Forecasting of the Malaysian Betas

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Abstract

Estimating beta is a straightforward application of the market model. However, investors are interested in the historical value of betas only in the hope of better able to forecast the probable future value.

The issue of beta forecasting is explored using segmented Malaysian industries data.

Four forecasting techniques are used to evaluate the forecasting ability of historical betas. The techniques included the commonly accepted Blume and Vasicek methods, a naïve constant model and a technique widely used by commercial providers.

These accuracy and suitability of these predicted betas will be examined with the MSE criteria.

It is observed that the commercial model adjustments greatly improve the MSE performance in both periods. Specifically it reduces the inefficiency element of the MSE components.

Introduction

Beta, the systematic risk of an asset, is empirically estimated via the market model using historical data to obtain the historical value. However, the main purpose of estimating beta of an asset is not to estimate its historical value but rather to infer from past records its probable future value for the purpose of in putting into the CAPM to estimate the capital cost or the required rate of return of an investment.

While the estimating of beta is a simple regression exercise of the market model, the estimation of beta is biased by several issues such as the thin trading effect of lesser traded securities, the tendency to regress to one over time, the different return interval options and the stability of beta over the period of estimation.

Due to the above biases, forecasting of future betas, particularly single security through mere extrapolation of historical betas has produced disappointing results and techniques have been suggested to minimize the various biases.

The objective of this paper is to explore the forecasting performance using techniques of Blume and Vasicek , a technique used by a commercial beta provider and a naïve raw OLS betas.

There are two aspects of forecasting, the accuracy and the dispersion of forecasts. The performance of the various techniques as predictors of next period beta will be examined using the M.S.E. (mean forecasted error) as it can be partition into three components of forecasted error, bias, variance and the random element of the different techniques. Bias measure the degree of accuracy, variance or inefficiency, the degree of order bias and the random refers to the forecasted error not related to the model.

Squared errors are used as the loss function is likely non-linear, that is, the cost of forecast errors increases exponentially with the size of the error.

In the case of Malaysia, as in most developing markets, there is potential for estimation inaccuracy as many of the shares are traded infrequently, while the bigger index and government linked shares are actively traded. As such, an attempt to circumvent this problem is to use sectors data rather than aggregated single securities to minimize the issues arising from thin trading effect.

Literature Review

The tendency of raw betas to regress to one was first recorded by Blume (1971), who then adapted a technique of regressing the current period raw betas against earlier period raw betas to capture the regression factor. According to Blume, the reversion tendency is independent of the order bias i.e. results contaminated by measurement errors. Management behaviour trying to bring the riskiness of the firm to be on par with the market average, natural evolvements of firms in diversifying business and spreading out risks, lack of high risk projects and monetary policy of the government all are possible reasons for the regression phenomenon.

The regression model for a seven year period developed by Blume, based on US data, was:

Forecasted beta (next seven years) =0.343+0.677(prior seven years raw betas) Using Australian data and a regression of forty months, Castagna and Matolcsy (1978), suggested the following adjustment forAustralian securities:

Adjusted beta=0.541+0.464(raw betas)

Another common adjustment technique to the regression tendency issue is the Bayesian approach of Vasicek (1973) who adjusted the estimated betas towards the average beta using weighted the average of average and historical betas. The weight to be allocated to he historical and average betas will depend upon i) the variance of the estimated betas of the securities and ii) the variance of the distribution of historical betas estimates ofbetas over the sample of stocks. Quality of estimated betas is improved by giving greater weightage to either the industry estimated or the overall estimate depending which has the lower estimated variance.

Both techniques have been adopted by investment and academic institutions that provide betas for the markets. For example Value Line supplies Blume betas, London Business School supplies Vasicek adjusted betas, and Merrill Lynch supplied a variant of Blume betas subject to the constraints that the parameters added to unity.

One problem noted for the Vasicek technique is the tendency to bias downwards its estimate's of beta (particularly for stocks of high leverage and bias upwards stock of low leverage). Blume method assumes continued extrapolation of trend change in beta but this would be problematic where there is no reason to believe beta will continue changing in the same direction.

A solution generally adopted to overcome these issues is to adjust the forecasted betas such that it has the same mean as the historical mean. An example is Merrill Lynch's simple adjustment of averaging the sample estimate and averages them with unity,

Adjusted beta=0.66(sample beta) + 0.33 (1)

Value Line also adopted a similar adjustment with a constant of 0.66 according to the model:

Adjusted Beta = (1-k)+k $beta_{OLS}$

Statman(1981) obtained the relationship between Merill Lynch and Value Line beta as:

ML beta=0.125+0.879 VL beta.

Another reputable data source, Bloomberg, provides both raw betas and Blume-Adjusted betas with Blume-adjusted betas as:

Adjusted beta=(0.67)beta raw + 0.33(1)

Given the widespread acceptance of the above model by commercial providers we will include this estimation technique in our empirical test.

Murphy (1990) concludes that beta estimated by leading investor advisers are consistent with beta estimated by Vasicek technique.

Brooks and Faff (1997) explored the performance of simple transformation of the raw betas using weights of 0.5 i.e. Adjusted beta=0.5+0.5(prior period beta) and noted that the relationship perform only marginally worse than the more complicated technique of an optimal choice of weight, and concluded that more computationally difficult weighting techniques may not produce a large enough gain in forecast to justify additional computational cost.

Klemkosky and Martin (1975) and Eubank and Zumwalt(1979) using Mean Square Error (MSE) as a criteria noted that there was little different between Blume and Vasicek adjustment and in general adjusted betas outperform Merrill Lynch and unadjusted betas. Eubank and Zumwalt (1979) concluded that Blume is better for short term and Vasicek is superior for long term forecasting with irrelevant results when betas are closed to one. Luoma, Martikaiven and Perttunen, (LMP) (1996) found Vasicek has the better record, and both findings of L.M.P. (1996) and Murray (1995) find that adjusted betas have superior forecasting results for thin trading capital markets. However, there is no unanimous opinion on which technique is preferable. Blume's technique captures any tendency of true beta to regress to grand mean of one and Vasicek's method attempts to address sampling error.

Kolb and Rodriguez (1989) noted that there seems to be two movements of beta regression, the extreme betas seem to converge, and the patterns to reverse for those close to unity, keeping the distribution of bets reasonably stationary over time.

For the local Malaysian market, Kok, (1994) conducted a test of the Blume and Vasicek technique on seventy five index linked stocks and concluded that the adjusted betas are good predictors of next period betas.

sBrooks and Faff (1997) reexamined Kok's (1994) data with a simpler adjustment technique and the result indicate this simpler adjustment is superior to Vasicek's adjustment under moderate mean reversion tendency and Vasicek's method is superior under slower mean reversion affirming simple transformation is equally effective as complicated techniques.

Lally M.(1998) argued for the superiority of separate estimator equation for each industry rather than a common estimator applied to companies in aggregate as the absolute errors with partition is smaller. Though conventionally Vasicek estimation is used for industry and Blume technique is commonly applied to aggregates, Lally indicated both methods are suitable for industry subsets parameter estimation.

It is based on this argument that this paper will estimate sector regression rather than an overall aggregate regression model.

Bera and Kannan(1986) argued that as the extreme values betas showed greater regression tendency, with the lower values stronger than the higher values, a non-linear relationship might capture the regression better.

Methodology

This study will explore the performance of four forecasting techniques as applied to industries. The period under study is a period of great volatility witnessing a formation of the bubble period in 1995 when the share index reach an all record high and a bursting of the bubble due to the financial crisis in 1997.

One underlying observation of earlier papers was that forecasting accuracy is worse during periods of great volatility indicating a linear model might not be the best.

Monthly log returns of seven industries were computed based on data obtained from Perfect Analysis. The time series runs from January 1995 to December 2006 for three sectors, namely, The Finance, Plantations and Properties sectors and from August 1995 to December 2006 for four sectors, the Construction, Trading, Consumer products and industrial products sectors..

The composite index of Bursa Saham Malaysia (Malaysia Stock Exchange) proxies as the market index. The OLS beta for each industry was estimated via the market model. The study period was divided into three, Period 1, January 1995 to December 1998, Period 2, January 1999 to December 2002 and Period 3, January 2003 to December 2006 for the three sectors of finance, plantations and properties. For the four sectors of construction, trading, consumer products and industrial products, the study periods are divided into 3 of period 1; October 1995 to August 1999, period 2, September 1999 to March 2003, and period 3, April 2003 to December 2006. Period 1 will serve as the period of estimation for input of data to forecast period and period 2 inputs will be for the forecast of period 3 betas.

The beta coefficients were computed using log monthly returns over non-overlapping forty eight months or forty five months period, depending on data availability. These are then used to predict next period betas, based on the various techniques.

The aim of the study is to test if the prior period betas estimated in period 1 and 2 are good predictors for period 2 and 3, using Blume, Vasicek, a commercial provider model and a naïve model.

The performance of the four techniques are compare using the mean squared error (MSE).MSE is used as it identifies factors causing movement in value.

Empirical Results

Table 1: Period 2 beta forecast:

	Finance	Plantation	Properties	Construction	Trading	Consumer Products	Industrial Products
Actual Unadjusted OLS	0.7119	0.3396	0.21665	-0.2090	1.0795	0.4736	0.3336
Naïve Prediction	0.3228	0.6683	0.5858	-0.5387	1.0039	0.7710	1.0044
Naïve Prediction (Commercial)	0.5463	0.7778	0.7225	-0.0309	1.0026	0.8466	1.0029
Blume	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Vasicek	1.0352	1.5130	1.157	1.1329	1.0001	0.8889	0.9130
Vasicek (Commercial)	1.0235	1.3437	1.0151	1.0890	1.000.	0.9255	0.9386

Blume's value is not available as the model requires the regression model to be obtained based on regression of first and second period OLS beta estimated.

The predicted beta for the naïve constant model is that of actual OLS beta of period one (1995 to 1998)

From table 1, the following was obtained,

	Mean	variance
Naïve model	0.5453	0.2855
commercial naïve model	0.6954	0.1281
Vasicek model	1.0914	0.0446
commercial Vasicek model	1.0479	0.0200

The mean of the actual OLS beta is 0.4208 and a variance of 0.1623. The data appears to support Kolb and Rodriguez theory that there are two movements of beta regression, those further away from unity exhibiting convergence tendency and those nearer to unity tends to move away from unity. These two movements would minimize the impact of the movements, creating an ideal condition for the constant model .The actual beta value of each sector is much lower than unity most likely due to the non synchronous trading of these sectors compare to the market. Applying the commercial model, would tend to shift the value closer to unity and a reduction of the variance.

Table 2: Period 3 beta forecast:

	Finance	Plantation	Properties	Construction	Trading	Consumer Products	Industrial Products
Actual Unadjusted OLS	2.2648	0.0941	2.1063	3.5346	0.9468	0.8906	1.2903
Naïve Constant Prediction	0.7119	0.3396	0.2166	-0.2090	1.0795	0.4736	0.3336
Naïve Prediction commercial	0.8069	0.5575	0.4751	0.1899	1.0532	0.3174	0.3574
Blume	0.7079	0.3404	0.2605	-1.7403	-1.1115	-0.4973	-0.3304
Blume (Commercial)	0.8042	0.5580	0.5046	-1.1138	-0.4147	-0.0031	-0.1692
Vasicek	0.8280	0.6636	0.730	1.0132	0.7395.	0.6343	0.8670
Vasicek (Commercial)	0.8847	0.7746	0.8191	1.0088	0.8254.	0.7549	0.9108

The Blume regression obtained for the sectors are:
Finance: 0.7151-0.0100(prior period Beta)
Plantation: 03418-0.0025(prior period Beta)
Properties: 0.2485+0.0545(prior period Beta)
Construction: -1.7705-0.1435(prior period Beta)

Trading 1.097-0.0135(prior period Beta)
Consumer Products: 0.4240-0..1548(prior period Beta)
Industrial Products: 0.3448+0.0431(prior period Beta)

From table 2, the following was extracted

	Mean	variance
Naïve	0.4208	0.1623
Adjusted naïve	0.5367	0.0907
Blume	0.7822	0.0171
Adjusted Blume	0.8540	0.0077
Vasicek	-0.3386	0.7504
Adjusted Vasicek	0.0237	0.4416

The mean for the actual beta for this period is 0.4208 and variance of 0.1623.The two movements of beta regression is not so noticeable for this period. Except, for plantation sector, all the sector betas shows a jump in value. This could be the impact of heavier than market transactions for the securities in these sectors. Commercial adjustment tends to shift the value towards the grand mean with reduced variance

Table 3: Period 2 Mean square forecast error (MSE):

	Finance	Plantation	Properties	Construction	Trading	Consumer Products	Industrial Products
MSE. Vasicek	166.0382	2.2411	558.74	1417.9	0.5741	25.6	289.180
Bias	0.0028 (0%)	0.0 (0.02%)	0.044 (0.%)	1.5592 (0.1%)	0.062 (10.8%)	0.245 (0.96%)	0.2148 (0.07%)
inefficiency	163.69 (98.5%)	1.4364 (64.09%)	552.93 (98.9%)	14.051 (99.1%)	0.085 (14.9%)	24.63 (96.24%)	285.18 (98.6)
Random	2.3430 (1.4%)	0.8041 (35.58%)	5.76 (1.03%)	11.15 (0.78%)	0.425 (74.2%)	0.714 (2.79%)	3.78 (1.3%)
MSE. Vasicek commercial)	0.7558	0.2212	2.8067	8.3034	0.2036	0.5927.	1.2576
bias	0.0027 (0.36%)	0.0277 (12.54%)	0.1716 (6.1%)	0.9928 (11.95.%)	0.0208 (10.22%	0.2637 (44.49%)	0.0011 (0.08%)
inefficiency	0.6366 (84.22%)	0.1263 (57.10%)	2.6198 (93.3%)	64.854 (78.10%)	0.0889 (43.67%)	0.3046 (51.39%)	1.2135 (96.46%)
Random	0.1164 (15.4%)	0.0671 (30.34%)	0.0152 (0.54%)	0.8251 (9.937%)	0.0938 (46.09%)	0.0243 (4.1%)	0.0429 (3.41%)
MSE. Constant β	26.391	10.292	24.722	221.386	2.791	13.972	27.469
bias	5.431 (20.58%)	3.634 (35.31%)	6.896 (27.89%)	0.015 (0.0%)	2.151 (77.07%)	11.266 (80.63%)	17.280 (62.90%)
inefficiency	16.648 (63.08%)	5.796 (56.32%)	8.151 (32.97%)	204.189 (92.28%)	0.209 (7.52%)	1.288 (9.21%)	4.292 (15.62%)
Random	4.311 (16.33%)	0.860 (8.36%)	9.674 (39.13%)	17.18 (7.76%)	0.429 (15.4%)	1.417 (10.14%)	5.896 (21.46%)
MSE. Constant β commecial	15.08	2.654	12.4747	111.9	3.3087	9.467	39.06
bias	3.227 (21.39%	1.930 (72.73%)	3.352 (26.87%)	0.031 (0.02%)	2.7858 (84.3%)	7.481 (79%)	10.4025 (60.5%)
inefficiency	7.546 (50.02%)	0.342 (12.1%)	4.042 (32.40%)	94.687 (84.61%)	0.0880 (2.6%)	0.568 (6.%)	0.8767 (5.10%)
Random	4.311 (28.58%)	0.380 (14.34%)	5.080 (40.72%)	115.359%)	0.4299 (13.%)	1.417 (14.9%)	5.8970 (34.3%)

From table 3, the largest component of error of Vasicek betas are the inefficiency component, implying the method are unbiased but inefficient. The source of MSE error for the naïve constant model is evenly distributed among the three components.

However, the lower random component would support Vasicek as the more suitable model for this period.

The commercial model improves the accuracy of the unadjusted models via reduction of the inefficient element.

Table 4: Period 3 Mean square forecast erroe (MSE)

	Finance	Plantation	Properties	Construction	Trading	Consumer Products	Industrial Products
MSE. Vasicek	1895.04	2452.02	11,189.	263.21	3541.87	225.34.	42.94
bias	0.068 (0%)	0.458 (0.018%)	'0.033 (0%)	0.469 (0.%)	0.1450 (0.%)	0.08 (0.04%)	0.003 (0.04%)
inefficiency	1883.09 (99.3%)	2214.9 (90.33%)	11160 (99.7%)	263.01 (99.9%)	3518.2 (99.3%)	203.26 (90.20%)	4.613 (68.8%)
Random	11.887 (0.6%	236.65 (9.65%)	28.21 (0.2%)	193.9 (0.0%)	23.46 (0.6%)	21.97 (9.74)	2.080 (31.06%)
MSE. Vasicek Commercial	4.2845	236.36	31.4063	302.29	19.4538	12.4117.	1.9367
bias	0.3759 (8.7%)	0.4583 (0.19%)	0.0369 (0.1%)	0.4699 (10.15.%)	0.1450 (0.7%)	0.1082 (0.8%)	0.0032 (0.16%)
inefficiency	3.7909 (88.4%)	212.576 (89.9%)	30.56 (97.3%)	298.84 (98.8%)	8.4187 (94.6%)	10.944 (88.1%)	1.6365 (84.4%)
Random	0.1176 (2.7%)	23.329 (9.8%)	0.8081 (2.57%)	2.9792 (0.9%)	0.8900 (45.%)	1.3590 (10.9%)	0.2969 (15.3%)
MSE. Blume β	23.819	238.146	42.254	322.44	35.060	24.478	5.504
bias	2.423 (10.17.%)	0.060 (0.02%)	3.407 (8.06%)	27.826 (8.63%)	4.237 (12.08%)	1.926 (0.87%)	2.626 (47.72%)
inefficiency	0.008 (0.03%)	27.192 (11.41%)	0.415 (0.34%)	55.168 (16%)	0.457 (1.30%)	0.016 (0.06%)	0.0001 (0.%)
Random	21.387 (89.78%)	210.893 (88.55%)	38.700 (91.58%)	289.45 (89.76%)	30.365 (86.60%)	(92.06%)	2.877 (52.26%)
MSE. Blume β commercial	5.106	238.668	48.2067	305.82	31.7055	23.2733	5.504
bias	5.102 (99.92%)	0.009 (0.%)	4.4559 (9.24%)	12.136 (3.96%)	0.9021 (2.84%)	0.7041 (3.0%)	1.6862 (36.9%)
inefficiency	0.003 (0.06%)	27.765 (11.63%)	0.1089 (0.22%)	4.406 (1.44%)	0.4377 (1.38%)	0.0328 (0.1%)	0.0032 (0.07%)
Random	0.0 (0.%)	210.89 (88.3%)	43.6417 (90.53%)	289.27 (94.59%)	30.365 (95.7%)	22.536 (96.8%)	2.8752 (62.9%)
MSE. Constant β	27.824	229.309	55.808	309.409	32.123	23.994	39.06
bias	2.411 (8.6%)	0.0602 (0.02%)	3.571 (6.39%)	14.014 (4.520%)	0.0176 (0.05%)	0.173 (0.72%)	0.915 (9.83%)
inefficiency	4.025 (14.4%)	18.356 (8.8%)	8.652 (15.50%)	6.114 (1.97%)	1.7526 (5.45%)	1.283 (5.35%)	5.515 59.26%)
Random	21.387 (76.8%)	210.893 (91.96%)	42.585 (78.09%)	289.279 (93.49%)	30.353 (94.48%	22.536 93.92%)	2.875 (30.89%)
MSE. Constant β commercial	31.312	232.06	53.713	305.62	32.10	24.5836	7.4102
bias	8.180 (26.12%)	0.1004 (0.04%)	4.795 (8.9%)	15.1268 (4.9%)	0.5252 (1.6.%)	1.4973 (6%)	2.1912 (29.57%)
inefficiency	1.745 (5.57%)	21.0738 (9.08%)	5.276 (9.8%)	1.2161 (0.39%)	1.2260 (3.8%)	0.5476 (2.2.%)	2.3436 (31.6%)
Random	21.387 (68.30%)	210.893 (90.8%)	43.641 (81.2%)	289.279 (94.6%)	30.3533 (94.5%)	2.2538 (91.6%)	2.8752 (38.80%)

For period 3, the data again indicated the commercial model did a good job in improving the MSE results with a vastly reduced inefficient element. The random elements again indicate the Vasicek betas are the most suitable model for this period.

To predict the future value of beta, stability of pre and post prediction beta values period is essential, particularly for linear model. The drastic reversal means that predicting power of such model is of limited use of the period under investigation, due to time varying nature of beta.

Conclusion:

This paper attempted to predict the sector betas of 7 of the 13 sectors of the Malaysian Stock Exchange, using a naïve constant beta model, Blume and Vasicek techniques and a model commonly used by commercial beta providers. The suitability of the various models is examined by the MSE method. Based on the breakdown of the MSE component, the commercial models vastly improved the results by reducing the inefficient element and its random element indicated that Vasicek is the more optimal model, even though no one method is clearly dominant.

The possible conditions favoring Vasicek technique are likely due to the model taking error variances into account and does not assume any tendency of true betas regressing to one.

The regression coefficients vary drastically from one period to another, indicating instability in the regression tendency.

The regression tendency tends to be evidenced only after two periods for most sectors, hence, implying single period regressions model may not be the best estimate of this tendency.

Other possible deviations from the predictions of the models include assumptions of constant variance and the assumption that industries' beta would also regress to one rather than the industry average.

Further research on this area of research could include prediction based on the GARTH model and ARIMA model, and estimation of betas using the Kalman filter and GMM processes.

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