

“Dynamic Securities Assets Allocation in Portfolio Insurance: The Application of Constant Proportion Portfolio Insurance and Time Invariant Portfolio Protection Methodologies in the Chinese Capital Market”

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| ARTICLE INFO | Wang Tiefeng and Kami Rwegasira (2006). Dynamic Securities Assets Allocation in Portfolio Insurance: The Application of Constant Proportion Portfolio Insurance and Time Invariant Portfolio Protection Methodologies in the Chinese Capital Market. <i>Investment Management and Financial Innovations</i> , 3(1) |
| RELEASED ON | Wednesday, 01 March 2006 |
| JOURNAL | "Investment Management and Financial Innovations" |
| FOUNDER | LLC “Consulting Publishing Company “Business Perspectives” |



NUMBER OF REFERENCES

0



NUMBER OF FIGURES

0



NUMBER OF TABLES

0

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Dynamic Securities Assets Allocation in Portfolio Insurance: The Application of Constant Proportion Portfolio Insurance and Time Invariant Portfolio Protection Methodologies in the Chinese Capital Market

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Abstract

The goal of this paper is to study the application of the methodologies of dynamic allocation for securities assets on the basis of option theories. In order to limit the risk of the market value fluctuating in Chinese capital market, we designed the portfolio insurance in the light of Constant Proportion Portfolio Insurance (CPPI) and Time Invariant Portfolio Protection (TIPP) methodologies. The results of the data analysis suggest that the most important consideration is to set a floor for the value of the portfolio, and then seek to achieve the maximum participation in securities markets for the rising return.

1. Problem definition and literature review

Portfolio insurance originated from the option theory for portfolio of stocks and put options. But in reality, it is hard to get the perfect matched options, and it is not easy to purchase put options to fulfill the insurance concept.

Black and Scholes (1973) developed the valuation formula for call options in 1973, thus the practice of the concept about portfolio insurance was initiated. Rubinstein (1985) offered the concept of replicating options of stocks and risk-free assets. In as much as there may not be suitable put options, the investors who prefer portfolio insurance can still implement the portfolio insurance methodologies to replicate the return of options through dynamic assets adjustment; thus the application of insurance methodologies in portfolio is highly feasible.

Robert D. Arnott (1994) indicated that an investor who manages his assets by mostly depending on his estimation of the market, might make mistakes easily under emotion.

As for the institutional investors, such as insurance, fund or securities companies, which hold many funds and many diversified portfolios, these may use some quantitative methods, such as dynamic assets adjustment methodology based on option theories, and offer an objective basis. The investors may avoid emphasizing the recent experiences and ignoring the situation about the real potential market. This is the focus of this study.

The goal of this paper is to study the implications of the application of the methodologies of dynamic allocation for securities assets on the basis of option theories in the Chinese capital market by designing the portfolio insurance in the light of Constant Proportion Portfolio Insurance (CPPI) and Time Invariant Portfolio Protection (TIPP) methodologies.

The dynamic assets allocation methodologies based on option theories work as follows:

1.1. High calls-low puts methodology (purchase of insurance)

Synthetic puts methodology: based on the valuation model of options suggested by Black and Scholes (1973), you adjust the amount of risky assets and risk-free assets to replicate the return of European puts.

Referring to the avoidance of the disturbance from the estimation of volatility rate, researchers have developed some simple methods to achieve the target of insurance without the estimation of volatility rate, mainly are Constant Proportion Portfolio Insurance (CPPI) and Time Invariant Portfolio Protection (TIPP) methodology respectively.

- ◆ CPPI methodologies

Rerold (1986), Black and Jones (1987) suggested CPPI methodology. They utilize the following equation to define the amount of risky assets and the risk-free assets:

Amount of risky assets invested = multiple factor \times (total value of insured portfolio – initial Floor).

The multiple factor and initial floor are defined at the beginning of the period and without any change.

The equation for CPPI is given as:

$$E = M * (A - F),$$

where E – the part of active assets should be invested;

M – multiple factor;

A – total value of portfolio;

F – initial Floor.

There are two categories of assets, the part with higher risk and higher return called active assets, and the part with lower risk and lower return called reserve assets. In this paper, the active assets are represented by the fund, and the reserve assets are taken to be bonds and cash etc. When the total of assets is changed, one can calculate the amount of risky assets with the above-mentioned equation. The difference between the total of assets and the risky assets will be the allocated part for risk-free assets.

◆ TIPP methodologies

On the other hand, Estep & Kritzman (1998) introduced TIPP methodology. The equation for TIPP adjustment is very similar to the equation for CPPI. The only difference is the assumption in respect to the initial floor: it is not constant, the new initial floor will be the maximum value through the comparison of original amount and a constant proportion of assets at that time.

$$\text{Insured amount} = \text{Max} (A * f, F),$$

where: f = the insured proportion the investor supposed (suppose 90%);

F = the initial Floor defined at the beginning of the period.

When the total assets are increased, the initial floor should be increased correspondingly. When the total assets are decreased, the total assets should not be less than the insured amount, and in that way TIPP is a more passive approach than CPPI.

1.2. Low calls-high puts methodology (sale of insurance)

Constant mix: the allocation principle is that the proportion of risky assets or risk-free assets in portfolio is constant. This methodology will be a special case of constant proportion methodology. The initial floor offered is 0, and the multiple factor is between 0 and 1.

Rubinstein (1985) pointed out that the choice between option and insurance methodologies reflects investor's risk preference. If the market situation is as perfect as Black and Scholes assumed, constant mix methodology might be mostly suitable for investors. However the market situation is always not perfect. Thus the insurance methodologies will be the most suitable.

2. The design and assumptions of the study of assets allocation methodologies

2.1. The design for the study

The design concept of dynamic assets allocation methodology is for the break-even of investment portfolio as well as getting higher return rate. In order to break-even, the major part of funds should be invested in repurchasing securities, bonds, cash and other securities with constant return, and the minor part will be invested in the financial products with high risk and high return.

Since, the financial derivatives such as options have not been developed in the Chinese market, we can only use options replication methods in the assets allocation to achieve the break-even target. Linking with the practice and studying through preliminary numerical empirical analysis, we believe CPPI or TIPP insurance methodologies for dynamic allocation of assets will basically realize the break-even of assets.

As for the different trends of quotations in future financial market, CPPI and TIPP method have their respective advantages. But because the future is not certain, the break-even will be the first requirement in the design for break-even products of portfolio insurance in order to maximize the rising return from stock market on the base of break-even.

2.2. The assumptions of the study

A number of assumptions are explicitly made in this study. The main assumptions are as follows:

2.2.1. The initial amount of portfolio is 100 million Chinese yuan.

2.2.2. Fund and bonds will represent risky asset and risk-free asset respectively, and since there is sufficient research to back up their valuation system, it will be easier to influence the ability of fund managers for selecting investment products, and estimating the market trends.

2.2.3. CTIS fund index¹ will be the target of risky assets, and CTIS treasury bonds index² will be the target for risk-free assets. These two indices are calculated by weighting with trading amount / issued amount, and they are identified with many research institutes and fund companies.

2.2.4. The fund indices and treasury bonds indices will be used for zero-sum transaction.

2.2.5. Daily adjustment of holding amount according to the variation of the fund index and the treasury bonds index on previous day, daily calculate the market value of the fund and bonds included in the portfolio, then follow the predetermined regulation to adjust the holding amount.

2.2.6. The index following error is neglected. In practice, through the relative mature analysis system, the funds, selected by average funds discount rate, the liquidity of investment portfolio and the growth of funds net value can perform better than the funds index. It is not difficult that the leading bonds, which are evaluated adequately, can perform better than the treasury bonds index.

2.2.7. Tax and expense in transaction are not considered. Stamp tax is not needed in the transaction for fund or treasury bonds, and the commission for fund or treasury bonds is under 0.01% for institutional investors. To simplify the study, the tax and expense in transaction are not considered.

2.2.8. The period for the study is from December 30, 1999 to June 6, 2003. During this period of 3.5 years, the fund indices passed big bull market, big bear market and margin market. Thus utilizing the daily closed fund indices to calculate the data of targeted assets for the design of break-even products, one may objectively investigate the investment achievements with two kinds of policies under different market quotations.

3. Study Results

The test for comparing CPPI and TIPP with constant risk multiple factor determined at the beginning of the period, had the results as given in Table 1.

After analyzing the above-mentioned results, except the last stage, TIPP methodology indicates to realize the result of break-even in all other stages, and the analysis shows that it will bring higher rate of final return than CPPI methodology. Theoretically, the utilization rate of CPPI should be higher than TIPP, and if the securities market goes well, the return rate of CPPI will be better than TIPP, yet if the price rises at the beginning and then fluctuates, the return rate of TIPP will be higher than CPPI. What does this mean?

¹ This is a value-weighted bonds index in China bond market, published by China Trust and Investment Securities Co.

² This is a value-weighted funds index in China funds market, published by China Trust and Investment Securities Co.

This means that TIPP is preferred in Chinese stock market. However the utilization rate of TIPP is not high in the Chinese market. This could be because during the process of dynamic allocation for portfolio, it is necessary to use TIPP and CPPI methodologies alternately and flexibly.

Table 1

Test results for CPPI and TIPP (with constant risk multiple factor determined at the beginning of the period)

| Starting time | Ending time | Rising range of funds | Rising range of treasury bonds | Description of market | Multiple factor | CPPI | | TIPP | |
|---------------|-------------|-----------------------|--------------------------------|---|-----------------|--------------|----------------|--------------|----------------|
| | | | | | | Insured rate | Rate of return | Insured rate | Rate of return |
| 2000-1-1 | 2001-1-1 | 26.66% | 4.15% | Funds and bonds are rising unilaterally | 2 | 80% | 14.06% | 80% | 12.81% |
| 2000-1-1 | 2001-1-1 | | | | 3 | 80% | 19.18% | 80% | 16.93% |
| 2000-1-1 | 2001-1-1 | | | | 4 | 95% | 10.48% | 80% | 20.73% |
| 2000-1-1 | 2001-1-1 | | | | 5 | 95% | 11.99% | 85% | 19.41% |
| 2000-1-1 | 2001-1-1 | | | | 8 | 95% | 15.20% | 90% | 19.45% |
| 2000-1-1 | 2002-1-1 | 22.60% | 10.32% | Funds are rising in the beginning and then falling; bonds are rising unilaterally | 2 | 80% | 13.13% | 80% | 16.20% |
| 2000-1-1 | 2002-1-1 | | | | 3 | 80% | 13.74% | 80% | 19.39% |
| 2000-1-1 | 2002-1-1 | | | | 4 | 95% | 8.17% | 80% | 22.68% |
| 2000-1-1 | 2002-1-1 | | | | 5 | 95% | 7.41% | 85% | 22.64% |
| 2000-1-1 | 2002-1-1 | | | | 8 | 95% | 9.41% | 90% | 25.05% |
| 2000-1-1 | 2003-6-6 | 2.72% | 17.34% | Funds are rising sharply in the beginning and then falling; bonds are rising unilaterally | 2 | 80% | 4.84% | 80% | 14.42% |
| 2000-1-1 | 2003-6-6 | | | | 3 | 80% | -1.23% | 80% | 15.72% |
| 2000-1-1 | 2003-6-6 | | | | 4 | 95% | 2.64% | 80% | 18.43% |
| 2000-1-1 | 2003-6-6 | | | | 5 | 95% | 0.63% | 85% | 20.49% |
| 2000-1-1 | 2003-6-6 | | | | 8 | 95% | -2.05% | 90% | 25.16% |
| 2001-1-1 | 2002-1-1 | -1.43% | 5.86% | Funds are rising a little and then falling in medium extent; bonds are rising unilaterally | 2 | 80% | 3.73% | 80% | 4.92% |
| 2001-1-1 | 2002-1-1 | | | | 3 | 80% | 3.20% | 80% | 4.64% |
| 2001-1-1 | 2002-1-1 | | | | 4 | 95% | 3.10% | 80% | 4.66% |
| 2001-1-1 | 2002-1-1 | | | | 5 | 95% | 4.10% | 85% | 5.39% |
| 2001-1-1 | 2002-1-1 | | | | 8 | 95% | 6.21% | 90% | 7.17% |
| 2001-1-1 | 2003-6-6 | -17.42% | 12.60% | Funds are rising a little and then falling sharply; bonds are rising unilaterally | 2 | 80% | 2.14% | 80% | 2.14% |
| 2001-1-1 | 2003-6-6 | | | | 3 | 80% | 0.03% | 80% | 0.03% |
| 2001-1-1 | 2003-6-6 | | | | 4 | 95% | -0.48% | 80% | -0.48% |
| 2001-1-1 | 2003-6-6 | | | | 5 | 95% | 2.28% | 85% | 2.28% |
| 2001-1-1 | 2003-6-6 | | | | 8 | 95% | 6.30% | 90% | 6.30% |
| 2002-1-1 | 2003-6-6 | -18.82% | 6.18% | Funds are fluctuating within an extent and then falling sharply; bonds are rising, then falling and then rising | 2 | 80% | -3.00% | 80% | -3.00% |
| 2002-1-1 | 2003-6-6 | | | | 3 | 80% | -6.99% | 80% | -6.99% |
| 2002-1-1 | 2003-6-6 | | | | 4 | 95% | -10.63% | 80% | -10.63% |
| 2002-1-1 | 2003-6-6 | | | | 5 | 95% | -8.67% | 85% | -8.67% |
| 2002-1-1 | 2003-6-6 | | | | 8 | 95% | -7.54% | 90% | -7.54% |

In order to ensure the break-even, even when the TIPP methodology is implemented, risk multiple factor M selected should not be very big, and not be too small as for obtaining higher utilization rate. After studying the results of the recent test, we recommend M to be 3~5.

The operation for dynamic allocation methodologies highly depends upon the variation of market prices. When the market price rises at the beginning and then falls, it is easy to operate for the break-even; if the market price falls at the beginning and then rises, it is hard to keep a good utilization rate. For example, regarding the last stage of the above-mentioned test, the price of risky assets (funds) fall sharply from the beginning, if we prefer M with 2 and the insured rate be adjusted to 95%, the break-even will still be realized.

4. Summary

Through the above-mentioned empirical tests and analysis, we find out that implementing the methodologies of CPPI and TIPP of portfolio insurance and realizing dynamic assets allocation

perfectly and passively, may basically realize the result of break-even at the end of the period. In assets management, the design concept of break-even products is actually utilized. However there are no financial derivatives in China as yet. Therefore one must implement the design concept in combination with the concept of active investment management. And this general approach may entail the following :

4.1. Define the lowest limit of amount for the fixed return securities in the portfolio: then follow the portfolio insurance methodologies to dynamically allocate the investment proportion of fixed return securities and stocks for break-even and enjoy the rising return in securities market.

4.2. In order to raise the investment return of portfolio, especially to raise the utilization rate of risky assets, it is necessary to actively invest both fixed return securities and fund. As regards to the fixed return securities, we invest the bonds with lower credit risk and with the match for surplus period with break-even period, and fully exert the ability in selecting chance and selecting securities to obtain certain excess return in bonds investment. As regards to the funds investment, we suggest that the investment proportion for funds should not surpass the investment limitation demanded by dynamic allocation, and through the estimation of the achievement and market tendency, we must assure the stability and return of the portfolio.

4.3. The above-mentioned test is based on the multiple factor and the initial Floor, which are assumed at the beginning of period, the countermeasures of allocation for the situation after fluctuation of market price will be the key study in next stage. According to the results from foreign studies, there are three adjusting rules for practice (Etzioni, 1986). They are the adjusting rule for drop, periodical adjusting rule, and adjusting rule for market fluctuation. But through the recent empirical studies, we find out that in different market situations, there is no any rule whose achievement will consistently surpass all other rules. According to the empirical results from Taiwan, they predicted the achievement of adjusting rule for market fluctuation is better in long market, and the periodical adjustment rule is better in short market.

Finally, when the funds entrusted for financial management are near the end of entrusted period, the redemption of the funds should be considered, and because at this time the investment proportion of fixed return securities is high, it is necessary to establish through further analysis, the appropriate investment methodologies for this situation.

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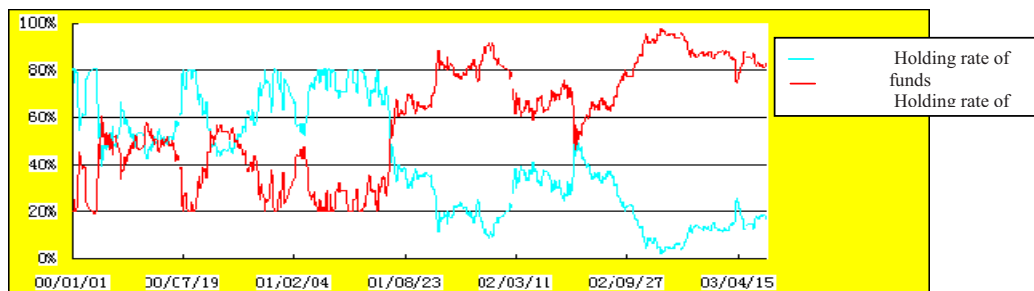
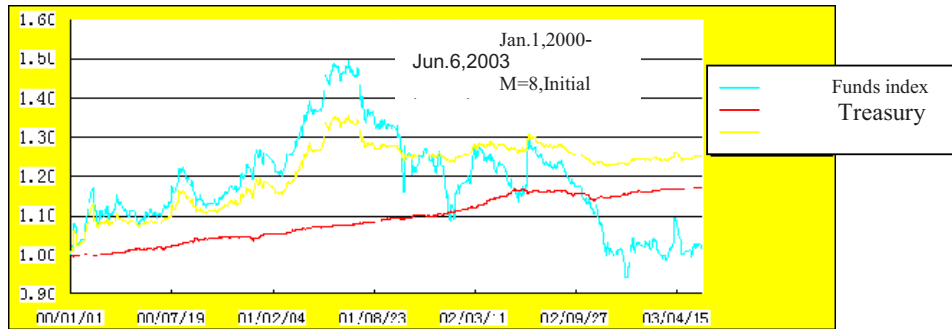
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Appendix

Part of Test and Data Analysis

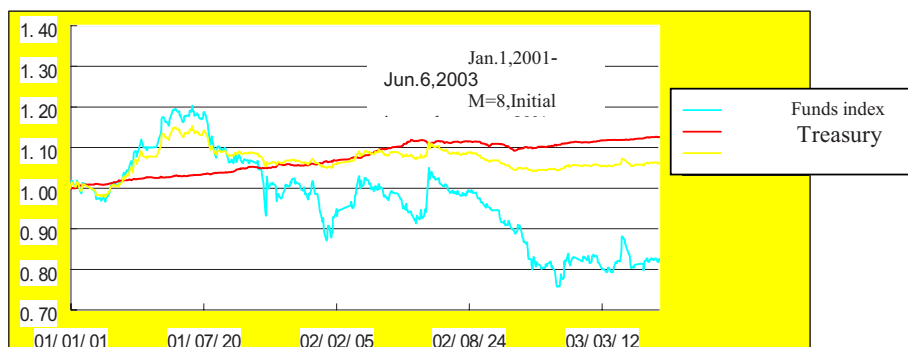
I. Jan.1, 2000-Jun.6, 2003 : TIPP methodologies (M=8, Insured amount=90%) test and data analysis results

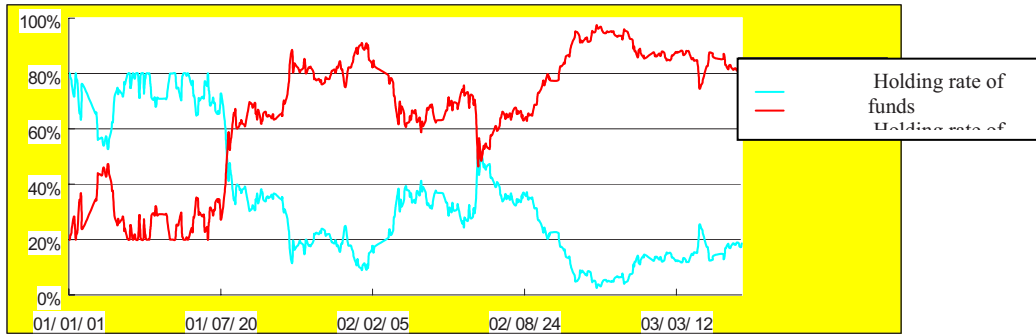
| Original assets | Rising range of funds | Rising range of treasury bonds | Ending rising range | Average rising range | Lowest rising range | Largest rising range | Standard deviation | Average holding rate of funds | Average holding rate of bonds |
|-----------------|-----------------------|--------------------------------|---------------------|----------------------|---------------------|----------------------|--------------------|-------------------------------|-------------------------------|
| 10000 | 2.72% | 17.34% | 25.16% | 21.33% | 0.00% | 35.84% | 8.01% | 41.3% | 58.7% |



II. Jan.1, 2001-Jun.6, 2003: TIPP methodologies (M=8 , Insured amount=90%) test and data analysis results

| Original assets | Rising range of funds | Rising range of treasury bonds | Ending rising range | Average rising range | Lowest rising range | Largest rising range | Standard deviation | Average holding rate of funds | Average holding rate of bonds |
|-----------------|-----------------------|--------------------------------|---------------------|----------------------|---------------------|----------------------|--------------------|-------------------------------|-------------------------------|
| 10000 | -17.42% | 12.60% | 6.30% | 6.93% | -2.17% | 15.37% | 3.24% | 34.5% | 65.5% |





III. Jan.1, 2002-Jun.6, 2003: TIPP methodologies (M=2, Insured amount=95%) test and data analysis results

| Original assets | Rising range of funds | Rising range of treasury bonds | Ending rising range | Average rising range | Lowest rising range | Largest rising range | Standard deviation | Average holding rate of funds | Average holding rate of bonds |
|-----------------|-----------------------|--------------------------------|---------------------|----------------------|---------------------|----------------------|--------------------|-------------------------------|-------------------------------|
| 10000 | -18.82% | 6.18% | 4.23% | 2.89% | -0.95% | 4.88% | 1.39% | 7.97% | 92.03% |

