Testing the Rational Expectations Hypothesis on the Retail Trade Sector Using Survey Data from Malaysia

Puah, Chin-Hong and Chong, Lucy Lee-Yun and Jais, Mohamad

Faculty of Economics and Business, Universiti Malaysia Sarawak, Malaysia

October 2011

Testing the Rational Expectations Hypothesis on the Retail Trade Sector Using Survey Data from Malaysia

Chin-Hong Puah[♣], Lucy Lee-Yun Chong and Mohamad Jais
Faculty of Economics and Business, Universiti Malaysia Sarawak, Malaysia

Abstract

The rational expectations hypothesis states that when people are expecting things to happen, using the available information, the predicted outcomes usually occur. This study utilized survey data provided by the *Business Expectations Survey of Limited Companies* to test whether forecasts of the Malaysian retail sector, based on gross revenue and capital expenditures, are rational. The empirical evidence illustrates that the decision-makers expectations in the retail sector are biased and too optimistic in forecasting gross revenue and capital expenditures.

Keywords: *REH, Unbiasedness, Non-serial Correlation, Weak-form Efficiency*

I. Introduction

Expectations affect the behavior of people in firms, households and the government. The incentive to use expectations becomes stronger as the potential "profits" begin rising (Sargent, 2008). Investors decide to invest when they expect a stock will yield superior returns; consumers decide to consume less when they expect the recession will persist; firms decide to expand their business when they expect the profit opportunities to be higher; and the government decides to use a monetary, or fiscal, policy when they expect the policy to boost economic performance.

[♣] Corresponding author: Chin-Hong Puah, Department of Economics, Faculty of Economics and Business, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia. E-mail: chpuah@feb.unimas.my

The rational expectations hypothesis (REH) states that when people expect things to happen, with the available information, the predicted outcomes will occur, on average. This occurs because the avoidable errors were adjusted when the current forecast took place, considering feedback from past outcomes, as highlighted by Sargent (2008), Muth (1961) and Friedman (1980). Albeit the future is not fully predictable, the systematical error can be minimized, as people will adjust their expectations, from time to time, using all available information in forming expectations. Thus, although the economic variables were created by a systematical process, the forecasted outcomes will be the same as those predicted by the REH. As noted by Mishkin (1983) and Zarnowitz (1992), not all market participants need to be rational to display rational expectations, indicating that the behavior of an individual is not necessarily the same as the behavior of the market. The market will behave as if those expectations are rational, rather than irrational, as long as the unexploited profit opportunities are eliminated by the rational participants in the market.

Recent studies have focused on testing the rationality of inflation expectations in industrialized countries (see for example, Mestre, 2007; Henzel and Wollmershaeuser, 2008; Schmeling and Schrimpf, 2008). Few studies have examined the REH of the financial and commodities markets in the business sector in developing countries. In 2009, the retail business in Malaysia had increased by 29.7 percent, as compared to 2002. This increase was partially driven by market liberalization, an increase in food demand, and an expansion of hypermarket and tourism sectors. Unlike merchant trade that focuses on the international market, the business in retail trade concentrates on the domestic market (Lim et al., 2003). As such, retail trade is one of the main value added components to consumption in a nation. It also acts as the engine of growth, since incomes generated by retailers have a multiplier effect that will boost the economy. For that reason, it is crucial to investigate whether the decision-makers in this sector are rational in making business expectations.

This paper aims to investigate whether data from the Malaysian *Business Expectation Survey of Limited Companies* could provide the basis for prediction that supports the rationality of expectations in the sense of unbiasedness, non-serial correlation and efficiency. The rest of this paper is structured as follows. Section 2 presents the theoretical framework related to the REH, Section 3 explains the methodology used to test the REH, Section 4 provides the empirical results, and lastly, Section 5 concludes.

II. Theoretical Framework

Based on Beach et al. (1995), the REH model is implied by:

$$E\{\varepsilon_{t+h} \mid \Omega_t\} = E\{x_{t+h} - {}_t x^e_{t+h} \mid \Omega_t\} = 0 \tag{1}$$

$$E\{\ \varepsilon_{t+h} \bullet \Omega_t \mid \Omega_t\ \} = 0 \tag{2}$$

where: ${}_t x^e_{t+h}$ is the subjective (quantitative) expectation of x_{t+h} formed at time t=1,2,…,T, E is the mathematical expectations operator, ε is the forecast error, and Ω_t is the information set available to the economic agent at time t.

The realizations x_{t+h} are subjected to data revisions unknown by individuals when forming the expectations (Pesaran and Weale, 2006). Next, the data revisions and conversion errors are abstracted by assuming ${}_t x^e_{i,t+h}$ and the associated expectations errors are observed to be free of measurement errors. Beach et al. (1995) point out that the REH is often tested by setting h=1 in Equations (1) and (2):

$$x_{t+1} = \alpha_0 + \beta_1\ {}_t x^e_{t+1} \tag{3}$$

$$\varepsilon_{t+1} = \gamma_1\ \mathrm{X}_t \tag{4}$$

where $X_t \subseteq \Omega_t$ is a vector that corresponds to all relevant information available to an economic agent at time t. The REH entails the forecasting to be unbiased and consistent. In addition, the null hypothesis of unbiasedness is accepted if $\alpha_0=0$ and $\beta_1=1$. According to Pesaran and Weale (2006), if the $E_i(x_{t+h} \mid S_{i,\, t+\ell})$ is equal to $E_i(x_{t+h} \mid S_{it})$ for all of ℓ, the subjective expectations $E_i(x_{t+h} \mid S_{i,\, t+\ell})$ formed at time $t+\ell$ for period $t+h$ ($h>\ell$) tend to be consistent under the REH.

III. Methodology

This paper used bi-annual survey data published by the Department of Statistics Malaysia in the *Business Expectations Survey of Limited Companies,* from June 1991 until June 2006, to examine the rationality of retail firm expectations toward a macroeconomic trend based on the gross revenue (GR) and capital expenditures (CE). The econometric testing procedures employed in this study include the Augmented Dickey-Fuller (ADF) unit root test, Engle-Granger cointegration test, unbiasedness test, non-serial correlation test, as well as the Mullineaux weak-form efficiency test. Consequently, the Breusch-Godfrey Autocorrelation LM test will be employed to support the rationality test results.

Preliminary Test

A unit root test examines the stationarity properties of a time series dataset. Generally, time series data for macroeconomic variables are non-stationary in the level form. However, most of the data becomes stationary after the first differencing. Stationarity implies that the lag effect of the variable (Y_{t-1}) will not influence the current value of it (Y_t). On the other hand, the cointegration test has some meaningful implications for testing the REH, particularly in establishing the long-run relationship between the realized and anticipated series. The "optimal forecast" and the actual value

of the series being predicted must be cointegrated under a relatively general condition; otherwise these series will not result in similar long-run properties (Granger, 1986).

Unbiasedness Test

The rational expectations must be unbiased in Muth's sense of the subjective expectation. This expectation is identical to the corresponding mathematical expectations (Friedman, 1980) shown by:

$$r_t = {}_{t-s} r_t^e + u_{st} \tag{5}$$

where: $r_t$is the observed value at time t, ${}_{t-s} r_t^e$ is the expectations of r_t at time t-s, and u_{st} is a zero mean finite-variance disturbance term uncorrelated with ${}_{t-s} r_t^e$, but may be serially correlated with an (s-1) order moving-average process. The equation used to regress the survey expectations on the realizations following the unbiasedness test is:

$$r_t = \alpha + \beta_{t-s}\, r_t^e + u_{st} \tag{6}$$

and the null hypothesis of unbiasedness is defined as H_0: (α, β) = (0, 1). The acceptance of the joint hypothesis above implies that the expectations are an unbiased predictor of the actual incidence.

Non- Serial Correlation Test

The non-serial correlation test is applied to examine the presence of serial correlation between the forecast errors and its lag forecast errors. Based on Evans and Gulamani (1984), the regression model to test the serial correlation is:

$$\eta_t = \delta_0 + \sum_{i=1}^{p} \delta_i \eta_{t-i} + \varepsilon_t \tag{7}$$

where η_t is the forecast error, p is the lag length and $i \in \{1,2,3,\ldots p\}$. The rejection of the joint null hypothesis H_0: $(\delta_0, \delta_i) = 0$, $i \in \{1,2,3,\ldots p\}$ denotes that η_t is correlated with its lagged values.

The Mullineaux Weak-Form Efficiency Test

The Mullineaux weak-form efficiency test is used to examine whether the forecast errors are unpredictable. This implies that they are uncorrelated with any variables contained in the information set available at the time of forming the expectations (Beach et al., 1995). According to Raja et al. (2009), the strong form efficiency reflects all publicly or privately (monopolistic insiders) available information that is incorporated with the complete model. The semi-strong form efficiency, in contrast, reflects the publicly available information incorporated with the complete model; the weak-form efficiency reflects the partial information contained in the historical sequence incorporated with the incomplete model.

Friedman (1980) states that rational expectations and the corresponding realizations share a common autoregressive representation. In addition, the estimation of the paired regressions employed in the efficiency test is illustrated as follows:

$$r_t = \beta_0 + \sum_{i=s}^{N} \beta_i \, r_{t-i} + \upsilon_{st} \tag{8}$$

$$_{t-s} r_t^e = \beta_0' + \sum_{i=s}^{N} \beta_i' \, r_{t-i} + \upsilon_{st}' \tag{9}$$

where: the υ_{st} and υ'_{st} are the random error terms.

IV. Empirical Results

The ADF unit root test results illustrate that both of the realized and anticipated GR and CE are non-stationary in levels, but stationary after the first differencing, indicating that they are integrated of order one, or $I(1)$. The results for the unit root test are available upon request from the authors. We then proceeded to conduct a cointegration test, unbiasedness test and LM test. The evidence drawn from the Engle-Granger cointegration test in Table 1 denotes that there is a long running co-movement between the realized and anticipated GR and CE. In addition, the LM test shows that all the disturbance terms are white noise.

Table 1: Results of Engle-Granger Cointegration Test and Unbiasedness Test

	GR	CE
Cointegration Test		
ADF	-6.186***	-4.981***
Unbiasedness Test		
Constant (α)	2.295*	1.990***
Slope (β)	0.699***	0.481***
F-statistic (α=0, β=1)	2.670*	5.048***
LM(2)	0.371	0.924

Note: Asterisk (***), (**) and (*) denote statistically significant at the1%, 5% and 10% levels, respectively.

Even the F-statistic of the joint hypothesis that imposed the restriction for α=0 and β=1 in Table 1 illustrates that GR and CE are biased as the null hypothesis of the unbiasedness test is rejected, the non-serial correlation test and the Mullineaux weak-form efficiency test results, presented in Table 2, denotes that the GR and CE are not correlated with past forecast errors. We failed to reject the null hypothesis in both of the non-serial correlation and the Mullineaux weak-form efficiency tests, indicating the decision-makers are efficient in utilizing all available information.

Table 2: Results of Non- Serial Correlation Test and Weak Form Efficiency Test

	NSC	WF
	1	
GR	1.104[0.346]	1.330[0.281]
CE	0.317[0.731]	0.791[0.464]
	2	
GR	1.123[0.358]	0.868[0.471]
CE	0.361[0.782]	0.979[0.419]
	3	
GR	1.140[0.362]	0.888[0.487]
CE	0.410[0.799]	0.749[0.569]

Notes: Figures in square brackets indicate the *p*-value. NSC refers to non-serial correlation test while WF refers to weak-form efficiency test.

V. Conclusions

Business survey expectations had significant implications for the respondent firm, society, and government. Empirical results illustrate that the gross revenue and capital expenditures passed the non-serial correlation and weak-form efficiency tests. Even so, the predictions made by the decision-makers in the retail sector tend to be biased and are too optimistic in forecasting their gross revenue and capital expenditures. This might imply that decision-makers in the retail trade sector in Malaysia had tried to utilize available information in formatting their expectations towards economic trends. Nevertheless, their forecasts were still biased. Based on Baillie et al. (1983), the biased results may be attributable to an uncertain future. In addition, the variety of non-linear feedback caused by the heterogeneity group will also lead to biased results. Likewise, Dovern and Weisser (2008) point out that a bias can be caused by large structural shocks or gradual changes in the variable trends.

Acknowledgments:

Financial support from the Universiti Malaysia Sarawak (UNIMAS) and Fundamental Research Grant Scheme [FRGS/05(27)/781/2010(62)] are gratefully acknowledged. All remaining flaws are the responsibilities of the authors.

References:

Baillie, R.T., Lippens, R.E. and McMahon, P.C. (1983). Testing Rational Expectations and Efficiency in the Foreign Exchange Market. *Econometrica*, *51*(3), 553-563.

Beach, E.D., Fernandez-Cornejo, J. and Uri, N.D. (1995). Testing the Rational Expectations Hypothesis Using Survey Data from Vegetable Growers in the USA. *Journal of Economic Studies*, *22*(6), 46-59.

Department of Statistics Malaysia. *Business Expectations Survey of Limited Companies*, various issues. Putrajaya: Department of Statistics Malaysia.

Dovern, J. and Weisser, J. (2008). *Are They Really Rational? Assessing Professional Macro-Economic Forecasts from the G7-Countries*. Kiel Institute for the World Economy, Working Papers, No. 1447.

Evans, G.W. and Gulamani, R. (1984). Tests for Rationality of the Carlson-Parkin Inflation Expectations Data. *Oxford Bulletin of Economics and Statistics,* 46(1), 1-19.

Friedman,B.M. (1980). Survey Evidence on the 'Rationality' of Interest Rate Expectations. *Journal of Monetary Economics*, *6*(4), 453-465.

Granger, C.W.J. (1986). Developments in the Study of Cointegrated Economic Variables. *Oxford Bulletin of Economics and Statistics*, *48*(3), 213-228.

Henzel, S. and Wollmershäuser, T. (2008). The New Keynesian Phillips Curve and the Role of Expectations: Evidence from the CESifo World Economic Survey. *Economic Modelling*, *25*(5), 811-832.

Lim, Y.M., Badarulzaman, N. and Ahmad, A.G. (2003). *Retail Activity in Malaysia: From Shophouse to Hypermarket*. Paper presented at the Pacific Rim Real Estate Society 9th Annual Conference, Australia.

Mestre, R. (2007). *Are Survey-Based Inflation Expectations in the EURO Area Informative?* European Central Bank, Working Paper Series No. 721.

Mishkin, F.S. (1983). *A Rational Expectations Approach to Macroeconomics: Testing Policy Ineffectiveness and Efficient-Markets Models*. Chicago and London: The University of Chicago Press.

Muth, J.F. (1961). Rational Expectations and the Theory of Price Movements. *Econometrica*, *29*(3), 315-335.

Pesaran, M.H. and Weale, M.R. (2006). Survey Expectations. In G. Elliott, C.W.J. Granger, and A. Timmermann (Eds.), *Handbook of Economic Forecasting* (pp.715-776). North-Holland.

Raja, M., Sudhahar, J.C. and Selvam, M. (2009). Testing the Semi-Strong Form Efficiency of Indian Stock Market with Respect to Information Content of Stock Split Announcement: A Study in IT Industry. *International Research Journal of Finance and Economics*, *2009*(25), 7-20.

Sargent, T.J. (2008). Rational Expectations. *The Concise Encyclopedia of Economics*. Library of Economics and Liberty. Retrieved May 7, 2009, from http://www.econlib.org/library/Enc/RationalExpectations.html.

Schmeling, M. and Schrimpf, A. (2008). *Expected Inflation, Expected Stock Returns, and Money Illusion: What Can We Learn from Survey Expectations?* Deutsche Forschungsgemeinschaft, SFD 649 Discussion Paper 2008-036.

Zarnowitz, V. (1992). *Business Cycles: Theory, History, Indicators, and Forecasting*. Chicago and London: The University of Chicago Press.