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# Multi Factor SUR in Event Study Analysis: Evidence from M&A in Singapore's Financial Industry

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## *Abstract*

This paper proposes a use of multi-factor seemingly unrelated regression (SUR) in event study analysis to study mergers and acquisitions in Singapore's financial industry. We also study the cross-sector (banking and insurance) domestic acquisition in Singapore's financial industry. By contrasting to the use of ordinary least squares (OLS) method, it is found that OLS method seems to underestimate the value of the sample cumulative abnormal returns as compared to SUR. The study also found that post mergers and takeovers in banking and insurance industries tend to have high possibility of negative returns.

**JEL classification codes:** C50, G14, G21, G22, G34, O53

**Keywords:** Event study; Seemingly unrelated regression (SUR); Merger and Acquisition (M&A); Singapore; Financial Industry; Cross-sector

## **1. Introduction**

The financial industry has experienced, and continuously engaging, an enormous level of consolidation due to reason that gains can accrue through expense reduction, enhanced efficiency, increased market power, reduced earnings volatility, consolidated services, and scale and scope economies. A review of the literature suggests mixed evidence with regards to the alleged gains and in general they are unique on countries or markets under study. The consolidation referred here is activities involving mergers and acquisition (M&A) that can be generally identified with takeovers and changes in the ownership structure of firms in any given industry. In terms of efficiency operations, the most appealing reason for having an M&A is synergy among activities such as research and marketing.<sup>[1]</sup> On the other hand, arguments against the M&A activities include reasons such as no improvement were made subsequent to the acquisition, a mere redistribution of wealth from labour and other stakeholders, and speculative activities.

In this paper, we will examine the merger and acquisition in the Singapore's financial industry as the emerging financial hub in Asian region using event study analysis. Prior to that, this paper proposes a use of multi-

factor seemingly unrelated regression (SUR) method to calculate the abnormal returns in which only a single industry in a single country is under study—financial industry in Singapore. This is an appropriate method since it allows for contemporaneous cross-equation error terms in the joint estimation to obtain the abnormal returns in performing event study and basically the main merit and contribution of the paper. Saunders and Walter (1996) argued that the M&A activity in the financial industry can involve at least 12 types of transactions. Specifically, we analyze the type of transaction whereby domestic bank, as an acquiring institution, is targeting domestic insurance company, as the target institution in Singapore. This is in the light of recent acquisition attempt by one of the Singapore's local bank, Overseas Chinese Banking Corporation (OCBC), to take over Great Eastern Holding (GEH), one of the leading life insurance companies in the Asian market. The paper is organized as follows: Section 2 deals with the event study analysis using multi-factor SUR method to understand the effect of M&A in Singapore's financial industry. The aim is to verify the fact whether consolidation of services in the banking and insurance industry will be more likely to be value-enhancing or value-degrading. Assuming efficient market hypothesis, this information is reflected through the movement of stock prices. Section 3 will be devoted to analyze the empirical findings of the cross-sector (banking and insurance) domestic acquisition in Singapore and to highlight key developments up to date. Section 4 concludes.

## **2. Event Study Analysis Using Multi-Factor SUR**

This paper uses an event study analysis to examine the impact of M&A in Singapore's financial industry with a notable extension of using multi-factor SUR methodology. This paper is complementary to Gadad and Thomas (2005) who examined the performance improvements accruing to those UK firms making assets sales in a single divestiture using an event study method. An alternative choice to study the impact of M&A is to use a stochastic dominance approach that is well reported by Abhyankar, Ho, and Zhao (2005) to evaluate the long-run post-merger stock performance of UK acquiring firms. The event study analysis relies on several methods to determine the abnormal returns, namely the mean adjusted returns, the market models, and the market adjusted returns. The abnormal returns can implicitly tell us whether the events such as merger, acquisition offers, etc are indeed affecting the performance of the companies under study. Assuming efficient market hypothesis, if they indeed affect the performance of institutions of interest, then this information will be captured directly through the movement in stock prices. Thus, it naturally follows that we use the stock returns as the independent variable (and at the same time, the variable of interest).

Thus far, one can be assured that market models provide much better estimates by leveraging to the regression method, namely ordinary least squares (OLS) that minimize that sum of squares of residuals. In comparison, the other two methods, namely the mean and market adjusted returns, do not take into account the possibility of non-normality in the distribution of returns; hence they are very prone to some outliers or extreme return values. This is because both mean adjusted and market adjusted returns simply use arithmetic averages (in the clean period, or in the period whereby no major "events" occurred) as a benchmark to calculate the abnormal returns. In a typical event study analysis, OLS is utilized in the form of single equation least squares (SELS).

However, it would be unrealistic to expect that the equation errors would be uncorrelated, especially shocks affecting financial sector will affect, symmetrically or asymmetrically, the entire financial institutions under study. Thus, we propose to model a set of equations that has contemporaneous cross-equation error correlation, which is called a seemingly unrelated regression (SUR) system. At first look, the equations seem unrelated, but the equations are related through the correlation in the errors. This is basically the main reason of proposing an alternative method to gain better estimates for the normal returns in studying the event study analysis.

In a usual setting of event study using the market model, one typically uses a single market index as an explanatory variable. MacKinlay (1997) has pointed out the fact that the gains from employing multi-factor models for event studies are limited. However, he also mentioned that the variance reduction will typically be greatest in cases where the sample firms have a common characteristic, for example they are all members of one industry or they are all firms concentrated in one market capitalization group. In these cases, the use of multi-factor model warrants consideration. In the first exercise, we will perform an event study analysis on the overall financial industry in Singapore. It will then be followed with the cross-sectoral event study analysis in the banking and insurance industry in Singapore, namely the proposed merger between OCBC and GEH. In introducing the concept of SUR, we will first outline the usual setup for the ordinary least square (OLS) regression method. We are considering seven SELS regression equations to represent Singapore's local banks and insurance company and then estimating the parameter values in calculating the abnormal return using the market model. The equations are as follow:

$$\begin{aligned}
 RET_{KEPPEL-t} &= \alpha_1 + \beta_1 MKT\_INDEX_{1t} + \beta_2 MKT\_INDEX_{2t} + \beta_3 MKT\_INDEX_{3t} + e_{KEPPEL-t} \\
 RET_{OCBC(A)-t} &= \alpha_1 + \beta_4 MKT\_INDEX_{4t} + \beta_5 MKT\_INDEX_{5t} + \beta_6 MKT\_INDEX_{6t} + e_{OCBC(A)-t} \\
 RET_{UOB-t} &= \alpha_1 + \beta_7 MKT\_INDEX_{7t} + \beta_8 MKT\_INDEX_{8t} + \beta_9 MKT\_INDEX_{9t} + e_{UOB-t} \\
 RET_{OUB-t} &= \alpha_1 + \beta_{10} MKT\_INDEX_{10t} + \beta_{11} MKT\_INDEX_{11t} + \beta_{12} MKT\_INDEX_{12t} + e_{OUB-t} \\
 RET_{DBS-t} &= \alpha_1 + \beta_{13} MKT\_INDEX_{13t} + \beta_{14} MKT\_INDEX_{14t} + \beta_{15} MKT\_INDEX_{15t} + e_{DBS-t} \\
 RET_{OCBC(B)-t} &= \alpha_1 + \beta_{16} MKT\_INDEX_{16t} + \beta_{17} MKT\_INDEX_{17t} + \beta_{18} MKT\_INDEX_{18t} + e_{OCBC(B)-t} \\
 RET_{GEH-t} &= \alpha_1 + \beta_{19} MKT\_INDEX_{19t} + \beta_{20} MKT\_INDEX_{20t} + \beta_{21} MKT\_INDEX_{21t} + e_{GEH-t}
 \end{aligned}$$

RET is the stock return of the corresponding financial institution with 3 explanatory variables for each firm such as the S&P 500 composite market index, MCSI Singapore market index, and Straits Times Index (STI) *inter alia*. For the moment we make the usual least squares assumptions about the errors:

$$\begin{aligned}
 E(e_{it}) &= 0 & \text{var}(e_{it}) &= \sigma_i^2 & \text{cov}(e_{it}, e_{jt}) &= 0 \\
 i &= KEPPEL, OCBC(A), UOB, OUB, DBS, OCBC(B), GEH \\
 j &= KEPPEL, OCBC(A), UOB, OUB, DBS, OCBC(B), GEH \\
 i &\neq j
 \end{aligned}$$

Note that the all the functions have different error variances,  $\sigma_i^2$  and the errors in each equation are homoskedastic and they are not correlated over time. Under these assumptions, we would expect OLS to be the best (minimum variance unbiased) estimation technique. Such is indeed the case if we estimate each equation separately, i.e. SELS. However, under certain conditions we can improve on separate OLS estimation by combining both equations into one single model and applying a GLS or ML estimation procedure (or even an un-weighted least squares). The required conditions for joint estimation to be better than SELS estimation are: there is contemporaneous correlation between each individual error term and the values of the explanatory variables are not the same in both equations.

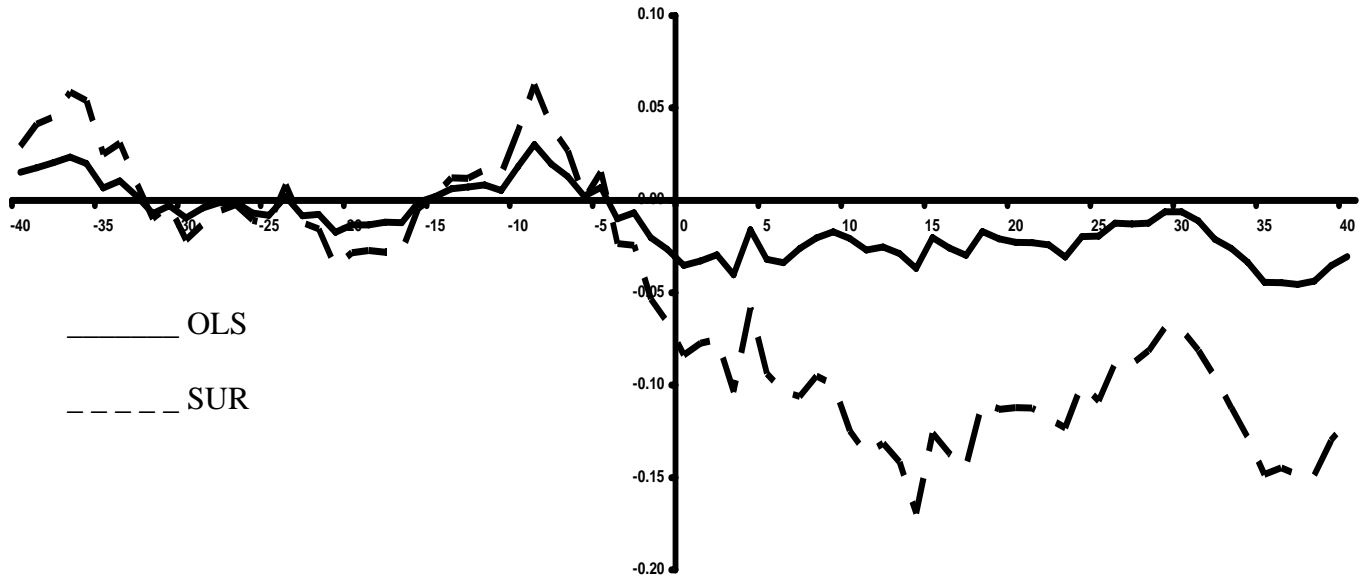
Contemporaneous correlation refers to correlation between the error terms in the two equations at the same point in time. To understand why each error term might be correlated, recall that these errors contain the influence on stock returns of factors that have been omitted from the equations. Such factors might include Monday and the weekend effect of stock prices, current and past interest rates and the general state of the economy, macroeconomic stabilization in Singapore, as well as other government policies that affected financial industry as a whole. Since all firms are similar in many respects, it is likely that the effects of the omitted factors on stock returns by OCBC will be similar to their effect on stock returns by DBS, for example. If so, then each individual error term  $e_i$  will be capturing similar effects and will be correlated. To allow for a nonzero contemporaneous correlation we write:

$$\text{COV}(e_{it}, e_{jt}) = \sigma_{ij}$$

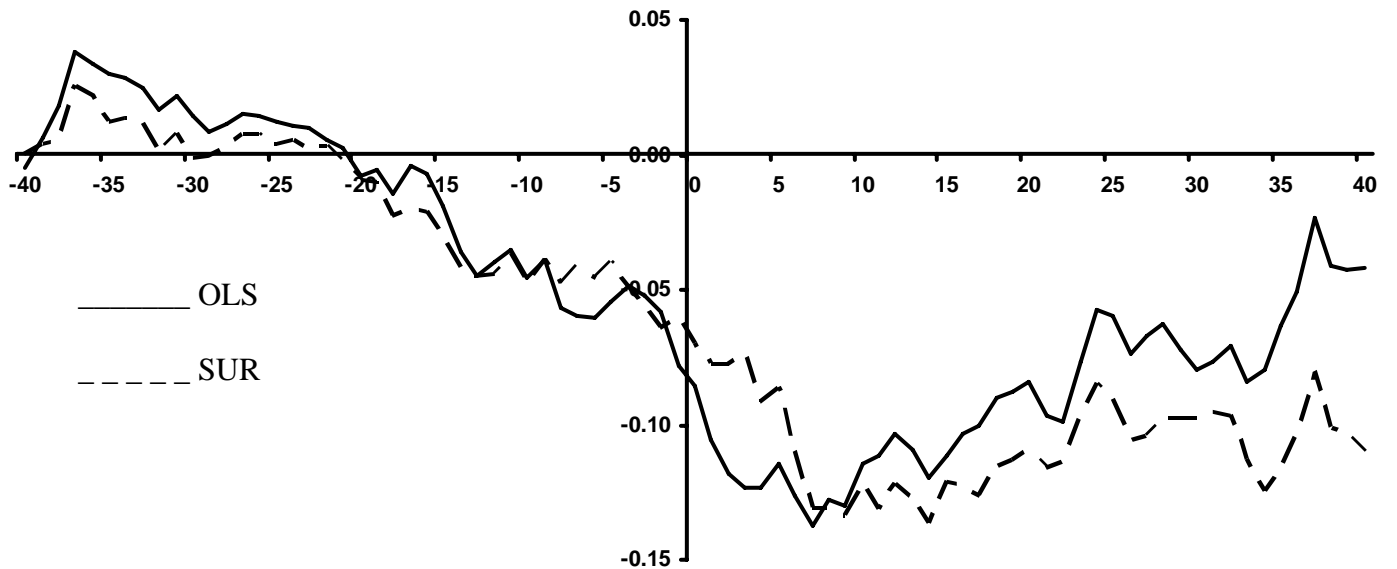
We continue to assume that errors in different time periods are uncorrelated (no autocorrelation within or across equations). Adding the contemporaneous correlation assumption has the effect of introducing additional information that is not included when we carry out separate least squares estimation of the two equations. This information cannot be utilized when the equations are estimated separately. However, it can be utilized to produce better estimates when the equations are jointly estimated. Because the equations appear to be unrelated, but nevertheless can be estimated jointly to yield more efficient estimates, Zellner (1962) called them seemingly unrelated regressions. There is one situation where improved estimation is not possible even when  $\sigma_{i,j} \neq 0$  which is when the values of the explanatory variables are the same in all (or some) of the equations, then it can be shown that the GLS and ML estimators are identical to OLS applied separately to each equation.<sup>[2]</sup> Thus, to tackle this issue we will be using several market proxies for each and every equations and estimate them jointly. This means we will draw several important market proxies which are heavily related to Singapore's financial industry. Such indicators might be the MCSI index, STI index, S&P 500 index to name a few. We will present the empirical findings and comparisons between SELS and SUR methods and then drawing inferences for the hypothesis of whether mergers in Singapore's financial industry will be value-enhancing or value-degrading.

In doing so, we will segregate the results into two parts, namely the acquirer and the targeted firms (acquiree). The cumulative abnormal return for each firm and an average cumulative abnormal return can be found as well in the appendices. In this paper, we will only consider the market model with emphasis on comparison between SELS and SUR estimation method as we have noted that the other two methods are prone to non-normality that will cause the calculation of abnormal return bias (thus, its cumulative as well).

**Figure 1 Acquirer Financial Institution**



**Figure 2 Acquiree Financial Institution**



The results of our study are consistent with the stylized facts and observations in the movement of stock prices during times near to the event date. The evidence supports the hypothesis that merger announcements (and the actual merger itself) only marginally convey useful information for the valuation of firms. However, we do have mixed results for each and every firm in both categories, i.e. acquirer firms and acquiree firms. In the case of the *acquirers*, the sample average cumulative abnormal return using the market model (SELS) is -0.0304677 with the standard errors of 0.017927, thus giving us the t – statistics of 1.7 in absolute term and we found insufficient evidence to reject the null hypothesis at 5% level. Similarly, using the SUR estimation method we found that the sample average cumulative abnormal return using the market model is -0.0895581 with the standard errors of 0.047818, thus giving us the t – statistics of 1.87 in absolute term and we found insufficient evidence to reject the null hypothesis at 5% level. However, if we allow the level of confidence to be 90% (i.e. 10% level of significance), we found that both t – statistics are significant to reject the null hypothesis and conclude that merger events do affect acquirers' return.

In the case of the *acquirees*, the sample average cumulative abnormal return using the market model (SELS) is -0.04159 with the standard errors of 0.049348, thus giving us the t – statistics of 0.842 in absolute term and we found insufficient evidence to reject the null hypothesis at 5% level. On the other hand, using the SUR estimation method we found that the sample average cumulative abnormal return using the market model is -0.11004 with the standard errors of 0.050727, thus giving us the t – statistics of 2.17 in absolute term and we found sufficient evidence to reject the null hypothesis at 5% level.

The mixed results come from the individual firm test of whether the event (i.e. merger) is value enhancing or value – degrading. Using the SELS method, the cumulative abnormal return is 0.10191 and -0.087805 for OCBC and DBS respectively with the standard errors of 0.049694922 and 0.037299096 consequently. Thus, both t-statistics are 2.05069 and 2.354069696 in absolute terms and both are significant at 5% level to reject the null hypothesis. The case are very much different when we use the SUR method, whereby none of these acquirer firms appear to have sufficient evidence that merger does affect return significantly. In the case of acquiree firms, there is not much different in using the SELS or SUR method to conclude that we do not have sufficient evidence to reject the null hypothesis and thus we can safely say that merger events do not affect the return of the individual acquiree firms. OUB results are rather an exception in a sense that it provides very significant evidence that the merger between UOB and OUB affects the return of OUB.

There are several important remarks that we could bring into surface from the empirical results in the event study analysis for Singapore's financial industry. First, our statistical results have shown that by implementing multi-factor SUR method, we found the fact that by acknowledging the same random error components in the financial industry, SELS method seems to underestimate the value of the sample cumulative abnormal returns and thus it might be relatively easy for us to conclude an insufficient evidence to reject the null hypothesis. This is plausible since SELS does not acknowledge the same shocks that affect the financial industry as a whole, such as the government initiatives to reduce the number of local banks in Singapore to ensure the seamless and integrated

banking activities and more integrated financial markets in terms of lending institutions and some other factors that are captured in the common error term. With SUR, we acknowledge this type of common shocks and hence it is more likely that the M&A activities in Singapore are jointly determined by the government forces to some extent and although we only found that the null hypothesis can only be rejected marginally, SUR performs better than SELS in predicting the abnormal returns and hence more evidence to reject the null hypothesis.

Market reaction is an important conclusion to be drawn next. If we were to look at all the post merger days stock returns, almost all of the firms in the financial industry shown a lower return as compared to the event date itself (and several days before the actual merger took place). Thirdly, the number of events considered here are perhaps too few such that we might not be able to argue convincingly whether the merger events do not affect the stock returns significantly. As MacKinlay (1997) pointed out that testing of null hypothesis in conducting the event study analysis is rather suboptimal if we were to use only a few firms with only a few events in the study.<sup>[3]</sup> Nevertheless, the main aim of our study is to show and propose an alternative method of making the usefulness of additional factor in estimating the market model using the seemingly unrelated regression (SUR) to acknowledge the common shocks in a particular industry when we conduct the event study analysis in order to gain better results.

### **3. Cross-Sector Domestic M&A in Singapore's Financial Industry**

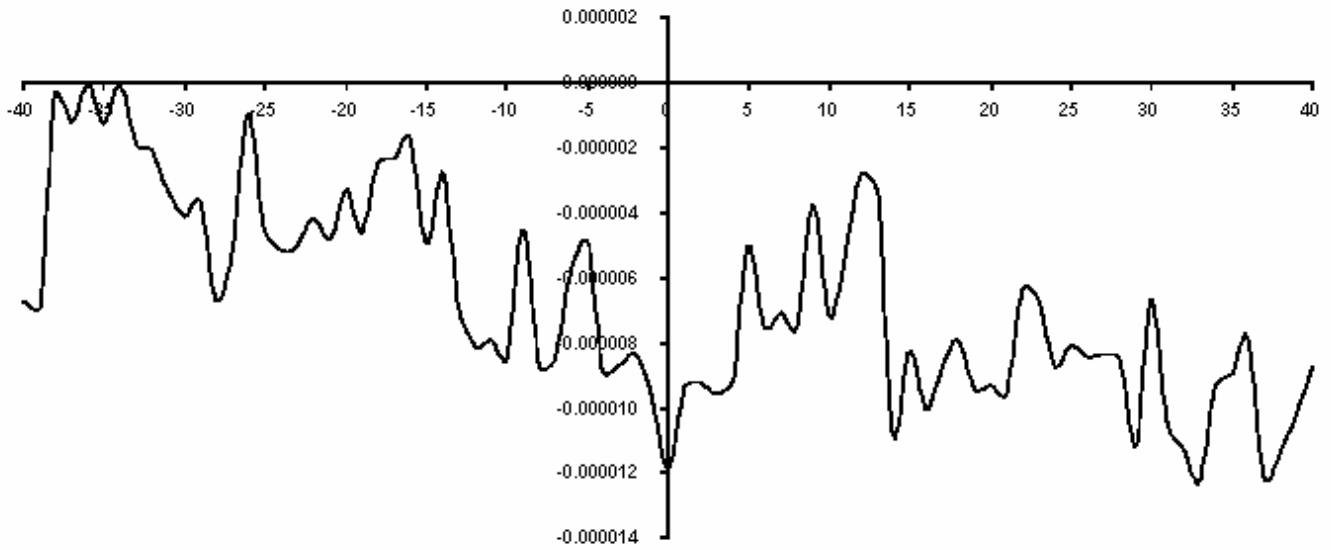
This section documents the empirical findings on cross-sector domestic M&A between bank and insurance company in Singapore. The results of our study show that in the case of GEH, the sample cumulative abnormal return is -0.000009 with the standard errors of 0.000003, thus giving us the t-statistics of 2.765705 in absolute term and we found sufficient evidence to reject the null hypothesis at 1% level. On the other hand, the sample cumulative abnormal return for OCBC using the market model is -0.08312 with the standard errors of 0.05311, thus giving us the t-statistics of 1.56504 in absolute term and we found insufficient evidence to reject the null hypothesis even at 10% level. Nevertheless, the cumulative average return for GEH shown negligible returns, i.e. the returns around the event date is effectively 0%. If we refer to the actual stock price for GEH around 25<sup>th</sup> February 2004, it is relatively stable at S\$12.2 to S\$12.5. However, the returns for OCBC shown a slightly higher return of 1%. Our domestic cross-sectoral study has shown that the M&A activity in Singapore, i.e. between OCBC and GEH, is not likely to affect the performance of each institution. This prediction is inline with the recent development whereby the proposed merger by OCBC to GEH failed to materialize. Weston et al's (2001) results have supported our empirical findings whereby post mergers and takeovers activities in banking and insurance industries tend to have high possibility of negative returns. The message is rather clear for GEH shareholders: their valuable market shares and position in Singapore and Malaysia will be transferred to OCBC and hence brings out the adverse impact on GEH shareholders. The reverse is true for the OCBC shareholders that this merger will be more likely to improve the value of OCBC given GEH position as a leader in the insurance industry in the Singapore and Malaysia market.

Several quantitative market research studies have shown (in which they do not use the event study method) that OCBC's assets will increase in the Malaysian Market from 13.7% to 19% should this merger took place. In

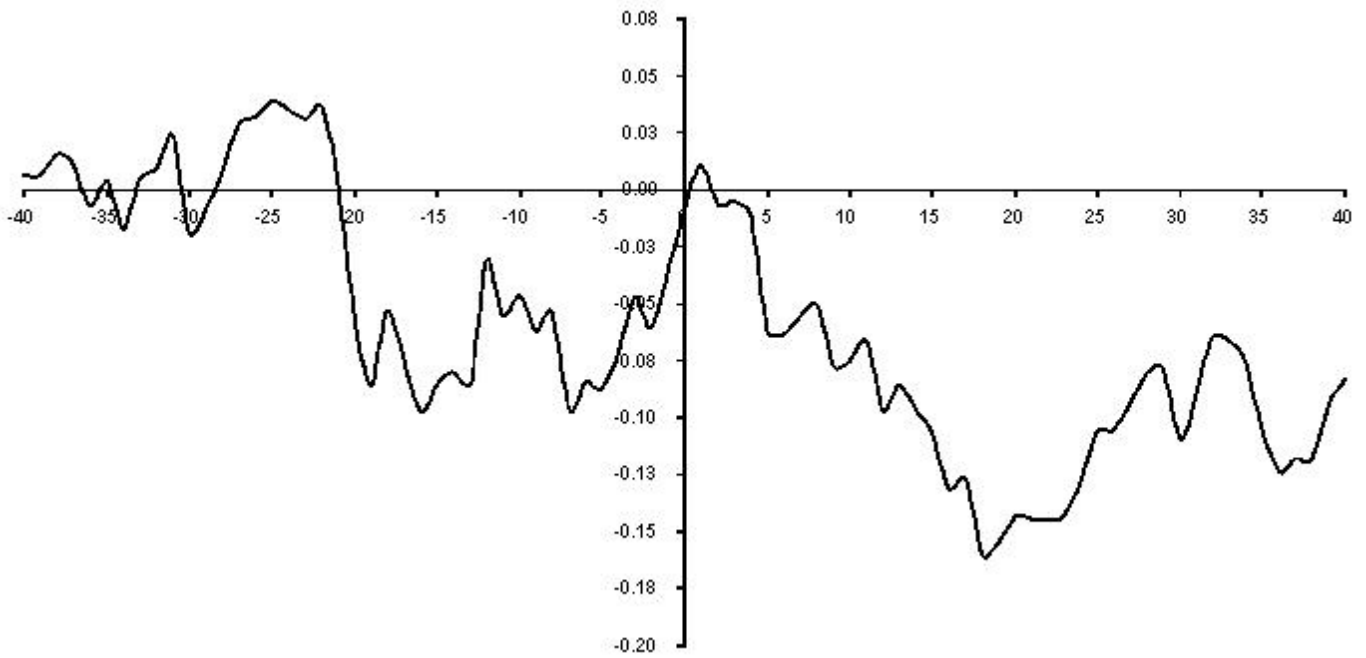


addition to that, substantial contribution towards fee based & insurance income will be due to OCBC if they could successfully acquire GEH and thus adding more portfolio in OCBC's banking activities to embrace insurance sector

**Figure 3 CAR of GEH**



**Figure 4 CAR of OCBC**



as well. The calculation showed that  $33.60\% + 11.70\% = 45.30\%$  will be the total percentage point in the fee based and insurance income. Increase in earnings to S\$ 1024 M, based on Dec – 2000 figures, from earlier S\$ 954 M should be an evident benefit that we could notice without even engaging in any formal analysis for OCBC and GEH.

Furthermore there are a number of reasons why it doesn't make sense for GEH shareholders to take the offer. First, GEH is a leading insurer in Singapore and Malaysia and its strong franchise will be very difficult to replicate. Currently, it has a 26.5% weighted share of the premium market in Singapore and 23.2% in Malaysia. And the outlook is upbeat with the recovery of the economy, insurance sales will pick up, thus adding fuel to its earnings growth. Second, the insurer has hidden reserves not taken into account in the OCBC offer. Over time, as the equities market improves, these surpluses will surface. Third, OCBC is not pricing in any revenue or cost synergies in its offer to GEH shareholders. Fourth, by swapping out of GEH into OCBC, a shareholder is in effect switching from a leader in the insurance market into just another competitor - albeit a relatively big one - in the cut-throat banking market (*Business Times*, February 26<sup>th</sup> 2004).

OCBC will also be likely to have an increase in asset base from S\$ 84Billion to S\$ 113Billion should they acquire GEH and this will make OCBC to be the largest assets holder in Singapore-Malaysia Assets (S\$ 105Billion, whereby close contender DBS S\$ 104 Billion). Finally, it is estimated that ROE will increase from 11.1% to 11.7%. In the end, it can be concluded that the alliance of the two major players may eventually form a financially integrated firm that will provide almost all investment avenues or solutions to satiate the risk appetite of the investors and consumers in the ever increasing integrated financial markets. OCBC, if they could succeed with this merger, will then be the solution of “one-stop-financial-services” provider.

Recent developments validated our findings further. It happened that OCBC's general offer for Great Eastern has expired with the result of the banking group increased its shareholding in the insurer up to 81.7 percent, short of the 90 percent level that would allow it to take GE private<sup>[4]</sup>. In the market on 30<sup>th</sup> June 2004, Great Eastern shares closed 0.8 percent down at S\$11.80 on a volume of just 630,000 shares. The attention is now centered on whether OCBC could up its stake above the 90 percent threshold that would allow the bank to take Great Eastern private. In spite of a two-week extension to its offer, OCBC has failed.

Some analysts argued that the effort of taking GEH private does not really make much of a difference from a financial perspective since there is no foreseeable significant advantage of a privatization. They argued that because as long as there is control over Great Eastern via their subsidiary status, OCBC can derive a lot of synergies, for example in the cross-selling of insurance and banking products; being able to leverage on the bigger exposure to Malaysia of Great Eastern and helping its interest income and core banking business<sup>[5]</sup>. Market observers, however, viewed that from a management perspective there would certainly be advantages to OCBC if it takes Great Eastern private such as with a de-listing, Great Eastern would then no longer need to have an independent board of directors and OCBC's board will be able to make all the decisions for the merged entity. Some also argued that the move by the four Great Eastern directors to reject OCBC's offer could be seen as an internal power struggle of some sort by

the old guard. OCBC could certainly do without such problems, which could be why it will continue buying Great Eastern shares to cross the 90 percent threshold.

#### **4. Conclusion**

In this paper, we have shown econometrically that there are mixed evidences of benefits in the merger and acquisition activities in the Singapore's financial industry using multi-factor SUR. However, looking at the predicted cumulative abnormal returns, we can see that there are slightly decreasing trends in returns *ex-post* merger or takeovers activities for the overall domestic financial institutions. These results are very much inline with previous event study analysis (for example Weston et al. 2001). They found that the bank sub-samples exhibits a significant drop in the predicted success rate. Arguably, Singapore's domestic banks M&A has resulted in a much different way because there are limited number of players in the domestic bank institutions and government put a great deal of attention, through banking policy and regulations, to ensure the efficiency of these banks.

Before we reach to our conclusion, we need to acknowledge that the number of events and the number of firms observed are too few. Consequently, we expect that our estimates and statistical results to be more credible given a larger sets of firms and recording more events in our study, such as earnings announcement, mergers announcement, government initiatives and proposal, market capitalization, and perhaps the macroeconomic decision made by central bank such as interest rates and exchange rates policies that directly affect the financial industry.

Nevertheless, this paper has distinguished itself by proposing an alternative method to measure the abnormal returns with regards to the event study analysis. It shows that SELS seems to underestimate the value of the sample cumulative abnormal returns and thus it might be relatively easy for us to conclude an insufficient evidence to reject the null hypothesis. This is plausible since SELS does not acknowledge the same shocks that affect one particular industry as a whole but rather treat the error terms across equations to be uncorrelated contemporaneously.

#### **Endnotes**

1. See Cabral (2000) for stylized facts discussion.
2. Please refer to Zellner (1962) for further information and more advanced theoretical content of SUR. For the purpose of this event study analysis, I feel that the theoretical notes given is sufficient to justify the usefulness of implementing multi-factor SUR analysis in doing the estimates for market model.
3. In his study, MacKinlay used the sample of 30 firms with 20 announcements for each firm that was aggregated up to 600 event observations in total.
4. By the time when offer lapsed, Singapore's third-largest lender by assets garnered only an additional 3.1%, after getting a 78% stake at the June 16 close. The bank owned 49% of Great Eastern before launching its all-stock offer valued at 2.9 billion Singapore dollars (US\$1.69 billion) in February.
5. Channel NewsAsia, 30<sup>th</sup> June 2004.

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