AN OPTIMAL CONTROL APPROACH
TO MARKET TIMING STRATEGY

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ABSTRACT

This paper presents an optimal control approach to market timing strategy for the property investor in allocating investment funds between the risk-free savings deposit and the comparatively risky property investment. Investment recommendation is generated in terms of the four possible investment actions in a typical property investment scenario, namely: buy, hold, sell and wait. The investment performance of the proposed market timing strategy is compared with that of the buy-and-hold strategy. Results from the simulation study for the 20-year period from 1977/Q1 to 1996/Q4 indicates that the proposed market timing strategy is capable of achieving superior investment returns in the Singapore property market.

INTRODUCTION

Market timing is defined as an investment strategy in which funds allocated to a designated set of assets are adjusted on an on-going basis in response to changes in the investor's financial capability and the forecast of market price movement. It has been advocated that at least 70% accuracy rate in market timing is required to make the practice worthwhile [1]. Since achieving a 70% accuracy rate is extremely difficult, most investors believe that one should minimize trading and adopt a buy-and-hold strategy.

However, subsequent studies show some success in asset allocation which is essentially a market timing strategy [2, 3, 4]. In addition, regressions of returns and dividend yields have been employed to track expected returns [5]. A strategy of tactical asset allocation using logit analysis has also been developed [6]. These studies show that their strategies can achieve greater terminal wealth with less variability of returns.

The use of market data to predict the property price movements, thereby suggesting the feasibility of integrating such information into the market timing strategy can be found in recent studies [7, 8, 9]. While many of these studies show some success in market timing, they do not take into consideration the financial strength of the investors in their market timing strategies. A successful market timing strategy depends a great deal on the financial strength of the investors who aim to reap maximum returns from the market.

Perfect liquidity is assumed in this study in that that buyers are readily available in the market. The "imperfect liquidity" constraint, if incorporated in our optimal control approach, will make the problem more realistic. However, such a liquidity constraint is difficult to specify in the real-world situation and furthermore it is also influenced by numerous external non-quantifiable factors.

MARKET TIMING STRATEGY

The proposed market timing strategy is designed to generate an optimal investment recommendation which is formulated as a function of the cash available, the property assets held by the investor as well as the forecast of the property price movements. The coefficients of this function are determined such that an objective criterion, i.e., terminal wealth, is maximized. These coefficients are determined by regressing a set of optimal control on the state variables. This set of optimal control is the optimal policy derived from the stochastic dynamic programming procedure in which the various relevant property investment parameters and the definition of the objective function are required to be pre-specified. This objective criterion is expressed in terms of the income, the expenses, and relevant investment parameters. Hence, the market timing problem has been cast into a maximization problem where the objective is to maximize the return on investment, i.e., the terminal wealth, subject to the constraints of the investment dynamics.

Evaluation of the investment performance of the market timing strategy requires a comparison of the relative performance of such an active market timing strategy with that of the passive buy-and-hold strategy. We use the quarterly residential property price index published in the *Real Estate Statistics Series for Price and Rental Indices* by the Urban Redevelopment Authority of Singapore. The price indices are the widely used indicators of price movement for the property market and are compiled from caveats lodged with the Registrar of Titles while rental information is collected through surveys. These publications are available five weeks after the end of each quarter.

Quarterly data series on the property investment and the interest rates of the savings deposit are gathered for the period from 1977/Q1 through 1996/Q4 (a total of 80 data points for each series). This twenty-year period, containing approximately two property market cycles, is deemed to be sufficiently long to justify the use of statistical analysis.

INVESTMENT PERFORMANCE

Any investor using a market timing strategy would be very interested to know the investment performance of such market timing strategy in comparison with the alternative passive investment approach such as the buy-and-hold strategy. A 72-quarter (i.e., 18-year) data sample is gathered for the assessment of the investment performance of the proposed market timing strategy in comparison with the buy-and-hold strategies. Observation and estimation of each of the three state variables representing the input data are fed into the market timing control function to generate the optimal investment recommendation.

Table 1 summarizes the results for the overall comparison of investment performance by the two strategies for the period from 1979/Q1 to 1996/Q4. The investment strategies that are examined are the proposed market timing strategy and the buy-and-hold strategy. For the 72-quarter investment horizon, the property price moves up in 49 quarters, moves down in 21 quarters and stays flat in 2 quarters. The property price is observed to move in eight up trends and eight down trends. The market attained a net present value of 4.66 times the initial capital invested; this figure translates to an equivalent annual returns of 8.93%. The buying and selling expenses are assumed to be, respectively, 5% and 2% of the transacted price. The risk-free rate of return is assumed to be fairly constant at 4% per annum.

Inspection of Table 1 reveals that our market timing strategy executed 7 buy decisions and 7 sell decisions throughout the investment horizon. Despite the fact of missing out the opportunities to buy and sell, the equivalent annual returns of our market timing strategy is relatively attractive at 16.42% in comparison with returns of 13.54% attained by the buy-and-hold strategy. The above results seem to indicate the superior performance of our market timing strategy.

CONCLUSIONS

The simulation results suggest that the proposed market timing strategy is able to add value to the returns on investment for the property investor. Risks are controlled and returns are enhanced. Lost opportunities for gains in the bullish markets are more than compensated by avoiding losses during the market downturns. The benefits from the proposed market timing strategy has demonstrated to be significant, at least in the type of market environment in the Singapore property market during the last two decades. Notably, the financial strength of the investor must be taken into consideration for a market timing strategy to be realistic.

The market timing strategy proposed in this study is easy to use and yet inexpensive to implement. Input to the strategy can be readily obtained from public sources and investor's own database. The proposed market timing strategy does not depend on subjective judgement. Furthermore, the forecasting rule for the property price movement is well known and clear.

The study has been simplified in that we consider only two classes of assets, namely the savings deposit and the property assets. This concept can be easily extended to include other asset classes. We restrict the number of independent variables and our procedure allows shifting of funds only at the beginning of each quarter. Furthermore, in the present study, it is assumed that ready buyers are always available in the market. However, this may not be the case in the actual market. There may not be any buyer for a particular property and hence a possible extension of the present study is to incorporate such a liquidity scenario into the strategy in the forms of the probability of a successful property sale. By assuming perfect liquidity, we are able to compare the optimal control approach with the buy-and-hold approach. The introduction of liquidity constraint will definitely deteriorate the investment performance of our market timing strategy. The investigation of such impact of liquidity constraint on the investment performance would be a topic for future research.

Table 1 – Overall Comparison of Investment Performance for Various Strategies

Investment Strategies	Market Timing	Buy & Hold
Number of BUY decisions	7	1
Number of SELL decisions	7	1
NPV of Terminal Wealth	15.43	9.84
Equivalent Annual Returns (%)	16.42	13.54

Notes:

Number of UP quarters:	49 (in 8 Up trends)
Number of DOWN quarters:	21 (in 8 Down trends)
Number of FLAT quarters:	02
Total Number of quarters:	72
NPV of Market Returns:	4.66 × initial capital
Equivalent Annual Returns:	8.93%
Risk-free Returns per year:	4%
Buying Expenses:	5% of transacted price
Selling Expenses:	2% of transacted price

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