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Are business forecasts of the construction sector rational? Survey-based evidence from Malaysia

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ABSTRACT

This paper extends the direct measure to business expectations in assessing the doctrine of forecast rationality in the contemporary environment of Malaysia's construction sector. The survey's expectational series on business operational forecasts across the period 1990 to 2010 is inconsistent with Muth's concept of rational expectations. Although strict rationality failed to be evidenced, weakly rational conduct can be observed in capital expenditure forecasts. Nevertheless, both operational variables in question are optimistically biased upward and neither of them can accurately reflect the true market perception. This evidence casts doubt on the usefulness of the investigated survey series in providing a realistic panorama of the construction sector in the near future. Notwithstanding, the irrational upshot may drop a hint to the reader on the root of alarming property overhang and price hikes in construction-related markets since expectations play a foremost role in providing equilibrium in the supply and demand in this growth-initiating market.

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1. Introduction

Market participants, predominantly business players, take full advantage of their available information in pursuit of their self-interests. In response to costly available information and scarce resources, forward-looking profit-maximisers generally do not waste information, and such optimal use of information tends to drive them toward rational expectations as proposed by Muth (1961). With the use of knowledge fully exploited in a cost-efficient manner, Egginton (1999) maintained that market participants can generate unbiased and efficient forecasts. For this reason, the author argued that the rational expectation hypothesis (REH) can serve as a means to evaluate the usefulness of survey data. This is because survey forecasts that deviate significantly from rationality would propose that biased and inefficient forecasts barely converge with the market's true perception and these outlooks are no longer of value to market participants. Hence, in the course of validating whether

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the expectational series has been built on a rational mechanism, we are indeed assessing the usefulness of the available survey forecasts.

Since the theory of rational expectations comes into practical use, a broad literature on REH testing has arisen upon the evolvement of methodological approaches in modelling expectations. Yet, empirical findings on forecast rationality are generally inconclusive because the validity of the REH is time-dependent and subject to the nature of the sample being examined. Among others, Leonard (1982), Chazelas (1988), Buckle, Assendelft, and Jackson (1990), Madsen (1993), Heinemann and Ullrich (2006), Mestre (2007) and Lui, Mitchell, and Weale (2011) have examined the rationality framework in various aspects of expectations formation, ranging from inflation, wages, investment, and banking survey to manufacturing prices and quantity as well as entrepreneurial expectations. Accumulated evidence of forecast rationality reveals that the properties of expectations vary across variables and the implications from past studies should not be generalised into a boarder perspective.

Forecast rationality is ultimately an empirical question, regrettably, and most of the past studies on REH validity were concentrated in developing economies, while, in developing nations such as Malaysia, we barely find much empirical evidence on forecast rationality besides Habibullah (1994a, 1994b, 1997, 2001, 2003, 2005). Those studies were carried out in two decades ago when the Malaysian economy was commodities-dominated and yet to enter into a rigorous transformation. Some recent studies by Puah, Chong, and Jais (2011), Wong, Puah, and Abu Mansor (2011), Chong, Puah, and Md Isa (2012), and Puah, Wong, and Liew (2013) have heightened the notion of forecast rationality in Malaysia's real and financial sectors. Nevertheless, the construction sector has had un-assessed business operational forecasts since the first and only work of Habibullah (1994a). As a result, up-to-date revisits to the behavioural basis of expectations formation in the construction sector in Malaysia is certainly an important issue that welcomes empirical investigation.

Despite a small contribution to gross domestic product (GDP) of 3% in 2010, strong performance of the domestic economy coupled with Malaysia's aspiration to bring Vision 2020 into reality has created a growth-oriented environment that establishes the construction sector as a major contributor to domestic-oriented industries. Even though several economic slowdowns have resulted in a great deal of caution among contractors and developers, construction work, especially in civil engineering and non-residential activities, has been sustained with the support of government expansionary policies and stimulus packages. Steady growth in the construction sector was noticeable when the economy recovered from the 1997 Asian financial crisis, whereas the emergence of attractive financing packages and affordable interest rates after the 2009 downturn caused a surge in construction activity, especially for residential and commercial properties.

Nevertheless, Lee (2010) noted that residential property prices rose by 16% in 2010 even though property overhang is mounting and is tremendously ahead of income growth. Furthermore, 22.6% of new launches in the second quarter of 2010 were unsold compared with 19.5% in the fourth quarter of 2009 (National Property Informational Centre (NAPIC), 2011). A similar issue can be observed in the commercial properties market, in which oversupply of office space, shops, and industrial units in highly property-concentrated cities such as Kuala Lumpur city centre, Penang, Selangor and Johor has become a rising issue. With all these concerns, some market evaluators have perceived a threatening force in the Malaysian property market toward a property bubble (Ahmad, 2010), while some real estate

agents and developers have privately expressed worries that the market is too speculative and the price acceleration is not sustainable (Lee, 2010).

At this point, it appears that the construction sector is growing in an ever-erratic environment in which sensible business operation, management and planning play a vital role in sustaining not merely the business unit per se, but also the sector as a whole. Since business operational forecasts play an essential role in businesses' short-term planning for production and investment, we observed a crucial need to revisit the nature of these forecasts and present contemporary evidence on forecast rationality for the construction sector. Furthermore, business expectations from the standpoint of limited construction companies will be of particular interest as limited companies, including both private and public, dominated the entire construction sector with a value of gross output reaching 90% in 2010 (Department of Statistics Malaysia, 2012).

Importantly, the nature of the construction sector, which is market-driven and growth-dependent, makes the role of business expectations particularly significant to both the businesses and public agents. On this basis, the contractors' intention or decision to initiate construction output indeed corresponds to the contractors' perceived demand in the market. The perceived market outlook, whether good or bad, will first be reflected in the business operational forecasts because business operations are regulated and/or expected to conform to market performance. Accordingly, the way contractors anticipate their business operations explicitly reveals how they perceive the changing economic conditions in the near future. Thus, the contractors' rational or irrational conduct, to some extent, offers a mechanism that guides contractors to envision and counteract the market evolution in all the construction-related sectors.

Thus, irrational business expectations, either too optimistic or too pessimistic, could reflect contractors' inability to correctly interpret the true market situation in an unbiased and efficient manner. As a result, conflicting insights about the true growth in the market tend to shape erroneous market confidence, and this conflict possibly drives contractors to perceive an incorrect value of the true market. After all, business decision-making that is built on irrational convictions is less likely to be wise and construction output may not meet its demand at an equilibrium state. Incidentally, rapid commencement of construction development along with scrambling property prices emerges if optimistic behaviour and seemingly good market prospects undermine rational judgment.

All things considered, the current study takes a closer look into forecast rationality from the Malaysian contractors' perception with a twofold aim. First, we attempt to contemporise the direct evidence of forecast rationality in the situation where the construction markets are experiencing erratic changes. Second, we track the rational framework to gauge whether the survey data are useful in harmonising the business outlook with the true market perception. In brief, empirical evidence across the period of 1990 to 2010 shows that business operational forecasts disclosed by construction firms diverted significantly from forecast rationality for the case of gross revenue, while capital expenditures were deemed to be weakly rational. The rest of this paper is organised as follows. Section 2 describes the framework of rational forecasts, while Section 3 addresses the survey measure of expectations followed by the empirical testing procedure. Section 4 reports and discusses the empirical findings, and Section 5 concludes.

2. The framework of rational forecasts

For decades, economists have worked to apply greater thought to characterising the way economic agents or forecasters formulate expectations. Nevertheless, the ground breaking work of Muth (1961) eventually popularised the rational notion of hypothesising expectations. Muth's REH stresses that economic agents generally do not waste information and that expectation formation depends particularly on the structure of the entire system. In other words, a subjective expectation of an economic variable is identical to its mathematical expectation, conditioned on the currently available information when the forecasts are made (Friedman, 1980; Krause, 2000; Stein, 1992).

Certainly, expectations that ultimately convey error-free future forecasts are almost not feasible as information is imperfect and uncertainty occurs all the time. Thus, Muth's rational framework can be mathematically represented as:

$$\eta_t = \Pi_t^* - E\left(\Pi_t \middle| \Omega_{t-1}\right) \tag{1}$$

where Ω_{t-1} denotes all cost-free and publicly available information sets and η_t designates the random error term while Π_t and $\boldsymbol{\Pi}_t^*$ correspond to the observed value of the target variable at time t and forecast value for time t at time t–1, respectively. If forecast rationality is implied, η_t should capture the entire non-systematic component.

Muth's rational expectations are built on three basic assumptions that require empirical verification if the mechanism of rational forecast is to be verified. At the outset, a minimal but insufficient condition of the REH assumption is that economic agents would not make systematic forecast errors over time. This is because persistent learning takes place and this learning process will eventually compel individuals toward expectations formation that possesses no regularity. Hence, the expected value could serve as an unbiased predictor of its actual value. If the unbiasedness property has been violated, then economic agents are systematically over- or under-estimating the realised value (Nielsen, 2003, p. 2). We can mathematically portray the unbiasedness property as:

$$E\left(\eta_t\right) = 0 \tag{2}$$

In contrast, if the unbiasedness property can be detected, then, on average, the random error term has a mean of zero, and the subjective expectations will be identical to their mathematical expectations.

Subsequently, the soundness of REH needs to be upheld by the property of lack of serial correlation. In essence, this property requires that past forecast errors be non-serially correlated with current forecast errors. This assumption has been built on the fact that autocorrelation between the present and past error terms suggests that economic agents are not sufficiently learning from past mistakes. As past errors are part of the information set, inability to correct past mistakes consequently signifies that economic agents are not maximising the use of information, and this is a sign of inefficiency.

In addition, the REH framework necessitates no significant interdependence between random error terms and the expected value since the existence of such a phenomenon invites rejection of unbiased forecasts as well. Mathematically, we expressed the property of lack of serial correlation as follows:

$$E(\eta_t \eta_{t-i}) = 0, \quad \forall_i \neq 0 \tag{3}$$

After all, an important assumption of forecast rationality involves an efficient use of larger information set that includes past actual values of the targeted variable. Therefore, under an efficient condition where past history has been fully-incorporated in the expectation formation process, the forecasts error, conditional on the current and past values of the predicted variable, has a mean of zero, resembling the mathematical equation:

$$E(\eta_t | \Pi_{t-1}, \Pi_{t-2}, \ldots) = 0 \tag{4}$$

3. Direct measure of forecast rationality

The development of forecast rationality brings no conclusive support for how the theory should be tested. Essentially, whether the indirect test based on a constructed measure of expectation is compelling or a direct test with survey data is persuasive in preserving the empirical soundness of REH is still a debated issue. Although Muth's indirect testing procedure gained expediency in REH testing due to its use of actual market outcomes, the limitations of having to live with the problems created by joint testing have invited countless criticisms. The indirect test procedure, which also jointly tested other underlying model specifications, offers vague results for REH validity as a rejection of the joint hypothesis may be attributed to the rejection of the REH or other hypothesis (Beach, Fernandez-Cornejo, & Uri, 1995).

Consequently, many later works on REH testing have taken survey data as representative of market expectations and examined the REH framework directly without incorporating an economic model (see, among others, Beach et al., 1995; Dias, Duarte, & Rua, 2010; Forsells & Kenny, 2002; Gao, Song, & Wang, 2008; Lee, 1994; Mitchell & Pearce, 2007; Osterberg, 2000, for examples). The potency of direct testing via survey data has been emphasised by numerous researchers, including Frankel and Froot (1987), Keane and Runkle (1990), Kim (1997), Nielsen (2003), and Dovern and Weisser (2008). More to the point, the present study agreed on a direct testing procedure via the survey expectational series because a survey-based study on forecast rationality also establishes fundamental insight into the usefulness of survey forecasts in reflecting true market outlook in addition to enlightening with regard to the validity of REH in practical and empirical contexts.[1]

3.1. Time-series properties of the data

Given the survey data in time-series basis, we performed a standard time-series analysis based on the widely applied augmented Dickey-Fuller (ADF) unit root test developed by Dickey and Fuller (1979, 1981) to examine the stationary properties of the data. In a similar rationale for all time-series research, considering the consequences of the unit root is vitally important to avoid erroneous conclusions drawn on spurious regression results (Engle & Granger, 1987). In passing, much of the empirical work on rationality testing pays little attention to this matter, while Aggarwal, Mohanty, and Song (1995) and Nielsen (2003) even noted that some earlier REH evidence was derived from regression analysis without paying heed to the potential implications of non-stationary data. However, as we are exploiting non-stationary survey data to yield inferences on REH validity under an ordinary least

squares (OLS) framework, detecting the existence of unit roots and discerning the order of integration is vital, as Bonham and Cohen (1995) argued that the inference on forecast rationality might be falsely drawn if the issues of stationary data are not properly handled.

3.2. Cointegration test

In addition, optimal forecasts and realised series must be cointegrated under a broad-based condition, otherwise they will not share a similar long-run equilibrium path (Granger, 1986). Thus, the absence of cointegration would imply that the forecast owns no information content on its realised series even in the long run and therefore forecast rationality will hardly be feasible. This means that the cointegration test is deeply significant in most contemporary research in REH. In addition, in favour of Aggarwal et al.'s (1995) argument, we develop the evidence of cointegration using Johansen and Juselius's (1990) cointegration test.[2] Within this analysis, the inference of cointegration is derived from two test statistics, the trace and the maximum-eigenvalue.

3.3. Cointegration test

Under the rational expectations approach, a survey forecast is deemed to be rational under a set of explicit assumptions whereby hypothesis testing can be executed to reveal the behavioural feature of the survey forecasts. In this sense, the hypothesis testing under the Ordinary Least Square framework has been designed to explicate forecasts rationality based on Muth's theory of rational approach, taking into accounts the properties of unbiasedness, forecast errors, serial correlation and weak-form efficiency. Hence, the rationality approach envisaged in the current study incorporated three essential hypotheses that affect hypothesis testing on the presence of unbiased forecasts, no serial correlation between forecast errors and weak-form efficiency. In brief, to validate Muth's strict rational framework, the survey forecast needs to be accepted as an unbiased predictor of its actual value and the forecasting process necessitates an efficient use of information.

To test the unbiased nature of survey forecasts, OLS regression following a realisations forecast regression (RFR) equation proposed by Theil (1966) can be carried out to yield a set of parameter estimates, α and β. The RFR equation is as follows:

$$\Pi_t = \alpha + \beta \Pi_t^* + \eta_t \tag{5}$$

where Π_t is the realisation of the target variable at time t, $\boldsymbol{\Pi}_t^*$ is the forecast of Π_t formed at time t–1, and α (intercept) and β (slope of coefficient) are the parameters of interest. η_t denotes the random error term, which should be of zero-mean and finite-variance. The unbiasedness property is then tested by jointly hypothesising that α=0 and β=1. In other words, we jointly tested the null hypothesis of α=0 and β=1 against its alternative by means of the Wald test. The rejection of the null hypothesis suggests the existence of biased forecasts, and this bias implies either a systematic over- or under-prediction of the true value (Forsells & Kenny, 2002), which can be observed through the sign and magnitude of the β coefficient (Habibullah, 2003). A positive β coefficient exceeding unity indicates that, on average, the forecasts under-predict the true value, while a positive slope below unity implies over-prediction; a negative slope, however, signifies that the direction of forecasts is not aligned with their actual value. On the other hand, failure to reject the null hypothesis of α=0 and β=1

signifies the existence of unbiased forecasts, denoting that the survey expectational data are likely to be a rational forecast if weak-form rationality can be verified.

Subsequently, detecting the potential existence of unsystematic forecast errors can be accomplished by estimating the following regression:

$$\eta_t = \delta_0 + \sum_{i=1}^{p} \delta_i \eta_{t-i} + \varepsilon_t \tag{6}$$

where η_t is the forecast error and p is the lag length with $i \in \{1, 2, 3, \ldots, p\}$. Anchored in Evans and Gulamani (1984), the presence of serial correlation between current and past forecast errors can be verified via rejection of the joint null hypothesis H_0: $(\delta_0\ \delta_i)=0$, $i \in \{1, 2, 3, \ldots, p\}$. Specifically, we tested the null hypothesis of no serial correlation against its alternative under the Wald test setting. If the null hypothesis is to be rejected at any level of significance, then current and past forecast errors demonstrate an interdependence relationship, implying that the survey forecasts seize significant serial correlation. As a result, rejecting the null hypothesis of no serial correlation also denotes that the survey forecasts confront the potential effect of unsystematic forecast errors, resulting in irrational survey forecasts. This evidence also suggests that forecasters are unable to systematically correct from past mistakes, and this again signifies that past mistakes, which are also part of the information set, have not been fully incorporated into the forecasting process. Hence, violating the property of lack of serial correlation is a sign of inefficiency. Baghestani and Kianian (1993) have suggested rejecting the unbiasedness test if a serial correlation problem exists.

For a more profound analysis of forecast efficiency, we implemented the weak-form efficiency test on the basis of Mullineaux (1978) and the following equation was considered in the estimation:

$$\eta_t = \theta_0 + \sum_{i=1}^{N} \theta_i \Pi_{t-1} + \omega_t \tag{7}$$

where η_t is the forecast error and ω_t is the random disturbance term. θ_0 and θ_i are the parameters to be estimated and restricted to zero in the joint hypothesis testing. Then, F-statistics computed from the hypothesis testing of H_0: $(\theta_0, \theta_i) = 0, i \in \{1, 2, 3, \ldots, N\}$ against its alternative are used to validate the existence of efficient forecasts. The evidence of forecast efficiency could be established if we could not reject the null hypothesis of weak-form efficiency at any level of significant. Distinctively, rejection of the null hypothesis of weak-form efficiency implies that the survey forecasts failed to embody all available information in the past history of the target variable and the information has not been exploited in an efficient manner. To sum up, the rational mechanism envisaged by Muth can be validated if survey forecasts are successful in passing all three rationality tests.

3.4. The data

The soundness of REH from the perspective of the Malaysian construction sector, covering the period from 1990 through 2010, was investigated via survey-based expectational data extracted from various issues of the *Business Expectations Survey of Limited Companies* (BESLC), published by the Department of Statistics Malaysia (DOSM) on a biannual basis.

The business operational forecasts, specifically the gross revenue and capital expenditure forecasts, along with their actual realised values were gathered from a group of representative public and private limited construction companies selected through a three-stage sampling method.[3] This business operational outlook is a platform to provide inferences on the current and future stage of business activity in a particular sector, as well as the economy as a whole. In the course of interpreting survey forecasts of such kind, recognising the mechanism that drives these expectations is, on the whole, important to survey users.

4. Empirical results and discussion

Before the evidence of forecast rationality is articulated, we present the preliminary test on the ADF unit root in addition to the findings of cointegration analysis. The results of ADF unit root testing, presented in Table 1, show that both actual and expected gross revenue and capital expenditures are non-stationary in their level, but are stationary after differencing once. Hence, we can infer that all the investigated series followed the $I(1)$ stochastic process. In other words, they are integrated to the order of one. This finding empirically supports the subsequent analysis of series cointegration on the basis of Johansen and Juselius (1990).

On the other hand, Table 2 summarises the respective results of trace and maximum-eigenvalue test statistics. Under a 5% significance level, both test statistics firmly rejected the null hypothesis of no cointegration, regardless of gross revenue or capital expenditure. Furthermore, both test statistics collectively agreed on the existence of a single cointegrating vector, an outcome that favors us to conclude that co-movement between the forecast series and its actual realization is indeed taking place and both series are sharing a common

Table 1. Results of ADF unit root test.

	Level			First difference	
Variables	Constant	Constant trend	Variables	Constant	Constant trend
LAGR	−1.581 (2)	−2.944 (2)	ΔLAGR	−3.898 (2)***	−3.870 (2)**
LEGR	−1.654 (2)	−2.833 (2)	ΔLEGR	−3.937 (2)***	−3.791 (2)**
LACE	−1.826 (0)	−2.647 (3)	ΔLACE	−5.487 (2)***	−5.436 (2)***
LECE	−1.309 (1)	−2.415 (2)	ΔLECE	−5.363 (2)***	−5.325 (2)***

Notes: *LAGR* and *LACE* denote natural logarithms of actual gross revenue and capital expenditure, while *LEGR* and *LECE* represent natural logarithms of expected gross revenue and capital expenditure, respectively.
*** and ** indicate the rejection of the null hypothesis at 1% and 5% levels, respectively.
Lag length for ADF test has been chosen on the basis of Akaike's information criteria (AIC).
Source: Authors' calculations.

Table 2. Johansen and Juselius cointegration test results.

Variables	H_0	H_1	λ-trace	H_0	H_1	λ-max
LAGR, LEGR	$r = 0$	$r \geq 1$	20.655**	$r = 0$	$r = 1$	17.026**
	$r \leq 1$	$r \geq 2$	3.629	$r \leq 1$	$r = 2$	3.629
LACE, LECE	$r = 0$	$r \geq 1$	21.532**	$r = 0$	$r = 1$	20.410**
	$r \leq 1$	$r \geq 2$	1.122	$r \leq 1$	$r = 2$	1.122

Notes: **denote significant at the 5% level, r is the number of cointegration vector(s); The critical values for λ-trace are 15.495 and 3.841 for H_0: $r = 0$ and $r \leq 1$. Alternatively, the critical values for λ-max are 14.265 and 3.841 for H_0: $r = 0$ and H_0: $r \leq 1$, respectively.
Source: Authors' calculations.

stochastic trend. In the REH context, this evidence is a minimum but vital condition to ensure that the forecast series portrays a modest criterion to satisfy the rational framework.

After all, rationality testing must come to a standstill if evidence of cointegration cannot be established. Hitherto, our empirical outcomes have been in line with the key condition of rational forecasts advocated by Fischer (1989) and further supported by Lahiri and Chun (1989) and Cheung and Chinn (1999), that is, the survey-based forecast series Π_t^* must be integrated into the $I(1)$ process, the forecasted value and the actual value and must be cointegrated, and the cointegrating vector must be 1. As such, our present results on unit root and cointegration support the idea of consistency, termed by Cheung and Chinn (1999) as a manifestation of weak-form rationality.

However, we have to bear in mind that verifying Muth's doctrine of rationality is far beyond the evidence of stationarity and cointegration. Then again, validating the REH properties will be the essence of the entire rationality testing. Table 3 details the empirical test results of each of the three rationality tests for both operational variables. The RFR unbiasedness test put forward by Theil (1966) suggests that contractors in Malaysia are less likely to produce unbiased forecasts in their operational variables. This inference has been established under a firm rejection of the joint hypothesis of $\alpha = 0$, $\beta = 1$ at the 1% level for the case of capital expenditure.

Likewise, the expected gross revenue is not accurate to be accepted as an unbiased predictor of its actual value despite non-rejection of the joint hypothesis because the presence of serial correction reported by the Lagrange multiplier (LM) test provides room to violate the unbiasedness property as the error terms are not white noise. Moreover, the β coefficients are significantly positive at the 1% level in both cases, indicating that Malaysia's contractors are, in general, predicting correctly the direction of future changes in their operational variables. However, the coefficients of less than 1 imply that the contractors are systematically over-estimating the true value, a sign of optimistic behaviour.

Next, we examined the information content of the survey forecasts. Information content in this context refers to past forecast errors that reflect continuous learning along with corrections based on past mistakes, while the past actual values embody past history of the

Table 3. Empirical testing results on REH properties.

		Gross revenue	Capital expenditure
Property 1: *Unbiasedness*	α	0.668	2.021
	β	0.910***	0.558***
	F-statistic (α=0, β=1)	1.759	22.962***
	R-squared	0.891	0.636
	LM χ^2 (1)	6.427**	2.048
	LM χ^2 (2)	4.381**	1.156
Property 2: *Non-serial correlation*	*Past forecast errors at lag:*		
	1	5.738**	2.423
	2	4.277**	1.043
	3	3.867**	0.739
	4	2.827**	1.856
Property 3: *Efficiency*	*Past actual value at lag:*		
	1	4.538**	0.017
	2	6.016***	0.887
	3	5.294***	2.205
	4	5.323***	2.087

Notes: *** and ** indicate the rejection of the null hypothesis at 1% and 5% levels, respectively.
Source: Authors' calculations.

targeted variables. The former corresponds to the non-serial correlation test on the basis of Evans and Gulamani (1984), while the latter is the evaluation of weak-form efficiency based on Mullineaux (1978). The findings derived from *F*-statistics are summarised collectively in Table 3. With a lag length of 1 to 4, we determined that the contractors are unable to efficiently use and incorporate all available information while formulating their predictions on gross revenue, as rejection on non-serial correlations and forecast efficiency has been reported at the 5% and 10% levels of significance. In sharp contrast, forecasts on capital expenditure are consistent with the advocates of forecast rationality in terms of non-serial correlation and efficient use of information since none of the hypotheses tested within this context can be rejected under any conventional level of significance.

Therefore, one major inference that we can draw here is that business operational forecasts revealed by Malaysian contractors are less likely to exhibit rational conduct in Muth's sense. Although none of the investigated operational forecasts is successful in passing all the rationality tests, forecasts on capital expenditure, in part, do demonstrate an efficient use of information. Despite the biased forecasts possibly emerging by reason of optimistic insight, with all possible sources of bias that have not been empirically tested in the present study, the capital expenditure forecasts are deemed to be weakly rational as the evidence of forecast efficiency can be established. In contrast, forecasts on gross revenue depart significantly from rationality and this proposition was jointly confirmed by all rationality tests executed in the present study.

In addition, we found surprisingly different results from those reported by Habibullah (1994a). Business forecasts from construction firms prior to the 1990s were weak in performing unbiased volume-related operational forecasts, such as employment forecasts, but value-related operational forecasts, specifically those series tested in the current study (gross revenue and capital expenditure), displayed an unbiased nature toward actual value. Our contemporary evidence, in sharp contrast, tends to be biased upward and this over-estimation even occurred in tandem with inefficient use of information in the case of gross revenue forecasts, leading to a strong rejection of forecast rationality on this variable.

The unbiased nature of contractors' business forecasts no longer prevailed in this recent decade because upward bias dominated both forecasts, and this bias probably derived from business-people's optimistic views of future market growth. In addition, an upsurge in the property market with loose property mortgages once made the prospects of the construction market look hopeful, leading the optimistically biased mindset to translate this further. As a result, unbiased forecasts were no doubt less available in these recent years than in earlier decades.

Moreover, we also found evidence of weak-form efficiency in capital expenditure forecasts, which is contrary to Habibullah (1994a). This finding may suggest that assimilation and utilisation of all cost-free information is becoming more efficient and even capable of providing an accurate picture of how much firms should spend on their capital. It is appropriate to argue that efficient use of information on capital expenditure forecasts is easy to achieve in comparison with gross revenue forecasts. This is because many limited construction companies in these latest years have gone into modernised management in which advanced information systems and computerised data mining have been adopted to support their capital budgeting process and investment appraisals. On the other hand, gross revenue depends critically on sales of the construction output, and this output is subject to market demand and fluctuating material prices. Thus, efficiency is prone to shrink when the

market is erratic as information tends to be dynamically interdependent, but less predictable. This is probably why revenue prediction in the past could be efficient, whereas now it is not.

5. Conclusion

Presumably, businesses produce explicit forecasts for a prospective course of events and use these forecasts to facilitate strategic business planning and operational management. In addition, realising the expectations formation process without ignoring others' inferences secures an opportunity to clarify the endogenous uncertainty in making investment decisions (Miranda & Helmberger, 1992). Hence, business expectations, which critically reflect how a businessperson perceives what is to happen in the near future, are without doubt a key input to business decision-making. This prospect, when reported in the publicly available survey outlet, furnishes a ready reference for public users, for the most part policymakers and investors, to recognise the industry-wide state of affairs so as to commence future projections and policy decisions based on economic context and investment purposes, respectively. Although rational conduct is intuitively crucial to uphold a realistic survey of business forecasts, developing thoughtful empirical evidence with this focus is far more critical to correctly interpret any publicly available survey-based expectational data.

The current study adds to the limited literature on forecast rationality from a business perspective and doubles as an important reference for the survey users regarding the utility of the survey material to reflect the realised business conditions in Malaysia. The construction sector is the central focus in this study as contractors' expectations of their business operations reflect meaningful information on the way they observe and interpret changing business and economic scenarios. Empirical evidence from this study demonstrates that rational forecasts in Muth's sense have not been established in business operational forecasts of contractors in Malaysia. They are prone to be irrational in formulating their gross revenue predictions, while forecasts on capital expenditure are evidently biased despite efficient use of information.

Nevertheless, it is interesting to note that optimistic bias in capital expenditure forecasts is rather typical in Malaysian business since previous studies by Habibullah (2003), Wong et al. (2011), Puah et al. (2013), and Chong et al. (2012) have consistently revealed that business firms in other economic sectors also confront upward bias in capital expenditure forecasts. Wong et al. (2011) regarded optimistic bias as a business goal to make the business outlook more attractive to potential investors, as optimistic capital expenditures reflect stronger business cultivation for the near future. Eventually, goals tend to compromise accuracy. Therefore, the existence of biased forecasts in the case of capital expenditures does not convince us to conclude that capital expenditure forecasts are irrational in Muth's sense, unless the presence of serial correlation violates the unbiasedness property and weak-form efficiency is not evident, such as in the case of gross revenue forecasts.

To some extent, we believe that contractors' irrational expectations, particularly the observed optimistic bias in both operational forecasts, play a vital role in illuminating the recent scenarios of property overhang and price hikes in Malaysia. The rationale is that optimistic bias triggers stronger market confidence and this positive sentiment favours greater construction demand in the property market and infrastructure development. In addition, the ease of financing and an upsurge in the property market even make the construction market appealingly fruitful, leading contractors to optimistically perceive a

greater rise in their operational variable when they look ahead to a significant expansion in construction demand. In such an encouraging environment, enthusiasm to seize profits easily undermines rational judgement. Thus, optimistic contractors are likely to respond by initiating more construction supply, especially in property markets, with the intent to satisfy the booming market.

This optimistic survey of business forecasts invites property investors and speculators to irrationally believe that the construction-related markets are heading toward a boom. Under a supportive financing scheme, the buoyant property investment and speculative demand collectively urge property prices upward. Nonetheless, irrational contractors are likely to recognise this incident as an opportunity rather than a threat. Thus, they are induced to expedite their business operations and output supply with the aim of grasping the abnormal profit during the good times. Property prices will accordingly be adjusted upward as contractors confront limited resources to build, and rising material and building prices.

Toward the end, when the market does not perform according to perceptions of the contractors and the general public, market disequilibrium emerges while prices mount to an unreasonable level; this is what has been experienced in the highly property-concentrated cities in Malaysia. The real-life issues of the Malaysian property market have materialised in a business arena dominated by irrational players; this could provide a good reason for contractors to practise rational conduct in their business forecasting process even though irrational behaviour is an underpinning but not exclusive root of the said issues.

Since the investigated survey of business forecasts deviated significantly from Muth's strict rational framework, we could infer that this publicly available survey material is of little value to market participants if it is adopted directly into the decision-making process or policy establishment. The nature of the expectations formation must be established and proper judgement should be incorporated to reflect the practical context. We recognise the inability to foresee rational business outlooks and accurately present them in the survey material. Therefore, Malaysian contractors are urged to uphold rational conduct in interpreting the future course of events as well as to reveal truthful business expectations to survey institutions.

Notes

1. See Ghaffar and Habibullah (1987) and Habibullah (1988) for empirical work on indirect measures of expectations in Malaysia.
2. Aggarwal et al. (1995) affirmed the use of cointegration testing to assess the unbiased nature of the survey forecasts if both the expected and realised series are non-stationary.
3. The three-stage sampling method began with evaluation of the sectors' contribution to gross revenue and employment, and net value of the fixed assets in the overall business segment, to allocate the 270 companies among the sectors. Then, the representation of industry within each sector was derived from the industries' contribution to gross revenue in the sector. Finally, the individual company's contribution to gross revenue was calculated and used to select the companies within each industry.

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