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by

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THE BLACK SCHOLES CALL OPTION PRICING MODEL AND THE AUSTRALIAN OPTIONS MARKET: WHERE ARE WE AFTER 15 YEARS?

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Abstract:

The Black Scholes model has not been tested in Australia for about 10 years implying tests previously carried out used data from a developing options market. This study carries out cross sectional tests of the model using the most recent data available. The conclusion, unlike earlier studies, is that the Black-Scholes model cannot be rejected, and thus that the market is efficiently pricing options in an unbiased manner (in a Black Scholes sense), or alternately, that the model is capable of effectively pricing options. A unique time series analysis of mispricing is also carried out in order to determine whether this can be attributed to a 'market learning effect' over time. There is some evidence of such an effect. The tests differ from those of previous studies in a number of ways. One of the major limitations of past studies is overcome as the tests do not depend on historical measures of volatility. Special care is taken to exclude possible misleading observations occurring from non-synchronous share/option prices. The effects of dividends and the possibility of early exercise are dealt with by exclusion. Controls are also used to limit the possibility of incompatible risk free interest rate proxies having a confounding effect on results.

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1. INTRODUCTION

The option pricing formula developed by Black and Scholes (1973) led to a great number of studies attempting to test the model in the United States, whilst only 3 published studies have used Australian data. The model devised by Black and Scholes presents a closed form solution for the price of a European call as a function of the price of the underlying share, the exercise price, the continuous risk free interest rate, the standard deviation of the rate of return on the share, and the options time to expiration. Merton (1973) demonstrated that an American call on a share which does not pay a dividend over the life of the option, will not be exercised prior to maturity. Thus by implication, American calls whose underlying shares do not pay dividends can be priced by the Black and Scholes European call option pricing model. The following study provides further cross sectional as well as time series tests of the Black Scholes model using the most recent Australian data available, and further limits many of the methodological problems of previous studies.

2. LITERATURE REVIEW

In February 1976 the Australian Options Market (AOM) commenced operations facilitating and standardising the trade of share options in Australia. It was not until 1978 that the first Australian test of the extremely popular Black and Scholes (1973) options pricing model was published by Brown (1978). Since then, only two other Australian studies of the model have been published, the first by Chiarella and Hughes (1978) and the second, by Brown and Shevlin (1983a). The limited number of published tests of the model in Australia is in sharp contrast to the large number of tests published in the USA[1].

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[1] for example Black and Scholes (1973); Latane and Rendleman (1976); Galai (1977); MacBeth and Merville (1979); Battacharya (1980); Battacharya (1983); and Rubinstein (1985).

Brown (1978) used a sample of data from options traded between February 1976 and June 1977 (The first 16 months of the AOM's operations). He used data from options written on CSR, Western Mining Corporation, Woodside-Burmah Oil, and Bougainville Copper. The methodology followed by Brown was similar to a previous US study by Latane and Rendleman (1976), who calculated the standard deviation of stock price returns implied by the Black Scholes model and then compared them to historical values and actual realised values over the life of the relevant option. Brown concluded that the implied standard deviation (ISD) was upwardly biased relative to historical standard deviations, implying that the model tended to underprice options, except in 1977 where the opposite was found.

Chiarella and Hughes (1978) used a sample of BHP and Western Mining Corporation options traded between May and October 1977 (in the second year of operation of the AOM), and concluded that the model tended to overprice options in 1977, which was consistent with Brown (1978).

Brown and Shevlin (1983a) tested the model using trade data on options written on BHP, CSR, Western Mining Corporation, and Woodside Petroleum stock for the period February 1976 to December 1980 (the first five years of operation of the AOM). Brown and Shevlin used the MacBeth and Merville (1979) methodology. Their test involved calculating the theoretical option price according to the model, and then comparing it to the actual price at which options were traded. Brown and Shevlin documented that their results were sensitive to the different methods employed for estimating the standard deviation of returns on the underlying stock. They used a historical measure (based on historical stock values) and an implied standard deviation (based on past option prices). Their results generally suggest the model tends to underprice options when a historical measure of the standard deviation is used (except for 1977), and an overpricing when an implied standard deviation was used. Brown and Shevlin stated that their results "suggest that the market is using a lower estimate of volatility then used in the model [in their study]" [p. 10].

There are a number of justifications for the present study. Firstly, owing to the early stage of development of the Australian Options Market at the time of the above studies[2], they only examined options written on a small number of different stocks in testing the model. This effectively limited their studies to time series tests, that is, a test of the options model on stocks written on very few different shares over time. The current test is more cross-sectional in nature, which is made possible by the increase in the number of options written on different shares.

The infrequency of options trading at the time of the data collection for the Australian tests also limited their findings owing to the potential for non-synchronous trading between stocks and options [Brown, 1978, p. 21; Brown and Shevlin, 1983a, p. 6]. The growth in options trading in Australia [3] suggests tests using current data will not be as limited with respect to this problem, and suggests more tests using current data are in order.

Thirdly, a number of arbitrary adjustments to and weightings of the historical and implied standard deviations of the returns on stocks, are carried out in all studies of the model. The 'matched pairs' research design adopted in the current study does not rely on such adjustments.

Fourthly, the only study which effectively deals with the possibility of early exercise owing to dividends implying the Black Scholes model may not correctly price the American type calls traded in Australia is Brown and Shevlin (1983a). Brown and Shevlin overcame this problem by using Blacks' (1975) adjustment to the model. The problem with any adjustments for dividends are highlighted by Geske and Roll (1984, who attributed option mispricing anomalies to the 'improper treatment of dividends' by the different approximation methods available [p. 445]. In order to abstract from this problem and the potential for mis-pricing due to such 'ad-hoc' [Geske and Roll, 1984, p. 444] adjustments for dividends, call options sampled are shorter maturity

2 This point is exemplified by the fact that currently options are written on the stocks of 27 different corporations, whilst in 1976 when the AOM was first established, options were only written on the stocks of 3 companies.

3 The growth in trading is exemplified by the fact that the number of options traded on the AOM in June 1976 was 12,897 [Sydney Stock Exchange Annual Report 1976] and in June 1980 48,814 [Sydney Stock Exchange Annual Report, 1980], whilst in June 1989 846,399 such contracts were traded [Australian Stock Exchange Annual Report 1989].

options whose lives are less likely to include dividend payments. A further stricter control employed to avoid the need for adjustments and their associated biases, was to simply exclude from the sample those options which were expected to pay dividends over the life of options sampled.

Finally, Brown (1978) suggested that "a process of market learning" [p. 27] may have taken place during the periods in which the option model was tested. Since it has been 10 years since the last test took place, which is ample time for a learning process to have progressed, then a test using recent data which would likely abstract from this effect is appropriate. Further this paper attempts to determine whether such a learning effect has taken place within the Australian Options Market by determining whether the mispricing of Australian options (in a Black Scholes sense) has decreased over time.

3. METHOD

3.1 Testing Procedure

The basic nature of the methodology used to test the Black Scholes option pricing model follows Rubinstein (1985) with a number of methodological improvements. The methodology involves a pairwise matching of options which differ only with respect to exercise prices. Theoretically, if the Black Scholes model is correctly pricing calls, and the options market is efficient, then market participants would be using the same standard deviation to price these calls. This proposition can be tested by comparing the implied standard deviation[4] on a matched pair of calls. If there is a discrepancy in the implied standard deviation of matched pairs, then according to Rubenstein [1985, p. 457] this is evidence that either:

(1) The options market is inefficient, or

(2) The mathematical structure of the Black-Scholes Formula is

[4] see Latane and Rendleman (1976), who appear to have first suggested the technique, for an explanation of this procedure.

incorrect

Although Rubenstein matches pairs and allows firstly the exercise price to vary between matched pairs, and then the time to maturity to vary, only the exercise price will be allowed to vary in the present study. This is because the implied standard deviation of options of different maturities should not necessarily be the same for two reasons. Firstly, for options of different time to maturity, if the standard deviation is changing, then different standard deviation values would be used in pricing [Cox & Rubenstein, (1985), p. 278]. Secondly, proxies of the risk free interest rate for options of different maturities may have slightly different risk characteristics which, if used in the Black-Scholes formula, could bias results in a systematic way.

3.2 Measurement of Variables

Brown (1978) used a variety of measures for the risk free interest rate which, if used in the present study may introduce a systematic bias as noted above. The publicly available interest rates used by Brown are the 13 week and 26 week Treasury Note yields [Reserve Bank of Australia, Monthly Statistical Bulletin, Sydney]. Obviously, use of the 26 week Treasury Note yields would have implied using options with over 6 months to maturity. Since most Australian companies pay dividends bi-annually, then the time to expiry of such options would inevitably have included an ex-dividend date implying the increased possibility of early exercise and the innappropriateness of the classic Black-Scholes model. For the previous reasons discussed, rather than modifying the model, it was decided to focus on options with approximately 13 weeks to maturity, and solely use the 13 week Treasury Note yield.

Data on exercise prices, stock prices and option prices were extracted from the *Australian Financial Review*. In order to limit the possibility of non-synchronicity between call and stock prices the control used by Brown and Shevlin (1983a) was adopted. The control involves only recording option data for a particular day for inclusion in the sample if the following conditions are fulfilled:

(1) an option trade actually occurred (as evidenced by non-zero entries in the 'volume traded column' and in the daily high/low columns),

(2) the 'last sale' option price was within the closing bid/ask spread for that option

The time to maturity was measured by using information provided by the Options Clearing House. The possibility of early exercise through the ex-dividend date falling within the time to maturity of options was reduced by only using options with 13 weeks to maturity, and was further controlled for by eliminating such options from the sample.

In order to eliminate options written on stocks which go ex-dividend, the ex-dividend date was estimated as a naive extrapolation from the previous year. Thus, 1990 ex-dividend dates were estimated to be perceived by the market to be the same as the 1989 ex-dividend dates. Such an estimation procedure can be justified on three grounds. Firstly, for purely pragmatic reasons, as at the time of the tests a readily available and comprehensive source of actual ex-dividend dates was not yet available. Secondly, the use of actual 1990 ex-dividend dates would assume perfect foresight, which in turn would have implied the use of information in tests which would not have been available to the market at the time of trading. Finally, it would seem that such an estimation method is not unreasonable, as almost 80% of corporations whose options were included in the sample has ex-dividend dates occurring in the same months in 1988 and 1989.

3.3 Matching Procedure

For any company there are a number of options with different exercise prices which have 13 weeks to maturity. It has been suggested that the extent to which an option is 'in-the-money' may dictate its implied standard deviation [Latane and Rendleman, 1976]. Thus, in order to achieve as tight a match as possible, any potential matching candidate was matched with an option with as near an exercise price as possible, and was then removed from the pool of matchable observations. Thus, any option could only appear once as a matched pair in the sample tested.

A further matching technique was designed to abstract from any problem caused by empirical evidence suggesting systematically different market pricing occurs for in-the-money and out-of-the-money options [MacBeth and Merville, 1979; Brown and Shevlin, 1983]. The control simply involved avoiding the match of an in-the-money call with an out-of-the-money call.

3.5 Statistical Tests

The primary reason nonparametric tests were relied upon was because it is extremely complex to ascertain the nature of the distribution of observations (the implied standard deviations) owing to the indirect nature by which they were derived. Thus, because nonparametric tests are "distribution free" [Siegel et.al., 1988, p. 3], or make no assumptions about the nature of the distribution from which the data is drawn, they were considered more appropriate.

If the Black Scholes formula is being used efficiently to price options, then it is expected that the standard deviation implied by options written on a particular companys' stock is equal. Specifically, stated as a formal hypothesis in null form:

H_{o1} *: There is no significant difference between the implied standard deviation on options with lower exercise prices and options with higher exercise prices written on the same stock.*

Since the observations are in the nature of matched pairs, and the magnitude as well as the direction of the difference between pairs can be ascertained, then the Wilcoxon Signed Ranks Test is the appropriate statistical test to apply [Siegel et.al., 1988, p. 87].

Although the Matched Pairs Signed Ranks Test will ascertain whether overall there is no systematic difference in the implied standard deviation of one particular group of options, it will not detect a reversal over time in the systematic difference of implied standard deviations, which in turn implies the formula is systematically biased over time. Since both Rubenstein (1985) and Brown (1978) both detected systematic time series changes in the degree of overpricing/underpricing by the model, it becomes necessary to test whether there has indeed been a systematic change in the difference between implied standard deviations over the observation period. Specifically, the null hypothesis to be tested is:

H_{o2} : *The time series positive and negative differences between implied standard deviations of lower and higher exercise price options occur in a random order,*

against the alternative hypothesis:

H_{a2}: *The differences between the implied standard deviations of lower and higher exercise price options are firstly predominantly in one direction and then predominantly in another direction over time.*

Since the above hypotheses are concerned with the randomness of a single sequence of observations, then, the One-Sample Runs test is the appropriate test to apply [Siegel et. al., 1988, p. 58]. Further, since we are concerned with a single reversal in the time series of differences, then a one tailed test is implied. That is, fewer runs are expected than if the data were drawn from a random sample.

3.6 Time Series Analysis

The previous section outlines tests on a cross section of data in that all observations are drawn from one particular year. A time series analysis of mispricing differences will also be carried out in order to ascertain whether any biases in pricing (or mispricing) changes over time. In order to do this, the time series behaviour of an average percentage mispricing error (ME%) for each company sampled will be calculated as follows:

$$ME\% = [(P_m - P_t)/P_m]$$

where

P_m = the market price of the option with the lower exercise price from a matched pair of options,

P_t = the theoretical price of the lower exercise price option in a matched pair using the ISD calculated from data on the higher exercise price option in a matched pair.

For each year, theme% was averaged across companies, and this average mispricing error for any year was then graphed in order to determine whether it exhibits a systematic pattern over time.

4 DATA

The study was based on trade data reported in the *Australian Financial Review* for the latest complete calendar year of trading, being the period January 1990 to December 1990. As a result, options with expiration dates from April 1990 to March 1991 were included in the sample.

The yield on 13 week treasury notes reported in the Reserve Bank Bulletin are based on the "last trade for the month" [Reserve Bank of Australia, Monthly Bulletin]. Thus the yields available are for a 3 month period commencing and ending at month end. So that the options considered had a life synchronous with the interest rate data, only options data reported at month end were used.

For the cross sectional tests the total number of 13 week option data sets reported at month end for the year January 1990 to December 1990 were approximately 4000. This data formed the initial pool of data for matching (implying a maximum of 2000 matched pairs could result). The application of the matching procedure together with

TABLE 1 - A DESCRIPTION OF THE OPTIONS INCLUDED IN THE FINAL CROSS SECTIONAL SAMPLE		
Expiry Date of Option	**No of Matched Pairs**	**Companies on which Option written**
April 1990	3	BHP, Goldman, NAB
June 1990	1	CSR
July 1990	2	Elders, MIM
August 1990	3	Amcor, Fletcher Chall, News Corp
September 1990	1	Westpac
October 1990	4	BHP (Gold), BHP, Elders, NAB
November 1990	2	Santos, TNT
December 1990	1	Westpac
January 1990	2	BHP(Gold), MIM
February 1990	2	Boral, TNT
March 1991	3	BTR, CRA, CSR
TOTAL	24	

controls designed to reduce non-synchronicity resulted in a sample of 68 matched pairs of observations, of which 52 related to out-of-the-money and 16 to in-the-money options. The application of the control designed to exclude options written on stocks paying dividends further resulted in the loss of 39 observations, leaving a total of 29 matched pairs consisting of 24 out-of-the-money options and 5 in-the-money options.

The implied standard deviation was calculated for the total of 48 observations comprising the 24 matched pairs. Since there is no analytical solution for the standard deviation in the Black Scholes model, a program using an iterative trial-error procedure was used, where a solution was deemed to have been found if the ISD used produced an error of less than 0.00001 in the option price. An implied standard deviation cannot be found for an option when its traded option price is not within the upper or lower limits of the model price [see Brown, 1978, p. 23]. Two matched pairs were lost owing to non-availability of ISD's, leaving a total of 28 matched pairs available for testing, of which 24 were out-of-the-money options and 3 were in the money. The small sample size of in-the-money options precluded the application of statistical tests. Tests were only applied to out-of-the-money options which limited the external validity of conclusions. Details of options which were subject to empirical tests are reported in Table 1. The table does not readily reveal any biases in the sample, as it appears options data included in the final sample is spread across companies and fairly evenly over the sample period.

In collecting the time series sample of observations, only options written on the 5 stocks which were initially traded on the Australian Options Market in 1976 were used. These were options written on BHP, Bougainville Copper, CSR, Woodside Petroleum and WMC.

For each of these types of options only 3 month options whose life to expiry did not contain an ex-dividend date were included in the sample. This greatly limited the potential dates from which a sample could be compiled. For each stock an attempt was made to find an observation for each year *on a consistent date* given the above exclusion criteria, and the other controls outlined in the measurement of variables section. Thus, observations were sought on the *same date* in every year in order to avoid any potential time series mispricing biases. Unfortunately, the strict nature of controls implied that for some years, no observations were available for a particular option. A description of the final time series sample used is reproduced in Table 2 below.

TABLE 2 - A DESCRIPTION OF THE OPTIONS INCLUDED IN THE FINAL TIME SERIES SAMPLE					
Year	**Number of Observations in each Year**				
Option	**BHP**	**Bougain. Copper**	**CSR**	**WMC**	**Woodside Petroleum**
1976	2	0	0	1	1
1977	1	1	0	0	2
1978	2	0	1	1	1
1979	1	1	1	1	1
1980	1	1	0	2	0
1981	1	0	1	0	2
1982	3	1	1	1	1
1983	1	2	1	1	1
1984	1	0	0	1	1
1985	2	0	1	1	0
1986	1	1	1	1	0
1987	1	0	0	1	0
1988	1	0	0	1	0
1989	1	0	1	1	0
1990	1	0	0	0	1
TOTALS	20	7	8	13	11

5 RESULTS

5.1 Test of H_{o1}

In order to test H_{o1}, that is, whether the implied standard deviations of the matched pairs of options were significantly different, the Large Sample Wilcoxon Matched Pairs Signed Ranks test was appropriate owing to the large sample size of 24 [Siegel et.al.,1988, p. 91]. Since the region of rejection is not predicted, the region of rejection is two tailed. The test statistic *z* is -0.7714. The two tailed probability associated with the occurrence of a *z* value as extreme as that observed when the H_{o1} is true is 0.44. Thus the null cannot be rejected for conventional levels of significance, and we conclude that there is insufficient evidence to reject the model based on this test.

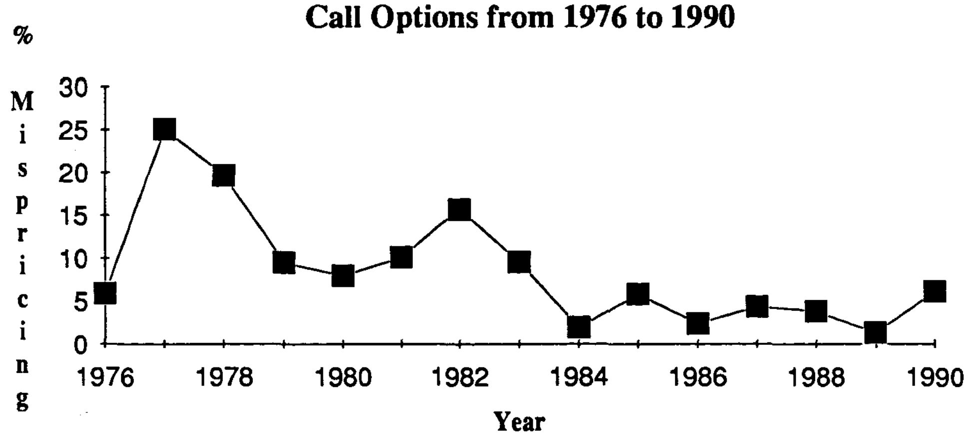
5.2 Test of H_{o2}

In order to test H_{o2}, that is, whether the implied standard deviation of options with lower exercise prices are initially greater (or smaller) than those with higher exercise prices, and become smaller (or larger) than options with higher exercise prices over time the Single Sample Runs Test of randomness was applied. The test statistics are m = 11, n = 13 and r = 14, where m and n are the number of positive and negative observations (differences in implied standard deviations) respectively, and r is the total number of runs. Since m and n are both less than 20, a Small Samples Runs test is appropriate [Siegel, 1988, p. 59]. Since the alternative hypothesis states that the number of runs should be fewer than expected in a random sample, then a one tailed test is implied. For m = 11 and n = 13 , the critical or maximum of those values of r which are so small that the probability associated with their occurrence under H_{o2} is 0.025 or less is 7. Since the observed r is 14, then the null cannot be rejected at the 0.025 level of significance, as it is greater than the critical value of 7. This suggests that the differences in ISD's occur randomly over time. Thus it can be concluded that there is insufficient evidence to support the existence of a pricing bias which reverses over time for the lower exercise price options as compared to the higher exercise price options.

5.3 Time Series Test

Diagram 1 below portrays the AME% for the time series sample of options. The diagram suggests a trend of convergence between the theoretical option price and the market option price. Thus, there appears to be some evidence of a learning effect, which may offer a means of reconciling the findings of the current study with earlier findings. However, the results need to be interpreted cautiously, as the strict controls used reduced the sample for some years to 2 (refer to Table 2). This prevented the application of further statistical tests.

Diagram 1 - Average Mispricing Error for BHP, Bougainville, CSR, Woodside Petroleum and WMC Call Options from 1976 to 1990



6 FURTHER CROSS SECTIONAL TESTS FOR EXERCISE PRICE AND VARIANCE BIASES

Geske and Roll (1984) reviewed a number of biases associated with the Black Scholes option pricing model. These biases include "Striking Price Biases", the "Time to

Expiration Bias" and "Variance Biases". The existence of striking price biases and variance biases may be tested using the current sample, however, the time to expiration bias cannot as all options considered are of equal lives : 13 weeks. The existence of such relationships are evidence that the Black Scholes model is systematically biased in pricing, and would not have been revealed in the tests of hypotheses 1 and 2.

The striking price bias implies that the Black-Scholes model underprices out-of-the-money options and overprices in-the-money options [Geske and Roll, 1984, p. 445,]. An extended interpretation of this bias for out-of-the-money options, is that the bias implies the further out-of-the-money an option, the greater the level of underpricing. Thus, this interpretation of the bias implies a relationship exists between the extent to which an option is out-of-the-money and the level of mispricing which occurs. Stated as a formal hypothesis in the null form:

H_{O3} *: There is no significant relationship between the extent to which an option is out-of-the-money and the extent of mispricing by the model.*

Although the extent to which an option is out-of-the-money can be measured following Rubenstein (1985), as the ratio of exercise price to the underlying stock price of a particular option, the level of mispricing of an option presents difficulties. For a matched pair of options, if it is assumed that the option with the higher exercise price is correctly priced, then a standardised measure of the `relative mispricing error' (RME) for the lower exercise price option is the difference between the two options implied standard deviations divided by the implied standard deviation of the option with the lower exercise price. Thus, a test of hypothesis 3 can proceed by determining whether there is a significant correlation between the RME and the ratio of exercise price to stock price for the sample of matched pairs.

Variance biases imply that the model underprices call options on low variance stocks and overprices call options on high variance stocks [Geske and Roll, 1984, p. 453]. Stated formally as a null hypothesis:

H_{O4} *: There is no significant relationship between the standard deviation of a stock on which an option is written and the level of mispricing.*

Again, the level of mispricing can be measured using the RME, whilst the implied standard deviation of an option can be used as a measure of the variance of a stock on which an option is written. Thus, this bias can also be tested by determining whether there is a significant degree of correlation between the RME and the implied standard deviation of an options underlying stock.

A convenient and appropriate test of the above null hypotheses can be carried out by calculating a Spearmans Rank Order Correlation Coefficient and in turn testing its significance [Siegel, 1988, p. 235-245].

6.1 Test of H_{o3}

The Spearman Rank-Order Correlation Coefficient r_s was used in order to determine the degree of correlation between the extent to which the options in the sample were out-of-the-money and the extent of mispricing by the model (RME). Since the direction of correlation is implied by previous research on the exercise price bias, then the test of significance is one tailed. The observed correlation coefficient is r_S = -0.219. Since the sample size is 24, the small sample test of significance of this correlation coefficient is appropriate [Siegel,1988, P,242].

For a value of r_S = -0.219, the null, H_{o3} cannot be rejected for conventional levels of significance. And thus it can be concluded that there is insufficient evidence to indicate a statistically significant relationship exists between the extent to which the sample of options are out-of-the-money and the extent of mispricing by the model.

6.2 Test of H_{o4}

The degree of correlation between the extent of mispricing by the model (RME) and the implied standard deviation of options in the sample was also calculated using Spearmans Rank-Order correlation coefficient. The observed correlation coefficient was only $r_s = 0.105$. Again a small sample test of the significance of the coefficient is appropriate. The null, H_{o4}, for a value as large as $r_s = 0.105$ cannot be rejected for conventional levels of significance. Thus, we conclude that there is insufficient evidence to indicate the existence of a variance bias.

7 DISCUSSION OF FINDINGS

Tests were applied to 1990 Australian call option data that was carefully screened and strict controls applied in order to ensure the assumptions of the Black-Scholes model were likely to have been satisfied. The tests did not allow rejection of the model unlike earlier Australian studies. Further, the time series analysis of mispricing suggests that the discrepancy between the theoretical and traded option price has decreased over time since 1976. A number of implications stem from these findings. Firstly, the model can be currently used to effectively price options in Australia. An alternative interpretation of the findings is that the Australian Options Market currently prices options efficiently in a Black-Scholes sense.

Secondly, owing to the nature of the tests, the implied standard deviation of the underlying stock of an option can be used to price another option which satisfies the matching criteria and controls used in this study without the need for any ad-hoc adjustments.

The reasons for the discrepancy between the earlier studies and the current studies can be attributed to the factors which motivated the study. That is, that data and research design problems relevant to nonsynchronous option/share prices, and problems associated with historical measures of volatility as well as the ad-hoc adjustments for dividends used in earlier research may explain the differing conclusions. Further, a 'learning effect' may have set in the market, or widespread use of the formula may have caused it to become self prophecising.

8 CONCLUSIONS

The tests indicate, unlike previous studies, that there was insufficient evidence of mispricing or systematic biases in the pricing of options in Australia relative to the Black-Scholes model. This discrepancy was demonstrated to result from a possible learning effect causing the incidence of market mispricing of options (in a Black Scholes sense) to decrease since 1976. Thus the Australian Options Market is currently efficiently pricing options in a Black-Scholes sense. Alternately, the Black-Scholes model can be currently used to effectively price options in Australia.

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