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THE RELATIONSHIP BETWEEN PHILIPPINE INTEREST RATES AND STOCK PRICE MOVEMENTS

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For fund managers who are allowed asset-allocation choices between stocks and bonds, the relationship between these two assets is a matter of great concern. Since the interest rate is sometimes used as a key decision variable — and in a few cases as the sole decision variable — in the decision to shift between bonds and equities, the present study uses a bivariate approach in its analysis.

Using the Box-Jenkins technique, the study found no significant relationship between 91-day interest rates and the Composite and Sectoral indices of the Makati Stock Exchange using data from January 1987 up to August 1993..

1. Introduction

The relationship between the movements of interest rates and stock prices has been the subject of much speculation and empirical investigation. The relationship between the two is of interest not only to economic theorists but also to investors who have to grapple with issues regarding asset allocation and market timing (i.e. switching from stocks to bonds and vice versa). This paper will seek to determine the relationship between Philippine interest rates and stock market returns.

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Data on the stock market were provided by Financial Access and data on interest rates were provided by Union Bank.

2. Review of Literature

A Keynesian view of the relationship between interest rates and stock prices was proposed by Gordon (1990) who speculated that an increase in the money supply will encourage people to transfer the excess money into savings accounts and the stock market, thus simultaneously raising the price of stocks and reducing the interest rate.

Another viewpoint regarding the relationship between interest rates and stock prices stems from the Life-Cycle Hypothesis of Franco Modigliani which suggests that consumption spending, which is conducted smoothly over a consumer's lifetime, depends not only on the disposable income but also on assets such as stocks. Using this analytical framework, Bosworth (1986) found empirical evidence supporting the view of an inverse relationship between stock prices and the savings rate. The savings rate would itself have an inverse relationship with interest rates. Using this particular framework, it can therefore be said that a decline in stock prices would lead to an increase in the savings rate and this would in turn lead to a decline in the interest rate. The Life Cycle Hypothesis would therefore suggest parallel movements between stock prices and interest rates.

James Tobin and Milton Friedman developed models which showed that the demand for money can be seen in terms of a portfolio wherein money is one among several assets including bonds, stocks and goods. Since M1 is viewed as a substitute within the portfolio for both bonds and stocks, an excessive increase in M1 will be used to purchase stocks, thus leading to an increase in stock prices.

A monetarist view of the relationship between interest rates and stock prices has been implied in the studies of Sprinkel (1971) whose work dealt primarily with money supply and stock prices. Monetarists contend that a contraction in money supply would tend to increase interest rates while an expansion of the money supply would tend to decrease the interest rates. His study on US data indicated that from 1918 to 1968, nine out of 12 substantial market declines were preceded by a period of monetary contraction, with money supply changes leading stock market advances by an average of two to three months and stock market declines by an average of nine months.

A study applying the monetarist model of Sprinkel was conducted by Zamora (1983) on the Philippine financial and capital markets of the 1970s. The results of her study indicated that money supply variations explained 48.68 percent of the variation in the Commercial/Industrial index. However, the relationship between the money supply and the mining and oil issues was not as clear.

Cohen, Zindbarg and Zeikel have noted that certain forms of stocks (such as utilities, construction and building materials, savings and loans, telephones and banks) are interest-sensitive. They speculate that as the inflationary pressures arise from an over-heating economy, the monetary authorities reduce the money supply and hence raise the interest rates. The rise in the interest rates would tend to dampen the consumption of cars, houses, construction materials, appliances and other types of merchandise. Furthermore, they reason that an increase in the interest rates would increase the costs of financing and therefore reduce the earnings of corporations thus leading to a decline in their stock prices.

As evidence, Cohen, Zindbarg and Zeikel cite the fact that since the mid-sixties, US stock prices have increased a few months after both short-term and long-term US interest rates had peaked. They reason that investors who are interested in income would shift from stocks into bonds as the interest yields increase. Moreover, the investors who are after capital gains would shift from stocks to bonds when an economic recession begins to appear.

A similar view of such a relationship is observed by Philips and Ritchie (1983) who claim that debt and equity securities are competing forms of investment. They note that bonds become more attractive as investments as their yields rise relative to stock dividend yields.

The importance of the interest rate is even directly imputed in the stock valuation models used by financial experts. For instance, consider the basic stock valuation model which discounts the future dividends of a stock. The basic valuation model can be written as:

$$P_o = \frac{d_1}{(1+k)} + \frac{d_2}{(1+k)^2} + \ldots \frac{d_n}{(1+k)^n}$$

where:

P_o	:	the present worth of the stock
$d_1, d_2 \ldots d_n$	:	the expected annual dividend stream
k	:	the appropriate discount rate

It is thus evident from the equation that, *ceteris paribus*, a higher interest rate would decrease the present value of the stock while a lower interest rate would increase the present value of the stock. Hence, the investors who use such stock valuation models will therefore be imputing a reverse relationship between interest rates and stock prices.

Studies analyzing the empirical evidence regarding the relationship between interest rates and stock prices have shown mixed results. Bernstein (1975) analyzed US data from 1965 to 1974 which showed a coefficient of correlation between the two of -0.85. Therefore, the study implied that the behavior of short-term interest rates "explained" almost 73 percent of the counter-cyclical variation in US stock market returns. The study also indicated that a 1 percent change in short-term interest rates was associated with a change of nearly 10 percent in the opposite movement of stocks.

Titman and Warga (1989) conducted a study which indicated a positive relationship between US stock returns and US interest rate changes during the November 1979 to October 1982 period. They reason that due to the federal economic policy of that time, the interest rate changes were more sensitive to changes in the industrial output. Therefore, an increase in output would lead to an increase in the interest rate and since stock returns tend to lead output, an increase in stock prices would also lead to an increase in the interest rates.

However, Campbell and Ammer (1993) found a very low correlation between stocks and bond returns using data from 1957 to 1987.

Colby and Myers (1988) analyzed the behavior of US interest rates and US stocks from 1944 to 1986. Instead of using the usual statistical analysis concerning these two variables, they formulated trading decision rules based on the premise of an inverse relationship between interest rates and stock prices. The trading rule was to buy and hold stocks when the Federal Reserve discount rate was falling and to sell and sell short stocks when the Federal Reserve discount rate was rising. The test showed profitable results based on this trading rule. They also discovered that the trading rule can be optimized by applying threshold level filter rules in order to reduce the volatility. The optimized results showed significant improvements in the profitability of the decision rules. However, Colby and Myers noted that the rules were more useful for the periods of higher interest rates and therefore this revealed factors about the valid range of the interest rate variables.

A similar decision rule was devised by a stock market analyst named Edson Gould (1968). Gould's decision rule was that an increase by the US Federal Reserve of any one of three things (the discount rate, the margin requirement or the reserve requirement) three times in a row would lead to a decline in the prices of stocks. Gould's investment principle became known as "Three Steps and a Stumble". This rule was tested by Norman Fosback using data from 1914 to 1983 and all the 12 signals given by the trading rule were followed by average declines of 30 percent with highly variable lead times.

Fosback himself created a similar rule which states that a decrease by the Federal Reserve of any of three things (the discount rate, the margin requirement or the reserve requirement) two times in a row will increase stock prices. He tested this rule on data from 1914 to 1918 and "buy" signals were generated 17 times. The decision rule was wrong only once and in 16 out of the 17 signals, stocks increased by an average of 30.5 percent after one year.

3. Methodology

3.1. Research Design

This study will conduct a correlation analysis between interest rates as represented by 91-day treasury bill rates and the stock prices as represented by a) the composite index b) the commercial/

industrial sector index, c) the mining sector index and d) the oil sector index. A cross-correlation analysis will also be performed in order to determine the existence of time-lag correlations. The usual guideline is to conduct cross-correlation analysis on lag periods equal to one-fourth of the total number of observations. Since there are 80 observations in the data, the cross-correlation analysis will be performed from $t = 0$ to $t = -20$.

3.2. Sample

The actual auction rate results of the 91-day Treasury Bill at the end of every month from January 1987 to August 1993 will be used to represent the level of the short-term interest rate. This particular bond was chosen since it was considered to be the best indicator of a short-term interest-bearing security that an investor can place his funds in. The 30-day Treasury Bill rate is not always available for investors and will lead to problems of "missing observations" in the time series.

The stock prices are to be represented by the composite and sectoral indices of the Makati Stock Exchange since these are traditionally assumed to be accurate surrogates of the stocks that they represent. The values of these indices at the end of every month from January 1987 to August 1993 will be analyzed.

3.3. Scope and Limitations of the Study

The orthodox procedure of using the composite and/or sectoral indices as surrogates of stock prices in the current study is dictated by the need to facilitate comparison with previous studies made in this area. However, it is recognized that the indices have undergone substantial changes over time in terms of both structure (i.e. the formula used to derive the value of the index) and composition (i.e. the choice of the particular issues that are used). This may present a problem regarding the consistency of the time series to be analyzed since statistically, every change in the structure and/or composition of the index concerned actually creates a different index and therefore what may seem to be a long-term series of the index may just be a set of statistically different indices spliced together. Despite the shortcomings mentioned here, the current study has no choice but to use the currently accepted indices until more statistically consistent indices are devised and tested.

Furthermore, a study of this type would have more meaningful results if the specific industries (such as banking and construction as opposed to broad sector classifications such as "Commercial/ Industrial") are analyzed in order to determine which particular types of firms are interest-sensitive. Unfortunately, the local stock markets offer only a limited array of publicly-listed firms and only a small portion of these are actively traded. For instance, there are more than ten banks whose shares are traded in the market but only three of these are actively-traded (i.e. traded at least once a month). Of the three actively-traded bank stocks, PNB was offered to the public only in the second half of 1989 while Union Bank and Citytrust were offered only during the second half of 1992. There is, therefore, a significant limitation regarding the data for such industry-specific relationships in terms of both sample size and historical basis. Likewise, very few construction companies are publicly-listed and most of these are not actively-traded. The only actively-traded shares in the construction industry belong to Engineering Equipment Incorporated. However, the impact of interest-rate movements on the construction industry is not reflected in the movement of this company's share prices since the bulk of this firm's revenues comes from foreign projects.

4. Procedure

The interest rates as represented by 91-day Treasury Bill rates of the end of the month from January 1987 up to August 1993 are correlated with the stock index values at the end of every month for the same period. Cross-correlations for 20 lag periods are performed in order to determine if there are any lag periods in the relationship between the interest rates and stock prices.

Stock prices are to be represented by a) the Composite index in order to measure the general market behavior, and the three sectoral indices of b) Commercial/Industrial, c) Mining and d) Oil representing their own particular industries. The closing values of these four indices at the end of every month from January 1987 up to August 1993 will be used in the analysis.

Using the Box-Jenkins approach, all of the five series (91-day interest rates, Composite index, Commercial/Industrial index, Mining index and the Oil index) are analyzed through the Autoregressive Integrated Moving Average (ARIMA) procedure. The ARIMA

procedure requires the series to be stationary and if it does not turn out to be stationary, then a differencing of 1 period is to be performed. The autocorrelation values are then to be analyzed.

The interest rate variables are then to be subjected to cross-correlation analysis at different lag periods with the four stock indices. A lag period of 25 percent of the total time series will be analyzed. Since there are approximately 80 observations, cross-correlation analysis from $t = 0$ up to $t = -20$ will be performed.

5. Results

The autocorrelation analysis showed that all of the five variables exhibited random walks, thus implying that their past values cannot predict the future values. The results showing the random walk behavior of stock prices is not surprising and actually validates the results of earlier studies in Philippine stock conducted by Zamora (1985), Azurin (1979) and Gregorio and Saldaña (1990).

However, the results are more puzzling in the case of interest rates. Interest rates are known to be controlled or at least highly influenced by the Central Bank. The results showing a random walk behavior of the interest rates would therefore imply that the monetary authorities are not following a Constant Growth Rate Rule for the money supply as recommended by monetarists such as Milton Friedman. Nor do they seem to influence the interest rates in a deliberate way over long periods. Instead, the auto-correlation results suggest that the local monetary authorities simply react to economic events which occur in a random manner. An alternative explanation is that the monetary authorities react in a random manner to economic conditions which may behave in a definite trend. A third explanation is that the monetary authorities react in random manner to economic events which themselves behave in a random manner.

91-Day Treasury Bill Rates

Autocorrelation Check for White Noise

Lag	Autocorrelations	Probability for Periods
1	0.091	
2	-0.099	
3	-0.051	
4	-0.110	
5	-0.060	
6	0.018	1 - 6 = .797
7	0.068	
8	-0.120	
9	-0.022	
10	0.086	
11	0.139	
12	0.297	7 - 12 = .202
13	0.007	
14	-0.022	
15	-0.044	
16	0.103	
17	0.020	
18	-0.025	13 - 18 = .509
19	-0.176	
20	-0.077	
21	-0.096	
22	0.039	
23	0.129	
24	0.144	19 - 24 = .321

Composite

Autocorrelation Check for White Noise

Lag	Autocorrelations	Probability for Periods
1	.194	
2	-.202	
3	-.092	
4	-.033	
5	-.004	
6	-.116	1 - 6 = .207
7	-.039	
8	.051	
9	-0.037	
10	-0.070	
11	0.000	
12	0.019	7 - 12 = .665
13	-0.096	
14	-0.096	
15	-0.086	
16	0.059	
17	-0.070	
18	0.062	13 - 18 = .785
19	0.013	
20	-0.146	
21	-0.146	
22	0.015	
23	0.096	
24	0.044	19 - 24 = .851

Commercial/Industrial

Autocorrelation Check for White Noise

Lag	Autocorrelations	Probability for Periods
1	.214	
2	-.119	
3	.011	
4	-.007	
5	-.044	
6	-.247	1 - 6 = .107
7	-.053	
8	.072	
9	-0.070	
10	-0.059	
11	-0.041	
12	-0.094	7 - 12 = .373
13	-0.140	
14	-0.015	
15	.163	
16	.059	
17	-.087	
18	.101	13 - 18 = .340
19	.026	
20	-.170	
21	-.0870	
22	-.038	
23	.082	
24	-.046	19 - 24 = .409

Oil

Autocorrelation Check for White Noise

Lag	Autocorrelations	Probability for Periods
1	.108	
2	-0.215	
3	-0.130	
4	-0.054	
5	-0.019	
6	.025	1 - 6 = .365
7	.028	
8	-0.022	
9	.0016	
10	-0.080	
11	-0.108	
12	0.016	7 - 12 = .753
13	.008	
14	-0.033	
15	-0.099	
16	-0.077	
17	0.097	
18	0.060	13 - 18 = .874
19	.045	
20	-0.073	
21	0.070	
22	.142	
23	0.080	
24	.021	19 - 24 = .894

As far as the cross-correlation results are concerned, there seems to be largely no relationship whatsoever — either positive or negative — between interest rates and stock prices. The tests were conducted at the .05 level of significance. The only exception is for the six-month lag between the 91-day treasury bill rates and the Commercial/Industrial index. Normally, a significant correlation period for a particular lag period would have similar correlation periods in the adjoining lag periods. However, it is quite possible that the correlation value of 0.33096 at t = -6 is just due to chance since the adjacent lag periods do not exhibit significant correlation results.

If, indeed there is no significant positive or negative relationship between interest rates and stock prices from t = 0 up to t = -20, then it is rather difficult to speculate regarding the probable reasons for such a pattern. It must be noted that the lack of clear negative or positive relationships between interest rates and stock prices is not due to the random walk behavior of these variables as revealed by the ARIMA autocorrelation tests. The fact that these variables move in random walks merely indicate that their historical behavior cannot be used to predict future behavior. Nevertheless, pro-cyclical or counter-cyclical movements between them are still possible.

A positive relationship between interest rates and stock prices could at least be explained by the Life Cycle Hypothesis of Franco Modigliani. Such positive relationships were indeed verified in a study on US stocks by Titman and Warga (1989).

A negative relationship between the interest rates would, in fact, be easier to explain in terms of the stock valuation model, the Monetarist explanations by Sprinkel (1971), the portfolio models of Tobin and Friedman and by the asset allocation approaches of investment analysts who suggest that investors would shift their funds to assets which yield the highest potential returns.

Cross Correlation of 91-Day Treasury Bill Rates and Composite Index

Lag	Correlation
0	-0.20277
1	-0.12806
3	0.00646
4	-0.17330
5	0.0843
6	0.26390
7	0.00117
8	-0.00984
9	0.08633
10	0.08633
11	0.01996
12	-0.019659
13	-0.13430
14	0.11840
15	0.00181
16	0.03805
17	0.14317
18	0.14317
19	-0.11496
20	-0.0885199

Cross Correlation of 91-Day Treasury Bill Rates and Commercial/Industrial Index

Lag	Correlation
0	-0.19151
1	-0.08604
2	-0.12227
3	-0.02165
4	-0.20592
5	0.03802
6	0.33096
7	0.0795
8	-0.01309
9	0.03796
10	0.06679
11	-0.03809
12	-0.18218
13	-0.03255
14	0.14277
15	-0.01787
16	0.03655
17	0.14305
18	0.07544
19	-0.07347
20	-0.09548

Cross Correlation of 91-Day Treasury Bill Rates and Mining Index

Lag	Correlation
0	-0.06249
1	-0.09940
2	-0.00446
3	-0.02174
4	-0.11722
5	0.13197
6	0.11060
7	-0.01968
8	-0.04600
9	0.09288
10	0.0244
11	0.14218
12	-0.06996
13	-0.13537
14	0.10425
15	-0.05476
16	0.00427
17	0.22085
18	0.13956
19	-0.21674
20	-0.13861

Cross Correlation of 91-Day Treasury Bill Rates and Oil Index

Lag	Correlation
0	-0.07123
1	-0.05072
2	-0.10367
3	0.0435
4	-0.13080
5	-0.00969
6	0.01624
7	-0.17602
8	-0.00721
9	0.10403
10	0.04900
11	0.11288
12	-0.13199
13	-0.16732
14	0.10791
15	0.06986
16	0.00332
17	0.01274
18	0.02553
19	-0.09560
20	-0.04225

Although the results of the present study parallel the results of Campbell and Ammer (1993) who found very low relationships between US interest rates and US stock prices, the results nevertheless raise several puzzling implications. One implication of the results is that local investors do not shift their funds from fixed-income securities to stocks when the interest income becomes too low. This is rather puzzling since institutional fund managers certainly shift funds from fixed-income asset to stocks and vice versa depending upon their relative potential yield. It also implies that local stock market investors who go on margin (i.e. borrow funds to be used in stock purchases) are not deterred by higher interest rates.

One possible explanation is that most of the movement of Philippine stock prices is determined not by local investors but rather by foreign investors who are not affected by Philippine interest rates but instead by their respective countries' interest rates. However, this explanation is difficult to accept since even though the foreign investors may have a significant influence on the stock market during certain speculative episodes, they certainly do not dominate the trading of Philippine stocks most of the time.

An alternative explanation is that local stock market investors influence the movement of Philippine stock prices but are themselves highly influenced by the behavior of Philippine stocks traded in New York (such as PLDT, Benguet and Atlas) and also by the behavior of the US stock market since analysts may consider the US economy as a major indicator of the international economy. Since the behavior of Philippine stocks traded in New York and the behavior of US stocks are not expected to have any significant relationship with Philippine interest rates, then the results of the present study are not surprising. However, we can only speculate at this point since the present study did not include an analysis of these variables.

Perhaps future research can probe into other factors which will help to explain the movement of Philippine stock prices.

6. Conclusions

There are a number of American investment books which note the negative relationship between US interest rates and US stock prices. Notable among these is the book by Zweig (1986) which recommends that investors should shift to stocks when the interest rate yields starts to decline. Such a strategy is sometimes applied even to foreign markets sometimes without consideration of the empirical validation of such a strategy.

Note for instance, the recent article in the Oct. 27, 1993 issue of the *Asian Wall Street Journal*. In analyzing a recent bull market in European stocks, the explanation was:

> Behind Europe's stock surge is a simple thesis: If it worked in America, it will work in Europe. "Interest rates came down in the U.S. And as they came down, the stock market did extraordinarily well, notwithstanding that the earnings growth was poor," says Gary P. Brinson, president and managing partner at Brinson Partners Inc., a Chicago money-management firm. "In Europe, they say the same thing is going to happen."

Apparently, the same habit of subscribing to American investment principles without determining the applicability of such to the local situation is also done by Philippine analysts. Some newspaper articles cited the same line of reasoning by Philippine stock market analysts. Many of them attributed the lowering of interest rates during the past several months as a major reason for the rise in stock prices during the summer months. The long-term evidence does not support such a relationship.

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