liberation. Reading Heidegger in relation to Hegel he produced in *Being and Nothingness* (1956 [1943]) an impressive restatement of the entire project of modernity as the discovery of human autonomy. Here the commitment to freedom as the fundamental prerequisite for any valued form of human being is restated with unsurpassed determination. The result is less a secular version of a Christian notion of existence (Kierkegaard) than the consecration of a particular kind of Romanticism (Fichte). This is characteristic also of Albert Camus (1913–60), whose *The Rebel* (1954) returned to nineteenth-century Russian literature for an understanding of nihilism as the most consistent and fearless of existential views of the human world. Only the free act could be considered authentically human, and as conformity to any existing convention was tainted with coercion, acts of rebellion bore the only indubitable sign of freedom and, therefore, of authenticity.

Sartre increasingly sought for his existentialism a larger and more dramatic stage; history and the collective subject, rather than the small individual acts of everyday life, supplied the setting for the working out of the great refusal; the negation of everything intolerable in modern life. The attempted synthesis of existentialist and Marxist traditions resulted, in *Critique of Dialectical Reason* (1976 [1960]), in a social theory paradoxically 'founded' on 'anti-foundational' existential insights. Through this Sartre sought to establish praxis relevant to contemporary life rather than an explanation of its various features.

His views, thus, remain rooted in existential insight; 'The only concrete basis for the historical dialectic is the dialectical structure of individual acts.' The radical freedom central to *Being and Nothingness* is somewhat muted here—reciprocity and otherness, mediated through a series of 'objective' forms (dyad, triad, serial group, fused group, statutory group, organization, class), are conceived as pre-given and as essential aspects of, and constraints upon, every human project. However the subversive genius of its empty form is also invoked: 'For freedom is nothing other than a choice which creates for itself its own possibilities.' The human remains the being for whom 'The upsurge of freedom is immediate and concrete.'

Existential social theory seeks to realize two distinct and seemingly incompatible values; the absolute and untrammeled freedom of the subject; and the actualization of authentic selfhood. Much of the development of existentialism is an attempt to reconcile these two values and to imagine a social world in which they could be harmonically interrelated. The urgency and difficulty of such a task is the source of the pathos, which distinguishes all serious existential social theory.

See also: Marxist Social Thought, History of; Modernity; Modernity: History of the Concept; Modernization and Modernity in History; Nietzsche, Friedrich (1844–1900); Sociology, History of; Weber, Max (1864–1920); Weberian Social Thought, History Of

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Expectations, Economics of

'Expectations' in economics refers to the forecasts or views that decision makers hold about future prices, sales, incomes, taxes, or other key variables. The importance of expectations is due to their often substantial impact on the current choices of firms and households, and hence on current prices and the overall level of economic activity.

1. *Expectations in the History of Thought*

Modern economic theory recognizes that the central difference between economics and natural sciences lies in the forward-looking decisions made by economic agents. Therefore expectations are a basic building block of economic theories. For example, in consumption theory the paradigm life cycle and permanent income approaches stress the role of expected future incomes. In investment decisions present value calculations are conditional on expected future prices and sales. Equity prices, interest rates, and exchange rates all clearly depend on expected future prices.

A central aspect of economic theories is that expectations influence the time path of the economy, and conversely one might reasonably hypothesize that the time path influences expectations. The current standard methodology for modeling expectations is to assume *rational expectations* (RE), which is in fact an equilibrium in this two-sided relationship.

RE modeling is a recent key step in a long line of dynamic theories which have emphasized the role of expectations. The earliest references to economic expectations or forecasts date to the ancient Greek philosophers and the Bible. Systematic economic analyses in which expectations play a major role began as early as Henry Thornton's treatment of paper credit, published in 1802, and Émile Cheysson's 1887 formulation of a framework which had features of the 'cobweb' cycle. The role of expectations was given some attention by the classical economists, but their method of analysis was based on the stationary state in which perfect foresight prevails. Expectations were equated with actual outcomes, which downplayed their significance.

Alfred Marshall is credited with the notion of 'static expectations' of prices. The *'cobweb' model* of a market with a production lag was one of the first formal models with expectations in the 1930s. In the same decade, the *temporary equilibrium* approach, initiated by the Stockholm school, explicitly introduced expectations of future prices influencing current demands and supplies. John Muth (1961) was the first to formulate the notion of rational expectations and did so in the context of the cobweb model.

In macroeconomic contexts the importance of the state of long-term expectations of prospective yields for investment and asset prices was emphasized by John Maynard Keynes (1936) in his General Theory. Keynes stressed the central role of expectations for the determination of output and employment, but did not have an explicit model of how expectations are formed. He even sometimes suggested that attempting to forecast very distant future events can virtually overwhelm rational calculation. In the 1950s and 1960s expectations were introduced into almost every area of macroeconomics, including consumption, investment, money demand and inflation using *adaptive expectations* or related schemes.

Rational expectations made the decisive appearance in macroeconomics in the work of Robert E. Lucas Jr. and Thomas J. Sargent in the beginning of 1970s. Many of the key contributions are collected in Lucas and Sargent (1981) and Lucas (1981). The RE hypothesis became widely used in the 1970s and 1980s and it is currently the benchmark paradigm in both micro- and macroeconomics. Some recent research has gone beyond RE by developing models of *learning behavior* with explicit theories of data collection and forecasting.

In this article we review developments in the modeling of expectations formation, with an emphasis on rational expectations and learning behavior. RE modeling is the subject of many books, e.g., Sargent (1987) and Farmer (1999). Evans and Honkapohja (2001) is a treatise on the learning approach.

2. Traditional Models

We will illustrate the modeling of expectations with some well-known simple models. The first example is the cobweb model. Consider a single competitive market in which there is a time lag in production. Demand is assumed to depend negatively on the prevailing market price:

$$d_t = m_I - m_p p_t + v_{1t} \tag{1}$$

while supply depends positively on the expected price:

$$s_t = r_I + r_p p_t^e + v_{2t} \tag{2}$$

where $m_p, r_p > 0$ and m_I and r_I denote the intercepts. We have introduced shocks to both demand and supply. v_{1t}, v_{2t} are exogenous *iid* (identically and independently distributed) random variables with mean zero and constant variance.

The interpretation of the supply function is that there is a one-period production lag, so that supply decisions for period t must be based on information available at time $t-1$. For simplicity we make the representative agent assumption that all agents have the same expectation. Extensions to heterogeneous expectations have been analyzed in the literature.

We assume that markets clear. The observed price is then obtained by equating s_t and d_t, which leads to

$$p_t = \mu + \alpha p_t^e + \eta_t \tag{3}$$

where $\mu = (m_I - r_I)/m_p$ and $\alpha = -r_p/m_p < 0$. $\eta_t = (v_{1t} - v_{2t})/m_p$ so that we can write $\eta_t \sim iid(0, \sigma_\eta^2)$, i.e., η_t is an *iid* random variable with mean zero and variance σ_η^2.

Equation (3) is an example of a temporary equilibrium relationship. It illustrates the central role of expectations by showing how the current market-clearing price depends on expected prices. Developments since the Stockholm School and Keynes can be seen as different theories of expectations formation, i.e., how to close the model so that it constitutes a fully specified dynamic theory. We now describe briefly some of the most widely used schemes with the aid of this example.

2.1 Static Expectations

Naive or *static expectations* were used widely in the early literature. In the context of the cobweb model they take the form

$$p_t^e = p_{t-1} \quad (4)$$

Once this is substituted into Eqn. (3) one obtains $p_t = \mu + \alpha p_{t-1} + \eta_t$, which is a stochastic process known as an autoregressive process of first order (AR(1)). This and related stochastic processes are studied in standard textbooks on time series analysis and econometrics.

In the early literature there were no random shocks, yielding a simple difference equation $p_t = \mu + \alpha p_{t-1}$. This immediately led to the question of whether the generated sequence of prices converged to the stationary state over time. The convergence condition is, of course, $|\alpha| < 1$. Whether this is satisfied depends on the relative slopes of the demand and supply curves. In the stochastic case this condition determines whether the price converges to a stationary stochastic process. (Loosely speaking, a stationary stochastic process is a non-explosive process with statistical properties that are unchanging over time.)

2.2 Adaptive Expectations

The origins of the *adaptive expectations* hypothesis can be traced back to Irving Fisher. It was formally introduced in the 1950s by Phillip Cagan, Milton Friedman, and Marc Nerlove. In terms of the price level the hypothesis takes the form

$$p_t^e = p_{t-1}^e + \lambda(p_{t-1} - p_{t-1}^e) \quad (5)$$

For the cobweb model it can be shown that both expectations and prices converge to stationary stochastic processes, provided the stability condition $|1 - \lambda(1-\alpha)| < 1$ is met.

Adaptive expectations can equivalently be written as a distributed lag with weights declining exponentially at rate $1 - \lambda$. Besides adaptive expectations other distributed lag formulations were used in the literature to allow for extrapolative or regressive elements.

Adaptive expectations played a prominent role in macroeconomics in the 1960s and 1970s. For example, inflation expectations were often modeled adaptively in the analysis of the expectations augmented Phillips curve.

3. Rational Expectations

The RE revolution begins with the observations that adaptive expectations, or any other fixed weight distributed lag equation, may provide poor forecasts in certain contexts and that better forecast rules may be readily available. The optimal forecast method depends on the stochastic process of the variable being forecast and this implies interdependency between the forecasting method and the economic model. On this approach we write

$$p_t^e = E_{t-1} p_t \quad (6)$$

for the cobweb example. $E_{t-1} p_t$ denotes the mathematical expectation of p_t conditional on variables observable at time $t-1$ (including past data).

RE is an equilibrium concept. The actual stochastic process followed by prices depends on the forecast rules used by agents, so that the optimal choice of the forecast rule by any agent is conditional on the choices of others. An RE equilibrium imposes the consistency condition that each agent's choice is a best response to the choices by others. In the simplest models we have representative agents and these choices are identical.

For the cobweb model we have $p_t = \mu + \alpha E_{t-1} p_t + \eta_t$. Taking conditional expectations E_{t-1} of both sides yields $E_{t-1} p_t = \mu + \alpha E_{t-1} p_t$ so that expectations are given by $E_{t-1} p_t = (1-\alpha)^{-1} \mu$ and we have $p_t = (1-\alpha)^{-1} \mu + \eta_t$. This is the unique way to form expectations which are 'rational' in the model (3).

Two related observations should be made. First, under RE the appropriate way to form expectations depends on the stochastic process followed by the exogenous variables, η_t in the example. If these are not *iid* processes then the RE will themselves be random variables, and they often form a complicated stochastic process. Second, neither static nor adaptive expectations are in general rational, except in special cases.

Next, we consider some key aspects of RE models.

3.1 Forward-looking Character

In the cobweb model expectations pertain only to current prices. Most economic models have forward-looking elements, so that expectations about future periods appear. A simple example is the *Cagan model of inflation* which postulates that the demand for money depends linearly on expected inflation:

$$m_t - p_t = -\psi(p_{t+1}^e - p_t) + \zeta_t, \quad \psi > 0 \quad (7)$$

where m_t is the log of the money supply at time t, ζ_t is an *iid* money demand shock with zero mean, p_t is the log of the price level at time t, and p_{t+1}^e denotes the expectation of p_{t+1} formed in time t. Solving for p_t we obtain the equation

$$p_t = \alpha p_{t+1}^e + \beta m_t + v_t \quad (8)$$

where $\alpha = \psi(1+\psi)^{-1}$, $\beta = (1+\psi)^{-1}$, and $v_t = -(1+\psi)^{-1}\zeta_t$. Note that $0 < \alpha < 1$ and $\beta = 1 - \alpha$.

The same formal model arises in other contexts, e.g., the standard model of asset pricing with risk neutrality takes the form of Eqn. (8) with different values for α and β. Under RE the model is

$$p_t = \alpha E_t p_{t+1} + \beta m_t + v_t \qquad (9)$$

Assume that m_t follows some general exogenous stochastic process. One can show that the expression

$$p_t = v_t + \beta \sum_{i=0}^{\infty} \alpha^i E_t m_{t+i} \qquad (10)$$

solves the model, provided that the sum converges. Given an exogenous stochastic process for m_t, techniques are available for computing the forecasts $E_t m_{t+i}$ and hence the RE solution (10).

An important feature of the solution (10) is its forward-looking character. The current price level is a sum of expected values of future money stocks. If, for example, there is a change in monetary policy which is anticipated to lower the money stock from some specified future date $T > t$, this will be reflected in the price level already at time t. Previously unexpected changes in policy will affect p_t from the moment they become known.

3.2 Solutions to Linear RE Models

Equation (9) is a simple example of a linear RE model. More general models allow for a dependence on lagged values of the endogenous variable p_t, expectations formed at different times and over various horizons, and more general exogenous processes. Generalizations to multivariate frameworks are particularly important in practice.

A number of techniques are available for obtaining solutions under RE. Undetermined coefficient methods are often particularly convenient. Frequently, as in the model (9) with $|\alpha| < 1$, there is a unique nonexplosive solution, given nonexplosive exogenous variables. In this case a method called the Blanchard–Kahn technique can be used to compute this solution.

4. Econometric Issues with Rational Expectations

4.1 Testing for Rationality

If the RE hypothesis is correct, then expectations obey very strong assumptions. The law of mathematical conditional expectations, from probability theory, states that $E(E(p\,|\,I)\,|\,S) = E(p\,|\,S)$ if S and I are alternative information sets with $S \subset I$. Here $E(p\,|\,\Omega)$ denotes the mathematical expectation of p conditional on an information set Ω. This result immediately implies $E(e\,|\,S) = 0$, where $e = p - E(p\,|\,I)$.

This result, called the *orthogonality principle*, implies that the RE forecast error e must be uncorrelated with every variable in the information set.

If data on expectations, for example from surveys, are available, then this provides a straightforward way to test for rationality. Suppose we have time series data on, say, the average one-period ahead forecast f_t of p_t, where the forecast f_t is made based on I_{t-1}, the information available at time $t-1$. Under RE $f_t = E(p_t\,|\,I_{t-1})$ and we therefore test whether $E(e_t\,|\,I_{t-1}) = 0$, where $e_t = p_t - f_t$. In practice, the test is implemented by a regression:

$$e_t = \phi' z_{t-1} + u_t \qquad (11)$$

where z_{t-1} is a vector of variables in I_{t-1}. Under the null hypothesis of RE the restrictions $H_0\colon \phi = 0$ hold and u_t is serially uncorrelated. H_0 can be tested using the standard F-test under some additional assumptions. The intuition for the tests is straightforward. If $\phi \neq 0$ then forecast errors are systematically correlated with z_{t-1} and the information in z_{t-1} is not being fully exploited.

Tests can also be conducted using forecast data with multiple period horizons and/or panel data, although these lead to econometric complications. In practice, tests of rationality using survey data on forecasts typically lead to rejections of rationality, although the interpretation of these results is controversial. Supporters of RE often argue that the individuals surveyed are not the relevant group of agents or that the expectations are measured with error. However, rejections of rationality also raise the possibility that agents do deviate from full RE owing to learning, forecasting costs, and/or strategic uncertainty. See Pesaran (1987) for further discussion of econometric tests of the rational expectations hypothesis.

4.2 The Lucas Critique

During the 1950s and 1960s, applied macroeconometric models explicitly or implicitly assumed that expectations were given by adaptive expectations or by some related lag scheme. The estimated systems were used for policy analysis by evaluating the effects of alternative policies. This implicitly assumed that the estimated coefficients reflect a structure that is invariant to alternative policies. Lucas (1976) criticized this approach, arguing that if expectations are rational, then the coefficients relating target variables to policy instruments will change when the policy process changes.

As an example, consider the Cagan model (9) with $\beta = 1 - \alpha$ and assume that money supply follows the rule

$$m_t = \mu + \rho m_{t-1} + w_t \qquad (12)$$

where $|\rho| < 1$ and w_t is an (unforecastable) mean zero *iid* shock. In this case the solution (10) reduces to

$$p_t = \delta + \gamma m_t + v_t \qquad (13)$$

where

$$\delta = (1-\alpha\rho)^{-1}\alpha\mu \quad \text{and} \tag{14a}$$

$$\gamma = (1-\rho\alpha)^{-1}(1-\alpha) \tag{14b}$$

The 'traditional' approach to policy would estimate δ and γ from historical data and use the estimated version of Eqn. (13) to evaluate the effects of alternative policy sequences m_t on the price level. However, it is clear from Eqn. (14) that γ is not invariant to the policy rule since, for example, a change in the policy parameter ρ affects the value of γ. Thus, under RE, the response of target variables to policy variables depends on the form of the policy rule.

The effect of the 'Lucas critique' has been to shift attention to estimation of deep parameters (such as α in the above example), which do remain invariant to policy changes and to use these estimates to evaluate alternative policy rules under RE.

4.3 Estimation and Testing of RE Models

When data on expectations are not available, it is still often possible in the context of structural models to both estimate the models under the assumption of RE and to test the RE assumption. In this case the RE assumption is being tested jointly with the model. A simple example is the Cagan model (9), with $\beta = 1-\alpha$, together with the money supply rule (12). Equations (12) and (13) can both be estimated, but Eqns (14a,b) imply that there are nonlinear cross-equation parameter restrictions that are imposed by the RE hypothesis. The system can be estimated under these overidentifying restrictions. The restrictions can also be statistically tested, in effect testing RE jointly with the model.

Another strand that has arisen recently is the estimation and testing of Euler equations. These are dynamic equations, relating, e.g., current consumption to expected future consumption and interest rates, which arise as optimality conditions from dynamic utility maximization. Under RE testable overidentifying restrictions again arise.

5. Multiple Equilibria and RE

Many RE models can have *multiple equilibria*. The existence of rational speculative bubble solutions besides the fundamental equilibrium illustrates this phenomenon. The standard model of asset pricing is formally identical with the Cagan model (8) if we set $v_t \equiv 0$, $\beta = 1$, $\alpha = (1+r)^{-1}$, where r is the real net interest rate. Here m_t represents the dividend at t and p_t is the price of the asset. Then Eqn. (10) is called the 'fundamental solution,' i.e., the present value of anticipated future dividends. A 'rational bubble solution' is the sum of the fundamental solution and a bubble, which is any process B_t satisfying $E_tB_{t+1} = \alpha^{-1}B_t$. The *bubble solutions* are 'explosive' since $\alpha < 1$, and macroeconomists are often content to assume away 'explosive bubbles,' although rational bubbles that burst periodically can be constructed. In models with carefully elaborated microfoundations, explosive solutions can often be ruled out theoretically. Nonetheless, the empirical issue of whether rational (or almost rational) bubbles affect asset prices is still debated.

Other models have multiple RE solutions, none of which are explosive. As a simple example, consider the model $p_t = \alpha E_t p_{t+1} + \beta m_t + v_t$ with $|\alpha| > 1$. (This case can arise from linearized versions of the overlapping generations model of money under some specifications of preferences.) If m_t is *iid* with mean $\bar{m}$, from Eqn. (10) there is the RE solution $p_t = (1-\alpha)^{-1}\alpha\beta\bar{m} + \beta m_t + v_t$. However, there are also solutions of the form

$$p_t = \alpha^{-1}p_{t-1} - \beta\alpha^{-1}m_{t-1} - \alpha^{-1}v_{t-1} + \varepsilon_t \tag{15}$$

where ε_t is an arbitrary process, observable at time t and satisfying $E_{t-1}(\varepsilon_t) = 0$.

These solutions are well-behaved nonexplosive processes. The variable ε_t is often called a 'sunspot' variable and the corresponding equilibrium a '*sunspot solution*.' The term sunspot is used to indicate the arbitrary nature of the variable. The solution depends on ε_t only because everyone believes that it does. It does not appear in the basic model structure. Guesnerie and Woodford (1992) provide a review of the results on sunspot equilibria and *endogenous fluctuations*.

It has been demonstrated formally that sunspot solutions can exist in overlapping generations models in which the microfoundations are carefully constructed. More recently it has been shown that, with increasing returns to scale and monopolistic competition, sunspot solutions can exist in variations of common business cycle models. These models raise the possibility that business cycle fluctuations may be due to random but rational fluctuations in household and firm expectations as a '*self-fulfilling prophecy*.' The empirical significance of self-fulfilling prophecies remains an open issue.

There are numerous other examples of multiple equilibria under RE. One example is provided by a variation of the Cagan model $p_t = \alpha E_t p_{t+1} + \beta m_t$, where now money supply is assumed to follow a feedback rule $m_t = \bar{m} + \xi p_{t-1} + u_t$. (Here also for convenience $v_t = 0$). This leads to the equation

$$p_t = \beta\bar{m} + \alpha E_t p_{t+1} + \beta\xi p_{t-1} + \beta u_t \tag{16}$$

For many parameter values this equation yields two RE solutions of the form

$$p_t = k_1 + k_2 p_{t-1} + k_3 u_t \tag{17}$$

where the k_i depend on the original parameters $\alpha, \beta, \xi, \bar{m}$. In some cases both of these solutions are stochastically stationary.

Other types of multiplicity of RE solutions arise in nonlinear models. Many nonlinear models can be put in the general form

$$y_t = F(y^e_{t+1}) \quad (18)$$

where random shocks have here been left out for simplicity. If y_t is increasing in y^e_{t+1}, i.e., $F' > 0$, there may be multiple steady states that satisfy $\bar{y} = F(\bar{y})$, i.e., that occur at the intersection of the graph of $F(.)$ and the 45° line. This possibility can arise in models with increasing returns to scale in production, externalities, or monopolistic competition. y is often a measure of output or aggregate economic activity and the low steady states represent inefficient '*coordination failures*' (Cooper 1999). Other specifications of Eqn. (18) have multiple perfect foresight equilibria taking the form of regular cycles in addition to a steady state.

Nonlinear models can also exhibit sunspot equilibria, taking the form of a finite state Markov process. For example, in models with two steady states it can be shown that there are RE solutions, depending on a two-state Markov sunspot process, in which the solution alternates between values close to the perfect foresight steady states.

6. *Learning*

The RE approach presupposes that economic agents have a great deal of knowledge about the economy. Even in the simple examples, in which RE are constant, computing these constants requires the full knowledge of the structure of the model, the values of the parameters and that the random shock is distributed *iid*. In empirical work economists, who postulate RE, do not themselves know the parameter values and must estimate them econometrically. A more plausible view of rationality might thus be that the agents also act like statisticians or econometricians when doing the required *forecasting*. This insight is the starting point of the *adaptive learning* approach to modeling expectations formation.

Taking this approach immediately raises the question of its relationship to RE. In many cases learning can provide at least an asymptotic justification for the RE hypothesis. For example, in the cobweb model (3), if agents estimate an unknown constant expected value by computing the sample mean from past prices one can show that expectations will converge over time to the RE value. In more general models convergence to RE can occur if agents use the appropriate econometric functional form and run regressions in the same way that an econometrician might.

Another major advantage of the learning approach arises when there are multiple equilibria. Consider the above example with a monetary feedback rule in which there are two solutions of the form (17). For the pure RE approach this is a conundrum. Which solution should we and the agents choose? Similarly, in nonlinear models of the form $y_t = F(y^e_{t+1})$ with multiple steady states, cyclic solutions or sunspots, one can ask which equilibria are stable under learning. The adaptive learning approach provides answers to all these questions, as discussed in the next section.

Finally, the transition under learning to RE may itself be of interest. The process of learning adds dynamics that are not present under strict rationality and they may be of empirical importance. In the cases just described these dynamics disappear asymptotically. However, there are various situations in which one can expect learning dynamics to remain important over time. For example, if the economy undergoes structural shifts from time to time then agents will need periodically to relearn the relevant stochastic processes.

6.1 *Statistical Approach to Learning*

In the adaptive learning approach economic agents behave like statisticians or econometricians when forecasting economic variables needed in their decision making. The economy is taken to be in a temporary equilibrium in which the current state of the economy depends on expectations. The learning approach to expectations formation makes the forecast functions and the estimation of their parameters fully explicit. A novel feature of this situation is that the expectations and forecast functions influence future data points.

As an illustration, consider again the cobweb model (3). Assume that agents believe that the stochastic process for the market price takes the form $p_t =$ *constant* + *noise*, i.e., the same functional form as the RE solution. The sample mean is the standard way for estimating an unknown constant, and in this example it is also the forecast for the price. Thus agents' expectations are given by $p^e_t = \frac{1}{t}\sum_{i=0}^{t-1} p_i$. Combining this with Eqn. (3) leads to a fully specified stochastic dynamic system. It can be shown that the system under learning converges to the RE solution if $\alpha < 1$.

If the economic model incorporates exogenous or lagged endogenous variables, it is natural for the agents to estimate the parameters of the perceived process for the relevant variables by means of least-squares regressions. As an illustration suppose that an observable exogenous variable w_{t-1} is introduced into the cobweb model, so that Eqn. (3) now takes the form

$$p_t = \mu + \alpha p^e_t + \delta w_{t-1} + \eta_t \quad (19)$$

It would now be natural to forecast the price as a linear function of the observable w_{t-1}. In fact, the unique RE solution is of this form:

$$p_t = \bar{a} + \bar{b} w_{t-1} + \eta_t \quad (20)$$

where $\bar{a} = (1-\alpha)^{-1}\mu$ and $\bar{b} = (1-\alpha)^{-1}\delta$ and the corresponding rational forecast is $p_t = \bar{a}+\bar{b}w_{t-1}$.

Under *least-squares learning* agents would forecast according to

$$p_t^e = a_{t-1}+b_{t-1}w_{t-1} \tag{21}$$

where a_{t-1} and b_{t-1} are parameter estimates obtained by a least-squares regression of p_t on w_{t-1} and an intercept, using the data available through time $t-1$. It can be shown that (a_t, b_t) converges to the unique REE $(\bar{a}, \bar{b})$ if $\alpha < 1$.

6.2 Stability Under Learning

In general, when expectations are modeled by least-squares learning there is convergence to the REE as $t \to \infty$ provided that a stability condition is met. The stability condition can usually be obtained by the *expectational stability* approach.

To illustrate this approach for the cobweb model (19), suppose that expectations are based on the *perceived law of motion* (PLM) $p_t = a+bw_{t-1}+\eta_t$ and hence given by $p_t^e = a+bw_{t-1}$, where (a, b) may not be the REE values. Substituting this into Eqn. (19) we obtain the corresponding *actual law of motion* (ALM):

$$p_t = (\mu+\alpha a)+(\delta+\alpha b)w_{t-1}+\eta_t \tag{22}$$

This yields a mapping from the PLM parameters (a, b) into the ALM parameters $T(a, b) = (\mu+\alpha a, \delta+\alpha b)$. Only at the REE values does one have $T(a, b) = (a, b)$. Expectational stability (*E-stability*) looks at whether the REE is the stable outcome of a process in which the parameters of the PLM are adjusted slowly toward the parameters of the ALM that they induce. Formally, this adjustment is described by a differential equation and E-stability corresponds to local stability of the REE under these dynamics. For details, see Evans and Honkapohja (2001).

In the cobweb model the E-stability condition is given by $\alpha < 1$. Even in fairly complicated models it is often straightforward to compute E-stability conditions and these appear generally to govern convergence of statistical learning rules.

Local stability under adaptive learning, or E-stability, provides a selection criterion in models with multiple RE equilibria. For example, in the Cagan model with policy feedback (16) there are two RE solutions of the form (17), but only one of these is E-stable and hence stable under least-squares learning. The other solution, although rational, is therefore unlikely to arise in practice. Similarly, in the nonlinear model $y_t = F(y_{t+1}^e)$, only the steady states with slope $F'(\bar{y}) < 1$ are E-stable. This model can also have sunspot solutions and it has been shown that an appropriate form of adaptive learning can converge to rational sunspot equilibria, provided the corresponding E-stability condition is satisfied.

6.3 Other Approaches to Learning

There are some other recent approaches to modeling expectation formation. '*Eductive learning*' and '*rational learning*' are closer to RE than adaptive learning. In the former agents engage in a process of reasoning using common-knowledge assumptions and the learning takes place in logical or notional time. Rational learning takes place in real time, but retains the RE equilibrium assumptions at each point in time.

In contrast, the adaptive learning approach assumes that agents possess a form of *bounded rationality* which may, however, approach rational expectations over time. Besides the statistical formulation outlined above, alternative models of bounded rationality learning have been studied. Concepts from *computational intelligence*, such as genetic algorithms, neural networks and classifier systems, have been used as models of adaptive learning in economics.

Finally, we note that the literature has also considered learning in situations with structural shifts and/or misspecification of the perceived stochastic process. Certain learning rules, such as constant gain algorithms, can track structural changes more accurately than least-squares algorithms, although they often fail to converge fully to an RE equilibrium if the economic structure is in fact constant. Such procedures can lead to new forms of persistent *learning dynamics* which may be empirically important.

See also: Asset Pricing: Derivative Assets; Bounded Rationality; Keynes, John Maynard (1883–1946)

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Experiential Psychotherapy

1. Introduction

The term *experiential* is defined in the *Concise Oxford Dictionary* (1990) as 'involving or based on experience' and experience is defined as the 'actual observation of, or practical acquaintance with, facts or events' or 'to feel or be affected by (an emotion, etc.).' A distinction between two ways of knowing, knowledge by acquaintance and knowledge by description, first made by St. Augustine, and later emphasized in the epistemologies of William James and Bertrand Russell, helps describe the essence of experiential therapy. Experiential therapy is an approach to therapy that focuses on promoting knowledge by acquaintance. Here a person does not come to know something about him- or herself conceptually but rather has an emotional experience of it. In experiential therapy the clients' experiencing process is kept as a continuous point of reference for all therapist responses and change is seen as occurring by the promotion of new in-session experience.

Although the term experiential therapy first arose to refer to Whitaker and Malone's approaches to psychodynamically oriented family and individual therapy (Whitaker and Malone 1953), this approach has subsequently grown out of a variety of 'third force,' humanistic, approaches. These include client-centered (Rogers 1959), Gestalt (Perls et al. 1951), and existential therapy (May and Yalom 1995), as well as other approaches that emphasize working with the clients in-therapy experiencing process (Greenberg et al. 1998). Experiential therapy consists of those approaches that, within the context of a facilitative human relationship, focus on the creation of new meaning by the symbolization of experience in awareness. The two major foci of experiential therapy practice are the personal presence of the therapist in the provision of an emphatic and facilitatively genuine therapeutic relationship, and increasing clients' awareness of internal experience by focusing them on their moment by moment subjective experience.

2. View of Human Nature and Functioning

Experiential therapy adopts an existential view of human nature, one that sees existence as preceding essence. People are seen as active agents in the construction of their own realities and choice is seen as the final arbiter in human functioning. Individuals are seen as being born morally neutral with a penchant both for health and sickness, and good and bad. What is essential, however, is that people are seen as having innate worth, the ability to know the difference between good and evil, and the capacity to choose. Free will thus is the foundational principle and therapy involves facilitation of the actualization of the potential for healthy functioning. Health is seen as arising from the ability to symbolize experience in awareness and to integrate different parts of the self to create equilibrium and coherent meaning.

Experiential theory of personality proposes a process model of the self. The self is seen as a dynamic experiential system that is in a continual process of self-organization. Experiential theory is constructivist in nature, and adopts a dynamic and dialectical view of functioning. It emphasizes that meaning is created by human activity, in dialogue with others, that change is an inherent aspect of all systems and that this occurs by a synthesis of parts. Meaning construction is viewed as being constrained by a bodily felt emotional experience but as influenced by language and culture and ultimately as created by a synthesis of experience and symbol (Gendlin 1962, Greenberg et al. 1993, Greenberg and Pascual-Leone 1995). Emotional experience is seen as both creating and being created by its conscious symbolization and expression. This view casts people as creators of the self they find themselves to be. In addition, experiential therapy, by adopting a relational view of functioning, sees the self as coming into existence at the boundary between inside and outside, between organism and environment, by a synthesis of bodily experience, symbol and interpersonal validation.

Emotional experience, although seen as a basically healthy resource, is viewed as capable of either providing healthy adaptive information based on its biologically adaptive origins or, in certain instances, as having become maladaptive through learning and experience. The most basic process for the individual in therapy is thus one of developing awareness of emotion and discriminating which emotional responses are healthy and can be used as a guide, and which are maladaptive, and need to be changed.

2.1 Goals

The general goals of treatment are to promote more fluid and integrative self-organizations. Therapy focuses on the whole person, i.e. it is person centered rather than problem or symptom focused, but within this wholistic focus, the underlying determinants of different types of self-dysfunction are also an important point of focus. Thus both a change in manner of functioning of the whole self and changes in particular problems in self-organization are viewed as important. For example, a client may be seen as changing the manner of functioning both by becoming more empathic to the self and by being able to symbolize bodily felt experience, as well as changing

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