

Rational Expectations And PIH/LCH Under REH

Macroeconomics I
ECON 309 – Cunningham

Muth: Rational Expectations

- Muth, John F., “Rational Expectations and the Theory of Price Movements,” *Econometrica*, vol. 29 no. 3 (July 1961).
- “In order to fairly simply explain how expectations are formed, we advance the hypothesis that they are essentially the same as the predictions of the relevant theory.”
- “... the economy does not waste information ... ”
- “What kind of information is used, and how it is put together to frame an estimate of future conditions is important to understand because the character of dynamic processes is typically very sensitive to the way expectations are influenced by the course of actual events.”

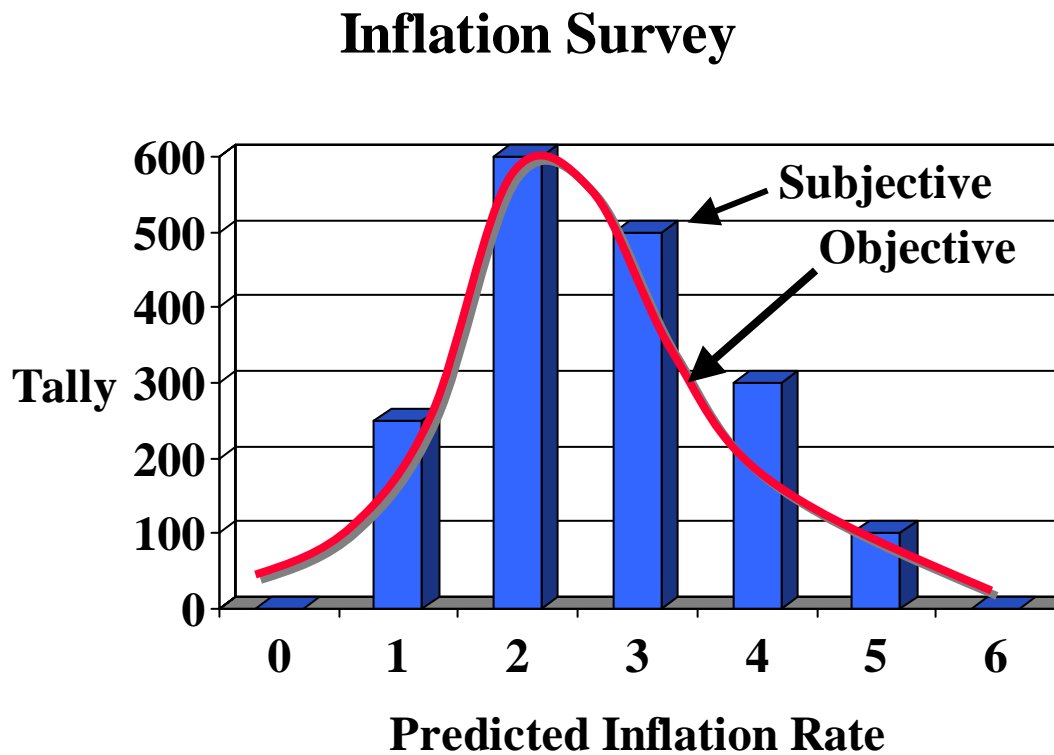
More Muth

- **Two major conclusions from studies of expectations data are:**
 - **Averages of expectations in an industry are more accurate than naive models and as accurate as elaborate equation systems...**
 - **Reported expectations generally underestimate the extent of changes that actually take place.**
 - **To order to explain these phenomena, I should like to suggest that expectations, since they are informed predictions of future events, are essentially the same as the predictions of the relevant economic theory.**

More Muth

- **More precisely, the expectations (the subjective probability distribution of outcomes) tend to be distributed, for the same information set, about the prediction of the theory (or the “objective” probability distributions of outcomes).**

Rational Expectations



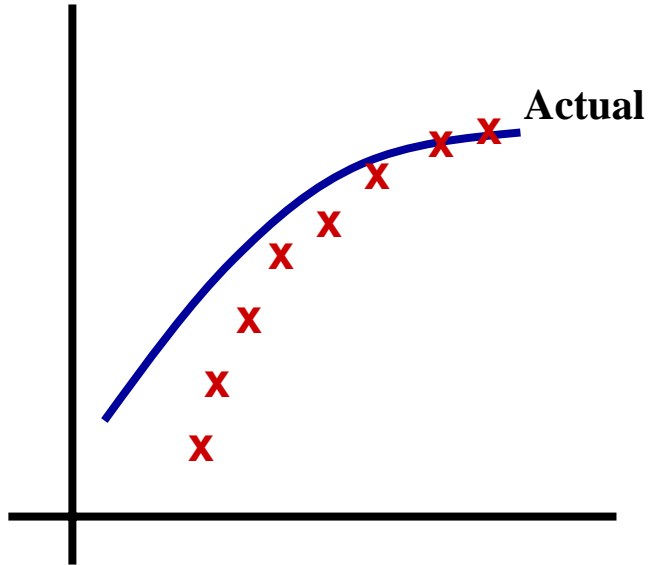
More Muth

- **Information is scarce, and the economic system generally does not waste it.**
- **The way expectations are formed depends specifically on the structure of relevant system describing the economy.**

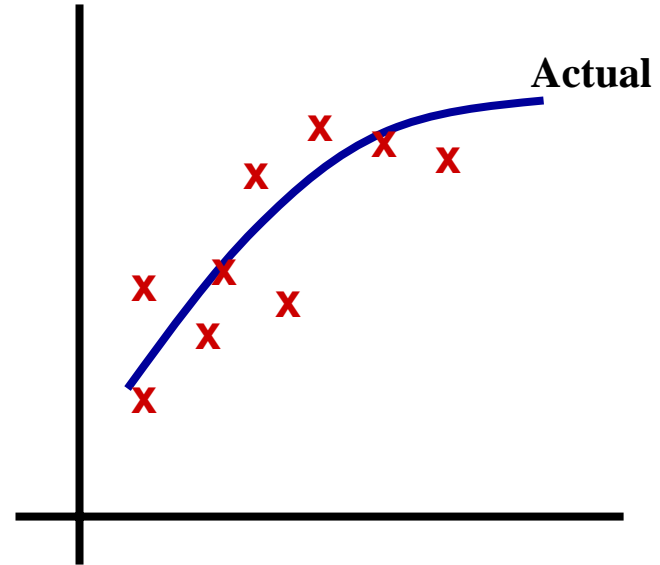
Rational Expectations Hypothesis (REH)

- **Expectations are formed on the basis of all available relevant information concerning the variable being predicted.**
- **Agents understand the underlying economic relationships.**
- **As a result, expectational errors are NOT systematic.**

Adaptive vs. Rational Expectations



Adaptive Expectations



Rational Expectations

Consumption Function

- **Major Problem of Empirical Research:**
 - Fitting the part of the model that relates current and past observed income to expected future income.
 - Usually done with a fixed distributed lag, amounting to adaptive expectations.
 - Muth (1960) shows that this is only optimal under certain stochastic processes for income.

Early Critiques

- Haavelmo (1943, *Econometrica*) and Friedman and Becker (1967, *JPE*).
- Problem: failing to account for income as an endogenous variable when it is the major independent variable in the consumption function.
 - $C = C_0 + cY$, and $Y = C + I + G + NX$.
 - This distorts the estimated functions.
 - Does it even make sense?
 - Requires simultaneous equation techniques.

Lucas Critique

- **Robert Lucas (1976), “Critique”.**
- **Criticizes 3 structural relations, and one of them is the consumption function. Argues:**
 - **It is not merely misspecified. There is no such thing!**
 - **There exists a structural relation between permanent income and consumption.**
 - **The consumption function asserts a structural relation between observed and permanent income, and there is no reason to expect a stable relation of that type!**
 - **Policy changes “apparently” unrelated to consumption behavior can affect the way that the consumer optimizes.**
 - **There exist structural relations in the economy, but consumption is not one of them.**

Hall's PIH/LCH under REH

- Hall (1978, JPE)
- Essentially an empirical investigation.
- Assumes none of the RHS variables is exogenous.
- When consumers maximize expected future utility, the conditional expectation of future marginal utility is a function current consumption alone—all other information is irrelevant.
- Aside from a trend, the marginal utility evolves as a random walk
- If the marginal utility is a random walk, then consumption must also be a random walk.
 - Therefore, only first-lagged consumption should have a nonzero coefficient.
 - This can be tested without regard to exogeneity.

Hall (2)

- The consumer seeks to maximize:

$$E_t \sum_s \left(\frac{1}{1 + \delta} \right)^s u(c_{t+s})$$

- Subject to:

$$\sum_s \left(\frac{1}{1 + r} \right)^s (c_{t+s} - w_{t+s}) = A_t$$

E_t = math expectation conditional on all available information

δ = rate of subjective time preference

r = real rate of interest, assumed constant over time

$u()$ = one-period utility function, strictly concave

c_t = consumption

w_t = earnings from sources (other than savings)

A_t = assets apart from human capital

Hall (3)

- Browning (1986) relaxes intertemporal separability.
- The Euler equation expressing the marginal rate of substitution

$$E_t u'(c_{t+1}) = \frac{1 + \delta}{1 + r} u'(c_t)$$

marginal utility next year equals the marginal utility this year, except for a trend related to the constant rate of time preference and the constant real interest rate.

Hall (4)

Implication:

$$u'(c_{t+1}) = \frac{1 + \delta}{1 + r} u'(c_t) + \varepsilon_t$$

$$E_t[\varepsilon_t] = 0$$

$$\text{cov}[\varepsilon_t, u'(c_t)] = 0$$

Note that Hall does not try to make use information about the functional form of the utility function.

Assuming a quadratic utility function:

$$c_{t+1} = \lambda c_t + \varepsilon_t$$

Test: Put many lags on the RHS, use t-test to test for exclusions.

Hall (5)

- **Result:**

- **Consumption is close to a random walk, but certain variables have enough predictive power that the hypothesis is rejected.**
 - **Confirmed for real disposable income. That is, lagged Y_d had little predictive power.**
 - **The only thing that helps predict next period's consumption is this period's consumption.**
 - **Rejected when stock prices are included. That is, lagged stock prices inform consumption decisions.**

Flavin's Response

- **Marjorie Flavin (1981, JPE)**
- **Revisits Hall's hypothesis using a structural, RE model.**
- **Argues that income is "fairly highly serially correlated"**
- **Fluctuations in current income should correlate with fluctuations in permanent income.**
- **Assumes that income follows a stable stochastic process.**

Flavin (2)

- **Uses an ARMA model of the income time series to quantify the magnitude of the revision in permanent income implied by a contemporaneous change in current income.**
- **Based on forecast errors or “innovations” to the income series, people revise their expectations about future income. That is, ΔY_d represents “new information”.**
- **Result: Observed sensitivity of consumption to current income is greater than that predicted by PIH/LCH under REH. This is referred to by others as “excess sensitivity to current income”.**

Flavin vs. Hall (1)

- **Analysis involves an explicit structural consumption function.**
 - It assumes real income obeys a stable stochastic process, and hence is open to Lucas' criticism.
- **Goodfriend (1986, FRB Richmond): Flavin's procedure is based on the assumption that aggregate income is immediately observable. If there is a one-quarter reporting lag, theory would suggest rejection roughly along the lines of Flavin.**
- **Mankiw and Shapiro (1985, JME): Her detrending procedure would induce her results, even if it were absent from the original data.**

Flavin vs. Hall (2)

- **Stock and West (1987, Harvard/NBER):**
 - Challenged Mankiw and Shapiro's result.
 - By detrending a random walk with drift, Flavin induced a change in the large sample distribution from a normal to a nonstandard distribution of the type associated with an ARMA process with unit roots.
 - Using the results of Sims, Stock, and Watson (1987, Hoover), they argue that Hall's original tests based on lagged consumption would be valid even with preliminary detrending.
 - The key difference is that Hall included lagged consumption, and Flavin did not. Stock and West present Monte Carlo studies to support their position.

Flavin vs. Hall (3)

- **Deaton (1986) also casts doubt on the detrending bias hypothesis.**
 - Argues that the response is too small rather than too big if we assume that income is AR1.
 - That is, you get different results under different assumptions about the proper ARIMA process for income.
- **West (1986) used variance bounds tests to examine relative variabilities on consumption and disposable income.**
 - Ambiguous result, but suggests excess smoothness.
- **Christiano (1987) argues that small influences through intertemporal substitution associated with variations of real returns could explain the excess smoothness.**

Flavin vs. Hall (4)

- **Nelson (1987, JPE) uses logarithmic utility and log-normal distribution for later consumption.**
 - Confirms Hall
 - Supports detrending explanation for Flavin
- **Miron (1986) argues that the results can be reversed by using seasonally unadjusted data and explicit handling of seasonal effects.**
 - Rejects Flavin, supports Hall.
- **Evans (1982) and Christiano (1984) argue that data composed as time averages can affect the results.**

Flavin vs. Hall (5)

- **Maybe the answer is a liquidity constraint.**
 - What if consumers are unable to borrow when income is temporarily low?
 - Conclusion: liquidity constraints help explain, but are not enough. It turns out that only a minority of consumers are constrained.
 - Hayashi (1987) provides a complete survey of the literature on this.
 - Muellbauer (1983, EJ) argues:
 - Consumer faced with binding liquidity constraints behaves as if faced by a higher interest rates.
 - Substitutes away from current consumption because it is, in effect, more expensive.

Flavin vs. Hall (6)

- **Flavin (1985, Canadian Journal)**
 - **Considers liquidity constraints in an extension of the earlier model.**
 - **Offers explanations for earlier results:**
 - **Consumers are myopic**
 - **Liquidity constraints**
 - **Uses unemployment rate as a proxy for liquidity constraints**
 - **Unemployment helps predict future income**
 - **When it is interpreted as a liquidity constraint indicator, measure excess sensitivity falls.**
 - **Problem: Because of the relation of U to Y, the results are not clear.**

Flavin vs. Hall (6)

- **Is sensitivity related to the durability of goods?**
 - **Mankiw (1982, JME)**
 - Assumes constant depreciation of durables.
 - Argues that durables purchases are close to a random walk, which implies that the deterioration rate for durables is 100%.
 - **Bernanke (1984, QJE)**
 - Looks at automobiles and finds no evidence of excess sensitivity.
 - **Bernanke (1985, JME) finds excess sensitivity under the assumption of constant real interest rates.**
- **Flavin (1981) and others suggest that consumption may have another stochastic component not explained by PIH/LCH.**