

Are A Rubber Firm's Gross Revenue, Capital Expenditure and Employment Forecasts Rational? An Empirical Evidence

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Business firms have always recognised the need for a view of the future and have used explicit forecasts in their decision making process. Forecasts of economic variables can be obtained directly from survey expectations.

This study evaluates the rationality of economic forecasts made by rubber limited companies in a survey published in Business Expectations Survey of Limited Companies. Data on actual and forecast values of gross revenue, capital expenditure and employment are subjected to unbiasedness, and have no serial correlation, efficiency and orthogonality tests for rationality. Findings suggest that forecast values are unbiased predictors of actual values. Moreover, rubber firms in Malaysia were also found to be rational and utilised all available information efficiently when making forecasts.

In recent years the performances of many micro- and macro-economic series have been erratic. For example, rate of inflation, price of crude oil, prices of primary commodities, rate of interest and other pertinent economic variables have been fluctuating widely and have caused concern among the public, politicians, economists and also the businessmen. According to Mayes¹, with such non-uniformity of economic variables observed in the last two decades, the role of expectations has become more relevant in the economic agents' decision-making process. Mayes¹ further states that under the present conditions it has become more important to consider what expectations actually are and how they are formed.

Heady² supports such contentions and acknowledges that the need for an efficient management has become more prevalent in the

present conditions. This is because a careful evaluation of the pertinent economic and business conditions, by incorporating not only the current situations but also a view of the future conditions of that variable, if correct, will greatly increase the probability of making successful decisions. Business firms have recognised the role of expectations in making their decisions, and thus, the role of management in the present context has become more challenging. Heady² postulates that *'The fundamental role of the co-ordinating unit, management in its true sense, is this: first, it must formulate expectations of the conditions which will prevail in the future. This task ordinarily is encountered before investment is made or production plans are ready to be committed. It involves the anticipation of future prices and production rates. Second, and after expectations of the future have been established, a plan of production (investment)*

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must be formulated which is logical and consistent with expectations Decisions must be made Third, the production plan must be put into action An auxiliary responsibility of management is the acceptance of the economic consequences of plans In summary then, the important steps in co-ordination include expectations, plans, action and acceptance of consequences '

Heady² further states that in formulating expectations of the future, at least three costs are involved, 'One cost is the time which the manager may himself devote to the assembling of information and data for estimation of the future Another cost may be represented by the inefficient use of resources or the unwillingness to commit resources (and hence the passing up of returns which might be forthcoming) until enough time has passed so that the operator can obtain and evaluate the information at hand The final cost of refining expectations is represented when the business firm hires a staff of economists and other experts to glean all reports, forecasts, and unanalysed phenomena which may have a bearing on future prices or production coefficients '

Therefore, business firms have always recognised the need for a view of the future and used explicit forecasts in their decision-making process. The value of economic forecasts of certain macro-economic variables can be derived from several methods. There are at least three main methods in deriving economic forecasts, that is, from time series and econometric model, and survey of intentions of concerned agents and organisations No doubt that time series analysis and econometric modelling are the two most widely used methods in economic forecasting, but their weaknesses have been noted by Holden and Peel³ However, more recently, explicit forecasts were derived directly from survey expectations. The role of economists in this

direction is to evaluate the rationality of forecasts from surveys of market participants

Empirical literature on direct tests of the rational expectations hypothesis is vast and growing The results of some of these studies are reviewed by Holden *et al*⁴, Lovell⁵, Wallis⁶, Maddala⁷ and Pesaran⁸. In general the studies do not support the rational expectations hypothesis Most of the studies carried out to evaluate the rationality of business firms' forecasts of economic variables were conducted on developed nations⁹⁻¹⁴ Madsen⁹ studied the formation of output expectations in manufacturing industry in Japan, Denmark, Finland, France, Germany, Netherlands, Norway, Sweden and the United Kingdom He found that the rational expectations hypothesis was weakly rejected and Williams¹⁰ and Chazelas¹¹ found investment forecasts biased predictors of the actual investment value for firms in the United Kingdom and France Meganck *et al*¹², also arrived at the conclusion that investment forecasts of the manufacturing firm in Belgium were unbiased predictors of the actual values However, Daub¹³ failed to find any rationality of the Canadian capital investment intention survey data On the other hand, a study by Leonard¹⁴ on employment forecasts by the United States services sectors found that the forecasts were biased and the rationality of these employment forecasts rejected

Nevertheless, there are two empirical studies pertaining to the developing economies by Kinoshita¹⁵ on Singapore and Yokoyama¹⁶ on Malaysia Yokoyama¹⁶ used the survey data of the *Business Expectations Survey of Limited Companies*¹⁷ published by the Department of Statistics Malaysia This however, did not test the rationality criteria of the business firm's forecast for Malaysia Thus, the issue of testing for rationality of the business expectations survey data in Malaysia is still an open issue

This paper mainly presents some empirical evidence on the rationality of business firms' expectations using survey data in Malaysia. This study evaluates the degree of accuracy of forecasts made by the rubber limited companies on gross revenue, capital expenditure and employment as reported in the *Business Expectations Survey of Limited Companies*¹⁷ published half-yearly by the Department of Statistics Malaysia. The study is important because it adds to the current literature on testing of rationality of survey data and provides empirical evidence from a developing country.

METHODOLOGY

Testing Rationality of Survey Data

The concept of rational expectations was first introduced by Muth¹⁸. For expectations to be rational, they must be based on all relevant information at the time they are formed.

According to Muth¹⁸ the concept of rational expectations has been widely tested on survey data. Since surveys are the only way of measuring expectations directly from market participants, the explicit forecast on economic variables of interest can be tested whether the survey supports rational expectations hypothesis or other alternatives.

There are four reported standard tests to evaluate the rationality of forecasts of economic variables from survey data, namely, unbiasedness; no serial correlation; efficiency and orthogonality tests. Let Q_t (Equation 1) denote the realisation of a variable of interest in period t , and ${}_{t-1}Qe_t$ denote the forecast made on the variable at period t made in period $t-1$. If the forecast is based on rational expectation then,

$$Q_t = E ({}_{t-1}Qe_t | I_t) \quad \dots 1$$

where E is an operator that denotes a mathematical expectation and I_t is the set of information available to economic units at the end of period t . It follows that:

$$E [(Q_t - {}_{t-1}Qe_t) | \Omega_t] = 0 \quad \dots 2$$

where Ω_t is a subset of the full information set I_t . Letting η_t represent the forecast error $Q_t - {}_{t-1}Qe_t$, Equation 2 can be written as:

$$E [\eta_t | \Omega_t] = 0 \quad \dots 3$$

which implies that the forecast error in Equation 3 is uncorrelated with each variable in the information set Ω_t . Defining the sampling interval of the forecasts as one period, Equations 1, 2 and 3 suggest the following testable tests of rationality:

- (i) Unbiasedness: $Q_t = {}_{t-1}Qe_t + \eta_t$
- (ii) No serial correlation: $E [\eta_t | \eta_{t-1}] = 0$
 $i = 1, 2, \dots, K$
- (iii) Weak-form efficiency: $E [\eta_t | Q_{t-1}] = 0$
 $i = 1, 2, \dots, K$
- (iv) Strong-form efficiency or orthogonality: $E [\eta_t | \Omega_{t-1}] = 0 \quad i = 1, 2, \dots, K$

Sources of Data

In this study, bi-annual time series data on observed realisation of gross revenue, capital expenditure and employment and their respective forecasts made by managers of rubber firms for the period 1978:I to 1992:II are compiled from various issues of the *Business Expectations Survey of Limited Companies*¹⁷. It also contains information on money supply ($M1$), net exports (NX), price (P) and income (Y) levels. Price and income are proxied using the consumer price index and industrial production index respectively. The four macro-economic variables are com-

piled from various issues of the *Quarterly Bulletin*¹⁹ published by Bank Negara Malaysia.

ESTIMATION AND DISCUSSION ON EMPIRICAL RESULTS

Table 1 shows the results of unbiasedness test to determine whether or not the economic forecasts are unbiased predictors of the actual values. Supposing the actual value is denoted as Q_t and ${}_{t-1}Qe_t$ is the forecast value, then the unbiasedness test is performed by estimating the following equation:

$$Q_t = \alpha + \beta_{t-1}Qe_t + \varepsilon_t \quad \dots 4$$

where ε_t is random error with zero mean and constant variance. The following F -test is used to examine the joint null hypothesis that $\alpha = 0$ and $\beta = 1$, that is consistent with unbiased forecast:

$$F_{(R, K-N-1)} = [(RSSR - USSR)/R]/[USSR/(K-N-1)]$$

where $RSSR$ is the restricted sum of squares residual of the regression in which the coefficients are restricted to their hypothesised values, $USSR$ is the unrestricted sum of squares residual, R is the number of restriction, N is the number of independent variables and K is the number of observations (*see* Maddala²⁰).

Furthermore, the estimated residuals from Equation 4 should not exhibit serial correlation if the forecasts are unbiased predictions of the actual values in Q_t .

As shown in Table 1, in all cases the estimated slope coefficients are significantly different from zero at 5% level. The calculated F -statistics for the three economic variables namely gross revenue, capital expenditure and employment, do not allow for the rejection of the null joint hypothesis that $\alpha = 0$ and $\beta = 1$. Moreover, the Durbin-Watson statistics do not indicate the presence of first-order serial correlation. The results therefore suggest that the economic forecasts made by rubber firms are unbiased.

The behaviour of the error term can be subjected to a formal test, that is by conducting the non-serial correlation test:

$$\eta_t = \sum_{i=1}^K \delta_i \eta_{t-i} + v_t \quad \dots 5$$

where $\eta_t = Q_t - {}_{t-1}Qe_t$ is the forecast error. The hypothesis of zero correlation is tested for the null hypothesis $H_0: \delta_i = 0, i = 1, 2, \dots, K$ for a range of choice of K . For degree of freedom, it was chosen from 1 to 3 lag terms. Results in Table 2 clearly show that the calculated F -statistics could not reject the null hypothesis of non-serial correlation.

TABLE 1. RESULTS OF UNBIASEDNESS TEST

	α	β	R ² /DW	F-tests
Gross revenue	12.843 (0.74560)	0.89541 (15.777)*	0.902 1.73	0.55
Capital expenditure	-0.07225 (0.02737)	0.78665 (8.9085)*	0.746 1.85	0.00
Employment	-1.1431 (0.93600)	0.98054 (41.289)*	0.984 1.95	0.83

*Statistically significant at five percent level;
 $t = 2.042, F(1,27) = 4.21$

Testing for weak-form efficiency, that is, to determine whether or not rubber firms used information on past values of variables in question are presented in *Table 3*. This is done by estimating the following equation proposed by Mullineaux²¹:

$$Q_t - {}_{t-1}Qe_t = \phi_0 + \sum_{i=1}^K \phi_i Q_{t-i} + \omega_t \quad \dots 6$$

where the dependent variable ($Q_t - {}_{t-1}Qe_t$) represents the forecast error in predicting values in Q and the independent variables Q_{t-i} are the actual values in Q . The null hypothesis to be tested is that the estimated ϕ_i are not statistically different from zero for all i ($i = 1, 2, \dots, K$) as a group. Moreover, the estimated error structure should not exhibit serial correlation. Generally, results in *Table 3* show that rubber firms made rational economic forecasts on gross revenue, capital expenditure and employment. In other words, past realisations of the variables in question are used efficiently.

The orthogonality test or the strong-form efficiency test indicates that for full rationality according to Muth, the forecast error will be uncorrelated with all available information. In this study, money supply (MI), net exports (NX), price (P) and income (Y) level were chosen as the information set as they are the most common macro-economic indicators that are not only available free to market participants, but also feature prominently in typical discussions of the national economic outlook.

To test whether the forecast errors are orthogonal or systematically uncorrelated with all relevant available information, the following was estimated:

$$Q_t - {}_{t-1}Qe_t = \theta_0 + \sum_{i=0}^K \theta_i I_{t-i} + \mu_t \quad \dots 7$$

The null hypothesis of rational expectations implies that all the coefficients in *Equation 7* should be equal to zero. The information set I_{t-i} refers to the lagged values ($i = 0, 1, 2, \dots, K$)

TABLE 2. TESTS FOR NON SERIAL CORRELATION

Lag	F-statistics		
	Gross revenue	Capital expenditure	Employment
1	0.44	0.13	0.01
2	0.15	0.35	0.04
3	0.12	0.48	0.05

*Statistically significant at five percent level;
 $F(1,27) = 4.21$; $F(2,25) = 3.39$; $F(3,23) = 3.03$

TABLE 3. MULLINEAUX'S WEAK-FORM EFFICIENCY TEST

	Lag 1	Lag 2	Lag 3
Gross revenue	3.22	4.74*	3.68*
Capital expenditure	1.29	0.84	1.07
Employment	0.51	0.24	1.73

*Statistically significant at five percent level,
 $F(1,27) = 4.21$, $F(2,25) = 3.39$; $F(3,23) = 3.03$

TABLE 4 F-STATISTICS FOR STRONG-FORM EFFICIENCY OR ORTHOGONALITY TESTS

	M	NX	P	Y
A. Current Value				
Gross revenue	0.97	0.49	0.71	0.92
Capital expenditure	0.11	0.75	0.14	0.11
Employment	1.79	0.92	1.50	1.91
B. One Lag Term				
Gross revenue	0.49	0.57	1.20	0.83
Capital expenditure	0.77	2.10	2.35	0.06
Employment	0.92	0.63	1.18	1.18
C. Two Lag Term				
Gross revenue	0.38	0.56	0.80	0.57
Capital expenditure	0.52	1.53	1.79	0.13
Employment	0.80	0.42	0.76	0.78
D. Three Lag Term				
Gross revenue	0.29	0.56	1.11	1.08
Capital expenditure	0.37	1.10	1.64	0.65
Employment	0.66	0.37	1.41	0.91

*Statistically significant at five percent level,

$F(1,28) = 4.20$, $F(2,27) = 3.35$, $F(3,26) = 2.98$, $F(4,25) = 2.76$

of money supply, net exports, price and income level that were incorporated at the time the forecast was made.

The results to determine whether the forecast errors are orthogonal to the variables in the forecaster's information set are presented in Table 4. In all cases, the calculated *F*-statistics did not allow for the rejection of the null hypothesis that rubber firms have utilised money supply, net exports, price and income level in the information set at the time the forecast was made. Results suggest that rubber firms are rational and efficient in incorporating the information contained in money supply, net exports, price and income level.

CONCLUSION

This study presents some empirical evidence on the rationality of rubber limited companies' forecasts on gross revenue, capital expenditure

and employment by subjecting the rationality tests on the survey data. Generally, it was found that rubber limited companies in Malaysia made rational economic forecasts. This implies that rubber firms utilised all relevant information efficiently at the time the forecasts were made. This is the first study that has shown that business firms' economic forecasts are consistent with both weak and strong forms of rationality.

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