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THE LONG-RUN EQUILIBRIUM RELATIONSHIP BETWEEN ECONOMIC ACTIVITY AND HOTEL STOCK PRICES

ABSTRACT

This study examines a long-run equilibrium relationship between economic activity and hotel stock prices. A hotel stock return model is formulated with the error correction term based on the results of the cointegration analysis. The model shows that changes in industrial production, changes in money supply and the error correction term are significant influences on hotel stock returns. The negative sign of the error correction term indicates that although the cointegrating relationship experiences the short-run deviations, the system tends to revert to the equilibrium relationship. This study highlights the importance of including the error correction term into a stock return model.

INTRODUCTION

According to the financial theory, stock prices reflect investors' expectations about future corporate earnings and dividends. Because the business condition influences the corporate earnings, it is often observed that stock prices fluctuate with economic activity. Although a vast amount of economic literature has highlighted the relationship between economic activities and stock prices (Fama, 1981; Chen, Roll and Ross, 1986; Campbell, 1987; Fama and French, 1988; Asprem, 1989; Wasserfallen, 1989; Bulmash and Trivoli, 1991; Booth and Booth, 1997; Cheung and Ng, 1998; Nasseh and Strauss, 2000), very few studies have investigated such relationships within hospitality literature (Barrows and Naka, 1994; Chen, 2005; Chen, Kim and Kim, 2005).

Moreover, the studies concerning the impact of economic variables on hospitality and hotel stocks have often used a static regression technique (Barrows and Naka, 1994;

Chen, 2005; Chen *et al.*, 2005). The ordinary least squares (OLS) regression fails to capture the dynamic characteristics of the non-stationary economic time-series data (Benassy, 1982). The objectives of this study are twofold: 1) to investigate a long-run equilibrium relationship between economic activity and hotel stock prices using the cointegration test developed by Johansen (1988) and Johansen and Juselius (1990), and 2) to build a stock return model with the error correction term in order to show the importance of taking transitory deviations into consideration when a relationship between economic variables and stock returns is modeled.

The remainder of the paper is organized as follows. The following section reviews the previous literature. Section 3 describes the methodology including data set and economic variables selected. In Section 4 results of the cointegration test and the formation of the error correction model are presented. Section 5 concludes the paper with contributions of this study and implications for hospitality stock investors and managers.

REVIEW OF LITERATURE

Unlike the single-index of the Capital Asset Pricing Model of Lintner (1965) and Sharpe (1964), the Arbitrage Pricing Theory (APT) of Ross (1976) states that a small number of systematic influences, which represent fundamental risks in the economy, affect long-term average security returns. However, the selection and the number of economic factors and their interpretation have been debatable since the inception of the APT. Roll and Ross (1980) tried a statistical technique, namely, factor analysis, to infer

factors from the stock return data; however, those factors resulting from the technique usually had no economic interpretation.

Instead of relying on the factor analytic technique, Chen, Roll and Ross (1986) used observed macroeconomic variables as risk factors. The stock price is the present value of the expected discounted stream of future dividends as given in Eq. (1). The choice of risk factors should cover systematic influences that could affect future dividends, the way in which traders and investors form expectations, and the rate at which investors discount future cash flows. Chen *et al.* (1986) showed that U.S. stock prices were significantly related to the growth in industrial production, the yield spread between long-term and short-term government bonds, the spread between low- and high-grade bonds, changes in expected inflation, and changes in unexpected inflation.

Following the work of Chen *et al.* (1986), numerous empirical studies have been conducted to reveal the relationship between macroeconomic variables and stock prices. Asprem (1989) examined a similar relationship using nine European countries. He found that stock prices were positively correlated to real economic activity, such as industrial production, exports, money, and the U.S. yield curve, whereas stock prices were negatively correlated to employment, imports, inflation, and interest rates. Wasserfallen (1989) also showed that stock returns were positively related to real activity in European countries such as the U.K., Germany, and Switzerland. He explained that a higher economic activity increases the expected profits of firms, thereby boosting stock prices positively.

The literature of economics and finance has long focused on factors affecting stock price returns. However, very limited research has been conducted in this regard within the hospitality and tourism industry.

Sheel and Wattanasuttiwong (1998) examined a relationship between the debt/equity ratios of restaurant firms and their risk/size-adjusted common equity returns using cross-sectional time series regressions. The authors found a significant relationship between a restaurant firm's debt/equity ratio and its risk/size-adjusted equity returns.

Sheel and Nagpal (2000) studied a long-run equity performance of acquiring firms in the U.S. hospitality industry. Negative equity value performance of the acquiring hospitality firms was observed during the past 20 years from 1980 to 2000.

Kim and Gu (2003) investigated the risk-adjusted performance of three restaurant sectors, including full-service restaurants, economy/buffet restaurants, and fast-food restaurants. Findings indicated that in the U.S., fast-food restaurants performed the best, followed by full-service restaurants and economy/buffet restaurants, although the performance of all three sectors was inferior to the performance of the market portfolio.

Barrows and Naka (1994) examined the effect of selected economic variables on stock returns of U.S. hospitality firms from 1965 to 1991. They hypothesized that five macroeconomic variables (the expected inflation rate, money supply, domestic consumption, term structure of the interest rate, and industrial production) could explain hospitality stock returns. Results indicated that hospitality stock returns had a negative relationship with the expected inflation rate, but a positive relationship with growth rates of money supply and domestic consumption. Overall, economic factors had a better

explanatory power in predicting stock returns of restaurant firms than they did for lodging firms.

Chen (2006) and Chen, Kim and Kim (2005) studied a set of economic and non-economic variables as determinants of hotel stock returns in China and Taiwan respectively. They discovered that not only economic factors but also non-economic factors (e.g., wars, presidential elections, natural disasters, sports mega-events, and terrorist attacks) could have powerful influences on hospitality stock returns.

Nonetheless, studies by Barrows and Naka (1994), Chen (2006) and Chen *et al.* (2005) employed the ordinary least square regression technique, which does not warrant the long-term effect of economic variables on hospitality stock returns. This study aims to examine the long-run co-movement between hotel stock prices and underlying economic forces that drive these stock prices throughout time. In addition, transitory deviations, which occur during this long-run relationship, are incorporated into the model of hotel stock returns.

DATA COLLECTION AND RELATIONSHIP AMONG SELECTED VARIABLES

Data and Selection of Variables

According to the Taiwan Stock Exchange (TSE) classification, the hotel portfolio includes stocks of six hospitality firms: Ambassador Hotel, First Hotel, Grant Formosa Regent Taipei, Hotel Holiday Garden, Lefoo Corporation, and Wan-Hwa. The value-weighted hotel stock price index (*SPI*) is computed by TSE based on the above six

hospitality stocks. The monthly time series data of the hotel stock price index (*SPI*), obtained from the financial database of the Taiwan Economic Journal, are available over the period from August 1995 to February 2004 ($n = 103$). Information on the monthly economic variables such as the industrial production (*IP*), consumer price index (*CPI*), money supply (*M2*), the short-term interest rate (*STR*), and the unemployment rate (*UNER*) are also obtained from the financial database of the Taiwan Economic Journal over the same time period to match the time period of *SPI*.

As Chen *et al.* (1986) noted, the asset pricing models, such as the stock valuation model in Eq. (1) and the APT of Ross (1976), have been silent about which exogenous influences or economic variables are likely to impact all assets. They argued that although the relationship between stock market and macroeconomic factors does not have to be entirely in one direction, stock prices usually respond to external forces. It is obvious that all economic variables are endogenous in some ultimate sense. Only natural forces, such as earthquake and the like, are truly exogenous to the world economy and it is far beyond our abilities to base an asset pricing model on those factors.

Based on the present value model, Chen *et al.* (1986) proposed that the selected economic factors could be those systematic factors that impact future expected dividends and the discount rate. Previous studies using data from various countries supported that the five economic variables selected in this study (*IP*, *CPI*, *M2*, *STR* and *UNER*) are generally consistent with the argument of Chen *et al.* (1986) (see Fama and Schwert, 1977; Fama, 1981; Campbell, 1987; Fama & French, 1988; Asprem, 1989; Wasserfallen, 1989; Bulmash & Trivoli, 1991; Booth & Booth, 1997; Cheung & Ng, 1998).

Relationship between Economic Factors and Hotel Stock Prices

To measure the value of economic activity or economic growth, economists use data on gross domestic product. Another popular measure is industrial production (*IP*) (Shapiro, 1988). *IP* measures economic activity more narrowly, focusing on the manufacturing side of the economy. The advantage of using *IP* is that *IP* is available on a monthly basis, which in turn can offer more observations. In this study, we use *IP* as a measure of current economic activity. Rapidly growing *IP* indicates an expanding economy with ample opportunity for a firm to increase sales and as a result stock prices across the board are expected to rise (Fama, 1981; Chen *et al.*, 1986; Asprem, 1989; Wasserfallen, 1989; Bulmash & Trivoli, 1991). Therefore, a positive effect of *IP* on hospitality *SPI* is hypothesized (Barrows & Naka, 1994; Chen, 2005; Chen *et al.*, 2005).

Second, the *CPI* may affect stock prices either positively or negatively based on economic theories and results of empirical studies in the literature. Asprem (1989) noted that the *CPI* and stock prices should be related one-to-one according to the Fisher equation. He further argued that stocks are claims on underlying real assets and should provide a hedge against inflation. Therefore, it is expected that *CPI* will have a positive relationship with *SPI*. However, Asprem (1989) found a positive relationship between *SPI* and *CPI* in five out of ten European countries, while there was a negative relationship in the other five countries. Fama and Schwert (1977), Fama (1981), Geske and Roll (1983), Wahlroos and Berglund (1986), and Chen *et al.* (1986) also showed that *SPI* and *CPI* were negatively associated. Fama (1981) used a combination of the money

demand function and the quantity theory of money to explain the negative relationship between *SPI* and *CPI*

Third, *M2* represents the monetary supply. An increase in *M2* implies an expansionary monetary policy, which in turn can stimulate the economy and have a positive influence on *SPI* (Campbell, 1987; Asprem, 1989; Bulmash & Trivoli, 1991; Abdullah & Hayworth, 1993; Booth & Booth, 1997; Cheung & Ng, 1998). Barrows and Naka (1994) and Chen *et al.* (2005) also find that hospitality *SPI* is positively impacted by *M2*.

Fourth, the three-month Treasury bill rates are used as a measure of short-term interest rates (*STR*). Interest rates may be related to stock prices either negatively or positively through the following two channels (Chen *et al.*, 1986; Campbell, 1987; Fama & French, 1988; Asprem, 1989; Bulmash & Trivoli, 1991). First, *STR* is expected to have a negative impact according to the basic valuation model given in Eq. (1) because a high interest rate reduces the present value of future cash flows, thereby reducing the attractiveness of investment opportunities. Second, T-bills are considered the most marketable of all money market instruments. T-bills provide not only a low-cost source of funds for firms that need a short-term infusion of funds, but they also provide a means of investing idle funds and reducing the opportunity cost, which in turn can increase expected cash flows. In this case, we can expect a positive impact of *STR* on *SPI*.

Lastly, the employment rate measures the extent to which the economy is operating at full capacity and provides an insight into the strength of the economy. High employment or low unemployment (*UNER*) implies an expanding economy, which

should affect *SPI* positively, i.e. the relationship between *SPI* and *UNER* is negative (Asprem, 1989; Wasserfallen, 1989; Bulmash & Trivoli, 1991). Thus, the negative relationship is hypothesized between hospitality *SPI* and *UNER* (Barrows & Naka, 1994; Chen *et al.*, 2005).

ANALYTIC FRAMEWORK

The cointegration concept originally developed by Engle and Granger (1987) was used to study a long-run equilibrium relationship between hotel stock prices and macroeconomic forces. Consider the concept of cointegration in a bivariate case. Given that two time-series variables are nonstationary in their levels and their first differences are stationary, these two time-series variables are cointegrated if one or more linear combinations exist between the variables that are stationary (Engle & Granger, 1987). In the presence of cointegration, we expect a stable long-run or equilibrium linear relationship between the two factors. For example, if *SPI* and *IP* are cointegrated, there exists a long-run relationship that prevents them from drifting away from each other. In other words, there is a force of equilibrium that keeps *SPI* and *IP* together in the long run.

To test for the existence of cointegration, we adopted the procedure developed by Johansen (1988) and Johansen and Juselius (1990). A precondition for the cointegration test is that all variables possess unit roots. In other words, all variables are not stationary. The Augmented Dicky-Fuller (ADF, 1979) and the Phillips-Perron (PP, 1988) tests were employed to examine the existence of a unit root in all data.

Lastly, when hotel stock prices and economic forces are cointegrated, we can state that hotel stock prices and economic variables tend to move together in the long run, while experiencing short-run transitory deviations from this long run relationship. Accordingly, we can derive an error correction model (ECM) from a cointegrated system. The ECM allows us to build a hotel stock return model with the error correction term, i.e. the short-run transitory deviations, and show the importance of taking transitory deviations into account when a relationship between hotel stock returns and economic variables is modeled.

RESULTS

Unit Root Tests

As explained in the methodology section, prior to the cointegration test, the Augmented Dickey-Fuller (ADF, 1979) and the Phillips-Perron (PP, 1988) tests were employed in order to examine the existence of a unit root in all data. *LSPI*, *LIP*, *LCPI* and *LM2* denote *SPI*, *IP*, *CPI* and *M2* in natural logarithms, respectively. The coefficient in the log function simply implies a percentage change in the dependent variable given a percentage change in the independent variable.

Results of ADF and PP unit root tests are reported in Table 1. Both ADF and PP tests indicate that the null hypothesis of a unit root cannot be rejected in levels of all variables, but is rejected in their first differences (at the 1% significance level). Therefore, there is a unit root in the level, but no unit root in first difference of all variables. Since the time series data of *LSPI*, *LIP*, *LCPI*, *LM2*, *STR*, and *UNER* have met the basic

assumption of non-stationarity for the cointegration test, the Johansen's cointegration technique is carried out.

(Insert Table 1 About Here)

Cointegration Test and Model Selection

Consider that Y_t is a p -vector of non-stationary $I(1)$ variables, a p -dimensional VAR of order k can be expressed as a Vector Error Correction Model (VECM):

$$\Delta Y_t = C + \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + Z_t, \quad (1)$$

where C is a constant vector, Δ is the difference operator, Z is a white noise vector and the coefficient matrix:

$$\Gamma_i = -\sum_{j=i+1}^p A_j \quad \text{and} \quad \Pi = \sum_{i=1}^p A_i - I. \quad (2)$$

The approach of Johansen (1988) involving choosing the cointegrating rank r , $0 < \text{rank}(\Pi) = r < p$ and their long-run relationship, $\Pi = \alpha\beta'$. The $p \times r$ matrices β and α represent the long-run coefficients and error-correction estimates respectively. Johansen (1988) provides two likelihood ratio tests for the cointegration rank, namely the maximum eigenvalue test and the trace test. A comprehensive description of the hypothesis test can be found in Johansen (1988) and Johansen and Juselius (1990).

Table 2 summarizes the Johansen test results of the cointegration between hotel stock prices and economic variables. Based on Osterwald-Lenum (1992) critical values, the null hypothesis of no cointegrating equilibrium is rejected at both 5% and 1%

significance levels. In fact, trace test statistics indicate five cointegrating equations at the 5% level and three cointegrating equations at the 1% level; maximum eigenvalue test statistics indicate three cointegrating equations at the 5% level and two cointegrating equations at the 1% level. Therefore, it is evident that a strong long-run (cointegrating) relationship exists between hotel stock prices (*SPI*) and economic activity, such as industrial production (*IP*), consumer price index (*CPI*), money supply (*M2*), the short-term interest rate (*STR*) and the unemployment rate (*UNER*).

(Insert Table 2 About Here)

Next, a decision remains on which specification to choose among identified cointegration vectors. Table 3 presents the estimated five cointegration vectors. Johansen and Juselius (1990) noted that the first cointegrating vector corresponding to the largest eigenvalue is the most correlated with the stationary part of the model and hence is most useful. Song and Witt (2000) suggested, “there is no clear-cut answer; however, as a rule of thumb, a researcher should be guided by both economic interpretations of the estimated long-run cointegrating vectors (such as signs and magnitudes) and statistical criteria (p.116).” After reviewing signs of coefficients of each economic variable, we deleted the cointegrating equations 2, 3, and 5 (refer to the methodology section for the expected relationship between *LSPI* and *LIP*, *LM2*, and *UNER*). Although *STR* could have either a positive or negative impact on *LSPI*, the

equation 4 (negative relationship) was deleted because the majority of equations (four of five) indicated a positive relationship. As a result, the equation 1 became our final choice.

(Insert Table 3 About Here)

Table 4 reports the estimated cointegration relationship between hotel stock prices and economic activity. Coefficients are normalized so that the coefficient of stock prices is unity. Real industrial production (*IP*) shows the largest coefficient (at the 1% level) among five economic variables, indicating that *IP* is the most influential on hotel stocks. More specifically, a 1% increase in production increases hotel stock prices by 23.11%. Of all five economic variables, *CPI* and *UNER* have negative impacts on hotel stock prices. According to the coefficient value, a 1% increase in *CPI* decreases *SPI* by 21.96%, while a 1% increase in *UNER* decreases *SPI* by 1.20%. As for the effect of monetary policy, a 1% increase in money supply (*M2*) increases *SPI* by 15.85%. This positive impact of money supply (*M2*) on tourism and hospitality stock prices is reported in earlier studies (Barrows & Naka, 1994; Chen *et al.*, 2005). Lastly, it is found that a 1% increase in the *STR* increases *SPI* by 0.5%.

(Insert Table 4 About Here)

Error Correction Model

The error correction term (*ECT*) is the cointegrating residuals, which are derived from cointegration results in Table 4. *ECT* is equal to:

$$ECT = LSPI - 23.11LIP + 21.96LCPI - 15.85LM2 - .50STR + 1.20UNER . \quad (3)$$

ECT can be interpreted as a measure of the deviation from the long-run relationship.

Table 4 also displays the descriptive statistics of the error correction term. Diagnostic checks for ECT are as follows. The skewness test measures the asymmetry of the data distribution centering the mean. The value of kurtosis in excess of three implies that the distribution is fat tailed. The error correction residuals are not skewed with the value of skewness (0.35), and furthermore are not fat tailed with the value of kurtosis (2.97). The Jarque-Bera normality test (Jarque & Bera, 1980) supports that error correction residuals are normally distributed. Q-statistic, $Q(n)$, is the Ljung-Box (1978) Q-statistic at lag n and is used to test whether a group of n autocorrelations is significantly different from zero. The Ljung-Box Q-statistics for the residual series show that error correction residuals have no statistically significant sample autocorrelations. Q-statistics for the square values of residuals show that error correction residuals have no nonlinear dependence and no presence of autoregressive conditional heteroscedasticity.

Note that the error correction residuals of a cointegrated system should follow $I(0)$ process. According to both ADF and PP unit root test results (not reported here), the null hypothesis of a unit root is rejected in level (at the 1% significance level), implying that the series of error correction residuals is an stationary $I(0)$ process.

Given the cointegration results, the error correction model is formed as follows:

$$\Delta LSPI_t = c + \sum_{i=1}^p \mu_i \Delta LSPI_{t-i} + \sum_{j=1}^5 \sum_{i=1}^k \phi_{ji} \Delta ECON_{t-i} + \sum_{i=1}^q \gamma_i ECT_{t-i} + \rho_t, \quad (4)$$

where $\Delta LSPI$ is the change in $LSPI$ (i.e., hotel stock return). $\Delta ECON$ represents the changes in economic activity such as LIP , $LCPI$, $LM2$, STR and $UNER$. c , μ_i , ϕ_i and γ_i are coefficient matrices of approximate dimensions. ECT is the error correction term, ρ_i is the regression error term, p , k , and q are the lag parameters. The specification of the above model forces the long-run behavior of hotel stock prices and economic variables to converge into a cointegrating relationship, while accommodating short-run deviations.

The second equation in Table 5 shows that lagged hotel stock returns, changes in industrial production, changes in money supply and the error correction term are statistically significant regressors whereas changes in consumer price index, changes in short-term interest rates and changes in the unemployment rates are insignificant regressors. The positive sign of the coefficient of changes in money supply and changes in industrial production indicate a positive impact on hotel stock returns. The negative sign of the coefficient of the error correction terms implies that the system has a tendency to revert to their equilibrium long-run relationship. The estimated coefficient of the error correction term measures the speed of adjustment to restore equilibrium in the dynamic model.

(Insert Table 5 About Here)

To gauge the importance of short-run adjustments to deviation from the long-run equilibrium, a model without error correction residuals is estimated (see equation 1 in Table 5). This regression mimics the standard VAR approach. Without the error

correction term (*ECT*), the explanatory power (\bar{R}^2) decreases from 9 % to 2 %. As a final step, we executed the error correction model only with variables that are statistically significant in explaining hotel stock returns (see equation 3 in Table 5). The explanatory power (\bar{R}^2) of the model improved from 9% to 10%.

Our result is similar to the previous findings of Barrow and Naka (1994), Chen (2006) and Chen *et al.* (2005). Barrow and Naka (1994) showed that the explanatory power of selected macroeconomic variables on U.S. restaurant and lodging returns was 12% and 8%, respectively. Chen (2006) reported that a set of macroeconomic factors explained 8% of Chinese hotel returns. Similarly, Chen *et al.* (2005) also found that the explanatory power of macroeconomic forces on the Taiwanese hotel return was 8%. As Barrow and Naka (1994, p.125) noted, these values of \bar{R}^2 s are relatively high for this kind of study.

Diagnostic checks on the model residuals are necessary to determine efficiency of estimators (see Table 5). The diagnostic tests indicate that residuals are normally distributed and have no sample autocorrelations, no nonlinear dependence, and no presence of autoregressive conditional heteroscedasticity. Therefore, it can be concluded that the estimators of the error correction model are efficient.

Conclusions

Most of the financial studies in the hospitality and tourism literature have evaluated the equity performance or investment risk of hospitality companies based on various financial ratios (Rushmore, 1992; Sheel & Wattanasuttiwong, 1998; Borde, 1998;

Sheel & Nagpal, 2000; Gu & Kim, 2002; Kim & Gu, 2003). Barrows and Naka (1994), Chen (2006) and Chen *et al.* (2005) asserted that investment risks or returns of hospitality firms should be explained in relation to key economic indicators. This study contributes to the hospitality finance literature where only a handful of studies exist regarding the impact of economic activity on hospitality and tourism stock prices.

The second contribution of this study is associated with the methodology used for hospitality stock return models. Although it is known that economic time-series data are nonstationary, hospitality finance researchers have used a static regression model in logarithmic levels using ordinary least squares (OLS) to estimate stock returns. The cointegration test of Johansen (1988) and Johansen and Juselius (1990) allows us to test the existence of a long-run stable relationship and estimate the strength of the relationship between variables. Cointegration results in this study verify our a priori expectation about the relationship between economic factors and hotel stock prices. In other words, Taiwan hotel stock prices fluctuate with five selected key economic indicators: industrial production, consumer price index, money supply, the short-term interest rate and the unemployment rate.

If hotel stock prices and economic factors are cointegrated, they tend to move together in the long run, while experiencing the short-run transitory deviations from this long-run relationship. Therefore, the error correction model was formulated to explain the dynamics of the short-run deviations and long-run linkage between hotel stock prices and economic forces. Note that *ECT* in the error correction model is significant and negative. The explanatory power of the model is significantly improved by incorporating

ECT. This justifies the reason why *ECT* should be included into a stock return model.

The negative sign of *ECT* indicates that although the relationship between hotel stock prices and economic activities experiences the short-run transitory deviations, the system reverts to their long-run equilibrium relationship.

In addition to *ECT*, the error correction model shows that growth rates of industrial production and money supply are significant predictors of hotel stock returns. This implies that an increase in industrial production or money supply at the current period leads to positive hotel stock returns at the next period. In particular, it is worth paying attention to the economic indicator of money supply. Money supply is consistently reported as a strong determinant of tourism and hospitality stock returns in previous hospitality literature (Barrows & Naka, 1994; Chen *et al.*, 2005). These findings can be used as valuable information for investors who may be interested in purchasing hospitality and tourism stocks.

For example, if the business condition is expected to boom at next period, which is often signaled by increases in industrial production, hotel stock investors can make a buy-and-hold decision at the present time and sell the stocks at next period to reap a positive investment return. It is also recommended to keep a close eye on the time period when the central bank is expected to pursue the expansionary monetary policy. As indicated in this study, the policy is likely to positively affect stock returns by increasing money supply in the market. In conclusion, an expansive monetary policy signals “good news” for hospitality and tourism stocks and investors should take advantage of it.

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Table 1
Unit root tests

Variable (Level)	<i>LSPI</i>	<i>LIP</i>	<i>LCPI</i>	<i>LM2</i>	<i>STR</i>	<i>UNER</i>
ADF	−1.11 (4)	−2.08 (3)	−2.15 (3)	−2.11 (4)	−0.39 (4)	−1.32 (4)
PP	−1.24 (4)	−2.95 (4)	−2.16 (4)	−1.80 (4)	−0.21 (4)	−1.07 (4)
Variable (1 st difference)	$\Delta LSPI$	ΔLIP	$\Delta LCPI$	$\Delta LM2$	ΔSTR	$\Delta UNER$
ADF	−4.32 ^{**} (4)	−6.13 ^{**} (3)	−6.48 ^{**} (3)	−5.33 ^{**} (4)	−3.76 ^{**} (4)	−3.92 ^{**} (4)
PP	−9.85 ^{**} (4)	−10.95 ^{**} (4)	−11.17 ^{**} (4)	−8.61 ^{**} (4)	−13.21 ^{**} (4)	−6.30 ^{**} (4)

Note: Δ denotes the first difference of variable under consideration. The optimal lags selected for the Augmented Dickey-Fuller (ADF) test and the truncation lag for the Phillips-Perron (PP) test are in parentheses. MacKinnon (1991) critical values for rejection of the null hypothesis of a unit root at the 5% and 1% levels are −2.89 and −3.50 respectively. The symbol (^{**}) indicates that the null hypothesis can be rejected at the 1% level. Both ADF and PP tests indicate a unit root in the level and no unit root in first difference of all variables.

Table 2
Cointegration tests between hotel stock prices and economic activity

The null hypothesis	Trace Statistic						Maximum Eigenvalue Statistic					
	$r = 0^{**}$	$r \leq 1^{**}$	$r \leq 2^{**}$	$r \leq 3^*$	$r \leq 4^*$	$r \leq 5$	$r = 0^{**}$	$r = 1^{**}$	$r = 2^*$	$r = 3$	$r = 4$	$r = 5$
	163.36	107.71	65.86	34.91	15.66	1.05	55.65	41.85	30.95	19.25	14.01	1.05
CV1	94.15	68.52	47.21	29.68	15.41	3.76	39.37	33.46	27.07	20.97	14.07	3.76
CV2	103.18	76.07	54.46	35.65	20.04	6.65	45.10	38.77	32.24	25.52	18.63	6.65

Note: r is the hypothesized number of cointegrating equation. CV1 and CV2 represent Osterwald-Lenum (1992) critical values of trace and maximum eigenvalue tests for rejection of hypothesis of no cointegration at 5% and 1% level respectively. The optimal lag selected for cointegration tests based on the Akaike information criterion (AIC, Judge *et al.*, 1985) and the Schwartz Bayesian criterion (SBC, Schwarz, 1978) is five. Trace test indicates 5 cointegrating equations at the 5% level and 3 cointegrating equations at the 1% level. Maximum Eigenvalue test indicates 3 cointegrating equations at the 5% level and 2 cointegrating equations at the 1% level.

Table 3
The estimated five cointegrating equations

$$LSPI = b_1 LIP + b_2 LCPI + b_3 LM2 + b_4 STR + b_5 UNER$$

	<i>LSPI</i>	<i>LIP</i>	<i>LCPI</i>	<i>LM2</i>	<i>STR</i>	<i>UNER</i>
Cointegration 1	1	23.1106	-21.9555	15.8477	0.5018	-1.2020
Cointegration 2	1	-3.2310	-14.3204	18.1805	0.1859	-0.6828
Cointegration 3	1	1.6546	27.0388	-3.5664	0.2545	-0.4058
Cointegration 4	1	1.1720	-16.8755	9.6435	-0.7148	-1.5304
Cointegration 5	1	2.7184	-51.2712	11.8859	0.3024	0.2033

Table 4
The estimated cointegration relationships between hotel stock prices and economic activity

$$LSPI = b_1 LIP + b_2 LCPI + b_3 LM2 + b_4 STR + b_5 UNER + ECT$$

Economic Activities	<i>LIP</i>	<i>LCPI</i>	<i>LM2</i>	<i>STR</i>	<i>UNER</i>
<i>b</i>	23.1106	-21.9555	15.8477	0.5018	-1.2020
Standard Errors	(3.5251)	(4.1927)	(5.7387)	(.2153)	(.3555)
<i>t</i> -value	10.80	-10.80	10.37	9.31	-9.20
Significance Level	1%	1%	1%	1%	1%
Diagnostic checks for error correction residuals (<i>ECT</i>):					
Mean= 0.00 Skewness= 0.3542 Kurtosis= 2.9726 JB= 2.1147					
Q(6)= 6.81 Q(12)= 9.73 Q ² (6)= 3.85 Q ² (12)= 5.74					

Note: The coefficient vector is estimated from the cointegrated system reported in Table 2. The vector is normalized so that the coefficient of each hotel stock index is unity. Jarque-Bera is the Jarque and Bera normality test and is defined as $[(T/6) b_1^2 + (T/24)(b_2-3)^2] \sim \chi^2_2$, where T is the sample size ($T=101$), b_1 is the coefficient of skewness and b_2 is the coefficient of kurtosis (Jarque and Bera, 1980). The critical value at the 5% significance level is 5.99. $Q(n)$ and $Q^2(n)$ are the Ljung-Box (1978) Q-statistic with a lag of n for the series of stock return and squared stock return respectively and distributed as χ^2_n . Critical values for $n = 6$ and 12 at the 5% level are 12.59 and 21.03 respectively.

Table 5
Estimation results of the error correction model

$$\Delta LSPI_t = c + \mu_1 \Delta LSPI_{t-1} + \phi_1 \Delta LIP_{t-1} + \phi_2 \Delta LCPI_{t-1} + \phi_3 \Delta LM2_{t-1} + \phi_4 \Delta STR_{t-1} + \phi_5 \Delta UNER_{t-1} + \gamma_1 ECT_{t-1} + \rho_t$$

Economic activities	$\Delta LSPI_{t-1}$	ΔLIP_{t-1}	$\Delta LCPI_{t-1}$	$\Delta LM2_{t-1}$	ΔSTR_{t-1}	$\Delta UNER_{t-1}$	ECT_{t-1}	\bar{R}^2
Equation 1	0.7500 (2.30) ^{***}	0.1385 (1.69) [*]	-0.2882 (-.26)	2.8780 (2.02) ^{**}	-0.0165 (1.09)	-0.0660 (-1.26)	---	0.0197
Equation 2	0.7494 (2.49) ^{***}	0.1360 (1.74) [*]	-0.0861 (-.08)	2.8580 (1.91) [*]	-0.0128 (-.82)	-0.0852 (-1.45)	-0.9125 (-2.94) ^{***}	0.0944
Equation 3	0.7190 (2.59) ^{***}	0.1128 (1.69) [*]	---	2.9267 (1.96) ^{**}	---	---	-0.8717 (-3.13) ^{***}	0.1001
Diagnostic checks for residuals ρ_t in Equation 3	Mean= 0.00 Skewness= -0.3496 Kurtosis= 3.5201 JB= 3.20 Q(6)= 2.91 Q(12)= 5.61 Q ² (6)= 5.05 Q ² (12)= 16.05							

Note: *ECT* denotes error correction residuals. T-values are in parentheses.