$$\sigma_i = \sqrt{\frac{1}{T}\Sigma_{i=1}^{T}(r_i - \overline{r}) * Trading\ \ days} \quad (4)$$

Historical and forward holding period returns and lookback drawdown returns were computed as input variables; historical returns for test of predictive qualities, and forward returns for payoff and Sharpe computation. Computation of holding period returns is trivial. Computation of lookback drawdown returns is illustrated in Equation 5. Lookback drawdown returns r_{LB} equation parameters are the option maturity stock price S_{Final} and option global minima price S_{min}.

$$r_{LB} = \frac{S_{Final} - S_{min}}{S_{min}} \quad (5)$$

Sharpe ratio was utilized to evaluate the performance of trading results. According to Harvey and Liu (2015), it is a routine industry practice to discount the reported Sharpe ratios by 50%, among many other proposed haircut methods, in trading backtests. In this research, we would discount any improvements or declines in Sharpe ratio, δS, when comparing two portfolio Sharpe by 50% as a simple penalization hurdle based on Equation 6.

$$\delta S = \frac{1}{2}\left(\frac{S_i}{S_{i-1}} - 1\right) \text{ where } S_i = \left(\frac{r_i - r_f}{\sigma_i}\right) \quad (6)$$

Since the dataset comprised of Singapore equities, annualized risk-free rate (r_f) was assumed at 2%, approximating the short-term annual interest returns of Singapore Government Securities.

Modelling

Modelling interactivity interface was generated using Microsoft Excel, supported by Python for computationally intensive iterative operations, for instance, high run-rate binomial option pricing modelling. SAS® Enterprise Miner™ version 14.1 ("EM") was also utilized during the results validation stage for its fast unsupervised clustering computation capabilities for large datasets, and SAS® JMP Pro 14.0.0 was utilized for One-way ANOVA and post-hoc Tukey Honestly Significant Difference (HSD) tests. Exhibit 4 illustrates the research modelling utilized to generate the research output.

K-means clustering was utilized to cluster-identify investable assets for its extensivity of use and simplicity as an unsupervised machine learning technique, for the purposes of industry adoption. According to Hartigan (1975), K-means clustering divides data observations into like-clusters, by breaking up M points in N dimensions into K clusters, through the minimization of within-cluster sum of squares (WSS). Repeated iterations are conducted until the stopping criterion is met. In this research, Euclidean distance is utilized for similarity distance and the Aligned Box Criterion is the method used to identify the optimal clusters generated. The latter improves on the gap statistic method (Tibshirani, Walther and Hastie 2001) through a high-performance machine-learning based analysis structure (SAS Institute 2016). Historical equity holding period return, historical equity lookback drawdown return and historical equity volatility were the input variables for K-means clustering; Equity names acted as the input ID.

Microsoft Excel and Python were utilized for the pricing of European floating strike lookback call options and standard European call options based on algorithms in Exhibits 2 and 3 respectively. Computation of binomial option pricing model required averaging binomial option price paths of 15,000 runs for each Monte Carlo simulation, at a total of 48 Monte Carlo simulations. Due to the computational intensiveness of the high number of iterations, Python was used for generation of binomial option pricing and Sharpe, among others.

In Exhibit 5, it can be observed that at about 15,000 runs and above, the standard deviations of 48 Monte Carlo binomial option pricing model simulations were reduced and plateaued at just below 2%. Above 15,000 runs, the marginal benefit of additional runs was insignificant. Hence, the research model utilized 15,000 runs of binomial option price paths for each Monte Carlo simulation.

RESULTS AND DISCUSSION

Exhibit 6 illustrates that in a relatively high positive Sharpe environment for the underlying stock, trading European floating strike lookback call options and standard European call options typically outperform its underlying equity trade. However, the option cost will offset payoff generation for option trades, to the