TIPP: Insurance without complexity

"It is not a free lunch, but a much tastier lunch."

Tony Estep and Mark Kritzman

James Thurber said that every American adult male, before he goes to sleep, imagines himself striking out the entire batting order of the New York Yankees. Perhaps the portfolio management equivalent is to imagine oneself being the prescient sponsor or manager who bought an index put in 1929, or adopted portfolio insurance in 1987.

Suppose you had bought a one-year put on your portfolio on January 1, 1929. How much would it really have helped you? The answer turns out to be disappointing. Stocks in the aggregate returned −8.4% in 1929. The "genius" manager with insurance designed to guarantee that his portfolio declined no more than 5% would have outperformed the market by only 3.4%. Nineteen eighty-seven was even worse: The S&P 500 finished the year in the plus column, despite a 30% drop from its high for the year, so that a put bought on January 1 provided no protection, just a cost of about 2.5%.

This example from so-called market crashes points up one of several fatal flaws in portfolio insurance based on puts or put replication. A put protects a chosen percentage of a portfolio's value between the starting date of the option and its expiration date, but that does not necessarily give buyers of insurance exactly what they want. They want protection against market declines, and they do not want to have to forecast when or from what level a decline might start. Nevertheless, even though insurance strategies are not supposed to require market timing, explicit or implicit, the protection offered by any time-dependent technique such as a put will depend heavily on timing — that is, on how well the time window covered by the put overlaps the period of decline.

We propose a technique of portfolio protection that is different from the complex and idiosyncratic methods of put replication that have been adopted by some fund managers. Our method, called TIPP (Time-Invariant Portfolio Protection), has the following characteristics:

- The portfolio can never decline below a pre-set floor;
- The floor is adjusted continuously to be a specified percentage of the *highest value the portfolio reaches;*
- Protection is continuous and has no ending date;
- Computations are simple and can be made at essentially no cost — no computer, no Black–Scholes formula, no estimates of standard deviation;
- The results of this strategy are more sensible than put replication, because they imply an attitude toward risk that varies smoothly with wealth and is not affected by time; and
- There is less trading, which means that the cost of equivalent protection is lower.

In 1929, a portfolio protected by a TIPP program beginning on January 1 would have ended the year with a return of 8.5%, beating the market by 16.9%. In 1987, a TIPP-protected portfolio would have ended the year with a return of 13.4%, beating the market by 8.6%. This latter result is not a simulation; TIPP protection worked just as expected in 1987 with real money. In neither case would the manager have

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had to make any forecasts of market action, standard deviation, interest rates, or anything else, nor would a computer have been needed to signal what to do. Pencil, paper, and the back of an envelope would suffice in either case.

TIPP gives the fund sponsor a means to get protection that matches true goals, without introducing arbitrary considerations that depend on the starting or ending date of the program, without abstruse formulas, and without excessive trading. *It is not a free lunch, but a much tastier lunch.*

THE ORIGINS OF TIPP

TIPP is a simple modification of the idea of constant-proportion portfolio insurance (CPPI), variously proposed by Merton (1971), Black and Jones (1987), and Perold (1986). As Perold describes it, CPPI starts by setting a portfolio floor below today's value. Over time, the floor grows at the risk-free rate. Then simple trading rules (see below) ensure that the portfolio always stays above the floor. This technique is optimal, whereas put replication is not, for investors who wish to insure a certain dollar value over a certain time period.

CPPI is heralded as being insensitive to time because there is no expiration date, thereby avoiding the purposeless trading incurred by put replication. Nevertheless, the actual protection offered by standard CPPI is still dependent on the relationship between today's portfolio value and the value on the day that the CPPI program was started. TIPP is CPPI with a different and better rule for setting the floor.

HOW TO DO IT

The rules for TIPP are simple. Assume that we are insuring a portfolio of stocks, and that the risk-free asset is Treasury bills. First, we choose a floor percentage and a multiplier. Once they are chosen, the steps are:

1. Value the portfolio (stocks plus bills).
2. Multiply the portfolio's value by the floor percentage.
3. If the result of step 2 is greater than the previous floor, then this result becomes the new floor; otherwise, keep the old floor.
4. Subtract the floor from the portfolio value.
5. Multiply the result of step 4 by the multiplier.
6. Buy or sell stocks until the value of stocks held equals the result of step 5; invest the rest, if any, in bills.

Of course, in real life transactions would be done with futures, and the purchase and sale of stocks and bills would be unnecessary.

It is easiest to explain TIPP using an example. Suppose that we have a portfolio worth $100, and we wish to start a TIPP strategy with an "80 floor." In TIPP parlance, this means that the trading program will be constructed so that the portfolio can never decline below 80% of the highest value it ever reaches. Note that the "cushiony" nature of TIPP management means that the portfolio will seldom fall close to the selected floor. As a consequence, an 80 floor generally means that in practice the worst-case value of the portfolio will turn out to be more like 85% of its all-time high. In any case, as the protection level is raised whenever the portfolio value advances, a lower floor generally proves acceptable.

For this example, we will choose a multiplier of 5. On the first day, the floor is 80% of 100, or 80. The difference between the floor and the portfolio value is 100 − 80, or 20. Stocks should be 20 times multiplier, or 20 × 5 = 100. The portfolio is fully invested, so there is nothing to invest in bills.

Now suppose that stocks go up by 2%, so that the portfolio is now worth 102. The new floor is 80% of 102, or 81.6. Stock exposure is 5 × (102 − 81.6) or 102. We are still fully invested. Assume stocks now decline by 1.5%. The portfolio's value drops to 100.47. The floor stays at 81.6. Stock holdings now are 5 × (100.47 − 81.6) or 94.35. The balance is held in bills. As noted, real life transactions would be done with futures, and no actual purchase or sale of stocks or bills would be needed.

TIPP IN BAD AND GOOD TIMES

Figures 1 and 2 depict the results of adopting a TIPP strategy to insure a stock portfolio in two turbulent but contrasting periods in market history, 1928–1937 and 1977 through the present. The graphs show the value of an all-stock portfolio, a TIPP-insured portfolio, and the floor.

The results during the depression years are not surprising; any form of loss reduction produced major benefits. Figure 1 has the virtue of providing a graphic illustration of how TIPP captured much of the gains earned during the upswings of those volatile years, while protecting against the calamitous declines.

The dynamic portfolio outperformed stocks by a substantial amount, never dropping below 79.3% of the highest value it ever reached,[1] and ultimately ending with a value of about four times its beginning value. The benefit of 4.5% shown in Figure 1 means that the dynamic portfolio's average annual return exceeded that of stocks alone by 4.5% per year, compounded over the entire thirteen-year period shown.

In the decade just ended (see Figure 2), there was no major decline until late 1987. Any insured strategy performs below an all-stock strategy in a

FIGURE 1

TIPP Analysis

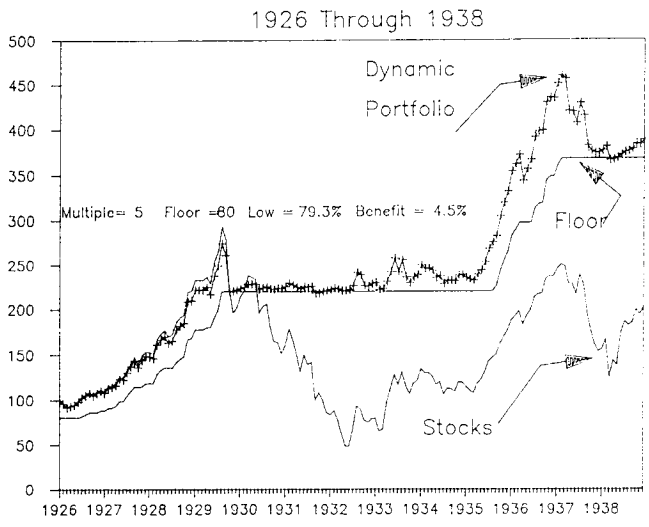
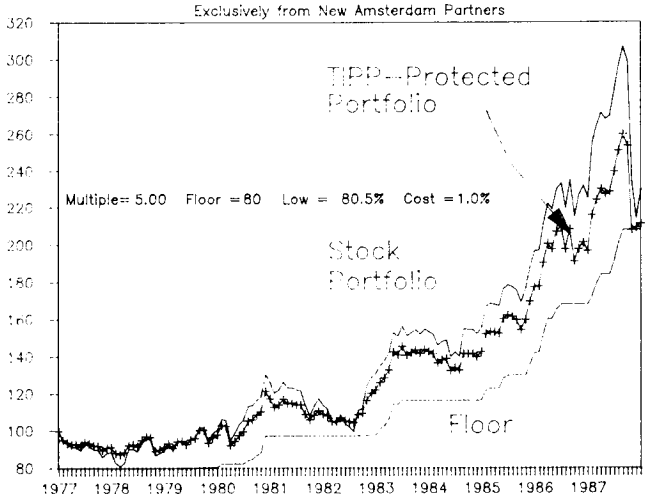


FIGURE 2

TIPP Analysis



straight-up market, and TIPP is not immune to that. The cost of TIPP over that remarkable period turned out to be a reduction in annual return of 1.7%. The difference between this result and that of the period shown in Figure 1 underscores the point that the cost or benefit of any protection technique will be specific to the period over which it is measured.

TIPP COMPARED TO PUT REPLICATION AND CPPI

In practice, portfolio protection usually has been achieved by put replication or CPPI. How do these strategies compare to TIPP?

Put replication is perhaps the most common — but also the least satisfactory — approach to portfolio protection. Put replication requires an investor to rebalance a portfolio continually between a risky component (stocks in our example) and a riskless component (T-bills in our example) in accordance with the hedge ratio computed from the Black–Scholes option valuation formula. In fact, put replication, as its name suggests, is a trading rule designed to produce the same outcome as if an investor had purchased a put option to protect the portfolio. This strategy has gained popularity, because it enables investors to protect portfolios for which put options do not exist, or for which there is not sufficient liquidity in traded options.

Put replication is deficient primarily because it is dependent upon a specific time horizon, typically one year. As the investor approaches the expiration date, the portfolio will be heavily weighted toward bills if its value is close to the floor value or toward stocks if its value significantly exceeds the floor value. If the investor starts the put replication process over at the expiration of the first strategy, the previous day's asset mix must be drastically altered, as if tolerance for risk had changed sharply. In reality, of course, the investor's attitude toward risk is just the same as it was the day before. Rather, the strategy's dependence on a particular expiration date has resulted in completely arbitrary trading.

As we noted in our example for two periods, put replication provides protection that is indexed only to the initial value of the portfolio. Subsequent gains in the portfolio are not protected. Investors have attempted to overcome this limitation by reinitializing the strategy prior to expiration ("rolling the put") and effectively incurring a new premium cost each time. The ongoing decision of whether or not to reinitialize a strategy, however, is tantamount to market timing, which means that the realized costs and benefits will be dependent to a great extent on the time and price of reinitialization. The irony of this approach is that an investor with the ability to time the market successfully would not need portfolio insurance.

Constant proportion portfolio insurance (CPPI) gained immediate acceptance as an alternative to put replication. CPPI requires an investor to specify a floor and a multiple. The difference between the portfolio value and the floor is called the cushion. The trading rule for CPPI is simply to allocate an amount equal to the multiple times the cushion to stocks, with the balance allocated to bills. An obvious advantage of CPPI is its simplicity. There is no need to deal with complicated option theory, nor does the success of the strategy depend on the investor's ability to forecast interest rates and volatility as is required of put replication.

Unlike a put, CPPI continues indefinitely. There is no need to alter the portfolio's mix abruptly

at an arbitrary date. The asset mix changes only as a function of the portfolio's value and not as a function of the passage of time. This usually reduces trading and associated costs.

Compared to put replication, CPPI seems to be less sensitive to arbitrary results caused by timing. After all, there is no expiration. This is only partly true, however. Although CPPI is superior to put replication, it too is deficient in its ability to protect a portfolio from declines that start from a higher value than the portfolio's initial value. Most applications of CPPI allow the floor to grow at the risk-free rate. If the portfolio's value rises faster than the floor, after a while there is no meaningful protection. This year the same problem that was mentioned above in connection with puts has afflicted users of CPPI. Consider a CPPI strategy implemented at the beginning of 1987. By June 30, the S&P had risen nearly 30%. The floor would have grown only a couple of percent. Hence, a portfolio that started out the year 90% protected, for example, would have only about 70% of its value protected by mid-year.

On the other hand, if the floor is allowed to grow at the risk-free rate while stock prices are declining, the portfolio will soon be allocated entirely to bills, so that there is no meaningful participation in any subsequent market rise. The problem is that the portfolio's value, not the risk-free rate, is the relevant value against which to index the floor. There is another subtle problem: In order to give the theoretically promised results, CPPI may require levering the portfolio — investing with borrowed money. This happens when the floor does not rise as fast as the portfolio, a problem that TIPP cures neatly. TIPP never requires leverage, because the floor is never out-of-date with respect to portfolio value.

The whole notion of portfolio insurance is based on the premise that an investor's attitude toward risk takes current wealth into account. Yet, neither put replication nor CPPI takes into account wealth generated by market increases during the insured period. In truth, when prices are rising the investor is always concerned about protecting today's fund value, not the value at some arbitrary date in the past. The investor's true utility is best matched by ratcheting the floor upward according to the TIPP rule, so that protection is geared to replacement cost rather than some arbitrarily chosen historical value.

The results obtained by put replication are sensitive both to the starting and ending dates of the put. CPPI has no expiration, so its results are not sensitive to a terminal date, but CPPI is just as sensitive as put replication to the starting date. Both strategies give their most effective protection when a decline starts at the same time the strategy is initialized. In practice, both strategies are highly time-dependent.

We believe that TIPP overcomes the drawbacks of other protection schemes. It has no expiration. Moreover, TIPP is not sensitive to the starting date. If the portfolio goes up, protection is in effect restarted daily; if the portfolio goes down, the decline will always begin from the floor that is most relevant to the fund sponsor. Trading costs are not increased by trades occasioned by the passage of time. Risk exposure changes smoothly with changes in wealth, in accordance with a plausible theory of investor utility. No forecasts of market volatility or market action are required, nor are any forecasts implicitly assumed in the practical operation of the process. Moreover, TIPP is as simple as CPPI. The trading rules are the same. The strategies differ only in the way the floor is set and adjusted. With CPPI the floor is defined as an absolute value that grows with time at the risk-free rate. With TIPP the floor is defined as a percentage of the portfolio's highest value up to a given moment.

THE COST OF INSURANCE

Every form of portfolio insurance reduces adverse outcomes but also has a cost over time. The goal of fund managers who adopt an insured strategy is to minimize the cost/benefit trade-off. For some forms of insurance, the expected cost is easy to compute; for others it is not. Nonetheless, in every case the true cost of insurance has the same meaning: the reduction in expected return that will result over many periods.

Consider buying a put on a stock portfolio worth $97.50. Typically, a one-year put that would guarantee an ending value no less than $95 would cost about $2.50. You invest $100 in total. If stocks go up, your ending value is 0.975 times the ending value you would have had. If they go down, you do no worse than ending up with $95. What is the true expected cost of the insurance?

The answer turns out to be a reduction in long-term portfolio return of about one percentage point. This is not clear from the data given. The cost has to be determined by evaluating all the possible outcomes from the probability distribution of portfolio returns, and then taking their average, weighted by frequency of occurrence. Any small sample, such as a five- or ten-year period of actual returns, may give a far different result, as we saw in Figures 1 and 2. The outcome of any such study will be dramatically time-dependent and should never be accepted as a proxy for expected costs.

In comparing the cost of puts or put replication to the cost of TIPP, there is a subtle but essential consideration. When you buy a put and the market goes up, the cost of the insurance is large, equal to

the full put premium. Even more important, however, when the market rises, the put's strike price moves farther and farther away from the current value of the portfolio. The portfolio could decline 10%, 20%, perhaps even 30%, and you would have no downside protection.

Consider an investor who bought a put with a 95 floor on January 1, 1987. At that time, this investor intended to protect the portfolio against a decline in value of more than 5%. Stocks have advanced about 35% through mid-year. At this writing, the floor is about 72% of the market value of the portfolio adjusted for the cost of the put, so the portfolio could decline by 22% before the insurance would "kick in." So the investor was asking questions like these: Should we buy another put and pay another premium of 2.5%? Should we forget about it, and decide not to feel bad if we lose the gains earned so far this year? Or should we adopt a TIPP strategy, and save ourselves such problems in the future? The answer was not long in coming.

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[1] Both CPPI and TIPP guarantee that an insured portfolio can never drop below the floor value if it is reviewed continuously. The floor can be penetrated only if there is a drop between trades greater than 1/multiplier, or in this case ⅕ or 20%. In the simulation shown, the portfolio was reviewed monthly, and there were in fact two months during which declines of over 20% were experienced — something to think about in today's markets.