ADAPTIVE AND RATIONAL EXPECTATIONS HYPOTHESES: REVIEWING THE CRITIQUES

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Abstract

The pervasiveness of expectations in economic analysis has created significant discussion on the merits and demerits of the two main expectations formation hypotheses, adaptive and rational expectations. This paper gives concise outlines of the two hypotheses and reviews their respective critiques to assess their validity. We outline that the two hypotheses have essentially been regarded as antitheses of each other in economic discourse. In this discourse, exaggerated theoretical intents and criticisms are evident. Inconsistencies among the advocates of rational expectations are also evident, with many of these inconsistencies manifesting themselves in spirited attempts to defend the hypothesis. In the end rational expectations and adaptive expectations are both based on some historical data and learning from experience. While evidence on the usefulness of the models is mixed, it is concluded that both models are beneficial. The adaptive expectations hypothesis may be considered an ad hoc approach, more appropriate for short-term expedient analysis when data and information are scanty. Rational expectations, being based on broader and longer learning experience and data, may be considered appropriate for more comprehensive and longer-term planning. It remains that the rational expectations hypothesis is not per se a model of expectations formation, but a concept pointing to the need for more systematic modeling.

Keywords: Adaptive expectations; rational expectations; forecasting; belief; uncertainty

1. Introduction

Expectations have become central and pervasive to economic analysis (Gertchev, 2007; Figlewski and Wachtel, 1981). This is partly due to the role they play in current decisions. Modeling of expectations has also gained in importance especially in contemporary macroeconomics. Expectations are unobservable – they exist or are formed in the mind and are abstract. Expectations formation models are arbitrary assumptions and their use is categorized as a 'positivism' approach. This methodology does not seek the truth about a hypothesis (assumption or model), but whether or not it works. There are various expectations models; however, the two most common ones are adaptive expectations and rational expectations, with the latter being the standard in mainstream economics. There was a radical shift of inclination in

economic discourse from adaptive expectations hypothesis to rational expectations hypothesis, which started in the 1970s when the latter was incorporated into the new classical economics, and continued in the 1980s under the new Keynesian macroeconomics (Vercelli, n.d.). The fact that the rational expectations hypothesis is a 'received doctrine' is also stated by Lovell (1986, 110).

To test models of expectations formation some kind of measured expectations surveys need to be conducted (Figlewski and Wachtel, 1981). Such surveys that yielded individual responses were conducted by Joseph Livingston over a period of over thirty years. Application of Livingston's data in applied studies as well as in the actual testing of expectations models has yielded mixed results regarding what the data shows of expectations formation, with some concluding that it supports rational expectations, some adaptive, yet some extrapolative expectations. Figlewski and Wachtel attribute the contradictory results to the fact that most studies did not utilize individual expectations responses, but average expectations, which ignore the distribution of responses across respondents leading to specification bias.

There is significant discussion on the merits and demerits of the two main expectations formation hypotheses. Critiques have touched both the theoretical constructs and empirical evidence. Each of the hypotheses has a significant share of strong advocates. The purpose of this paper is to give a brief outline of the theoretical constructs, review the main theoretical and empirical arguments for and against the hypotheses and assess the validity of those arguments. The paper shows that the two hypotheses have stood in opposition to each other in economic discourse, the question being: which one is the better model in explaining expectations formation? However, it is also clear that in this discourse some authors have gone beyond initial intent to ascribe greater purpose to these hypotheses than they theoretically could claim.

2. An Outline of the Adaptive and Rational Expectations Hypotheses

2.1 Adaptive Expectations

In simple terms, we may define adaptive expectations as the way of forming expectations in which the future value of the variable of interest is solely dependent on its past values. From the diversity of literature on adaptive expectations (for example Chow, 2011; Gertchev, 2007; Gujarati, 1988; Pearce, 1986), we may formulate this hypothesis in three equivalent forms, which are given by equations (1) to (3):

$$p_t^e = p_{t-1}^e + \delta\left(p_t - p_{t-1}^e\right) \tag{1}$$

$$p_t^e = \delta p_t + (1-\delta)p_{t-1}^e \tag{2}$$

$$p_t^e = \delta p_t + \delta(1-\delta)p_{t-1} + \delta(1-\delta)^2 p_{t-2} + \delta(1-\delta)^3 p_{t-3} + \\ + \delta(1-\delta)^4 p_{t-4} + \delta(1-\delta)^5 p_{t-5} + \ldots \tag{3}$$

where p_t is actual current price (we shall use price as the variable of interest in this section for demonstration purposes), p_t^e is the future expected price (price expectations) held in the current period (t) and δ is the coefficient of revision of expectations (or just coefficient of

expectation) that is normally assumed to lie between 0 and 1 (the denotation here is consistent with Gujarati, 1988). Below, the author demonstrates the equivalence of the three equations.

Expanding the RHS of (1) and factoring out the lagged expected price variable we get equation (2):

$$p_t^e = \delta p_t + (1-\delta) p_{t-1}^e \tag{2}$$

We successively substitute for the lagged expectation variable on the RHS of (2):

$$p_t^e = \delta p_t + (1-\delta)\left[\delta p_{t-1} + (1-\delta) p_{t-2}^e\right]$$
$$\therefore p_t^e = \delta p_t + \delta(1-\delta) p_{t-1} + (1-\delta)^2 p_{t-2}^e$$
$$p_t^e = \delta p_t + \delta(1-\delta) p_{t-1} + (1-\delta)^2\left[\delta p_{t-2} + (1-\delta) p_{t-3}^e\right]$$
$$\therefore p_t^e = \delta p_t + \delta(1-\delta) p_{t-1} + \delta(1-\delta)^2 p_{t-2} + (1-\delta)^3 p_{t-3}^e$$
$$p_t^e = \delta p_t + \delta(1-\delta) p_{t-1} + \delta(1-\delta)^2 p_{t-2} + (1-\delta)^3\left[\delta p_{t-3} + (1-\delta) p_{t-4}^e\right]$$
$$\therefore p_t^e = \delta p_t + \delta(1-\delta) p_{t-1} + \delta(1-\delta)^2 p_{t-2} + \delta(1-\delta)^3 p_{t-3} + (1-\delta)^4 p_{t-4}^e$$

Thus:

$$p_t^e = \delta p_t + \delta(1-\delta) p_{t-1} + \delta(1-\delta)^2 p_{t-2} + \delta(1-\delta)^3 p_{t-3} + \delta(1-\delta)^4 p_{t-4} +$$
$$+ \delta(1-\delta)^5 p_{t-5} + \ldots \tag{3}$$

The equivalence of the three adaptive expectations equations can also be proved (in reverse) by applying the Koyck transformation process to equation (3).

Thus, under adaptive expectations the expected value can be viewed as a sum of the immediate past expectation and the weighted expectational error (equation 1). In this formulation, it is clear that the individual is making his new expectations by using his current observed expectational errors to revise his previous expectations (Gertchev, 2007); hence, Gujarati (1988) also calls the adaptive expectations hypothesis *progressive expectation or error learning hypothesis*. Note that this formulation implies that if there was perfect foresight in the previous period's forecast (that is, zero expectational error), the previous forecast would be maintained (Lovell, 1986) perpetually until there are changes in exogenous factors affecting actual price. Thus, (as with rational expectations) this hypothesis implicitly argues that fulfilled expectations portend equilibrium. Equation (2) defines adaptive expectations as the weighted sum of the current value and the previous expectation (what it was expected to be), with the weights adding to unit. Equation (3) defines adaptive expectations as a process in which the expected value is formed as a weighted sum of all the past values of the variable, with the weights geometrically decreasing as we look further into the past. The economic agent in this hypothesis thus forms their expectation as a sample mean of historical values (Chow, 2011).

The derivation process for equation (3) shows that all past expectations and past values of the variable of interest are embodied in its current expectations, a rather different and more reasonable view than Gertchev (2007)'s view that it implies the agent is sensitive to all historical prices. It is impossible for the agent to be sensitive to all the past prices individually; rather it is that the past prices are already embodied in the current expectations through previous expectations. It may be argued that the key relationship issue is the value of the coefficient of expectation, since it is the one that relates both past prices and past expectations to current expectations.

Using equation (2), variants of adaptive expectations can be obtained by assuming that the coefficient of expectation is zero, 1 or lies between the two limits. Thus, we have:

Autonomous expectations: when $\delta = 0,\ p_t^e = p_{t-1}^e$ (4)

Static expectations: when $\delta = 1,\ p_t^e = p_t$ (5)

Induced expectations: when $0 < \delta < 1,\ p_t^e = \delta p_t + (1-\delta)p_{t-1}^e$ (2)

Induced expectations are the general formulation of adaptive expectations, and therefore the rest of the paper shall use adaptive expectations to refer to induced expectations.

2.2 Rational Expectations

Unlike adaptive expectations, it is not simple to construct a definition of rational expectations that captures all the variations of the concept in economic discourse. Conceptual diversity is as pervasive as the popularity of the hypothesis in mainstream economics. An attempt to define it would be, the expectation formation process in which optimal (rational and efficient) use is made of all available and relevant information that eventually eliminates systematic forecasting errors. This then makes expectations correct and equivalent to the prediction of the relevant theory (Pearce, 1986; Alejandro, 2008; Lane, n.d.). Thus, unlike adaptive expectations, rational expectations use information on all relevant variables.

Assuming that, besides the variable of interest (say, Y), other relevant (related) variables are X and Z. A mathematical outline of this hypothesis would be (Lane, n.d.; Agba, n.d.):

$$Y_t = a_0 + a_1 Y_{t-1} + a_2 X_{t-1} + a_3 Z_{t-1} + U_t \quad (6)$$

where U_t is a random variable. The values of all the lagged variables are known at the time of forecasting, which is at the end of period t-1, while the value of the random variable is only known at the end of period t.

Taking mathematical expectations of (6)

$$E_{t-1}(Y_t) = a_0 + a_1 Y_{t-1} + a_2 X_{t-1} + a_3 Z_{t-1} + E_{t-1}(U_t) \quad (7)$$

$E_{t-1}(U_t) = 0$, if U is truly random. Thus:

$$E_{t-1}(Y_t) = a_0 + a_1 Y_{t-1} + a_2 X_{t-1} + a_3 Z_{t-1} \quad (8)$$

Thus, rational expectations are the true mathematical expectation of the variable of interest conditional on information on all other related variables known (Lane, n.d.; Muth, 1961, as cited in Agba, n.d.). Muth (1961, 316) contends that since expectations are "informed predictions of future events, (as a first approximation, they) are essentially the same as the predictions of the relevant economic theory". A more precise rephrasing would be, "expectations of firms (or, more generally, 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 distribution of outcomes)" (Muth, 1961, 316). Indeed, the RHS of (8) is a simple predictive model. Subtracting (8) from (6) gives the random variable, which is independent of the other variables (Lane, n.d.; Muth, 1961, as cited in Lane, n.d.), and represents surprises or news (something that agents did not anticipate). Its value is actually equal to the expectational error. That is:

$$Y_t - E_{t-1}\left(Y_t\right) = U_t \qquad (9)$$

The rational expectations hypothesis does not argue that the random variable will always have a value of zero – that is, there is not always perfect foresight (Lane, n.d.; see Levine, 2012a and Muth, 1961). However, because the expected value of the random variable is zero, it means that on average the expectations will be correct. (Lane, n.d.) argues that the random variable has the least variance compared to other forecasting models, which makes rational expectations hypothesis the most efficient expectations formation process. It may be noted that the hypothesis implies that expectational errors can be eliminated by more information, hence the argument that theories based on rationality are inconsistent with actual phenomenon to the extent that they do not incorporate enough rationality (Muth, 1961). If the extreme assumption were made that there is complete information, then we would have perfect foresight (Pearce, 1986).

There are three major variations of the rational expectations concept (Gertchev, 2007). These are, first, that the individuals' expectations are heterogeneous, but on average equate to what the relevant economic model would predict. Two, the individuals' subjective probability distributions concerning the future are homogeneous and equal to the objective distribution. Three, in expectations formation, agents seek to maximize the total net benefit of obtaining and processing information by acquiring and processing information up to the point where the marginal cost of doing so is equal to the information's marginal benefit. Variation three, without claiming that equivalence between expectations and model prediction will be achieved, leaves it as a possibility, so that this may be identified as the common feature of the three and the main defining characteristic of rational expectations.

Three rationalizations or justifications of the rational expectations hypothesis have been advanced (Gertchev, 2007). The first one is an extension of human rationality, and argues that systematic expectational errors are eliminated over time because rationality embodies individual purposeful behavior or intentionality. That is, "If the same errors repeat over time, the individual could not be considered fully rational" (p.318). The second rationalization, which is associated with Lucas (1983a) (as cited in Gertchev, 2007), seeks to make rational expectations an imperative for rational economic agents. It states that a rational economic agent, in making decisions affecting his/her present and future, must in regard to unknown random

variables, formulate a subjective joint probability distribution. The implication of this position is that situations of risk can be handled in economic theory by applying Muth's hypothesis, and that uncertainties render economic theory of no value in explaining social phenomena. The third rationalization states that rational expectations are always fulfilled, and the fulfillment of expectations is an equilibrium state.

3. Reviewing the Critiques of the Hypotheses

3.1 Adaptive Expectations Critique

The single most significant merit of the adaptive expectations hypothesis is that it is easy to handle (Pearce, 1986), since it requires only past data on the variable of interest and not on any other variables. However, this very assumption that expectations are formed based on historical data on the variable of interest has been found to be less logically satisfactory than alternative assumptions that have formed the basis of the competing hypothesis of rational expectations. Gertchev (2007) notes that for the criticism that adaptive expectations do not fully account for individual's rationality, the hypothesis of rational expectations has gained predominance over it.

Gertchev (2007) argues that essentially adaptive expectations boil down to historical data, so that to assume that they affect reality is simply to assume that history, and not expectations, affects reality, which removes the forward-looking attitude. However, this criticism loses its validity in two respects. Expectations are thoughts, and thoughts cannot be divorced from experience. This criticism also looks at expectations as a process of influencing the future rather than a process of estimating the future. Expectations formation models focus on how the information gap represented by a future that is yet to become actual is filled, not how the future is formed. To argue otherwise is to say that when expectations about the future are gloomy rational economic agents have purposed to achieve a gloomy future.

However, two very valid criticisms of adaptive expectations are highlighted by Gertchev (2007). First, the formulation of adaptive expectations is *ad hoc* in that it exogenously postitulates the coefficient of expectation. It may be noted that there is no objective reason to postulate that the value of δ lies between 0 and 1, and that it is a constant. Gertchev notes in a footnote that in Khan (1977) a model with adaptive expectations in which the coefficient of expectation is variable is presented. It has also been shown empirically that values of the coefficient may not be the same for various groups of economic agents (Mlambo, 2011), individuals (Figlewski and Wachtel, 1981) and over time (Figlewski and Wachtel, 1981). Second, some have noted that the errors of expectation may be correlated and the expectations may lag behind actual phenomenon when trends change. Changes in the trend of a variable of interest may emanate from the behavior of related variables, which variables may be affected by broader factors, for example, the recent global financial crisis. Thus, the expected value of a variable will not only depend on its own past values, but also on the past, present and expected future values of other related variables.

Strong empirical arguments for adaptive expectations (versus rational expectations) are advanced by Chow (2011). Chow believes that the rejection of adaptive expectations in favor of rational expectations in mainstream economics has no empirical basis. He sets out to show that the adaptive expectations hypothesis is supported by theoretical statistical reason and econometric evidence. The statistical reasoning is that, in time series data, a mean in which observations that are more recent are given greater weights is used to estimate a future value

of the variable. Thus, the adaptive expectations hypothesis is simply assuming that "economic agents behave like good statisticians" (Chow, 2011, 5). However, this argument apparently has little merit because it is based on the assumption that statistical methods cannot be questioned, and that on average economic agents are experts in statistics.

In advancing the empirical argument, Chow (2011) uses an applied econometric study of stock prices for blue chip stocks in Taiwan over three decades (1971-2010). He estimates the model in which log stock price is a linear function of log dividend and expected rate of growth of dividends. He uses the mean of the rates of growth over the last three years for the expected rate of dividend growth. The results obtained (by retrospective prediction) are found to be consistent with actual Taiwan data for more than 50 companies over the three decades. Chow (2011) refers to four other studies (in Chow, 1989 and 2007, both cited in Chow, 2011) on stock price modeling, all of which strongly support adaptive expectations. However, the induced adaptive expectations in Chow (1989) have limited lags, which makes them differ significantly from an infinite sum as generally represented by equation (3).

Mills (1961) argues that the position taken by Muth (1961) that it is best to assume economic agents know the probability distribution of the variable to be predicted is an extreme position. Using a variable's past values to predict its future values is a more moderate position, for example adaptive expectations. In summarizing Mills' views, any stability model applying adaptive expectations will result in an expectation time path that is similar in dynamic characteristics to that of the actual values. Second, if the initial expectation value and the initial actual value coincide (that is, there is initial equilibrium) the expectations and the actual path will also coincide. Third, the time path of expectational errors from this application also exhibits the same dynamics. Fourth, the time path of expectational errors has a mean of zero – if the actual time path is convergent towards the intertemporal equilibrium, the expectational error path will also converge, but towards zero. In the adaptive expectations model, this implies, when the market is in disequilibrium, expectations are wrong in a clear systematic way. An intelligent agent can identify the pattern and then adjust his expectations accordingly.

In summary, the paper makes a number of findings regarding the adaptive expectations critique. The mathematical derivation of equation (3) of adaptive expectations clearly demonstrates how present expectations are linked to past expectations and eventually to past values. It is clearly shown that all past expectations and past values of the variable are embodied in present expectations, but does not imply that the agent is sensitive to them individually as suggested by some literature. Some critics have regarded expectations as a process of influencing rather than of estimating the future (the latter is the case). This has created unnecessary criticism of the adaptive expectations as merely a statement that history affects reality. The argument of adaptive expectations is, instead, that history affects thoughts or beliefs about the future. The restriction of the coefficient of expectation to between 0 and 1 implies that adaptive expectations are at maximum equal to static expectations. However, there is no objective reason to postulate such a limit. This suggests the need to allow the value of the coefficient of expectation to vary freely. Adaptive expectations have been supported from a theoretical perspective by the argument that they are consistent with the way statisticians estimate future values from a time-series of past values. Besides assuming that all agents are good statisticians, this argument also assumes without testing that conventional statistical methods of estimating the future are a correct representation of the forward-looking behavior of agents.

3.2 Rational Expectations Critique

Muellbauer (1981) concludes that employment decisions are consistent with rational expectations and not adaptive expectations. Empirical support is also found in the study of the agricultural market by Goodwin and Sheffrin (1982), in which they apply Muth (1961)'s rationality in the estimation of supply and demand for chicken broiler. However, cumulative empirical evidence from several studies reviewed by Lovell (1981) does not support the hypothesis ahead of other expectations formation hypotheses, as some evidence is supportive while some clearly show violation of the hypothesis. Several authors have tested rational expectations using Joseph Livingston's data (Figlewski and Wachtel, 1981). Figlewski and Wachtel use the formulation of inflation rational expectations given by equation (10) (the denotations have been changed slightly). They then use regression equation (11) to test if the forecasts are unbiased (that is, if $E(u_t) = 0$), which would indicate rationality:

$$\pi_t = \pi^e_{t-1} + \in_t \tag{10}$$

$$\pi_t = a + b\pi^e_{t-1} + u_t \tag{11}$$

where π_t is actual inflation in period t, π^e_{t-1} is expected inflation held in period t-1 for period t, $\in_t$ and u_t are random error terms. Equation (10) is indicating that rational expectations are essentially the same as the actual values except for some random error. To test for rational expectations, they test for the joint hypothesis that a = 0 and b = 1 in the regression equation. Using average expectations data the rational expectations hypothesis is rejected. When individual responses are used and panel data approaches applied, still they conclude existence of forecast bias. They go on to test whether readily available and relevant information was used in expectations formulation (as the second test of rationality) using the regression:

$$\pi^e_{i,t-1} - \pi_t = \beta_0 + \beta_1\left(\pi^e_{i,t-2} - \pi_{t-1}\right) \tag{12}$$

They find the coefficients in (12) to be significant; meaning the information on past errors was not fully used. Figlewski and Wachtel (1981) conclude that adaptive expectations best explain inflation expectations.

This section has so far shown that empirical evidence on rational expectations has been inconclusive. However, much debate is centred on theoretical arguments. There are contradictions in the understanding of the concept of rational expectations among its advocates. For example, the general understanding that rational expectations is an optimal process that eventually eliminates systematic errors does not seem to be consistent with the other view in Levine (2012a and b) that rational expectations are born out of uncertainty. The question that arises is: can systematic errors be eliminated where uncertainty is pervasive? The acknowledgement that uncertainty is a pervasive feature of economics carries the implication that it is perpetual.

The presentation of rational expectations in Levine (2012a and b) sounds like error learning hypothesis, for learning involves making errors and learning from them. Thus, it is next to adaptive expectations, differing only in: (a) the length of learning time and the frequency of

adaptations; and (b) the variable scope. In adaptive expectations, the learning time is shorter and adaptations are more frequent, while rational expectations may be regarded as more long-term adaptive processes. Lane (n.d.) argues that agents do not automatically know the variable generating process, but learn it through experience over some period and eventually know it so that the hypothesis is best regarded as a long-run concept. However, because of different learning abilities and starting points some agents will be in the long-run while others will be in the short-run. At any given point in time, some expectations will be rational while others will be non-rational. The average of rational and non-rational expectations is not exactly equal to rational expectations. This is further complicated by the fact that rationality itself, hence the optimality of outcomes, are subjective (vary from individual to individual and from group to group).

Muth (1961) asserts that average expectations should be the same as the predictors of economic theory, or there will be information arbitrage. However, we may note that arbitrage between the professional forecaster and the average firm is never complete. This is evidenced by the fact that price-forecasting services continue to exist in the form of business and economic consultancies. The argument of the equivalence of expectations to the predictions of economic theory apparently turns every individual in the economy into an economist. That is, it assumes that on average economic agents can analyze the complex economic relationships among various economic variables consciously or subconsciously and produce the same results that a trained economist would produce using economic models. If this were true, there would be no value in economic training. This is refuted by the fact that such training continues to exist.

The premise behind the theory's assertion that there will always be equilibrium (that expectations will always be correct) has been refuted in that such correctness cannot always exist for two reasons - it is an 'eventual' outcome of learning from systematic errors, and same errors may be repeated because of changed conditions (Gertchev, 2007). However, Gertchev's argument that correctness of expectations is not necessarily equilibrium would imply that rational expectations, which by definition are optimal, do not result in optimal outcomes, even when they are correct. This apparently would amount to saying that correct and optimal expectations are not important in making optimal decisions, and by extension, in achieving optimal economic outcomes. This is contrary to the essence of holding expectations in general, and correct expectations in particular. Expectations are information, or more precisely, an attempt to fill an information gap in current decision-making process, and like any information used in planning, accuracy matters for optimality of decisions and outcomes. If on average agents are correct in all expectations (all variables that they are forecasting), equilibrium must be inevitable. Lack of equilibrium must be an indication that expectations were not rational enough.

Levine (2012a) simplified the rational expectations hypothesis to, 'if people believe this forecast it will be true'. However, we may note that in this formulation the hypothesis is merely the argument that belief is self-fulfilling. While expectations are thoughts and indeed beliefs, it defeats the whole idea of expectations modeling, if all that will be required is to hold just any belief we want. Why then, as rational economic agents, do we not just agree to believe the best to achieve the best? Such formulation has resulted in Gertchev (2007)'s criticism that the advocates of the rational expectations hypothesis ultimately claim that thoughts become reality ("whatever individuals think will happen does happen", p.324; "subjective beliefs alone determine objective reality", p.325). In such reasoning expectations essentially become

equivalent to intentions.

A valid criticism is that the rational expectations hypothesis has little to contribute to economic discourse in that at the end it hinges upon the existence of some other model that describes objective reality – the actual model that does the prediction, which means that economic theory itself is developed independently of expectations (Gertchev, 2007). If all that the hypothesis says is that the future will conform to the predictions of the relevant economic model, what does the hypothesis itself really add to our understanding of expectations formation? Does it not become redundant, since the relevant model implicitly makes the same claim? Where we have two competing models, the hypothesis does not tell us which one is better.

The rational expectations hypothesis is also critiqued by Elliot (1986), who alleges that in the rational expectations context equilibrium is maintained in the face of changes (in policy) because the changes are assumed to be anticipated accurately so that behavior adjusts accordingly. He argues that uncertainty which faces agents in free markets, dynamism of the market and the existence of competition make the achievement of equilibrium an impossibility – certainly, some agents' plans will not be realized and there will be readjustments (disequilibrium). A market in disequilibrium cannot convey the correct information and this further frustrates rational expectations. Thus, with rational expectations assumed, for policy to be effective (that is, for change to happen), the policy maker must make it impossible for agents to anticipate policy, that is, to keep them guessing, which ultimately means no optimal policy is made. The policy maker must not only anticipate the actions (responses) of other agents but also their anticipations of him or her, and so on. In such a situation, there will be incentive on the part of each individual to hold non-rational expectations. The effect of public predictions that are believed can be viewed similarly with those of policy announced in advance of implementation (see Muth, 1961; Levin, 2012a).

Lane (n.d.) comes out as a strong defender of the rational expectations hypothesis. He argues that since expectations play a major part in economic decisions, which decisions are assumed rational, they must themselves be rational (see also Muth, 1961). The question he seeks to answer is whether the rational expectations hypothesis is the best way to model expectations. When we talk of the best way to model an actual phenomenon, of which expectations is one, we are in the positive side of economics. We are not asking if it would be the best way for agents to formulate their expectations (we are not putting value to it), but if it is the best way to describe how they actually formulate expectations. Lane responds to a number of criticisms leveled against the rational expectations hypothesis.

Regarding the criticism that the hypothesis assumes all economic agents are endowed with the ability to understand and use complicated economic models to formulate their expectations, Lane argues that Muth did not propose that same models are used by trained economists and economic agents, though the hypothesis still argues that the two groups arrive at the same expectations. However, it is difficult to imagine how two agents, not skilled to the same level and with differential access to relevant information, can process whatever information they have to arrive at an identical expectation outcome. The question is if the agents are not using, for example, the statistician's model, which model are they using to achieve the statistician's outcome? Rational intentions do not necessarily translate into ability.

It is further argued (by Lane) that the hypothesis is not claiming that every individual will gather information and formulate expectations. Many have it done for them by others, and

those who do it for them, for example the Central Bank, trade union appointees, specialists and consultants, have full information. However, this makes the unreasonable assumption that professional forecasters have full information. This is also an acknowledgement that economic agents are not as good as relevant economic models, and that there is room for professional forecasters to sell information. All this seems to go against the fundamental claims of the hypothesis, or at least show that there is no unity in the understanding of the hypothesis among its advocates.

Lane defends the rationality of rational expectations as being consistent with the core argument of economics that individuals are rational. However, the criticism against the hypothesis is not on its claim that people are rational, but that rationality is bounded by constraints of expertise and information. Rationality speaks of intention only, not also ability. That people seek the best does not mean that they achieve it, as individuals or on average.

We may summarize the main findings of this section as follows. A significant part of the criticism against the theoretical construct of the rational expectations hypothesis remains valid and much of the defense against the criticism amounts to claiming that the critics have misconstrued its claims. The latter argument may be regarded as an indication of lack of clear consensus on the claims of the hypothesis among its advocates.

We note that the argument by Muth that average expectations will be the same as the predictions of economic theory and that any discrepancy will be eliminated by arbitrage is refuted by the fact that price-forecasting consultancy services continue to exist. This implies that arbitrage is never complete. An implicit acknowledgement of this fact is the argument by some advocates that not every individual needs to gather information and formulate expectations since many have it done for them by Central Banks, trade unions, specialists and consultants.

The assumed eventual equivalence of expectations to predictions implies that at some point economic training becomes of no value, which is refuted by the fact that such training continues. The learning of the variable generating process assumed by rational expectations implies that, because of different learning abilities and starting points, some agents will be in the long-run while others will be in the short-run, and some expectations will be rational while others will be non-rational. The average of rational and non-rational expectations is not exactly rational expectations.

The reduction of the hypothesis to the statement that if a model is believed it becomes correct is too simplistic. It implies that rational expectations are at best just a belief, regardless of the basis of belief. Thus, correctness (or lack of it) is no longer an intrinsic attribute of the object of belief (the model) but one of any belief about it. While the hypothesis relies on the existence of other relevant models that explain variable formation process, in cases where there is more than one relevant model, the hypothesis does not tell us which one is best.

While the paper finds unacceptable the argument that expectations are always correct, it argues that since they are assumed optimal forecasts, their fulfillment (correctness) must inevitably be an optimal outcome that is consistent with equilibrium. However, because such fulfillment remains a rare outcome, rational expectations equilibrium is best regarded as an ideal.

4. General Conclusion

It is concluded that in practical estimation of models with adaptive expectations, the

coefficient of expectations, besides being allowed to vary between individuals and over time, should be allowed to vary among groups of economic agents (for example, buyers and sellers) and to vary without an upper bound. This would allow the characterization of expectations by groups and would allow the extremes in which the coefficient of expectation may be more than 1 to manifest. While, statistical models can be very useful, care must be taken to test each model for its validity rather than assume that all statistical models are correct representations of forward looking behavior.

There is need for clear consensus on the claims of rational expectations, as the ambiguities and inconsistencies can easily hamper practical application. Instead of assuming that rational expectations will always be correct, it is important to consider ways of making correctness a function of available information and skill level. Thus, there must be consideration of levels of rationality in rational expectations as a compromise between the extreme assumption of rational expectations (which almost amounts to perfect foresight) and the obvious limitations of a pure adaptive expectations approach. This would bring the claims of rational expectations closer to the reality of information deficiency, skills deficiency and lack of perfect equilibrium in the real world. In studies of expectations there is need to benchmark the learning process and to consider surveys and models that take the existence of various points on the learning curve and their distribution into account rather than regard experience as uniform among all agencies. It would also be necessary to understand the various perceptions of agents of the concept of rationality and optimality rather than assume them to be uniform.

In the end, rational expectations and adaptive expectations share two things: (1) they both assume some high level of analytical abilities on the part of economic agents; and (2) they both make use of historical data and learning from experience. The long time needed to learn the variable generating process makes the rational expectations hypothesis some form of long-term concept, while the adaptive expectations hypothesis is a short-term concept. That is, in the short-term there is the tendency to look at few past values of the variable of interest, while in the long-term a more holistic understanding of processes must develop. Thus, both models are useful, but differently - adaptive expectations hypothesis is a short-term and *ad hoc* approach appropriate where there is scanty information, while its antithesis is a suitable pointer for the need for more comprehensive economic modeling in long-term planning.

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