $S^* = -95.27 + .22Y^*$ | 1929–1940 | −12.0 | −7.4 | −9.2 | −7.6 |
| (6) $pS = -7.89 + .15pY$ | 1929–1940 | −13.9 | −9.8 | −12.0 | −9.7 |
| (7) $S = -6.61 + .14Y$ | 1923–1940 | −9.7 | −4.6 | −6.9 | −4.6 |
| (8) $S^* = -85.66 + .21Y^*$ | 1923–1940 | −11.7 | −7.1 | −8.8 | −7.2 |
| (9) $pS = -6.77 + .14pY$ | 1923–1940 | −12.4 | −7.9 | −10.1 | −7.7 |
| *Addendum* | | | | | |
| (1) Actual nominal consumption | | 165.6 | 177.5 | 178.8 | 184.2 |

# Reconciliation with Keynes' Theory? (1)

- **Arthur Smithies, Econometrica, 1954.**
- **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.**

# Reconciliation (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

**Modigliani, Franco. "Fluctuations in the saving-income ration: a problem in economic forecasting, " in *Studies in Income and Wealth* vol. 11, Conference on Research in Income and Wealth. NY: NBER, 1949, pp. 373-378.**

- **When Franco Modigliani (1949) estimates Smithies' relation over a different time period, the analysis completely breaks down.**
- **But, Modigliani is hooked...**

# More Problems

| Year | Consumption | Personal disposable income | Year | Consumption | Personal disposable income |
|---|---|---|---|---|---|
| 1929 | 215.1 | 229.5 | 1945 | 270.9 | 338.1* |
| 1930 | 199.5* | 210.6* | 1946 | 301.0 | 332.7* |
| 1931 | 191.8* | 201.9* | 1947 | 305.8 | 318.8* |
| 1932 | 173.9* | 174.4* | 1948 | 312.2 | 335.8 |
| 1933 | 170.5* | 169.6* | 1949 | 319.3 | 336.8 |
| 1934 | 176.9 | 179.8 | 1950 | 337.3 | 362.8 |
| 1935 | 187.7 | 196.8 | 1971 | 696.8† | 779.2† |
| 1936 | 206.2 | 220.5 | 1972 | 737.1 | 810.3 |
| 1937 | 213.8 | 227.7 | 1973 | 768.5 | 865.3 |
| 1938 | 208.8* | 212.6* | 1974 | 763.6* | 858.4* |
| 1939 | 219.8 | 229.8 | 1975 | 780.2 | 875.8 |
| 1940 | 229.9 | 244.0 | 1976 | 823.7 | 907.4 |
| 1941 | 243.6 | 277.9 | 1977 | 863.9 | 939.8 |
| 1942 | 241.1* | 317.5 | 1978 | 904.8 | 981.5 |
| 1943 | 248.2 | 332.1 | 1979 | 930.9 | 1011.5 |
| 1944 | 255.2 | 343.6 | 1980 | 935.1 | 1018.4 |

*Entry represents a decrease in a series.

†Entry is not chronologically contiguous with its predecessor.

*Source*: Rebenchmarked data furnished to the author by the U.S. Department of Commerce during the first quarter of 1981.

| Series | Year | Quarter 1 | 2 | 3 | 4 | Quarter 1 | 2 | 3 | 4 | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| Consumption | 1947 | 302.3 | 307.0 | 307.2 | 306.8* | 308.8 | 312.1 | 312.6 | 315.4 | 1948 |
| Income | 1947 | 321.5 | 314.6* | 321.6 | 317.6* | 324.8 | 334.6 | 341.2 | 342.7 | 1948 |
| Consumption | 1949 | 315.8 | 319.8 | 319.3* | 322.5 | 327.7 | 333.6 | 348.0 | 339.9* | 1950 |
| Income | 1949 | 336.2* | 336.2* | 336.5 | 338.2 | 361.5 | 359.4* | 362.2 | 368.2 | 1950 |
| Consumption | 1951 | 345.7 | 337.8* | 340.7 | 342.1 | 342.7 | 348.6 | 350.2 | 358.8 | 1952 |
| Income | 1951 | 365.7* | 373.7 | 375.6 | 375.6* | 375.1* | 379.0 | 387.3 | 391.2 | 1952 |
| Consumption | 1953 | 362.8 | 364.6 | 363.6* | 362.6* | 363.5 | 366.2 | 371.8 | 378.6 | 1954 |
| Income | 1953 | 395.5 | 401.2 | 399.7* | 400.1 | 399.8* | 397.5* | 403.9 | 411.7 | 1954 |
| Consumption | 1955 | 385.2 | 392.2 | 396.4 | 402.6 | 403.2 | 403.9 | 405.1 | 409.3 | 1956 |
| Income | 1955 | 414.8 | 423.7 | 430.8 | 437.8 | 441.0 | 444.5 | 446.9 | 452.5 | 1956 |
| Consumption | 1957 | 411.7 | 412.4 | 415.2 | 416.0 | 411.0* | 414.7 | 420.9 | 425.4 | 1958 |
| Income | 1957 | 452.7 | 455.5 | 457.7 | 456.2* | 452.2* | 454.9 | 464.7 | 471.0 | 1958 |
| Consumption | 1959 | 434.1 | 439.7 | 443.3 | 444.6 | 448.1 | 454.1 | 452.7* | 453.2 | 1960 |
| Income | 1959 | 474.4 | 482.2 | 479.2* | 483.0 | 488.2 | 490.9 | 490.9* | 489.0* | 1960 |
| Consumption | 1961 | 454.0 | 459.9 | 461.4 | 470.3 | 667.4† | 670.5 | 676.5 | 673.9* | 1970 |
| Income | 1961 | 493.6 | 500.6 | 505.8 | 515.0 | 737.4† | 752.5 | 760.1 | 756.2* | 1970 |
| Consumption | 1971 | 687.0 | 693.3 | 698.2 | 708.6 | 718.6 | 731.1 | 741.3 | 757.1 | 1972 |
| Income | 1971 | 771.1 | 779.9 | 780.7 | 785.2 | 792.0 | 798.7 | 812.4 | 838.1 | 1972 |
| Consumption | 1973 | 769.0 | 766.8* | 770.5 | 767.4* | 762.1* | 764.9 | 770.1 | 757.3* | 1974 |
| Income | 1973 | 855.6 | 862.9 | 868.8 | 874.1 | 861.2* | 860.6* | 860.1* | 851.8* | 1974 |
| Consumption | 1975 | 764.0 | 776.3 | 786.3 | 794.2 | 810.6 | 817.7 | 827.1 | 839.4 | 1976 |
| Income | 1975 | 845.8* | 892.2 | 879.2* | 886.1 | 900.3 | 904.7 | 909.5 | 915.1 | 1976 |
| Consumption | 1977 | 851.9 | 856.0 | 866.4 | 881.3 | 884.1 | 900.6 | 911.2 | 923.4 | 1978 |
| Income | 1977 | 918.7 | 931.6 | 948.1 | 960.9 | 966.8 | 975.5 | 985.9 | 998.0 | 1978 |
| Consumption | 1979 | 925.5 | 922.8* | 933.4 | 941.6 | 943.4 | 919.3* | 930.8 | 946.8 | 1980 |
| Income | 1979 | 1005.7 | 1006.9 | 1015.7 | 1017.7 | 1021.0 | 1008.2* | 1018.5 | 1025.8 | 1980 |

*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 in1935 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 betweem current income and consumption that sometimes occurs.**

# Duesenberry's Habit Persistence

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

$$\frac{S_t}{Y_t} = F\left[\frac{Y_t}{Y_{peak}}\right]$$

For no other reason than simplicity, he assumes linearity.

$$\frac{S_t}{Y_t} = a + b\left[\frac{Y_t}{Y_{peak}}\right]$$

# 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

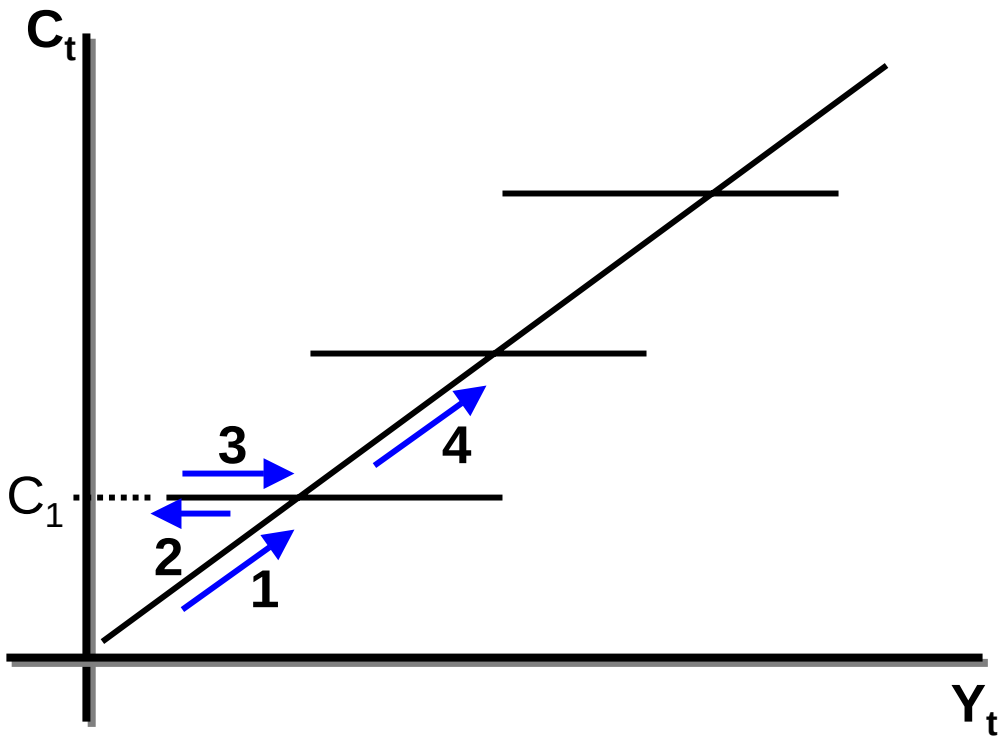
$$1 = \frac{S_t}{Y_t} + \frac{C_t}{Y_t}$$

and

$$\frac{S_t}{Y_t} = 1 - \frac{C_t}{Y_t}$$

**Kuznet's Result**

# Dusesenberry's "Ratchet Effect"



# Brown's Habit Persistence

Brown. "Habit Persistence and Lags in Consumer Behavior," *Econometrica* 20 (July 1952).

Brown tries: $C_t = a_0 + a_1 Y_t + a_2 C_{peak}$

*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 slugglishness 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.**

# LCH (2)

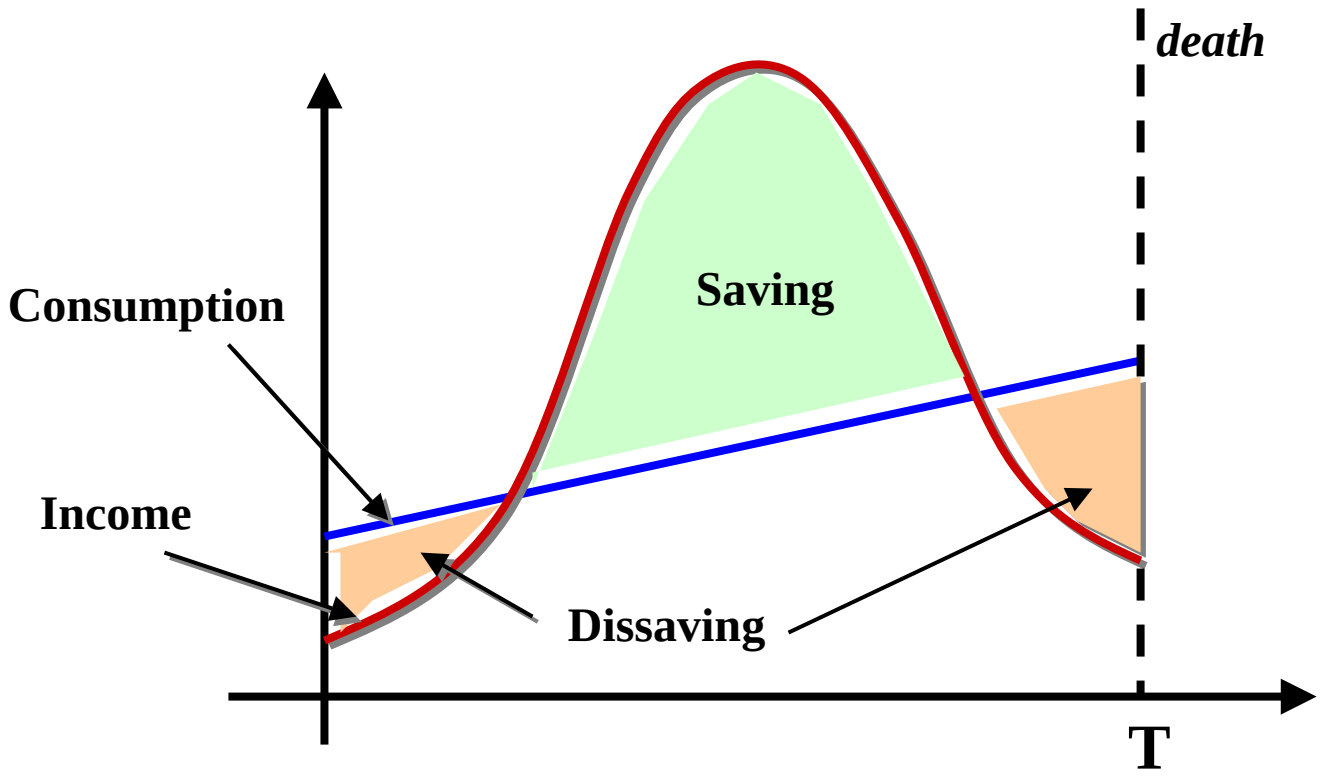
- **The consumption function implied by this logic is:**

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

**with the aggregate estimable consumption function look like this:**

$$C_t = b_1 Y_t^1 + b_2 \overline{Y}^{1e} + b_3 A_t$$

# Income and Consumption—LCH



# Testing the LCH

- **If the function form looks like this:**

$$C_t = b_1 Y_t^1 + b_2 \overline{Y}^{1e} + b_3 A_t$$

- **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)

- **Milton Friedman (*A Theory of the Consumption Function*. Princeton Univ. Press, 1957)**
- **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.**

# PIH, Continued

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: $c = i_A(r)w_e$

$c_1 = i_B(r)w_e$

# PIH, Continued

**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.**

$$c = c_P + c_T$$
$$y = y_P + y_T$$

# PIH, Continued

**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.**

# PIH (2)

- **Individuals update adaptively their estimates of permanent income based on changes in current income. That is, *they learn*.**

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

- **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**
  - $I_{n,t} = K_t - K_{t-1}$ = Net Investment
  - $I_{g,t} = K_t - K_{t-1} - \delta K_t$ = Gross Investment ($\delta K_t$ 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:**

$$K_t^d = \alpha Y_t$$

- **Investment is the process of moving from the current level of capital to a desired level:**

$$I_{n,t} = K_t^d - K_{t-1}$$

- **We assume that whatever the capital stock ended up being last period was the level of capital that businesses actually wanted:**

$$K_{t-1} = K_{t-1}^d = \alpha Y_{t-1}$$

# 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** $CC = \phi + \delta = r - \dot{p}^e + \delta.$
- **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:**

$$CC = (1-\tau)(r - \dot{p}^e + \delta).$$

- **This leads to an investment function of the form:**

$$I_{n,t} = I(Y_t, r_t, \dot{p}_t^e, \tau_t, K_{t-1})$$