

C A M B R I D G E A S S O C I A T E S L L C

EQUITY PORTFOLIO
PROTECTION: THE COST OF
"COSTLESS" COLLARS

July 2000

Kenneth Minklei

Copyright © 2000 by Cambridge Associates LLC. All rights reserved.

This report may not be displayed, reproduced, distributed, transmitted or used to create derivative works in any form, in whole or in portion, by any means, without written permission from Cambridge Associates LLC. Copying of this publication is a violation of federal copyright laws (17 U.S.C. 101 et seq.). Violators of this copyright may be subject to liability for substantial monetary damages.

The information and material published in this report are confidential and non-transferable. This means that authorized members may not disclose any information or material derived from this report to third parties, or use information or material from this report, without the prior written authorization of Cambridge Associates LLC. An authorized member may disclose information or material from this report to its staff, trustees, or Investment Committee with the understanding that these individuals will treat it confidentially. Additionally, information from this report may be disclosed if disclosure is required by law or court order, but members are required to provide notice to Cambridge Associates LLC reasonably in advance of such disclosure.

No part of this report is intended as a recommendation of any firm or any security. Factual information contained herein about investment firms and their returns which has not been independently verified has generally been collected from the firms themselves through the mail. We can neither assure nor accept responsibility for accuracy, but substantial legal liability may apply to misrepresentations of results delivered through the mail.

Introduction

In light of the exceptional returns of the past five years and the unprecedented valuations of the equity market, many investors have recently considered hedging all or part of their U.S. equity exposure, and brokers have been eager to sell them products designed to do so.

Neither the structural effects nor the costs of these portfolio protection strategies is well understood, however. In particular, analysis of the "Costless Collar"—the most common and visually appealing product, proactively marketed by Wall Street firms—reveals implicit as well as explicit costs, and unexpected consequences for portfolio structure, that confirm the timeless adage, *there is no such thing as a free lunch*.

Equity Portfolio Protection Products: Asset Allocation Impact

Portfolio protection transactions alter both the expected return and the distribution of returns of the underlying asset class.¹ Before engaging in such transactions, investors should therefore make sure they understand exactly how much and in what ways the portfolio's structure will be changed and how they should expect the new construct to behave under different market conditions. By ignoring the labels attached to the various portfolio protection products and instead analyzing how they actually affect a portfolio's asset allocation, we can determine which serve as true insurance policies as opposed to simply converting equity into cash. Armed with this understanding, investors can then select those strategies most likely to respond efficiently to changing market conditions in the ways they want, at the lowest possible cost.

Insurance Hedging

The purest form of insurance hedging is the put option. As with any insurance policy, the buyer pays a premium to the provider for a specified amount of protection over a given period of time. In the case of a put option, the premium buys an investor the right to sell securities at a predetermined price at any time during the option holding period. Although one can buy customized puts covering specific portfolio holdings, the most common form is exchange-traded options on market indexes such as the S&P 500 or the NASDAQ 100. For example, an investor wanting to insure a broadly diversified U.S. equity portfolio against any market decline in excess of 15% within the next year could buy a put option, expiring in 12 months, on the S&P 500 at a strike price approximately 15% below the current value of the

¹ The focus of this analysis is *portfolio* protection rather than the hedging of a single stock position, which has additional unique characteristics and considerations.

S&P 500 Index. The current cost of such insurance is approximately 2.7% of the value of the equity portfolio. If one assumes that this protection is paid for out of the equity portfolio itself, this means that a portfolio of \$100 million would be reduced to \$97.3 million. Note that the portfolio is protected only against a price decline *in excess* of 15%; in other words, a decline of exactly 15% would result in a terminal value of \$82.3 million for the "protected" portfolio compared to \$85 million if the portfolio had been left unprotected. Obviously, investors buying such insurance must either be possessed of prophetic insight or have, for some reason, a distinctly asymmetrical risk tolerance—in which case, they should perhaps reconsider how much they can truly afford to allocate to equities.

Synthetic Cash

Other forms of portfolio protection are less transparent, and have the effect of converting equity portfolios into synthetic cash rather than simply insuring them against a market decline. For example, the short-sale of equity index futures to offset a long position in equities has this effect, as does the implementation of the so-called "costless" collar, which involves the sale of a call option to finance the purchase of a put option of the same value (hence the appearance—illusory appearance—of protection at zero cost).

As illustrated in Exhibits 1 and 2, the "expected" return of a principally protected collared portfolio (i.e., the most likely statistical outcome) is a return equivalent to cash (minus implementation costs), with outlying probabilities of either a much higher or a much lower payoff. In other words, such portfolio protection both complicates and distorts portfolio asset allocation by altering the structure of the portfolio.

The Cost of "Costless" Collars

The term "costless collar" conjures images of free lunches at The Four Seasons. In reality, of course, someone always has to pick up the tab, and in this case that someone is the investor.

The problem starts with investors' tendency to forget that any investment option should be measured first against the permanently accessible, risk-free opportunity to invest in Treasury bills. For example, an investor could simply sell the aforementioned \$100 million equity portfolio outright, buy 12-month Treasury bills, and earn a return of 6.15% (as of June 22, 2000). Alternatively, by holding the equity portfolio, the investor will earn approximately 1.10% in dividends. In the simplest terms, the potential opportunity cost of this altered equity portfolio, in terms of foregone interest income from a cash investment adjusted for the benefit of dividends, is 5.05% or \$5.05 million.

Is a \$100 million collared equity portfolio likely to earn more or less than 6.15%, and is the new expected return on the collared portfolio worth the \$5.05 million in potential opportunity cost? On the basis of current pricing (as of June 22, 2000), a one-year costless collar designed to protect the portfolio from any loss of principal requires giving up any return greater than 12.7%. As Exhibit 2 indicates, the distribution of returns for the principal-protected collared portfolio is such that the investor has a 27% chance of earning zero and a 43% chance of earning 12.7%. Once the probability math is calculated, the expected (average) return is 7.4%. This way of viewing the collar converts the question from one of protection to, "Do I want to pay \$6.15 million to have a 43% shot at making an additional \$6.55 million over the cash return, with a 27% chance of losing it all?"

Other representative collars are analyzed for their impact on the portfolio in Exhibit 2. As presented, the wider the collar (meaning less protection), the closer the expected return, standard deviation, and distribution of expected returns become to uncollared equity. In fact, the relationship between the expected return and standard deviation of a collared equity portfolio is closely correlated with the risk-return relationship of the Capital Markets Line (CML) (Exhibit 1).

In summary, another way to understand the cost of a portfolio protection product is to compare it to the safest investment alternative, cash. Statistically, collars are priced fairly (leaving aside for now transaction costs), but they are not without cost. In addition, the example above highlights that the profile of the expected outcomes is not intuitively obvious. There is a 70% probability of the return being either 0% or 12.7%, which more closely resembles a coin-flip (heads 0%, tails 12.7%) than a long equity position with the benefit of a "disaster insurance policy." In short, the derivative has a much greater impact on the portfolio than is generally advertised or recognized.

Are Portfolio Protection Products "Efficient?"

To the extent one can measure the efficiency of any investment in terms of the trade-off between risk and reward, one can apply the same methodology to portfolio protection products. Would a rational investor be willing to accept cash returns if the expected risk of those returns were similar to those of emerging markets equity? It is in this light that we measure the efficiency of portfolio protection products.

Exhibit 1 plots the expected returns and standard deviation of the returns of selected portfolio protection strategies and compares them to a modified CML.² The exhibit highlights three observations. First, the chart confirms the no-free-lunch theory. None of the protection strategies allows an investor to

² The CML is modified to reflect current one-year Treasury bill rates as opposed to the long-run average of the three-month rate.

achieve a meaningfully higher expected return than is commensurate with a given level of market risk. Second, the chart confirms the asset allocation impact of equity collars. As equity risk is reduced to include principal protection through the use of a collar, the collared portfolio increasingly acquires the characteristics of cash. Similarly, as the level of protection is reduced, the expected return and risk increase. Finally, low-premium put options appear to be the most efficient "disaster scenario insurance." Low-cost, out-of-the-money puts (e.g., strike price 25% below current levels) fall much closer to the CML than high premium, close-to-the-money puts (e.g., strike price 5% below current levels).

Exhibit 3 shows the impact portfolio protection strategies have on the shortfall risk of a protected portfolio. Of particular note is the high-premium put strategy. This portfolio has a 68% probability of not achieving assumed equity class returns (11%), a 16% increase from an unprotected portfolio.

In summary, just as matter cannot be created or destroyed, but merely transformed, there does not seem to be a way to use portfolio protection products to improve the risk-reward relationship of the capital markets, only to move it along the CML. Specifically, some protection products (collars) appear to be relatively efficient ways of altering the risk-return profile of an equity portfolio while some, such as high-premium puts, appear to be inefficient ways of reducing risk. It should be noted, however, that although the standard deviation of hedged portfolio returns may be the same as those of a more conventional asset class, the distribution of the hedged returns is potentially far from "normally" distributed. As demonstrated previously, the return outcomes can more closely resemble a coin-flip than a conventional asset class distribution. Therefore, caution should be used when applying standard deviation (risk) as a metric to compare portfolio protection strategies to conventional asset classes.

Potential Applications

In light of the asset allocation implications, opportunity costs, and the risk-reward relationship of protection products, under what circumstances would one consider using these devices? Minimizing transaction costs and extending planning time are two particular circumstances worth noting.

Transaction Costs

Quite apart from the questionable merits of engaging in short-term asset allocation at all, the sale of a large equity portfolio generates transaction costs, disrupts manager relationships, and (in the case of taxable investors) triggers tax consequences. Synthetic cash hedging instruments can therefore serve a useful purpose as a viable alternative to the actual sale of the portfolio. However, each strategy must be carefully scrutinized for the explicit and implicit costs and potential risks. While transparent costs, such

as the difference between the purchase and sale price of observed exchange products may seem negligible (the difference for a one-year put option is a modest 15 basis points), other unseen costs can be potentially large and very real. These unseen costs include tracking error, unwind transaction costs, volatility skews, and credit default risk. In particular, investors should be extremely diligent when constructing and executing over-the-counter hedging programs because customized hedging products are often illiquid and rarely transparent. Moreover, custom over-the-counter transactions executed on a non-competitive basis can open the investor to potential abuses; and, for this reason, an experienced advisor should be retained to oversee the structure and execution of these trades.

Planning Time

Portfolio protection can be used to extend the investor's planning time horizon. For example, if an investor wanted to neutralize market exposure pending the restructuring of the portfolio at a meeting in a month's time, this could be effected quickly and cheaply (not including implicit costs such as tracking error) by selling index futures or through some other cash product.

Potential Risks and Considerations

In addition to altering the portfolio's investment time horizon and asset allocation structure, the use of portfolio protection products introduces new risks to the portfolio, of which tracking error and credit default risk (from the hedge provider) are the most significant.

Tracking Error

The majority of portfolio protection products available are designed to hedge a well-diversified, market portfolio. Although custom indexes are available, these are generally more expensive and less liquid than the more popular and liquid products based on the S&P 500 Index. However, to the extent that the composition of an investor's actual portfolio differs from that of the index which has been used as a hedge, there will be more or less tracking error between the two. For example, if an investor's U.S. equity portfolio were invested with the median performing value manager and hedged by a short sale of S&P 500 futures, the net loss from tracking error in 1999 would be 1390 basis points, since the S&P 500 returned 21.0% while the median value manager returned only 7.1%.

Credit Default Risk

An insurance policy is only as secure as the credit of the underwriter. In the case of homeowner fire insurance, it is extremely unlikely that a large percentage of insured houses would all burn at once (unless they were all in the same neighborhood!). In the case of portfolio protection, however, a market crash could well result in a deluge of claims against portfolio protection providers whose own solvency might well be impaired by such an event. In some ways, investment banks' providing market crash protection is like an insurance company underwriting fire insurance for all the buildings that surround its own—if the whole neighborhood burns down who is left standing to make good on the insurance? In the case of customized portfolio protection, it is therefore critical to scrutinize the credit-worthiness of the firm providing the "insurance." In the case of exchange-traded instruments, the exchanges' clearing corporations, which have AAA ratings, serve as counter-party to every transaction, making default extremely unlikely.

Conclusion

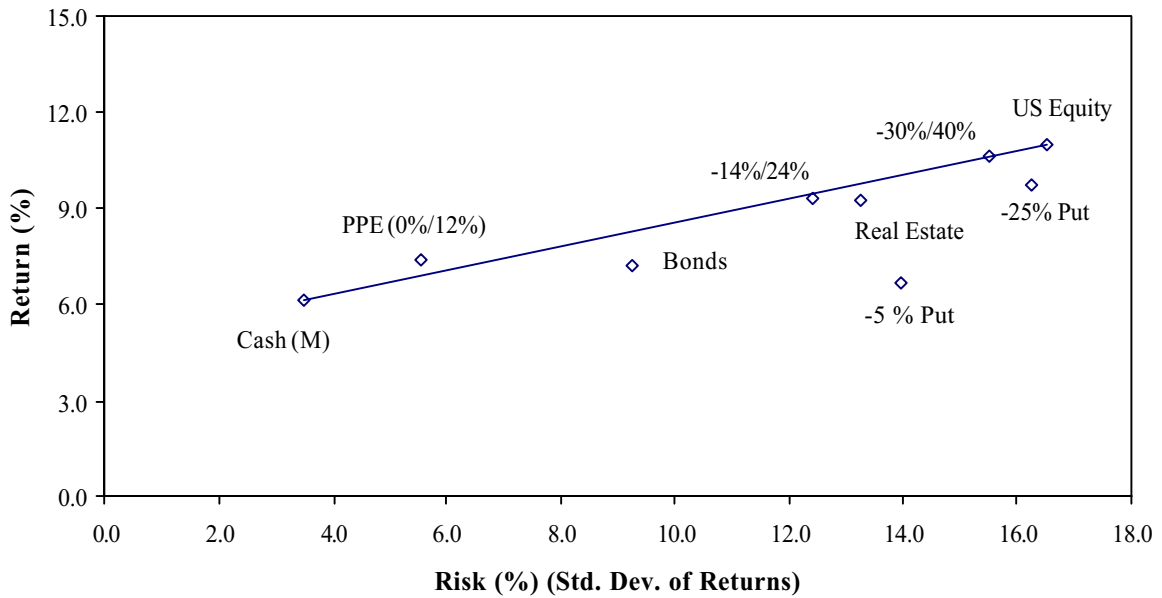
When investors consider hedging their equity portfolios against a market decline, they should first *define the risks that need to be hedged and determine the specific reason for asset reallocation*. This should help them recognize that portfolio protection strategies constitute a specialized form of short-term asset allocation and—if they want to proceed—point them to the products most suitable for realizing these objectives and enable them to monitor the effects of a specific strategy once it has been implemented.

Once a hedging strategy has been chosen, the investor must determine how much of the portfolio to hedge. If the intent is to insure against a disaster scenario, hedging a large part of the equity allocation may be most appropriate. However, if a temporary asset reallocation is the intended purpose, the appropriate amount to hedge is dependent on the amount to be allocated to synthetic cash.

In either case, investors should make sure that they understand the effects on the portfolio's structure, the explicit and implicit costs, the new kinds of risk they have incurred, how the strategy will perform under different outcomes, and what their subsequent actions should be in each of those various scenarios.

Exhibit 1

RISK-RETURN PROFILE OF HEDGING STRATEGIES



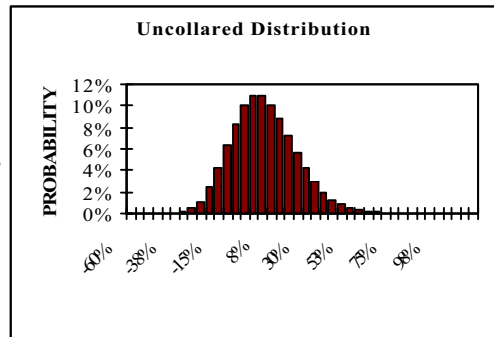
Asset Class	Symbol	Nominal Arithmetic Avg. Return (%)	Risk (%) (Std. Dev. of Returns)
U.S. Equity (Uncollared)	U.S. Equity	11.00	16.50
U.S. Equity (-30%/40% Collar)	-30%/40%	10.60	15.51
Real Estate	Real Estate	9.25	13.25
U.S. Equity (-14%/24% Collar)	-14%/24%	9.27	12.40
U.S. Bonds	Bonds	7.25	9.25
Principal Protected U.S. Equity (0%/12.7% Collar)	PPE (0%/12.7%)	7.42	5.55
Cash	Cash (M)	6.15	3.50

Notes: Cash rate modified to reflect current one-year Treasury bill rates as opposed to the long-run average of the three-month rate. This more accurately reflects the implicit interest rate used to calculate the one-year costless collars.

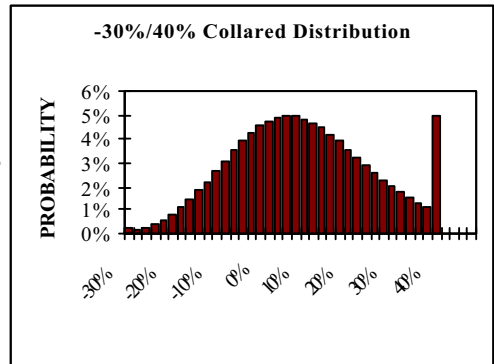
Exhibit 2

COLLARED EQUITY PORTFOLIO EXPECTED PROBABILITY DISTRIBUTIONS

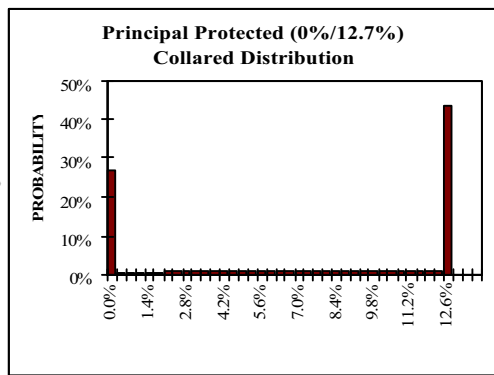
- Arithmetic Mean Return: 11.0%
- Standard Deviation: 16.5%



- Arithmetic Mean Return: 10.6%
- Standard Deviation: 15.5%



- Arithmetic Mean Return: 7.4%
- Standard Deviation: 5.5%



Notes: The above distributions were created using the Monte Carlo simulation with the Cambridge Associates Long-Term Asset Allocation assumptions. The results are based on the ending value of the simulated portfolio.

Exhibit 3

SHORTFALL RISK OF DIFFERENT HEDGING STRATEGIES

