

**DO MALAYSIAN BUSINESS FIRMS FORECAST RATIONALLY?  
A MULTI-SECTORAL ANALYSIS**

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## **ABSTRACT**

### **DO MALAYSIAN BUSINESS FIRMS FORECAST RATIONALLY? A MULTI-SECTORAL ANALYSIS**

By

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The application of Rational Expectations Hypothesis (REH) in macroeconomic research has marked the revolution in economic thinking and the magnitude of its impact on economics world is undeniably significant. Despite its well-established theoretical rationale in economic literature, the empirical support for the validity of REH in real-world decision making has been evidently mixed. Therefore, this study seeks to transform the 'Business Expectations Survey of Limited Companies' (BESLC) survey data into economically meaningful findings which offers a better comprehension on the validity of REH in Malaysia's business context. As follows, survey data on gross revenue and capital expenditure are subjected to three rationality tests which include unbiasedness test, non-serial correlation test and efficiency test. In general, the evidences of rationality in Malaysia's business context is clearly mixed but the BESLC' survey forecasts are less likely to be accepted as rational forecasts, implying that the observed survey materials are unable to reflect the real business setting in Malaysian economy. Additionally, aggregation bias is believed to impose certain potential effect in REH testing.

## ABSTRAK

# ADAKAH JANGKAAN FIRMA PERNIAGAAN DI MALAYSIA RASIONAL? ANALISIS BAGI PELBAGAI SEKTOR

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Pengaplikasian hipotesis jangkaan rasional (REH) dalam kajian makroekonomi telah mencatatkan satu revolusi dalam pemikiran ekonomi dan tahap kepengaruhan konsep ini dalam dunia ekonomi adalah besar. Walaupun konsep ini mempunyai teori yang cukup kukuh dalam kesusasteraan ekonomi, tetapi sokongan dari segi kajian empirikal atas kesahihan REH dalam dunia sebenar masih kurang menyeluruh. Oleh itu, kajian ini bertujuan untuk menganalisa data *Tinjauan Jangkaan Perniagaan Syarikat Berhad Malaysia (BESLC)* untuk mendapatkan penemuan yang bermakna dari segi ekonomi bagi mendalami kefahaman tentang kesahihan REH dalam konteks perniagaan di Malaysia. Dengan ini, data tinjauan bagi pendapatan kasar dan pembelanjaan capital telah diselidik melalui tiga ujian rasionaliti yang merangkumi ujian ketidakbiasan, korelasi ralat jangkaan bersiri and kecekapan. Secara umum, dapatan kajian mendapati bahawa bukt kerasionalan yang diperolehi adalah tidak consistent. Tetapi, data tinjauan BESLC kurang disetujui sebagai jangkaan rasional. Hal ini mengimplikasikan bahawa data tinjauan yang disediakan oleh Jabatan Statistik Malaysia tidak dapat mencerminkan situasi perniagaan yang sebenar dalam Malaysia. Tambahan pula, agregat bias dipercayai berpotensi untuk membawa kesan sampigan kepada ujian REH.

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## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.0 Introduction**

In the face of dynamic business environments, forecasting future economic events appear to be an important practice by which economic agents cannot overlook while dealing with their daily economic activities. Keane and Runkle (1990) state that the way people forecast economic events is of economists' interest since at least sixty years ago. In fact, there are several types of framework or theories involved in modeling the expectation formation but theory of rational expectation received more academic interest on the ground of empirical study. Researchers like Baghestani and Kianian (1993), Beach, Fernandez-Cornejo and Uri (1995), Habibullah (2001), Gao, Song and Wang (2008) and many more opted for rational expectation mechanisms proposed by Muth (1961) in testing the mechanism of expectation in various markets.

In addition, Keane and Runkle (1990) reveal that most economists believe that economic agents perform the economic forecasts as precise as possible given the information available to them at the time. This assumption in turn contributed to the widely application of rational expectation hypothesis as it may well imply that government policies impose less effect on people's behavior and consequently on the economy. Indeed, the idea of expectations and the use of expectations in business firm are not something new-found in the economics literature as Keynes (1936) emphasized the role of expectations and perceived expectations as a determinant of

output and employment in business firms. John Maynard Keynes, in his book titled *The General Theory of Employment, Interest and Money* portrays that:

*All production is for the purpose of ultimately satisfying a consumer. Time usually elapses, however-and sometimes much time-between the incurring of costs by the producer (with the consumer in view) and the purchase of the output by the ultimate consumer. Meanwhile the entrepreneur (including both the producer and the investor in this description) has to form the best expectations he can as to what the consumers will be prepared to pay when he is ready to supply them (directly or indirectly) after the elapse of what may be a lengthy period; and he has no choice but to be guided by these expectations, if he is to produce at all by processes which occupy time.<sup>1</sup>*

All the way throughout the year, the idea of expectations addressed by Keynes (1936) has become the leading motivator in the widely application of expectation in the business cycle theories and the formation of expectations are of particular consideration in this research area. For instance, Brannon (2006) acknowledged that Keynes's radical explanation on the occurrence of economic crisis during Great Depression suggests that people are not smart enough to verify the movement in prices and consequently make irrational decisions. This idea eventually swept the profession and masses of macroeconomic researches lay emphasize on his framework, as his idea clarifies how the economy accommodates the actions done by the government besides providing an answer to the source of Great Depression.

In spite of this, the evolution of the concept of expectations from Keynesian expectation into a testable expectation hypothesis is largely contributed by Metzler

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<sup>1</sup> This paragraph is adopted from Chapter 5: Expectation as Determining Output and Employment in Keynes (1936, pp. 47).

(1941), Cagan (1956), Muth (1961) and among others, the rational expectations hypothesis formulated by Muth (1961) possess an unique framework to economics and has been greatly tested empirically to evaluate the characteristic of expectations formation mechanism. Even though Muth was the first economist to formularize the idea of rational expectation, the honor and glory for the work on rational expectation ultimately goes to Robert Lucas<sup>2</sup>, the economist who eventually popularized the idea.

### **1.1 The Development of the Idea of Expectation before Rational Expectations**

Basically, expectations signify the forecast or prediction of the future values of economic variables conditional on the current stage of the economic variables, which are appropriate to the contemporary internal and external environments. Gertchev (2007) defines expectations as unnoticeable opinion about the future course of events that individual form in their minds. In spite of this, due to the lack of complete information and economic uncertainty, the formation of expectations is largely depending on the decision marker or forecaster's assessment, based on the relevant knowledge and information acquired by them. Pironi and Ricciarelli (2005) argue that the main cause of the imperfect information is the heterogeneous behavior of the economic agents.

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<sup>2</sup> Lucas is an American economist who received the Nobel Memorial Prize in Economic Sciences in 1995 for his contribution on the development and application of REH in macroeconomic analysis and deepened peoples' understanding in economic policy. Furthermore, Lucas has been regarded by The Swedish Academy of Sciences as an economist who has had the greatest influence on macroeconomic research since 1970. "The Lucas Critique" is one of the implications of REH and it is Lucas's contribution to macroeconometric evaluation of economic policy (see The University of Chicago (1995) and Persson (1997) for detailed comprehension about Lucas).

As noticed by Hoover (1992), economic behavior and the role of expectation in macroeconomic received a great number of thoughtful discussion in economics world since 1930s but most of the debates were carried out in words but not in mathematics. He further explained that the role of expectation in economics had been well-recognized and attentively discussed among its advocates such as Keynes, Hicks, Hayek, Hawtrey, Robertson, Robbins, Meade, Myrdal and others but much of the richness of those dissuasions was lost in the succeeding development. However, Keynes' work on General Theory was ultimately formalized the role of expectation. Keynes' analyses on level of employment, demand for money, the level of investment and the trade cycle are depend significantly on *animals spirits*, a term used to represent the movement in investment other than current variables. Keynes (1936) argued that movement in business investment could not be explained merely by current variables alone but should depend critically on the feeling of investor. Thus, subjective aspects such as business confidence or the mass psychology of the investors play a crucial part in his analysis in business investment.

Indeed, the role of expectation was greatly addressed and carefully emphasized throughout the *General Theory of Income and Employment* but a very obvious inadequacy was that Keynes did not discuss on how expectations were formed. Keynes (1936) did not suggest or model an approach of expectation formation, in which economic agent could be incorporated into a model analysis. Keynes maintains that expectation can be treated as exogenous rather than being endogenously established as the model evolves. Certainly, Keynes' idea on exogenous expectation is essentially less than adequate to explain the increasingly dynamics economic environment. Although Keynes' approach is deficient in cushioning the

macroeconomic expectation modeling but the richness of Keynes' work could serve as a stimulator to the subsequent development in expectation formation mechanism.

During the earliest post-Keynesian period, the time when autoregressive models came into widely applicable in economics analysis, Metzler (1941) developed the simplest form of autoregressive expectation formation called extrapolative expectation formation. In his argument, future expectations should incorporate the direction of change of an economic variable besides considering its past trends. Metzler's idea can be portrayed using the mathematical equation below:

$$X_{t+1}^e = X_t + \alpha(X_t - X_{t-1}) \quad (1.1)$$

where  $X_{t+1}^e$  is the expectation or forecast of variable  $X_t$  for time  $t+1$  at time  $t$  and  $X_{t-1}$  denotes the past level of  $X_t$ . Then,  $\alpha$  = coefficient of expectation. If  $\alpha > 0$ , then, the past trends are expected to be continue. On the other hand, if the  $\alpha < 0$ , the past trends are expected to reversed. The behavior in the extrapolative expectations is governed by the coefficient of expectation,  $\alpha$  which is to be selected based on the economic structure underlying the model. However, the hypothesis by itself does not offer any clarification about this selection behavior (Do and Kobayashi, 2000)

Although Metzler considers the past trends into future forecast but the shortcoming is that the past expectational errors are ignored. Thus, as Hoover (1992) disputed, extrapolative expectations are empirically testable but theoretically unattractive as they are not apparently established in sensible economic behavior. As such, this encouraged the establishment of a more advanced form of autoregressive

expectation formation approach which essentially overcomes the shortcoming possessed by Metzler's approach. This special form of autoregressive expectation formation is called adaptive expectation which is attributable to Cagan (1956). As the model clearly takes into account associative learning, thus, future expectations are formed based on the past forecasting errors.

The theory of adaptive expectations states that economic agents revise their expectations each period according to the degree of error in their previous expectations and it can be denoted mathematically as below:

$$X_{t+1}^e = X_t + \alpha(X_t - X_{t-1}) \quad \text{where } 0 \leq \alpha \leq 1 \quad (1.2)$$

where  $X_{t+1}^e$  is the expectation or forecast of variable  $X_t$  for time  $t+1$  at time  $t$  and  $X_{t-1}$  denotes the past level of  $X_t$ . Then,  $\alpha$  = coefficient of expectation. One significant different between extrapolative expectation and adaptive expectation is that the coefficient of expectation,  $\alpha$  needs to be in the range of zero to one in order for adaptive expectation to comply. But, in the case of extrapolative expectation, the coefficient of expectation can be lesser or greater than zero depending on the direction of change for that particular economic variable under study.

In short, the theory reveals that the expectation of economic variable for the next period is equal to the variable's expectation on current period plus some fraction of forecast errors done by current expectation. One shortcoming owned by adaptive expectations is that the framework cannot utilize the available information optimally (Sheffrin, 1983). Still, upon the development of the concept of rational expectations

contributed by Muth (1960), the framework attributed to Cagan (1956) was the most common formalization of expectations used in economics.

## **1.2 Muth (1961) and Rational Expectations Hypothesis (REH)**

John F. Muth was the first economist to bring up the concept of rational expectations through his ground-breaking work, titled *Rational Expectations and the Theory of Price Movement* in 1961. In Muth (1961), the hypothesis of rational expectations stresses that the economic agents generally do not waste information and the formation of expectation depends specifically on the structure of the entire system. Muth contends that, sometimes, economist believed that economic forecasts are not error-free and these errors had been playing a significant role in most of the rationalization of the changes in the stage of business activities. However, in the sense of Muth's concept of rational expectations, economic agents will not consistently make mistake while dealing with the prediction on future prices as people rationally and fully utilize the available information.

Muth argues that the hypothesis of rational expectations is based on the idea that the dynamic economic models do not assume enough rationality. Muth's point of view is exactly the reverse with the arguments claiming that the assumption of rationality in economic leads to theories inconsistent with, or inadequate to explain, observed phenomena, especially changes over time (Muth, 1961, pp. 316). For instance, Simon (1959) asserts that the assumptions of rationality are powerful and useful tools but he argues that these assumptions are inadequate to consider the

increasingly dynamics economic environment as it is unable to account for some of the central problems of conflict in the economic world<sup>3</sup>. Hence, Muth (1961, pp. 316) rephrases its hypothesis more precisely as follows:

*that 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 distributions of outcomes)*

As noted by Friedman (1980), Stein (1992) Krause (2000) as well as many other researchers, Muth's REH equates the subjective expectation of an economic variable with its mathematical expectation; conditional on the currently available information while the forecast is made. In other words, people's subjective expectations are, on average, identical to the true values of the variable (Sheffrin, 1983). In order to understand how Muth's idea is derived from, consider some mathematical works by Sheffrin (1983). Let  $X_t$  denotes the random variable at time  $t$  and  $I_{t-1}$  is the information set that is available to economic agents at time  $t-1$ . Then the notation  $f(X_t|I_{t-1})$  signifies the conditional probability density for random variable  $X_t$ , given the information at time  $t-1$ . The conditional probability density in turn corresponds to the conditional expectation and can be defined mathematically as follow:

$$\text{conditional expectation} = E(X_t|I_{t-1}) = \int_a^b X_t f(X_t|I_{t-1}) dX_t \quad (1.3)$$

---

<sup>3</sup> Simon (1954) applied an alternative to Muth's idea which called "bounded rationality" into his pioneering research on decision-making process within economic organizations and this won him the Nobel Memorial Prize in Economic Sciences in 1978. Basically, the theory of "bounded rationality" enlightens that people generally are lacking of ability and resources to arrive at the optimal solution, thus, they apply their rationality only after having greatly simplified the choices available. The term "bounded rationality" also used to designate rational choice that account for cognitive limitations of both knowledge and cognitive capacity (Tseng, 2006, pp. 8).

Thus, the condition expectation of a random variable is the expected value of the variable formed by using the conditional density. As Muth's idea coincides the subjective, psychological expectation of a random variable with the corresponding mathematical conditional expectation. Accordingly, the REH can be defined as follows:

$$\begin{aligned} \text{subjective expectation} &= {}_{t-1}X_t^e = E(X_t|I_{t-1}) \\ &= \text{conditional expectation} \end{aligned} \tag{1.4}$$

where  ${}_{t-1}X_t^e$  is the subjective, psychological expectation of a random variable  $X_t$ . As a consequence, there is a relationship between economic agents' belief with the actual stochastic behavior of the system. Sheffrin (1983) stresses that this is in fact the fundamental nature of rational expectations approach. In statistical standpoint, rational expectations require that the conditional expectation of the forecast errors should have a stable mean of zero, orthogonal to any and all variables involved in the information set available to the economic agent at the time expectations are formed. Thus, the forecast error is in fact unbiased and efficient in statistical explanation if rationality applies.

### 1.3 The Revolution of Rational Expectations

Although the concept of rational expectation was formulated by Muth and eventually popularized by Lucas but the discussion on the evolution of rational expectations is certainly attributable to John Maynard Keynes. Keynes's idea on expectation is derived from the onset of Great Depression during 1930s. As mentioned

by Brannon (2006), revolution in economics discipline takes place during the Great Dispersion as economists outline various justifications regarding the source of Great Dispersion. Later in 1936, Keynes in his well-known work titled *The General Theory of Income and Employment* reveals a radical discussion concerning why and how the Dispersion come about. Keynes (1936) used the drastic price fall on labor market during 1930s to explain the Great Dispersion. Keynes illustrated that economic agents were unwilling to accept wage cuts as they did not recognize the price fall. Thus, this created a false appearance for the economic agents as people appear to be materially well-off compared with before but the real situation was not what they perceived to be. Consequently, there were no wage cuts and there were unemployment.

Keynes argued that one significant rationale behind the Dispersion was that economic agents are not smart enough to determine the movement in prices. Therefore, people have a tendency to being irrational in their decisions making. Keynes's framework was strongly recognized in economics discipline and had been widely incorporated into macroeconomics research. Nevertheless, Keynes's model was certainly not perfect as Brannon (2006) points out that there are some problems on the model. For instance, Brannon was disagreed on Keynes's view that wages were not that rigid downward since wages fell by nearly a third in the early 1930s. Furthermore, Keynes's model fails to explain the real economic world in the long run. For example, the existence of high inflation accompanied by high unemployment during 1970s evidently overthrows the Keynesian's idea on inflation and unemployment.

Muth counterattacks the assumptions behind the Keynesian model even before it evidently break down. Muth (1961) disputes that people did not consistently make economic mistake in the marketplace as people generally do not waste information while evaluating the economic situation. In short, economic agents act rationally in order to understand the economic world. Muth uses the hog market to explain the existence of rationality in future forecasting. Muth argues that farmers in the hog market cannot consistently make economic mistakes as they will look at the causes that lead to low hog prices today and judge whether the current price influence the future prices. In other words, future forecasting on prices and production relies heavily on human rationality which brings in all the information available throughout the decision making process but not merely the current prices alone.

Though, Muth successfully applied his REH to solve problems in the dynamics of agricultural markets but the application of the framework of REH solely into microeconomics such as the infamous hog market contributed to the slow acceptance of Muth's idea. For instance, Brannon (2006) points out some probable reasons for the slow acceptance of Muth's idea on rational expectations, which are addressed by Donald McCloskey in his path-breaking book *The Rhetoric of Economics*. First, as contended by McCloskey (1998), Muth's paper was poorly written as the paper is difficult to read, the writing is very dense in places and contains unorthodox ideas that reader hardly get the thrust of his argument. Second, Muth's paper was occupied by masses of technical and mathematical terms that those readers at that time not comfortable in.

Lastly, Muth's ideas did not grant direct impacts in the economic world and the reaction to his approach was relatively minor when he tried to introduce his concept of rational expectations solely in microeconomics markets. This is partially due to the fact that nobody was skeptical on Keynesian model that seems to be working so well at that time. Hence, Muth's work is said to emerge in bad timing. At last, the ultimate honor and glory on the work of REH goes to Lucas who applying rational expectations into macroeconomic model and to the analysis of economic policy in 1970s.

#### **1.4 The Theory of Rational Expectations**

The concept of rational expectations which is initially formulated by Muth (1961) suggests that economic agents act rationally in such a way that they tend to utilize the full information set currently available to them at the time when the expectations are formed. Muth's argument on expectation suggests that expectations made by economic agents will not be substantially different from the predictions of the relevant economic theory. This is because expectations under the doctrine of REH are informed predictions of future events (Muth, 1961, pp. 316). In his paper, Muth clarifies that expectation of economic variables may be subject to certain degree of errors and these errors are probably due to imperfect information set and economic uncertainty. This is because economic agents are less than possible to grasp the full information as some information is strictly publicly unavailable or costly to acquire.

Furthermore, perfect knowledge on the structure of the economic system possesses certain degree of uncertainty and needs subjective judgments. As such, it is certainly not likely to make a perfect forecast which is error-free. Thus, Muth (1961) argues that the formation of expectations depend crucially on either the amount of available information or the structure of the entire system. As defined by Muth (1961, pp. 361), the hypothesis of rational expectation asserts three important assumptions:

- i. Information is scarce, and the economic system generally does not waste it.
- ii. The way expectations are formed depends specifically on the structure of the relevant system describing the economy.
- iii. A "public prediction", in the sense of Grunberg and Modigliani will have no substantial effect on the operation of the economic system (unless it is based on inside information).

Unlike the autoregressive expectations formation which relies heavily on past experience while doing future forecast, the theory of rational expectations emphasizes the use of relevant and currently available information set rather than past experience while dealing with future forecasting. Economic agents usually gather the related and publicly available information set and do their best to utilize the information rationally and efficiently. Muth's REH assumes that people generally do not waste information as information is scarce. Hence, people will not make systematic errors while predicting their future course of events (Menzies and Zizzo, 2006). Likewise, Koekemoer (2001) argues that economic agents do make mistakes in the short run, but in the long run, the systematic errors will be ruled out due to successive learning.

implying that rationality in Muth's sense would eventually privilege even though certain degree of forecast errors could exist during the forecasting process.

In short, Muth's idea explicitly implies that economic agents forecast in such a way as to minimize forecast errors based on present and publicly available information but subject to certain degree of restriction such as uncertainty. In the sense of Muth's idea, the forecast error in terms of statistical standpoint should have a stable mean of zero, no serial correlation and no systematic component.

## **1.5 The Rationality of Rational Expectations**

The emerging of rational expectations in macroeconomic research has marked the revolution in economic thinking and the magnitude of its impact on economics world is undeniably significant. Muth (1961, pp. 330) claims that "*expectations have not previously been regarded as rational dynamic model, since rationality is assumed in all other aspects of entrepreneurial behavior*". However, when compared with those of the Cobweb "theorem", he found that theories which involve rationality explain observed phenomena better than alternative theories.

Furthermore, as contended by Lane (1995), expectations often form a major part of the decisions which are made in the economy and as such they should be also come under the doctrine of rationality. Thus, the REH is perhaps one of the best available methods of modeling expectations. After a long discussion on the concept of rational expectations and how the idea evolves, it is worthy for us to understand how