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THE TRUE MEANING BEHIND THE STOCHASTIC HYPOTHESIS WHICH ASSERT THAT E(E)=0 ?

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ABSTRACT

The aim of this Paper is to examine the meaning about the classical hypothesis which claim that the error of expectation equal zero, by mentioning all theories of expectations before and after the REH. The rational expectations paradigm has dominated the field of economics ever since it was introduced some fifty years ago. Recently research in heterogeneous expectations, bounded rationality, and models of learning have gained leverage, and focus has shifted away from the rational expectations hypothesis. Despite these developments over the past few decades, the rational expectations paradigm is still very much the standard way of handling uncertainty in economic theory, and often the rationality assumption is not seriously questioned.

Keyword: Rational Expectations, errors, learning model

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INTRODUCTION

One of the most distinct implications of the rational expectations assumption to consumption theory is the Rational Expectations–Permanent Income Hypothesis (REPIH). The Permanent Income Hypothesis (PIH) itself, which has become mainstream macroeconomics, states that consumption is determined by long-term income expectations not by current disposable income, as the traditional Keynesian view suggests. The REPIH, which is an extension of this proposition, deals with the situation where future income is uncertain and cannot be perfectly anticipated. First proposed by Robert E. Hall (1978) ,by estimating of the Euler condition, while

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Davidson, Handry, Srba and Yeo popularized the Error Correction Mechanism ECM; ECM simultaneously models the long run dynamic and the short run fluctuation. After this model was seen as a consequence of cointegration via the Granger representation theorem, the hypothesis asserts that since all relevant information available to the agents should already be embodied in the optimal consumption decision, the only relevant predictor of future consumption level is its current level.

1. RATIONALITY AND THE ROLE OF EXPECTATION

1.1 Rationality

o Rationality is characterized by the coincidence of subjective expectations and mathematical expectations conditioned on the marginal-cost determined information set.

o What does it mean to say that a choice is "rational"? In rational choice theory it means only that an agent's choices reflect the most preferred feasible alternative implied by preferences that are complete and transitive (that is, choices reflect utility maximization.) This is a quite narrow definition of rationality.

o More generally, a "rational" choice must by definition be a choice based (somehow) on reason.

1.2. The role of expectations

One reason to be skeptical about model's predictions is that it assumes producers are extremely shortsighted. Assuming that farmers look back at the most recent prices in order to forecast future prices might seem very reasonable, but this backward-looking forecasting (which is called adaptive expectations) turns out to be crucial for the model's fluctuations. When farmers expect high prices to continue, they produce too much and therefore end up with low prices, and vice versa. In the stable case, this may not be an unbelievable outcome, since the farmers' prediction errors (the difference between the price they expect and the price that actually occurs) become smaller every period. In this case, after several periods prices and quantities will come close to the point where supply and demand cross, and predicted prices will be very close to actual prices. But in the unstable case, the farmers' errors get larger every period. This seems to indicate that adaptive expectations is a misleading assumption: how could farmers fail to notice that last period's price is not a good predictor of this period's price?

The fact that agents with adaptive expectations may make ever-increasing errors over time has led many economists to conclude that it is better to assume rational expectations, that is, expectations consistent with the actual structure of the economy. However, the rational expectations assumption is controversial since it may exaggerate agents' understanding of the economy. The cobweb model serves as one of the best examples to illustrate why understanding expectation formation is so important for understanding economic dynamics, and also why expectations are so controversial in recent economic theory.

2. EXPECTATIONS IN MACROECONOMICS

Rational expectations developed partly as a reaction against alternative specifications of expectations formation which may characterized as naïve-expectations or non-rational expectation1s.

2.1 The static expectations hypothesis

The simple way of modeling expectations in economic theory is to assume that conditions prevailing today will be maintained in all subsequent time periods. Expected future values then become identified with current values. This formulation can be considered on one of two levels prevailing today. Alternatively, the static expectations can be formulated to argue that the expected rate of inflation or the rate of economic growth in future period will be the same as the rate of inflation or growth prevailing today. In either case, the static expectations hypothesis is tantamount to assuming that the economy has achieved steady state equilibrium.

Much of classical economics tacitly assumed the existence of static expectations. Moreover, they tended to consider such expectations to be held with a reasonable degree of certainly and not to be subject to sudden and violent fluctuation.

The static expectations hypothesis can be modeled as follow, assuming that expectation of future values are formed with a one period lag then P^e is the expected price value and P the actual price value and the time period is denoted by the subscript *t* then at time ***t-1 a*** and at time

$p_t^e = p_{t-1}$ (1)

$p_{t+1}^e = p_t$ (2)

Considering that there is no necessary relationship between $p_{t+1}^e \, and \, p_t$.

The main criticism of the concept of static expectations is that it assumes that people ignore the information about possible shifts in policy variable.

2.2 Adaptive expectations hypothesis

A hypothesis stating that individuals make investment decisions based on the direction of recent historical data, such as past inflation rates, and adjust the data (based on their expectations) to predict future rates.

The Adaptive Expectations model is based on the notion that economic agents develop forecasts of future inflation based on past actual rates adjusted for their own past expectations. Specifically, inflationary expectations are calculated by using a weighted average of past actual 'π_t' and past expected inflation 'E [π_{t-1}]':

$E[\pi_t] = \theta \, \pi_{t-1} + (1-\theta)E[\, \pi_{t-1}]$ (3) where $0 < \theta < 1$

By algebraically rearranging this equation we have:

$E[\pi_t] = E\,[\pi_{t-1}] + \theta\, \{\pi_{t-1} - E\,[\pi_{t-1}]\}$ (4)

where the term in the brackets represents the forecast error made by the economic agent in attempts to determine the previous rate of inflation. From this second equation current inflationary expectations are defined to be the sum of the rate previously expected and this forecast error. The rate by which economic agents *adapt* to accelerating inflation depends on the value of the weight 'θ' assigned to past expected inflation in developing current inflationary expectations. Note if this weight is equal to one then current inflationary expectations are exactly equal to the size of this forecast error.

In its most general form the adaptive hypothesis states that in any one period expectation are revised in the light of past errors of expectation. In its simplest form it can be written as

$\Pi_t^* - \Pi_{t-1}^* = \theta(\Pi_{t-1}\Pi_{t-1}^*)$; (5)

Where Π_{t-1}^* stands for expectations of Π_{t-1} .the magnitude of the revision in expectations. In its simplest is determined by the coefficient θ, assumed to lie in the range $0 < \theta < 2$. A high value of θ means a rapid adjustment. The simple expectation formation mechanism is usually referred to as a first-order adaptive scheme or a first-order error-correction mechanism, and was initially applied in economics by Koyck in a study of investment, by Cagan in a study of demand for money in condition of hyper-inflation, and by Nerlove(1958) in the Cobweb

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phenomena. Up until the early 1970s, adaptive schemes were also used extensively in empirical studies of the relationship between inflation and unemployment.
The simple adaptive process can also be generalized in a straight-forward manner to higher-older schemes. The r^{th} order adaptive expectations model may be written as

$\Pi_t^* - \Pi_{t-1}^* = \sum_{i=1}^{r} \theta_i (\Pi_{t-i} \Pi_{t-i}^*)$;   (6)

One important feature of the adaptive mechanism lies in the fact that it can be written as a fixed-coefficient infinite distributed lag function in Π_{t-i} (i$>= 1)$, with suitable restrictions on the lag-coefficients. Using the one-period lag operator L (L $\Pi_t = \Pi_{t-i})$, equation may be written as:

$\{1 - (1-\theta)L\}\Pi_t^* = \theta \, \Pi_{t-i}$ (7)

Therefore, the first-order adaptive expectations hypothesis can also be viewed as a special case of a more general hypothesis that postulates

$\Pi_t^* = \sum_{i=1}^{\infty} \omega_i \, \Pi_{t-i} = W(L)\Pi_{t-i}$,   (8)

With the weights $\{\omega_i\}$ $restr$icted to follow a geometrically declining sequence. A comparison of (2,3) and (2,4) reveals that

$\omega_i = \theta(1-\theta)^{-1}$, i=1,2,…………

And that $\sum_{i=1}^{\infty} \omega_i = 1$. clearly, the use of higher-order adaptive schemes will result in less restrictive patterns for ω_i. Notice, however, that under the adaptive expectations hypopthesis the restriction $\sum_{i=1}^{\infty} \omega_i = 1$ cannot be relaxed. For the general adaptive scheme the infinite order polynomial $W(L)$ in the lag operator L is given by:

$$W(L) = \frac{\sum_{i=1}^{r} \theta_i L^i}{1-(1-\theta_1)L + \sum_{i=2}^{r} \theta_i L^i} , \qquad (9)$$

And W(1)=1, for all values of r.
The adaptive expectations hypothesis, whether in its simple form or the general distributed lag form, is, however, subject to two important objections. Firstly, in periods when the rate of inflation is accelerating, expectations of the inflation rate formed according to the adaptive hypothesis will systemically underestimate the actual rate of inflation.
The second objection to the simple adaptive expectations hypothesis or the general extrapolative formulation is more fundamental, and concerns the limited information set upon which the adaptive or purely extrapolative hypothesizes are based. It ignores relevant information.

2.3 The Rational Expectations Hypothesis (REH)

The essence of REH is in the assertion that individuals should not make systematic expectational errors. In effect, 'informed prediction' must be on average correct for economics agents to be satisfied with their mechanism of expectation formation. If systematic errors prevailed, there would be incentive to diagnose the source of the error and to amend the expectation mechanism accordingly. Thus, the REH is concerned with incentive to acquire information and to take advantage of any profitable opportunity for behaviour revision. Thus, the economic rationality attributed to a broad range of economic activity is extended to encompass expectation formation.

The formalization of the REH is attributable to Muth(1961). For linear macroeconomic models the rational expectation of a variable is its conditional mathematical expectation. This guarantees that expectational errors will be orthogonal

with respect to the values of all variables known at the time of expectation formation, so precluding any systematic error component.
Let *E* been the mathematical expectations operator. For x, as a continuous random variable, its associated probability vector is described by the density function f(x) and its expected values by:
E(x)= $\int_a^b f(x)dx$ where a and b represent the lower and upper limits of the x interval, respectively.
The of x at time t+1 conditional to some set information available at time t, denoted I_t, is given by:
E(x_{t+1}/I_t)= $\int_a^b f(x_{t+1}/I_t)$d x_t (10)
Where $f(x_{t+1}/I_t)$ is the conditional probability density function. For the linear models it is straightforward to specify the REH as the condition:
$x^e_{t+1,t} = E(x_{t+1}/I_t) = E_t x_{t+1}$
Such that the subjective expectation of x_{t+1} formed in period t coincides with the corresponding conditional mathematical expectation. The properties of the subjective expectation under the REH are then those of the conditional mathematical expectation. These are most importantly unbiasedness, orthogonality and efficiency.
Let $\varepsilon_{t+1} = x_{t+1} - E_t x_{t+1}$; (11)
The conditional expectation of the forecast error $\varepsilon_{t+1}$is Zero, the forecast of x_{t+1} is known in period t, while the conditional expected of x_{t+1} is simply the forecast again. Thus:
$E_t(\varepsilon_{t+1}) = E(\varepsilon_{t+1}/I_t) - E_t(E_t x_{t+1})$ (12)
So the expected value of errors is zero and they should be independent with all previous events. Formally, as property of conditional expectation, the requirement is that from some initial circumstance subsequent forecast errors must be unpredictable, in that they are independent of any $S_t$subset of available information set:
$E[x_{t+1} - E\,(x_{t+1}/I_t)]\,/S_t = 0$ (13)
empirical import of this property is that in attempting to test hypotheses regarding decisions incorporating rational expectations, it is not necessary to collect data on all information available when forming those expectations is deemed to hold for each and every subset.
A point to be emphasized is that REH applies to the typical or representative individual, and not necessary to specific individuals. It is not asserted that individuals have identical subjective expectations, all coinciding with the conditional mathematical expectation. Rather, those individual expectations should in the aggregate be distributed about that conditional expected value.

2.4. Learning hypothesis

There is no doubt that individual do learn from their own experience as well as from the experience of others, Generally speaking, learning takes place through 'repetition 'and 'understanding', learning by repetition alone is possible, but is generally confined to events that are serials which are rather rare, in the sense that they can be repeated many times under the same circumstance Learning involves a trial (formulation of new theories) and error elimination process. In learning, we have Bayesian learning, econometric learning and the automatic one.

2.4.1. Rational Learning Models

The rational learning framework assumes that agents know the correct specification of the correct equilibrium relationships between the market prices and private signals, but are uncertain about some parameters of those relationships. The problem of rational learning then centres on estimation of finite number of unknown parameters in interactive setting where there is a feedback from expectation to outcomes that takes place the learning period, by introducing an additional source of variability into the model, further complicates the act of learning.

2.4.2. Boundedly Rational Learning Models

This alternative model does not require that agents should the structural equilibrium relations, but assume instead that agents use some 'plausible' or 'reasonable' rule of learning to which they remain committed over the whole period that learning is taking place. The informational requirements of this approach are not severe as the rational learning model, but are subject to two important shortcomings. Firstly, the idea of 'bounded rationality' is not fully spelled out. Agent are supposed to follow a 'reasonable learning rule', but it is not explained what constitutes a reasonable rule, nor is it explained how, before of the commencement of the act learning, agents collectivity come to choose the same learning rule. Secondly, the approach does not follow for a revision of the learning rule, which is justifiable only if it can be shown that the rule chosen does in fact ensure convergence to the Rational Expectations Equilibrium (REE). The learning rules adopted in these models necessitate that agents know the reduced form equation of the true model expected for finite number of unknown parameters. The main difference between the rational learning models and this modal lies in the type of a *priori* information each model supposed that agents have.

2.4.3. Learning in a Cobweb Model

The model is composed of a linear supply function relating total quantity supplied(q_t^d) to a vector x_{t1} of exogenous variable and producer ' (average) price expectations in period *t* formed at *t-1* (i.e. $_{t-1}p_t^*$,or simply p_t^*).The quantity demanded (q_t^d) is assumed to be a linear function of the current price (p_t) ,and a vector of exogenous variable x_{2t} .both demand and supply are assumed subject to random shocks ε_{t1} and ε_{t1}.Here we assume that these random shocks are white-noise processes independently of all the exogenous variable of the model . The full model can be written as

Supply function: $q_t^s = x'_{t1}\alpha_1 + \beta_1 p_t^* + \varepsilon_{t1}$, (14)

Demand function $q_t^d = x'_{t1t2}\alpha_2 + \beta_2 p_t + \varepsilon_{t2}$, (15)

Market clearing condition $q_t = q_t^s = q_t^d$, (16)

Suppose now the producers do not know the structural parameters $\alpha_1, \alpha_2, \beta_1, and\ \beta_2$ and hence are not able to form (rational) expectations of prices. How are they then likely to form expectations? Clearly in the absence of any definite knowledge about the underlining model, or its parameters, producers have to make an initial guess at what the price will be during the $next\ period$.The problem of learning centers on whether there is adjustment or a revision rules that producers could use to modify their expectations(every time new evidence comes to light)in such a way as to lead them closer to RE values, p_{t0}^* ,.

CONCLUSION

The rational expectations paradigm has dominated the field of economics ever since it was introduced some fifty years ago. Recently research in heterogeneous expectations, bounded rationality, and models of learning have gained leverage, and focus has shifted away from the rational expectations hypothesis. Despite these developments over the past few decades, the rational expectations paradigm is still very much the standard way of handling uncertainty in economic theory, and often the rationality assumption is not seriously questioned.

A prominent theory is the Rational Expectations–Permanent Income Hypothesis (REPIH), which asserts that consumption decisions should, at the optimum, follow a random walk process. This result from applying the assumption of rational expectations: if our households form their expectations on future consumption rationally, they base them on all relevant information available to them. Then, no past information should have any predictive power over the future decision, since all relevant information is already contained in the most recent consumption decision.

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