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On the performance of options strategies in Switzerland

1. Introduction

Since 1973 and the initial trading of standardised options on the Chicago Board of Options Exchange, options established themselves as common investment vehicles. Many institutions developed financial packages (GROI, PIP, ELU, SMILE, etc.), mutual funds, hedge funds or structured products that use call and put options as building blocks. Many portfolio managers follow dynamic strategies that tend to replicate dynamically the behaviour of an option.

The increasing use of options in portfolio management has been accompanied by a variety of claims regarding their impact on improving performance and on risk-adjusted returns. Typically, these strategies are often praised for their ability to outperform the market. For instance, investors perceive covered call writing[1] simultaneously as a return enhancement and as a risk-reducing strat-

egy: it increases income of stock ownership through the received option premium and it converts the prospects for uncertain future capital gains into immediate cash flows. Protective puts buying[2] is perceived as a risk reducing strategy: it allows its users to ascertain a minimum value of their portfolio, limiting downside risk while keeping the upside potential of the stocks. This suggested out-performance violates the efficient market hypo-thesis, since the risk-adjusted portfolio return should not be improved by the systematic use of options.

Besides the specific characteristics inherent to option valuation, many authors have examined option management in a portfolio context. Unfortunately, neither the academic empirical studies nor the nostrums for market success offered by practitioners help the potential investor in verifying this dominance. The general lack of consistence among the results of the various statistical studies – mostly in the U.S. and the UK – does not set complete confidence in their results. In fact, most of these products and strategies have not received a careful theoretical analysis. Generally, they have even received an analysis using inadequate theoretical tools. Traditional portfolio performance evaluation is generally based on the mean-variance analysis. It assumes a buy and hold strategy with normally distributed returns over a specified time-horizon, and compares the results obtained with those of an efficient market index. None of these

assumptions is valid anymore when options are involved in a portfolio.

The goal of this paper is to examine the bias introduced by using the mean-variance framework when one considers options as investment alternatives. In addition to mean-variance performance measures, we will investigate the use of stochastic dominance and alternative equilibrium approaches to better appraise the performance of option based strategies. The empirical study is conducted on the Swiss market, which is a small concentrated market and with a relatively recent experience in derivatives securities. We will use both theoretical and quoted American and European option prices from 1975 to 1996.

The structure of this paper is the following: section 2 reviews the literature on option strategies performance studies; section 3 presents our methodology; section 4 illustrates the major empirical results of our study applied to the Swiss market; section 5 explains why even from a theoretical point of view, the market index is mean-variance inefficient and can easily be beaten when options are available; section 6 shows that using adequate tools will solve our problems; section 7 concludes.

2. Literature review on options strategies performance

Prior to the BLACK-SCHOLES-MERTON (1973) works on option pricing theory, most of the early research studies on optioned portfolio performance used reported prices of over-the-counter options over a short period of time to test different sets of strategies. The early results were generally that writing options was a better strategy than buying them, and it was commonly believed that covered call writing against a diversified portfolio would increase portfolio returns while lowering risk. For instance,

- KRUIZENGA (1964) examined the profits from hypothetical purchases of calls and puts on the basis of the nominal premiums reported to the S.E.C. from 1946 to 1956. His

results were that from a pure return point of view, buying calls was profitable, while buying puts was not. BONESS (1964) obtained similar results on the 1957–1960 period.

- Using the complete sample of options sold by a large U.S. brokerage firm during the years 1957 to 1960, ROSETT (1967) observed that most calls expired non-exercised and concluded that call-selling was a profitable strategy.
- MALKIEL and QUANDT (1969) compared the returns of 16 different options strategies over the 1960–1964 period. Option writing was found to be a better strategy than option buying, with the optimal strategy being straddle writing. This was confirmed by MALKIEL (1972) over the 1963–1965 period for the ten stocks used as underlying by the most traded options.

These results can be attributed to a particular time frame, to market inefficiencies and/or to the lack of a valuation model. Furthermore, there is no explicit quantification and comparison of risk in relation to expected return. In fact, a proper analysis should show that if options are traded at a fair cost, the risk-reward characteristics of an option position should fall on the efficient market line.

After 1973, most of the research studies still focused on covered call writing, but started using theoretical BLACK-SCHOLES option premium over an extended period of time as well as effectively quoted prices. Their results are mitigated. For instance,

- Using constant percentage premium, BOOK-BINDER (1976) estimated various options strategies on the forty-eight years period 1926–1973. His conclusions were that selling covered call produced substantially larger returns on investments than the traditional buy and hold strategy. KASSOUF (1977) obtained similar results on a Dow-Jones portfolio from 1950 to 1975. However, the constant option premium makes these results highly questionable.

- POUNDS (1978) considered an equally weighted portfolio of 43 shares on which listed options were traded. Using quoted stock prices and dividends from 1969 to 1976, he computed theoretical call premium using a historical 250-day volatility and simulated the selling of thirteen-week covered calls over that period for various exercise prices (10% in-the-money, at-the-money, 10% out-of-the-money). All applicable commissions incurred in the simulated portfolios were included. His conclusions were that each optioned portfolio was able to outperform the underlying portfolio, even though the risk level of the optioned portfolio (measured by the standard deviation of returns) was lower. Furthermore, selling covered out-of-the-money calls was the dominant strategy.

- GRUBE and PANTON (1978) tested a set of various "filter" strategies[3] against a systematic three-month at-the-money covered call writing strategy between 1973 and 1975. They observed that filter strategies did not beat covered-call selling.

- YATES and KOPPRASCH (1980) proposed the creation of the Institutional Option Writers Index (IOWI) to determine the returns available to covered call option writers. Over the simulated period (1973–1980), the IOWI outperformed the S&P 500 while reducing risk.

On the other hand, over the 1963–1977 period, MERTON, SCHOLES and GLADSTEIN (1978, 1982) obtained opposite results for a 136 stock portfolio and the Dow Jones portfolio: their results evidenced a more favourable situation for the option buyer than for the option seller. Note that these results are as well inconsistent with a cornerstone of option valuation theory, namely, that an investor combining a number of fairly priced options and an appropriate number of shares of stock will end up with a risk-free position yielding the risk-free rate. The authors simply attributed their results to an unusual behaviour of the stock price over the period (with sharp rallies and declines), and to a large dispersion of stock returns.

Similar results were also evidenced on different portfolios by DAWSON (1979) and by GASTINEAU and MADANSKY (1979).

Finally, studies using alternative performance measures such as stochastic dominance generally obtained results that were consistent with the efficient market hypothesis. For instance,

- BOOTH, TEHRANIAN and TRENNEPOHL (1985) used actual market returns for the period July 1963 to December 1978 to generate the sample probability distributions of various option strategies (call buying, long call and risk-free asset, covered-call writing, and long stock) during the time period. They find that these different hedged strategies are qualitatively identical.

- Assuming normally distributed returns, CLARKE (1987) used the BOOKSTABER and CLARKE (1983) algorithm and stochastic dominance rules with and without a risk-free asset to compare several strategies (100% stocks, 100% long calls, 90% T-bills and 10% calls, covered call writing and protective put options). His conclusions were that when the options were fairly values, no strategy dominated the pure stock portfolio. When options were mispriced by about 10%, dominance relationships started.

- BROOKS, LEVY, and YODER (1987) used various stochastic dominance tests to check whether investors were better off writing calls or buying puts on their portfolios. Their conclusion was that there was no dominant strategy.

When confronted with the strong bull market that started in the United States in 1982, covered call writing resulted in under-performance with respect to an indexed strategy. This reduced the strategy popularity and halted research on the topic. The researchers then focused on static (protective put strategies) and dynamic portfolio insurance. The failure of dynamic portfolio insurance in the 1987 crash halted again research on the topic.

More recently, AUSTIN (1995) examined S&P 100 index option overwriting from 1983 to 1993 using various holding periods (five to twelve weeks to expiration) and strike ratios (from 0.95 to 1.10). His argument was that under the efficient market hypothesis, the risk-adjusted portfolio return should not be improved by overwriting calls; thus, if the expected return on the underlying portfolio is positive, the expected return from written calls should be negative. But his empirical results showed that a broad range of out-of-the-money covered call selling strategies produce positive excess returns.

On the Swiss market, PRINCE (1996) examined the impact of writing a different number of call options on an equally weighted portfolio of nine Swiss stocks over a set of three short-term periods (selected for their growth, stable, and drop characteristics). Using stochastic dominance without a risk-free asset, his conclusions were that writing out of the money options usually enhanced the performance of the portfolio, while this was not necessarily the case using other degrees of moneyness.

At this point, we must say that the results of all these empirical studies are rather inconsistent. No clear evidence is emerging regarding the dominance of any option strategy. The results depend on the period, the market and the strategies considered. Furthermore, most of these studies were restricted to the U.S. or the U.K. markets. Therefore, it is interesting to examine the case of smaller stock markets such as Switzerland.

3. Methodology

In our empirical investigations on the Swiss market, we considered three strategies: naked stock, buying protective put and selling covered call. In each of the options strategies, it is assumed that the number of shares of stock in the portfolio is equal (in absolute terms) to the number of share of stocks underlying the options. For instance, the proceeds from the call selling are invested in the stock, so that the long stocks cover 100% of the short calls. Each of the considered strategies is a limited liability investment with losses limited to the initial investment and is bullish, in the sense that it is a non-decreasing function of the stock price.

The motivations behind this choice were twofold. First, these strategies are the ones that are mainly followed by institutional investors and more recently, by individual investors (through the use of mutual funds). Second, the various regulatory agencies have generally permitted these covered strategies while refusing the holding or selling of naked options.

Three rolling time-horizons are available: one month, two months, and three months. At the end of the time-horizon, the options are exercised for their intrinsic value, and the position is rolled-over using the same strategy. As we required that all positions to be held until expiration, we did not consider early exercise possibilities. The returns include reinvestment of all dividends (in the next rollover), take splits into consideration, and assume no taxes or transaction costs.

We performed two series of tests. The first series used effectively quoted prices for all options and underlying assets. The underlying stocks are listed in Table 1 (see appendix). They represent all underlying stocks on which options were traded at the Swiss Options and Financial Futures Exchange (SOFFEX) on a sufficiently long period (at least two years).

However, using effectively quoted prices considerably reduces our flexibility. First, as we can only pick up the "closest" exercise price among a set of standardised ones, we used three sets of exercise prices: at the money, in the money, and out of the money, but the exercise price to stock price ratio is not constant over time. Second, the length of the observation period is bounded below to 1988 (the SOFFEX creation date) and above for some options (which stopped trading in between). This might create a bias in our results, as options on some underlying might be available only in some particular bull or bear market conditions. Al-

though there is an obvious interest in using effective market prices, it has the significant shortcoming that the methodology is limited to a single run of historical parameters that cannot be controlled. There is no assurance that these real prices are representative, typical, and free of arbitrage.

For these reasons, we performed a second series of tests computing theoretical option prices using effectively quoted underlying prices. We restricted our second stocks sample to the ten[th] largest capitalisation of the Swiss stock market, plus a hypothetical SMI portfolio (see Table 1). This represents the ten most liquid and actively traded stocks, plus a diversified stock portfolio. The basic assumption underlying the latter choice is that a portfolio achieving the SMI returns is feasible for investors. To evaluate the initial premiums, we used the BLACK-SCHOLES (1973) and MERTON (1973) model for European options and the BARONE-ADESI and WHALEY (1987) model for American options[4]. The exact exercise prices considered were either at the money, 5% and 10% in the money, and 5% and 10% out of the money. We assumed that these arbitrary exercise prices were available on the option market as well as perfect forecasting of the timing and amount of the dividends. This is not too unrealistic in Switzerland, where most dividends payments are concentrated over a short period of the year and are stable over time, both in terms of payment date and amount. We used the sample historical volatility of the previous six months of daily logarithmic price changes as an estimate of the volatility parameter.

The first series of tests was limited by the option availability on the SOFFEX. For the second series, the period chosen for the simulation was the 21.5 years interval from January 1975 to June 1996. This period provides a variety of market environments, including booms, crash, up and down markets as well as volatile and quiet markets. We collected daily underlying prices, interest rates (Euro-deposits) and dividends from Datastream and from various federal tax reports, while daily options premiums were provided by the SOFFEX.

As a consequence of our above choices, we will display results for a large set of scenarios (strategy, exercise prices, American and European options, simulation or quoted prices), but for only the one month rolling strategy. Results for the two-month and three-month rolling strategy are similar and are detailed in LHABITANT (1998).

We compared the strategies on the basis of their respective average return, volatility, skewness, kurtosis, and SHARPE (1966) ratio. As the SHARPE ratio may be inadequate because of its failure to consider higher moments of the distribution, we have also performed first order and second order stochastic dominance tests in order to identify "efficient" and "dominated" strategies.

4. Empirical results

Tables 2 to 5 (see appendix) present our empirical results. We tested the normality of the log-returns on the underlying assets using one, two, and three month returns using the Béra-Jarqué statistics at the 5% significance level. For the monthly data, the normality assumption was rejected for all stocks. For the two monthly data, the following stocks had normally distributed log-returns: Roche, Ciba-Geigy, CS Holding, Zurich Insurance, Brown-Boveri, and the Swiss Market Index. When considering three-monthly returns, Sandoz and Swiss Bank Corporation were added to the previous set. When adding options in the stock portfolio, no series of log-returns was considered as normally distributed.

For the protective put, we find that returns decrease with higher exercise prices and are (almost everywhere) lower than the naked stock returns, volatility decreases with higher exercise prices and is lower than for the naked stock, skewness is positive and increases with higher exercise prices, and kurtosis strongly increases with higher exercise prices. This confirms the hedging aspect of the protective put strategy: it reduces volatility

and creates positive skewness, which are both desirable features, but this is generally done at the expense of a return reduction.

For the covered call, we find that returns increase with higher exercise prices, but are not necessarily lower than the naked stock returns, volatility increases with higher exercise prices, but it remains lower than the volatility of the naked stock, skewness is negative and decreases with higher exercise prices, and kurtosis strongly decreases with higher exercise prices. This also confirms the hedging aspect of the covered call strategy, as it also reduces volatility. However, this is not necessarily done at the expense of a return reduction, but also at the expense of a negative skewness, which is a-priori not desirable.

The above results are similar to those found by major empirical studies that used a similar methodology, in particular BOOKSTABER and CLARKE (1984, 1985). They are not sensible to the fact that the options are American-style or European-style. The difference seems to appear only in the average return: using American-style options will favour covered-call selling (at a higher price), while using European-style options will favour protective put buying (at a lower price).[5]

Table 6 (see appendix) shows the SHARPE ratios for each strategy. Underlined numbers show where the SHARPE ratio of an optioned strategy is higher than the SHARPE ratio of the pure stock strategy. Selling covered calls, and particularly in-the-money calls, appears very clearly as a dominating strategy. The purchase of protective puts seems to be a dominated strategy, whatever the time-horizon and the moneyness of the option. Holding only the stock is between the two strategies. This performance bias is in line with the earlier findings of ZIMMERMANN (1994) and ALBRECHT et al. (1995).

These results are generally confirmed using effective quoted options prices, but are less systematic. In particular, the decrease or increase of the return with the exercise price is sometimes replaced by a humped concave or convex curve. We did not find any explanation for this phenomenon. We should also note that the rolling frequency does not seem to have a determinant influence.

5. Theoretical results

In this section, we will reconsider our options strategies in a theoretical framework. Indeed, if options and their underlying stocks are correctly priced (which is the case in our theoretical model), then, without any particular information, there should not be a "best" strategy.

We work in the standard BLACK-SCHOLES and MERTON (1973) framework, with a time period defined as the finite interval [0, T]. Two non-redundant assets are traded: a risk-free asset (bond with price B_t, drift denoted by r) and a risky asset (stock, with price S_t, drift denoted by μ and volatility by σ). We also have put and call options on the stock. We denote by P_t and C_t their price, by K their exercise price, and by T their maturity date.

An investor seeks to maximize his expected terminal (time T) utility.[6] At time 0, he has the choice between 3 strategies: holding long stocks, holding long puts and long stocks (protective put), and holding short calls and long stocks (covered call writing). Without options, traditional modern portfolio theory tells us that the investor should select the strategy with the highest SHARPE ratio, that is, the strategy that gives him the highest expected return per unit of risk.

By going through simple, but lengthy algebra[7], it is possible to show that *all* moments of the optioned portfolio returns at maturity can be written as a *closed-form* expression of the six parameters K, T, S_0, r, μ and σ. In particular, for the moment of order one (mean return) and for the moment of order two (variance), we have:

For the long spot (S) returns:

$$E(R_S) = e^{\mu T} - 1$$

$$\sigma^2(R_S) = e^{2\mu T}(e^{\sigma^2 T} - 1)$$

For the protective put (PP) returns:

$$E(R_{PP}) = \frac{KL_{(0)} + U_{(1)}}{S_0 + P_0} - 1$$

$$\sigma^2(R_{PP}) = \frac{K^2 L_{(0)} + U_{(2)} - (KL_{(0)} + U_{(1)})^2}{(S_0 + P_0)^2}$$

For the covered call (CC) returns:

$$E(R_{CC}) = \frac{KU_{(0)} + L_{(1)}}{S_0 - C_0} - 1$$

$$\sigma^2(R_{CC}) = \frac{K^2 U_{(0)} + L_{(2)} - (KU_{(0)} + L_{(1)})^2}{(S_0 - C_0)^2}$$

The functions $U_{(n)}$ and $L_{(n)}$ are called n^{th} order upper and lower partial moments of the stock price and are equal to

$$L_{(n)} = S_0^n e^{n(\mu + (n-1)0.5\sigma^2)T} N\left(\frac{\ln\left(\frac{K}{S_0}\right) - \left(\mu + \frac{(2n-1)\sigma^2}{2}\right)T}{\sigma\sqrt{T}} \right)$$

and

$$U_{(n)} = S_0^n e^{n(\mu + (n-1)0.5\sigma^2)T} N\left(\frac{\ln\left(\frac{S_0}{K}\right) + \left(\mu + \frac{(2n-1)\sigma^2}{2}\right)T}{\sigma\sqrt{T}} \right)$$

where N() denotes the cumulative normal function. Therefore, it is also possible to write the SHARPE ratios of the optioned strategies as closed-form expressions.

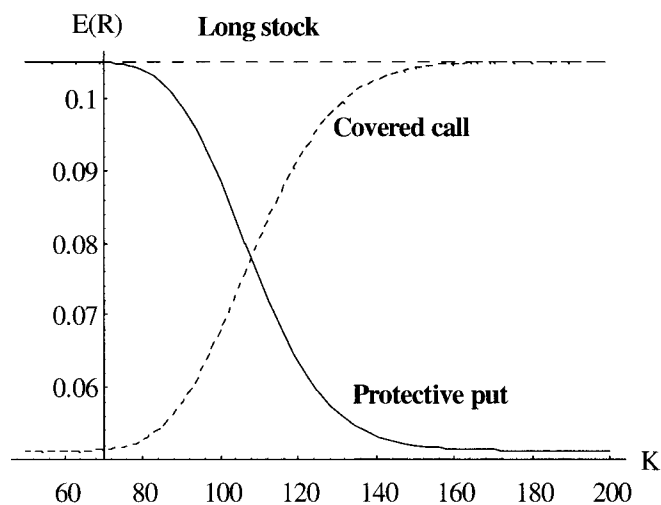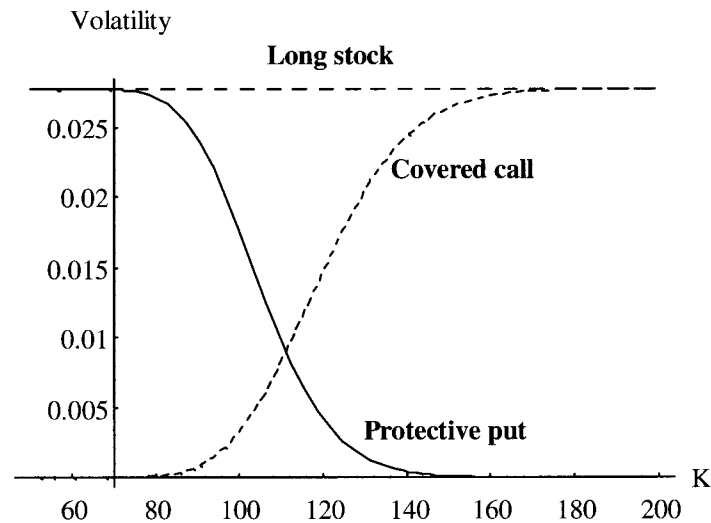**Figure 1: Expected returns for the strategies**

Figure 2: Expected volatility for the strategies

Using these analytical expressions, we are interested in comparing the strategies ex-post performance for different values of the parameters μ and σ, that is, for different underlying stochastic processes (i.e. different assets) and several time-to-maturity (T) and degree of moneyness (K) for the options. We are also interested in testing whether it is possible to create ex-ante a supra-efficient frontier using options in a portfolio.

We performed various simulations. While the results would differ depending on the assumptions, they share a common nature. Thus, we will only present hereafter the graphics for one set of simulation (μ = 10%, r = 5%, σ = 15%, T = 1 year, S_0 = 100) and discuss the results using different parameters.

Figure 1 and Figure 2 show the expected return and volatility for the three strategies as a function of the option moneyness. As one could expect, at a very low exercise price, the covered call strategy is almost a risk-free bond, while it is almost a stock for very high exercise prices. Therefore, increasing the exercise price should increase expected returns and expected volatility. At a very low exercise price, the protective put strategy is almost a naked stock, while it is almost a bond for very high exercise prices. Therefore, increasing the exercise price should decrease expected returns and expected volatility.

Figure 3 shows the SHARPE ratio for the three strategies as a function of the option moneyness. The results are consistent with our previous findings and with FERGUSON (1987). We are moving from a pure stock to a pure bond when increasing the exercise price of a protective put position. Therefore, the SHARPE ratio decreases from the SHARPE ratio of a pure stock position to zero. We are moving from a pure bond to a pure stock when increasing the exercise price of a covered call position. Therefore, the SHARPE ratio increases from zero to the SHARPE ratio of a pure stock position.

An additional fact is that the SHARPE ratio exceeds the SHARPE ratio of the long stock position for a set of exercise prices that are higher the at-the-money position. This finding is more important for long term options than for short term ones. Using only the SHARPE ratio, one could

think that the optimal strategy is to hold only the long stock portfolio, except for the values at which the covered call strategy dominates. The protective put has a SHARPE ratio that is always below the long stock position ratio. Thus, nobody should be interested in buying puts without having specific expectations on the market moves. This would confirm the empirical fact that for some exercise prices, *covered-call strategies form a dominating efficient frontier in the mean-variance space, while protective put are dominated*. The same bias will appear when using the TREYNOR ratio or the JENSEN alpha performance measure.[8]

The consequence is that if the underlying asset is a market index or a market indexed fund, it becomes possible to beat the market without any timing ability. Using the effective market parameters, simply derive the SHARPE ratio expression of covered call position to determine the optimal exercise price. Then, sell covered call options on the market with this exercise price and the longest maturity available. On average, such a strategy will appear as dominating on a mean-variance space. Thus, on an efficient market, without any information, beating the market is easy!

6. What is wrong?

Fortunately, this apparent dominance arises because the SHARPE ratio is not the adequate tool, as it ignores the asymmetric reduction of the variance and does not present the whole picture.

For instance, let us consider the protective put strategy with an underlying asset's log-returns that are normally distributed. The methodology remains valid if the underlying asset log-returns are not normally distributed. The resulting distribution is the result of two actions: first, we truncate the underlying distribution at the point $S_T = K$, and replace its left part by a Dirac delta function
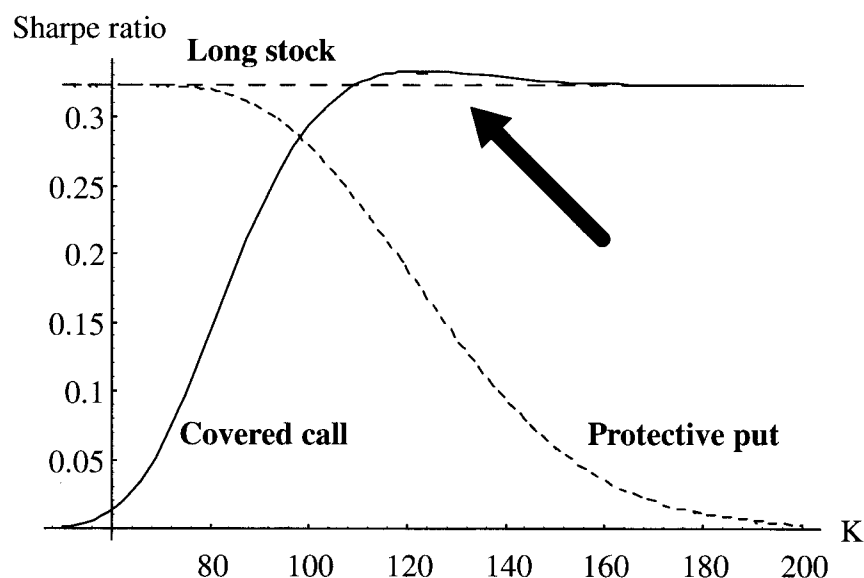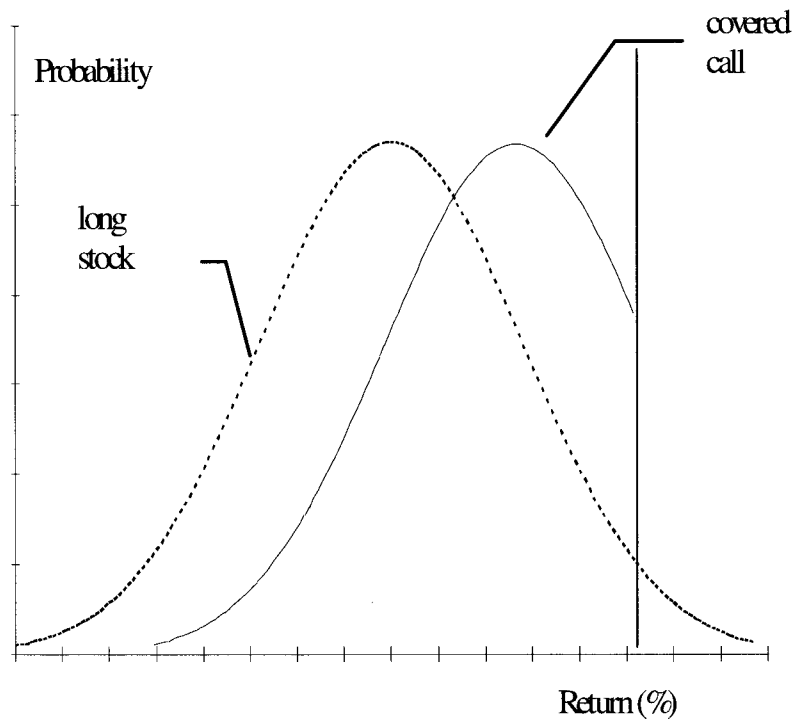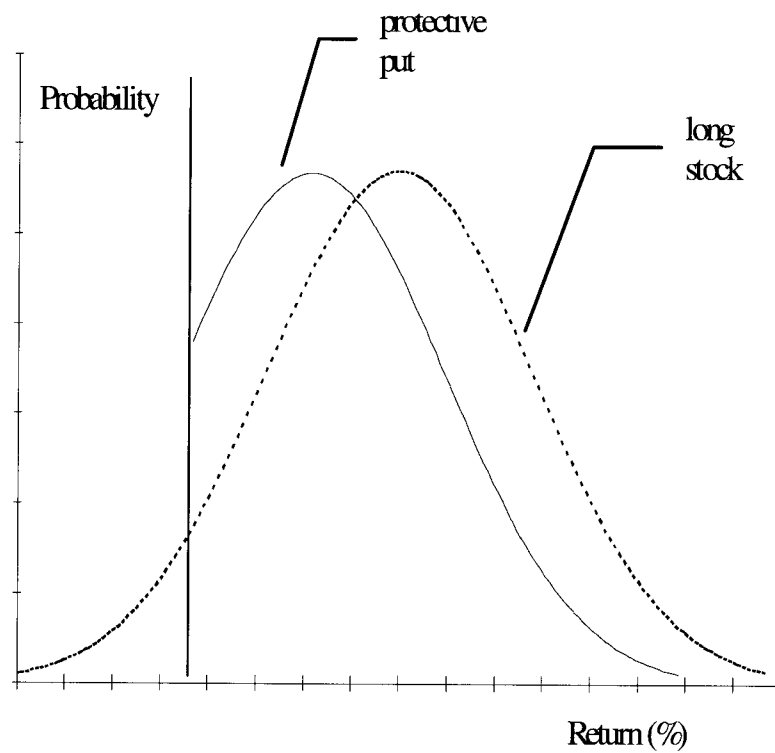
Figure 3: SHARPE ratios for the strategies

Figure 4: Log-return distribution of a protective put and a covered call

with weight equal to the probability that the stock price is lower or equal to the exercise price; next, we translate the new distribution to the left, in order to incorporate the put premium payment influence. For the covered call strategy, we can apply the same methodology, except that we truncate the right part and that we translate on the right, as the premium is received. As it is clear on Figure 2, the option strategies will have highly skewed distributions, with an asymmetric volatility reduction. Call writing truncates the right-hand side of a distribution and results in negative skewness (undesirable), while put buying truncates the left-hand side of a distribution and results in positive skewness (desirable). It is thus natural that the compensation for risk reduction varies between the two strategies, as there must be a reward for holding a portfolio with a skewed return distribution. As the SHARPE ratio ignores the asymmetric reduction of the variance, its application to optioned portfolios effectively overstates the performance of call writing and understates the performance of put buying.

This asymmetry of the return distribution will provide a formidable challenge for mean-variance models. A key postulate of the so-called modern portfolio theory is that investors are risk-averse, where risk is measured in terms of deviations from the average return (that is, volatility or variance). But this suffers from two major drawbacks. First, risk is a property defined for a set of utility functions. Different utility functions will have different risk measures. For the variance to be a correct risk measure, it is necessary for the third derivative of the utility function to be equal to zero, which implies that all derivatives of a higher order are also equal to zero. Second, a larger risk implies a greater variance, but a greater volatility does not necessarily imply a larger risk. For instance, in a protected put position, as the downside risk is limited, the higher the volatility the better.

An important consequence of this is that whereas for a given asset, uncertainty and volatility are the same for all investors, risk is definitely different. Thus, the output of a mean-variance optimiser should be considered as carved in a tablet of stone, particularly if non-normally distributed assets are available.

Recent studies attempted to show that investors wishing to maximise their expected utility could do very well considering only means and variances to approximate the optimal result, while at the same time, others have blamed these methodologies for their failure to include investor's preference for positive skewness. But the inclusion of skewness in the problem does not solve anything: LHABITANT (1997) provides examples in which rational risk-averse investors select a portfolio with the lower mean, higher volatility, and lower skewness. Considering kurtosis will only move us one step forward. What should we do with higher order moments?

In fact, as soon as options or dynamic strategies impacting the shape of the return distribution are considered, it is important to incorporate *complete preferences* in the performance evaluation process.

A first solution is to use *stochastic dominance*, which is the adequate tool for ranking any type of distribution for any investor having a specific set of known characteristics (such as: non-satiation, risk-aversion, prudence, etc.). In order to verify if there is an effective dominance of one strategy over another, we have applied the stochastic dominance criterion to our optioned portfolios.[9] As one should expect, there is no evidence of superiority of writing calls over purchasing puts, and particularly when using out of the money calls and in the money puts, which are the most frequent strategies. These results are generally consistent with those from BROOKS, LEVY, and YODER (1987) and CLARKE (1987): one cannot conclude that a strategy dominates another, even among a subgroup of investors. Thus, the apparent mean-variance dominance that we found using the SHARPE ratio does not appear any more; it was only arising because we did not consider the full impact of the options on the distribution of returns, as we focused our attention only on the two first moments.

Another possibility is to use the *equilibrium approach* developed by LELAND (1999). Basically, the idea is the following: if we assume that stock prices follow a given type of stochastic process, then, an equilibrium is only achievable in the economy if the investors have a specific utility function. For instance, the BLACK-SCHOLES framework is only consistent with a power utility investor (i.e. a positive preference for skewness). Using this approach, for any portfolio P in the BLACK-SCHOLES framework, LELAND (1999) derives a new risk measure B (which replaces β) and a new performance measure A (which replaces the JENSEN alpha). LELAND (1999) shows that when using A and B rather than α and β in the TREYNOR and JENSEN performance measures, managers who buy and sell fairly priced options do not have superior of inferior performance. Unfortunately, there is no SHARPE ratio equivalent.

It is worthwhile noting that these two approaches can complement each other. Stochastic dominance is valid for any distribution, but the performance ranking is only a partial order (that is, we can only identify a group of "dominated" and a group of "non dominated" strategies). The equilibrium approach is specific to one distribution, but provides a complete order (that is, we are able to rank the different strategies).

7. Conclusions

Options market should increase market efficiency by expanding the set of contingencies covered by traded instruments. Investors can use the asymmetric payoffs of options (and dynamic strategies) to create returns distributions that would be otherwise unattainable with static traditional positions.

Many institutional perceive covered call writing as a means of augmenting portfolio returns and protective put buying as a solution to avoid downside risk. Despite this, financial theory suggests that such strategies will partially hedge market risk at the expense of a reduced portfolio return, the reduction of returns being the market price of risk reduction. In fact, if options markets are efficient, the returns and risk reduction derived from the sale or purchase of efficiently priced options when combined with the risk and returns of a diversified market portfolio used as a collateral will be offsetting and yield no excess risk-adjusted portfolio returns. Observing positive excess performance when using options violates the efficient market hypothesis *or implies that there is a reward for holding a portfolio with a skewed return distribution.*

This paper shows that options strategies produce systematic bias in mean-variance performance measures. When applied for instance to the market portfolio, option strategies appear to beat the market on SHARPE ratio point of view. This bias is not due to option mispricing, as it is also found in a theoretical framework. Despite the fact that Switzerland is a small concentrated market with relatively low liquidity, these conclusions are consistent with other studies on the U.S. market. The use of stochastic dominance avoids this bias and evi-dences the importance of all moments of order three and higher in the choice between risky assets.

From there, several conclusions appear relevant. First, non-quadratic utility investors do value skewness on the market, as originally supposed by KRAUS and LITZENBERGER (1976). Therefore, mean-variance performance measures (or more generally limited number of moments performance measures) should definitely not be used to assess the performance of portfolios containing assets with non-linear payoffs such as options, dynamic strategies, or hedge funds. As shown by DYBVIG and INGERSOLL (1982), their return distributions are clearly not normal, or more generally, not two-fund separating. Furthermore, JARROW and MADAN (1997) have shown that in an economy trading options with investors having mean-variance preferences, there are arbitrage opportunities. Thus, whatever the investors' utility functions, mean-variance analysis is vacuus when options are involved.

Second, when evaluating alternative investment strategies with non-normal return distributions, close attention should be given to the specific investor's utility function. Clearly, what is optimal from the investor's point of view depends not only on the cash payoffs, but also on the utility he derives from these payoffs. Different option strategies will have different natural habitat, and other dimensions of the specific investor's preferences must be taken into consideration before the use of options will be preferred over not using them. Although there might not be a single best strategy for all investors, there might exist an optimal strategy for a given investor.

Third, stochastic dominance rules that place few restrictions on investors' preferences and no restriction on asset return distributions are appropriate criteria to rank portfolios with options. Equilibrium approaches are a valid alternative when the market returns distribution is known. Their application did not reveal any positive excess risk-adjusted portfolio returns when using options, and no preferences were clearly established between the different types of strategies. Note that this does not rule them out as viable (or even optimal) portfolio strategies for a particular class of utility-specific investors; it simply shows that the apparent dominance by the mean-variance rule is wrong because it ignores important aspects of the return distribution. Beating the market is still easy, but … using wrong performance measures.

Appendix

Table 1: SOFFEX listed stock-options contracts

	Type of Share	Code	Start date	End date	Used in simulations
Alusuisse	Bearer	ALU	06.05.89	16.04.93	
Alusuisse	Registered	ALUN	15.01.93	28.06.96	
Brown Boveri Corporation	Bearer	BBC	03.01.89	08.05.96	*
Brown Boveri Corporation	Registered	BBCN	21.06.91	16.10.92	
Ciba-Geigy	Bearer	CIG	03.01.89	16.04.92	
Ciba-Geigy	Registered	CIGN	17.01.92	28.06.96	*
Credit-Suisse Holding	Bearer	CSH	24.04.89	16.06.95	
Credit-Suisse Holding	Registered	CSHN	19.06.95	28.06.96	*
Holderbank	Bearer	HOL	16.06.95	28.06.96	
Nestlé	Bearer	NES	03.01.89	04.06.93	
Netslé	Registered	NESN	07.06.93	28.06.96	*
Roche	Certificate	ROG	06.06.89	28.06.96	*
Réassurances	Registered	RUKN	02.12.93	28.06.96	*
Réassurances	Certificate	RUKP	03.01.89	01.12.93	
Sandoz	Registered	SANN	21.01.94	28.06.96	
Sandoz	Certificate	SANP	03.01.89	15.04.94	
Union Bank of Switzerland	Bearer	SBG	03.01.89	28.06.96	*
Union Bank of Switzerland	Registered	SBGN	21.06.91	16.10.92	
Swiss Bank Corporation	Bearer	SBV	03.01.89	10.05.96	*
Swiss Bank Corporation	Registered	SBVN	21.06.91	28.06.96	
SMH	Registered	SMHN	21.08.92	28.06.96	
Winterthur	Registered	WI.N	19.09.94	28.06.96	
Zurich Insurance	Bearer	ZUR	03.01.89	15.10.93	
Zurich Insurance	Registered	ZURN	16.07.93	28.06.96	*
Swiss Market Index	Index	SMI	01.01.91	28.06.96	*

Table 2: Results using the BARONE-ADESI and WHALEY (1987) theoretical prices, one month rolling frequency

		Covered call					Protective put				
	Stock	0.9	0.95	1	1.05	1.1	0.9	0.95	1	1.05	1.1
ROG	14.14%	6.65%	9.84%	15.62%	18.41%	17.31%	13.30%	9.96%	4.07%	0.48%	−0.17%
	22.61%	8.15%	10.95%	15.04%	19.31%	21.70%	19.45%	17.27%	13.03%	7.59%	3.92%
	−1.44	−12.19	−8.23	−4.78	−2.74	−1.85	0.04	0.50	1.30	2.80	4.56
	9.17	174.22	94.76	39.39	16.74	10.67	0.20	0.16	2.14	11.73	34.89
NESN	14.78%	8.81%	10.69%	13.20%	15.07%	14.82%	13.98%	11.17%	6.71%	3.05%	1.55%
	17.80%	4.77%	6.20%	9.64%	13.53%	15.48%	16.95%	16.28%	13.22%	8.82%	6.26%
	0.76	−3.32	−5.04	−2.97	−1.44	−0.72	1.44	1.75	3.10	6.72	9.93
	8.22	46.92	56.28	19.78	6.09	3.80	7.42	8.61	18.70	62.18	115.32
SBG	10.69%	7.24%	7.46%	11.43%	13.15%	11.28%	11.21%	10.01%	4.55%	1.40%	1.44%
	20.28%	6.26%	8.88%	12.98%	16.93%	18.59%	18.15%	15.94%	12.05%	7.49%	4.84%
	−0.67	−6.65	−5.58	−3.50	−2.06	−1.50	0.33	0.98	2.35	5.45	8.61
	5.60	71.39	44.19	18.05	7.71	5.55	2.33	3.11	9.22	37.72	81.25
SANN	18.07%	7.85%	8.99%	12.20%	15.15%	17.05%	17.74%	15.65%	11.14%	6.89%	3.11%
	21.09%	5.11%	7.21%	11.28%	15.91%	18.82%	19.91%	18.23%	14.33%	9.09%	5.19%
	−0.08	−5.25	−5.74	−3.33	−1.58	−0.80	0.45	0.87	1.70	3.31	5.89
	2.47	71.93	52.66	17.77	5.22	2.50	0.83	1.02	3.43	13.32	38.85
CIGN	14.41%	8.03%	9.51%	13.35%	15.41%	15.26%	13.92%	11.55%	6.61%	3.29%	1.75%
	23.13%	6.53%	9.17%	13.45%	18.06%	20.69%	21.00%	18.75%	14.53%	9.59%	6.41%
	−0.29	−7.38	−5.81	−3.35	−1.78	−1.12	0.55	1.08	2.26	4.81	7.98
	4.24	78.28	48.34	18.22	6.63	3.94	2.16	3.27	9.19	33.10	77.50
CSHN	8.40%	9.45%	10.43%	12.91%	12.02%	9.37%	7.36%	5.26%	0.89%	0.31%	1.21%
	18.64%	5.14%	7.36%	11.30%	15.23%	16.85%	17.64%	15.78%	11.99%	7.57%	4.52%
	−0.04	−2.16	−3.89	−2.80	−1.42	−0.85	0.48	1.06	2.29	4.34	6.46
	3.30	28.40	28.09	12.28	4.12	2.66	1.97	2.62	7.65	23.97	50.03
SBV	7.40%	7.89%	8.79%	10.88%	9.91%	8.20%	7.38%	5.26%	1.99%	1.80%	1.70%
	22.03%	6.19%	8.96%	13.45%	17.69%	19.98%	20.09%	17.86%	13.51%	8.77%	5.71%
	−0.22	−6.26	−5.29	−3.01	−1.64	−1.02	0.58	1.18	2.53	5.08	8.17
	3.77	66.37	39.71	14.05	5.29	3.22	2.04	3.19	9.77	33.14	73.87
ZURN	14.42%	8.33%	10.15%	14.58%	15.44%	15.10%	13.51%	10.88%	5.12%	2.93%	1.49%
	18.97%	4.40%	6.31%	10.40%	14.82%	17.31%	18.07%	16.42%	12.56%	7.60%	4.33%
	0.04	−2.24	−4.19	−2.59	−1.19	−0.52	0.46	0.86	1.94	4.10	7.50
	2.89	49.53	38.40	11.73	3.52	2.24	1.60	1.79	5.39	22.35	64.79
RUKN	16.25%	8.71%	10.39%	12.56%	13.57%	15.17%	15.32%	12.80%	9.01%	6.57%	3.35%
	22.06%	4.19%	6.29%	10.33%	15.08%	18.43%	21.28%	19.81%	15.92%	11.00%	7.81%
	0.85	−0.99	−3.54	−2.32	−0.94	−0.29	1.09	1.44	2.53	4.84	7.52
	3.97	20.30	23.92	8.92	2.06	0.68	3.68	4.38	9.73	29.53	61.88
BBC	13.85%	8.47%	10.42%	14.31%	16.96%	15.99%	12.94%	10.14%	5.50%	2.03%	1.45%
	26.83%	8.93%	12.02%	16.60%	21.30%	24.10%	23.42%	20.58%	15.85%	10.60%	6.74%
	−0.69	−7.93	−5.58	−3.37	−2.03	−1.39	0.33	0.78	1.69	3.39	6.03
	4.67	99.64	51.05	20.26	8.75	5.57	0.71	1.37	4.85	17.72	49.81

Note: The table shows the mean, volatility, skewness and kurtosis of the various strategies returns for different exercise price/initial stock price ratio. All results are annualised.

Table 3: Results using the BLACK and SCHOLES (1973) and MERTON (1973) theoretical prices, one month rolling frequency

	Stock	Covered call					Protective put				
		0.9	0.95	1	1.05	1.1	0.9	0.95	1	1.05	1.1
ROG	14.14%	5.86%	9.54%	15.52%	18.37%	17.29%	13.32%	10.03%	4.31%	1.26%	1.99%
	22.61%	8.15%	10.95%	15.04%	19.31%	21.70%	19.45%	17.27%	13.03%	7.61%	3.99%
	−1.44	−12.18	−8.23	−4.78	−2.74	−1.85	0.04	0.50	1.29	2.74	3.96
	9.17	174.06	94.69	39.40	16.74	10.68	0.20	0.16	2.12	11.41	29.82
NESN	14.79%	5.45%	8.45%	12.89%	15.02%	14.80%	14.00%	11.23%	6.99%	4.70%	4.71%
	17.80%	3.87%	6.01%	9.65%	13.53%	15.48%	16.95%	16.28%	13.22%	8.85%	6.32%
	0.76	−8.16	−5.91	−3.00	−1.45	−0.72	1.44	1.75	3.10	6.59	9.56
	8.22	103.97	63.91	19.76	6.10	3.80	7.42	8.61	18.68	60.78	110.17
SBG	10.69%	4.18%	5.61%	11.10%	13.08%	11.26%	11.23%	10.08%	4.82%	2.65%	4.22%
	20.28%	5.52%	8.58%	12.95%	16.93%	18.59%	18.15%	15.94%	12.05%	7.53%	4.90%
	−0.67	−9.81	−6.11	−3.52	−2.06	−1.50	0.33	0.98	2.35	5.34	8.21
	5.60	113.96	49.68	18.16	7.71	5.55	2.33	3.12	9.23	36.74	76.10
SANN	18.07%	5.03%	7.36%	11.90%	15.09%	17.03%	17.76%	15.71%	11.40%	8.03%	5.83%
	21.09%	4.10%	6.90%	11.27%	15.91%	18.83%	19.91%	18.23%	14.33%	9.09%	5.18%
	−0.08	−11.55	−6.55	−3.33	−1.58	−0.80	0.45	0.87	1.70	3.27	5.68
	2.47	160.48	61.30	17.75	5.21	2.50	0.83	1.02	3.42	13.08	36.92
CIGN	14.40%	5.38%	8.06%	13.04%	15.33%	15.23%	13.94%	11.62%	6.87%	4.39%	4.18%
	23.13%	6.09%	8.97%	13.43%	18.06%	20.69%	21.00%	18.75%	14.53%	9.60%	6.43%
	−0.29	−9.19	−6.19	−3.36	−1.78	−1.12	0.55	1.08	2.25	4.75	7.71
	4.24	100.77	52.16	18.31	6.63	3.94	2.16	3.27	9.18	32.62	74.31
CSHN	8.40%	5.79%	8.14%	12.53%	11.93%	9.34%	7.38%	5.33%	1.16%	1.58%	3.90%
	18.64%	3.74%	6.85%	11.27%	15.24%	16.85%	17.64%	15.77%	11.99%	7.62%	4.61%
	−0.04	−7.76	−4.89	−2.83	−1.42	−0.85	0.48	1.07	2.30	4.24	6.05
	3.30	88.80	36.29	12.36	4.11	2.66	1.97	2.63	7.66	23.29	46.15
SBV	7.40%	4.78%	7.20%	10.52%	9.81%	8.17%	7.40%	5.34%	2.25%	2.77%	4.09%
	22.03%	5.43%	8.72%	13.41%	17.69%	19.98%	20.09%	17.86%	13.51%	8.81%	5.79%
	−0.22	−9.40	−5.69	−3.03	−1.64	−1.02	0.58	1.18	2.53	5.03	7.86
	3.77	106.89	43.32	14.16	5.29	3.21	2.04	3.20	9.79	32.67	69.80
ZURN	14.42%	5.67%	8.53%	14.32%	15.39%	15.08%	13.52%	10.95%	5.38%	4.14%	4.18%
	18.97%	3.34%	5.96%	10.38%	14.82%	17.31%	18.06%	16.42%	12.56%	7.62%	4.40%
	0.04	−9.04	−5.38	−2.61	−1.19	−0.52	0.46	0.87	1.94	4.04	7.03
	2.89	109.53	45.06	11.77	3.52	2.24	1.60	1.79	5.40	21.89	59.40
RUKN	16.25%	5.68%	8.44%	12.26%	13.51%	15.15%	15.34%	12.87%	9.28%	7.86%	5.96%
	22.06%	3.11%	5.92%	10.29%	15.08%	18.43%	21.27%	19.81%	15.91%	11.01%	7.82%
	0.85	−6.10	−4.67	−2.37	−0.95	−0.29	1.10	1.45	2.53	4.79	7.40
	3.97	50.04	30.36	9.08	2.07	0.68	3.68	4.39	9.75	29.17	60.31
BBC	13.85%	6.09%	9.29%	14.04%	16.87%	15.95%	12.97%	10.23%	5.75%	2.71%	3.24%
	26.83%	8.43%	11.83%	16.58%	21.29%	24.09%	23.42%	20.58%	15.85%	10.62%	6.78%
	−0.69	−9.60	−5.89	−3.39	−2.03	−1.39	0.33	0.78	1.69	3.37	5.85
	4.67	121.72	53.80	20.35	8.76	5.57	0.71	1.37	4.85	17.59	48.07

Note: The table shows the mean, volatility, skewness and kurtosis of the various strategies returns for different exercise price/initial stock price ratio. All results are annualised.

Table 4: Results using effective quoted prices, one month rolling frequency

				Covered call		Protective put	
	Stock	ITM	ATM	OTM	OTM	ATM	ITM
ALU	−2.89%	−1.79%	−4.54%	−5.21%	5.99%	9.59%	9.53%
	34.37%	14.65%	20.22%	26.56%	25.50%	20.20%	13.54%
	−0.21	−1.81	−1.43	−1.09	0.71	1.42	1.96
	−0.11	2.28	1.07	0.39	0.17	1.96	4.04
ALUN	30.31%	15.81%	21.89%	27.66%	19.70%	13.24%	7.57%
	19.04%	4.58%	8.64%	12.91%	17.03%	13.60%	8.80%
	−0.46	−1.30	−1.66	−1.22	−0.03	0.49	0.95
	−0.51	4.94	3.14	1.07	−0.98	−1.02	−0.32
BBC	15.89%	6.07%	9.46%	13.31%	17.87%	14.33%	9.17%
	25.50%	11.88%	16.36%	20.25%	18.69%	14.20%	10.39%
	−0.66	−2.15	−1.96	−1.51	0.44	1.11	1.96
	0.86	8.51	5.24	2.78	−0.31	1.17	3.62
CIG	9.12%	3.78%	4.29%	9.37%	14.60%	13.82%	7.68%
	28.25%	11.72%	17.72%	23.69%	21.04%	15.72%	9.96%
	−0.60	−3.19	−2.34	−1.27	0.38	1.00	2.47
	0.58	11.73	5.99	1.94	−0.96	0.39	6.11
CIGN	21.11%	8.72%	12.47%	14.44%	18.49%	14.67%	11.08%
	23.40%	6.21%	10.68%	14.54%	20.39%	17.49%	14.47%
	1.25	−2.39	−1.54	−0.87	2.24	3.68	5.21
	5.50	6.49	1.91	0.13	9.91	19.51	32.10
CSH	5.65%	6.34%	6.72%	5.72%	6.09%	5.06%	4.74%
	24.60%	9.14%	13.21%	18.05%	20.53%	16.42%	11.61%
	0.42	−2.24	−1.93	−1.03	1.34	1.92	2.55
	1.52	6.34	3.84	1.06	2.67	4.81	9.00
NES	12.39%	10.15%	15.22%	15.22%	9.92%	3.74%	1.84%
	14.68%	4.35%	7.93%	12.81%	13.19%	10.05%	4.36%
	0.23	−3.88	−1.34	−0.18	0.73	1.57	3.55
	0.64	22.62	2.68	0.55	0.46	2.84	14.58
NESN	8.86%	9.29%	9.54%	11.75%	4.58%	3.69%	1.34%
	14.96%	4.35%	8.64%	12.68%	12.91%	9.03%	4.85%
	−0.41	−2.42	−1.39	−0.91	0.11	1.01	2.20
	−0.11	8.25	1.98	−0.07	−0.98	0.29	5.39
ROG	26.13%	8.17%	15.26%	25.06%	23.53%	16.98%	6.49%
	18.75%	7.78%	10.97%	15.00%	14.73%	11.32%	7.28%
	−1.28	−5.47	−3.66	−2.18	−0.22	0.46	1.67
	2.84	32.85	16.04	6.36	−0.25	−0.06	3.51
RUKN	25.60%	12.36%	14.16%	13.34%	20.37%	18.52%	18.51%
	29.02%	8.50%	11.59%	14.70%	26.29%	23.26%	19.82%
	1.43	−0.81	−1.03	−0.52	2.04	2.54	2.98
	3.44	4.81	2.34	0.30	5.26	7.70	10.08
RUKP	11.55%	8.41%	4.87%	5.30%	9.71%	14.50%	12.91%
	26.34%	8.21%	14.96%	19.71%	22.09%	16.74%	11.41%
	−0.05	−3.12	−1.99	−0.94	0.60	1.35	2.23
	0.30	15.44	4.39	0.44	−0.18	1.33	4.61

Note: The table shows the mean, volatility, skewness and kurtosis of the various strategies returns for different exercise price/initial stock price ratio. All results are annualised.

Table 5: Results using effective quoted prices, one month rolling frequency

	Stock	Covered call			Protective put		
		ITM	ATM	OTM	OTM	ATM	ITM
SANN	24.44%	12.46%	13.30%	17.41%	19.62%	17.79%	12.68%
	19.38%	3.83%	5.93%	10.38%	19.04%	16.38%	12.87%
	1.29	2.13	−1.50	−0.78	1.52	2.33	3.42
	3.79	11.23	3.12	0.19	4.36	7.85	14.06
SANP	19.36%	11.85%	17.06%	22.69%	15.05%	10.57%	2.81%
	18.74%	4.44%	9.85%	15.68%	16.76%	12.32%	5.91%
	−0.58	−3.44	−2.30	−0.95	−0.13	0.56	1.68
	0.60	19.74	8.49	1.61	−0.48	−0.48	3.39
SBG	11.86%	9.04%	11.12%	12.23%	10.78%	7.25%	4.77%
	22.10%	8.69%	13.20%	17.19%	17.95%	13.57%	8.96%
	−0.24	−3.95	−2.51	−1.61	0.99	2.15	3.60
	2.70	19.92	8.52	3.86	2.41	7.01	16.79
SBV	7.65%	10.15%	8.96%	7.67%	5.83%	6.86%	6.34%
	24.33%	8.06%	13.68%	18.79%	20.59%	15.78%	9.74%
	0.33	−2.77	−1.74	−0.82	1.21	2.01	2.84
	1.73	11.31	3.99	1.15	2.19	4.62	8.98
SBVN	−7.22%	3.63%	−6.02%	−0.78%	2.40%	14.61%	9.10%
	24.30%	11.72%	16.48%	21.91%	18.51%	12.66%	5.67%
	0.14	−1.15	−1.14	0.04	0.90	1.04	1.90
	0.28	4.46	2.09	−0.04	−0.25	0.31	3.26
SMHN	13.51%	13.67%	21.43%	24.45%	5.31%	−1.09%	−4.23%
	25.73%	9.73%	13.84%	18.67%	21.76%	18.08%	13.68%
	0.18	−1.45	−1.24	−0.82	1.15	1.85	2.78
	0.37	2.27	1.02	−0.14	1.51	3.95	9.27
WI.N	10.54%	10.25%	10.95%	10.20%	3.01%	3.69%	3.82%
	16.15%	2.81%	6.51%	10.41%	15.12%	12.08%	8.16%
	0.35	−1.28	−1.38	−0.57	0.83	1.16	1.84
	−0.25	2.90	1.54	0.11	−0.48	−0.01	2.56
ZUR	6.27%	9.83%	8.48%	10.65%	5.89%	7.48%	3.69%
	21.01%	8.39%	13.03%	18.55%	16.47%	11.96%	6.22%
	−0.38	−2.86	−1.96	−0.96	0.52	1.18	2.72
	0.57	10.14	4.02	1.32	−0.52	0.75	7.75
ZURN	12.04%	5.82%	7.83%	12.30%	10.96%	8.51%	3.43%
	20.60%	7.18%	11.31%	15.10%	16.79%	13.25%	9.14%
	−0.09	−2.53	−1.69	−1.22	0.74	1.41	2.23
	0.16	5.80	2.14	0.57	0.35	1.70	4.85
SMI	19.45%	10.71%	13.08%	15.46%	12.25%	9.92%	7.57%
	13.30%	4.36%	6.05%	7.56%	10.84%	9.51%	7.92%
	0.28	−2.37	−2.21	−1.34	1.02	1.36	1.58
	1.14	7.15	6.39	2.40	1.26	1.91	2.32

Note: The table shows the mean, volatility, skewness and kurtosis of the various strategies returns for different exercise price/initial stock price ratio. All results are annualised.

Table 6: SHARPE ratios, one month rolling frequency

	Stock	Covered call					Protective put				
		0.9	0.95	1	1.05	1.1	0.9	0.95	1	1.05	1.1
		American options (BA & W prices)									
ROG	0.431	0.276	0.496	0.746	0.725	0.595	0.457	0.322	−0.025	−0.517	−1.167
NESN	0.583	0.925	1.014	0.913	0.788	0.673	0.565	0.416	0.175	−0.154	−0.456
SBG	0.310	0.453	0.345	0.541	0.517	0.370	0.375	0.352	0.012	−0.401	−0.613
SANN	0.648	0.675	0.637	0.691	0.676	0.672	0.670	0.617	0.470	0.273	−0.249
CIGN	0.432	0.555	0.557	0.665	0.609	0.525	0.453	0.381	0.152	−0.116	−0.413
CSHN	0.214	0.982	0.818	0.752	0.500	0.295	0.168	0.054	−0.293	−0.541	−0.707
SBV	0.136	0.564	0.490	0.482	0.311	0.190	0.148	0.048	−0.178	−0.296	−0.473
ZURN	0.528	0.892	0.911	0.979	0.745	0.618	0.504	0.395	0.057	−0.193	−0.674
RUKN	0.537	1.027	0.952	0.790	0.608	0.584	0.513	0.424	0.289	0.197	−0.134
BBC	0.352	0.455	0.501	0.597	0.589	0.481	0.364	0.279	0.069	−0.224	−0.439
		European options (B&S prices)									
ROG	0.431	0.178	0.469	0.739	0.723	0.594	0.459	0.326	−0.007	−0.413	−0.604
NESN	0.583	0.270	0.673	0.879	0.784	0.672	0.566	0.419	0.196	0.034	0.049
SBG	0.310	−0.041	0.141	0.517	0.513	0.369	0.376	0.356	0.034	−0.232	−0.037
SANN	0.648	0.152	0.429	0.666	0.671	0.671	0.671	0.620	0.488	0.399	0.274
CIGN	0.432	0.161	0.407	0.643	0.605	0.523	0.454	0.385	0.170	−0.001	−0.035
CSHN	0.214	0.371	0.546	0.721	0.494	0.293	0.169	0.059	−0.271	−0.371	−0.108
SBV	0.136	0.069	0.320	0.456	0.306	0.188	0.149	0.052	−0.159	−0.185	−0.053
ZURN	0.528	0.379	0.693	0.955	0.741	0.617	0.505	0.399	0.078	−0.035	−0.051
RUKN	0.537	0.411	0.682	0.763	0.604	0.583	0.514	0.428	0.306	0.314	0.199
BBC	0.352	0.201	0.414	0.581	0.586	0.479	0.366	0.283	0.085	−0.160	−0.172
		American options (effective quoted prices)									
			ITM	ATM	OTM			OTM	ATM	ITM	
ALU	−0.308		−0.648	−0.605	−0.486			−0.067	0.094	0.135	
ALUN	1.403		2.666	2.117	1.864			0.945	0.709	0.451	
BBC	0.392		0.014	0.218	0.366			0.640	0.594	0.315	
CIG	0.050		−0.334	−0.192	0.070			0.328	0.389	−0.002	
CIGN	0.714		0.696	0.756	0.691			0.691	0.587	0.462	
CSH	−0.030		−0.007	0.024	−0.038			−0.015	−0.082	−0.143	
NES	0.333		0.609	0.974	0.603			0.183	−0.374	−1.298	
NESN	0.365		1.354	0.711	0.659			0.091	0.032	−0.425	
ROG	1.084		0.305	0.862	1.284			1.204	0.988	0.095	
RUKN	0.772		1.078	0.946	0.690			0.653	0.659	0.772	
RUKP	0.165		0.147	−0.156	−0.096			0.114	0.436	0.500	
SANN	1.101		2.444	1.720	1.379			0.868	0.897	0.744	
SANP	0.660		1.092	1.021	1.001			0.480	0.290	−0.709	
SBG	0.274		0.373	0.403	0.374			0.277	0.107	−0.115	
SBV	0.072		0.527	0.224	0.094			−0.003	0.061	0.045	
SBVN	−0.618		−0.356	−0.839	−0.392			−0.292	0.538	0.229	
SMHN	0.377		1.014	1.274	1.106			0.069	−0.270	−0.587	
WI.N	0.485		2.687	1.267	0.720			0.021	0.082	0.137	
ZUR	−0.049		0.302	0.091	0.181			−0.086	0.015	−0.580	
ZURN	0.424		0.351	0.401	0.596			0.456	0.393	0.014	
SMI	1.079		1.287	1.319	1.370			0.660	0.507	0.312	

Note: The table shows the SHARPE ratios of the various strategies returns for different exercise price/initial stock price ratio. Values in italics indicate dominance over the no-option strategy.

Footnotes

[1] Covered call writing (also called "buy write" or "over-write") consists in selling call options while owning at the same time the obligated number of shares of the underlying asset.

[2] Protective put buying consists in holding a specific number of shares of stock and buying put options on the same number of shares of the same stock. Protective put buying is often implemented by the way of dynamic trading strategies under the name of "portfolio insurance".

[3] A filter strategy is defined as follows: each time the stock price changes by a given fixed percentage, a trade is executed.

[4] At the SOFFEX, options on the most actively traded stocks are American-style and options on the Swiss Market Index (SMI) were initially American-style, but changed to European-style in 1991.

[5] One may argue that in order to maximise its day to day return, the investor should consider the possibility of an optimal early exercise of the puts, which might happen even without a dividend payment, and that this event would higher the returns and the ratios on the protective put strategies.

[6] COX and LELAND (1982) have shown that in his context, any optimal investment strategy must be path independent, and the original dynamic problem can be replaced by an equivalent one-period problem that has the appropriate terminal state-prices.

[7] See LHABITANT (1998) for the complete mathematical derivation.

[8] See LELAND (1996) for an illustration.

[9] The mathematical conditions for testing stochastic dominance are slightly technical and complex and can be found in LEVY (1992). See also LHABITANT (1998) for the empirical results of the application of stochastic dominance to the optioned portfolios in Switzerland.

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