Portfolio Rebalancing

Investment Advisory Committee Meeting

September 21, 2011

The Benefits of Rebalancing

- The benefits of a rebalancing policy include taking advantage of the mean reverting tendencies of the market, and preserving the target asset allocation
- Markets in general tend to be mean reverting, even in an upward or downward trending market, and a rebalancing policy can add value by capturing a portion of the mean reverting tendencies by selling a small portion of assets that have done relatively well and buying a commensurate amount of assets that have not performed as well
- A rebalancing policy can add a measure of asset allocation discipline and prevent a portfolio from drifting from its intended allocation and expectations
- A disciplined and well executed rebalancing strategy can add value to a portfolio over time by lowering risk and increasing returns

Rebalancing Methodologies

- Rebalancing methodologies can be time or range dependent
- Time dependent rebalancing is choosing to rebalance on a predetermined day each period (e.g. the 15th business day of each month, quarter, semi-annual)
- Range dependent rebalancing involves setting a predetermined range (e.g. +/- 5%) around an asset class and gives consideration to the volatility and weight of the asset class

NCRS Rebalancing Policy

- When it comes to rebalancing, NCRS has several considerations including:
  - Equities and fixed income comprise 76.5% of the target asset allocation with equities representing 40.5%
  - Legislative prohibitions limit the amount of alternatives to a hard cap
  - Transaction costs
- The Investment Staff believes there are benefits to a range rebalancing methodology
- The benefits of a rebalancing strategy based on a range can vary depending on the size of range that is utilized
- A range dependent rebalancing policy allows Staff to approximate the price level in the market that would trigger a rebalancing

NCRS Rebalancing Policy

- The rebalancing ranges of the NCRS portfolio are largely predicated on the public equity portfolio given its weight and volatility characteristics
- The rebalancing ranges of the NCRS portfolio also assume that Alternative asset classes will remain close to target and are illiquid
- Therefore, the initial rebalancing range for the NCRS equity and fixed income portfolio was determined to be +/- 2.5% of target
  - Would require an approximate 10% move in the equity market holding all other assets constant
  - Historical realized volatility of the equity market is 16% annualized
  - Historical realized monthly volatility is equal to 4.6%
  - Rolling realized volatility will be evaluated in the context of our ranges on an ongoing basis

Rebalancing Options

- Rebalancing with equities can be accomplished by selling or buying physical equities when the predetermined range is breached
- Selling calls and puts at strikes that correspond to our predetermined price levels which are commensurate with our rebalancing range
- On expiration, there is not a P&L difference between selling physical equities or having sold calls/puts which are exercised except for the premium that is collected from selling the options

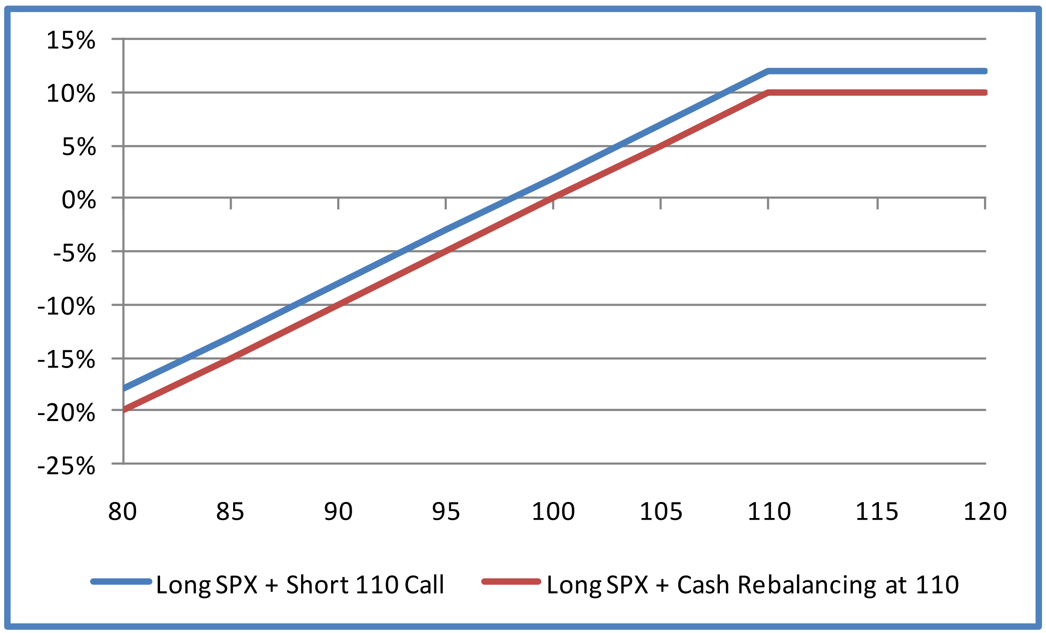
Option Basics

- Long Call = the right to buy an amount of securities at a certain price
- Short Call = the obligation to sell an amount of securities at a certain price
- Long Put = the right to sell an amount of securities at a certain price
- Short Put = the obligation to buy an amount of securities at a certain price
- Long Strangle = long an out-of-the-money call and put
- Short Strangle = short an out-of-the-money call and put
- European style exercise = options can only be exercised at expiration
- American style exercise = options can be exercised at any time prior to expiration
- Notional amount = is the face amount of the contract

Rebalancing with Calls

- The graph below illustrates the payoffs of rebalancing with physical equities and selling a call with a strike and notional in an amount that corresponds to where the physical equities would be sold

- The premium received for selling a 3-month 10% out-of-the-money call is equal to 2% of the index value at the time of the sale[1]

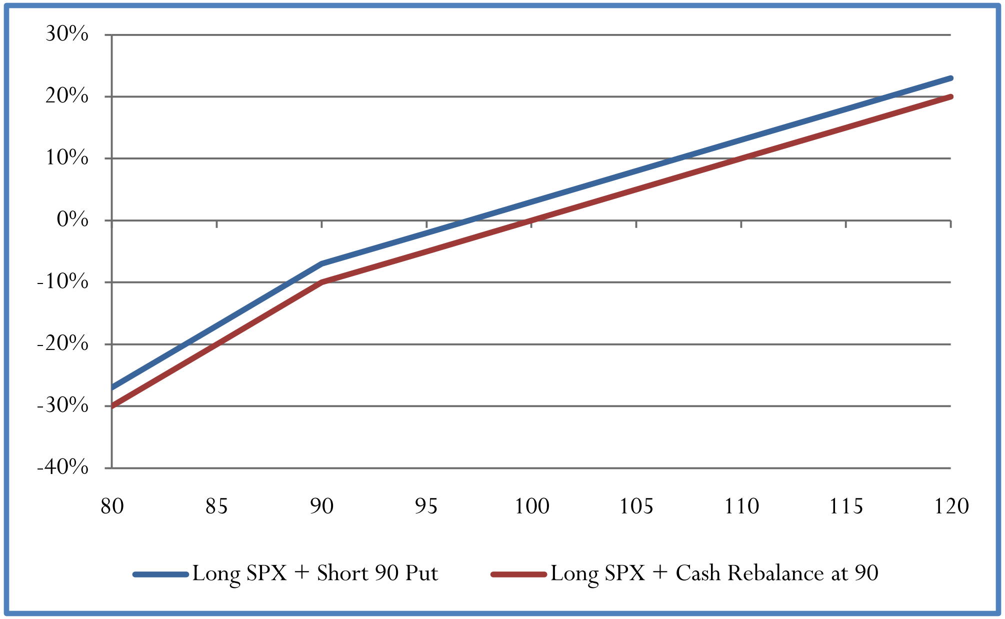


[1] As of Sept. 9, 2011, the option premium will vary from period to period

Rebalancing with Puts

- The graph below illustrates the payoffs of rebalancing with physical equities and selling a put with a strike and notional in an amount that corresponds to where the physical equities would be bought

- The premium received from selling a 3-month 10% out-of-the-money put is equal to 3% of the index value at the time of sale[1]

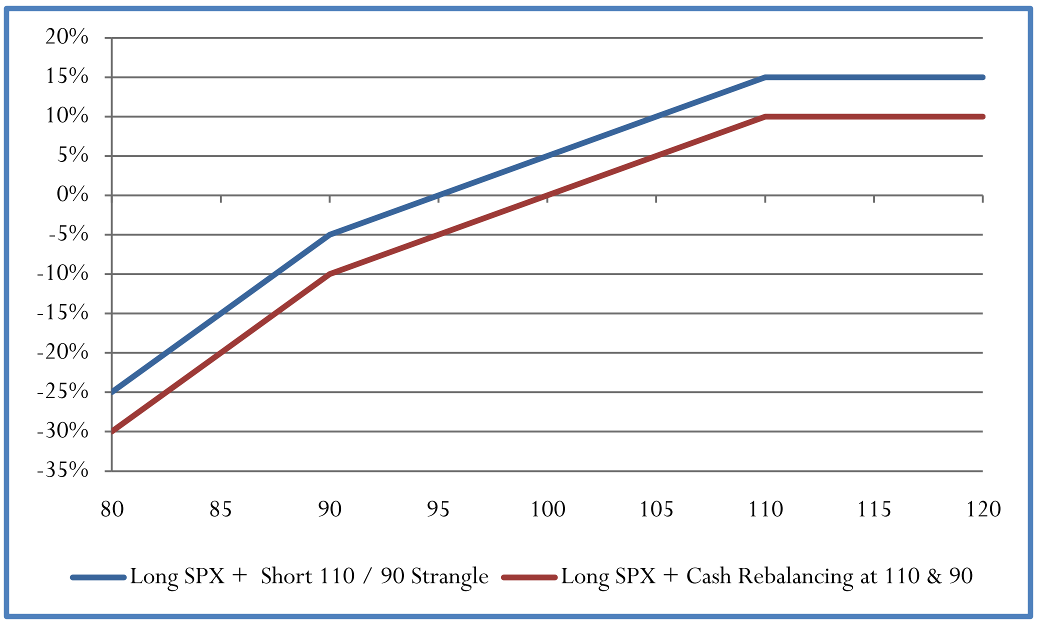


[1] As of Sept. 9, 2011, the option premium will vary from period to period

Rebalancing with Calls and Puts

- The graph below illustrates the payoffs of rebalancing with physical equities and rebalancing with calls and puts (strangle) that correspond directly to the same notional and price level as a physical rebalancing

- The premium received for selling a 3-month 10% out-of-the-money strangle is equal to 5% of the index value at the time of sale[1]



[1] As of Sept. 9, 2011, the option premium will vary from period to period

Rebalancing with Options

- An example below illustrates the mechanics of using options to rebalance equities
- Example
  - Sell 3-month calls and puts where we would naturally rebalance (10% out-of-the-money)
  - Since options are cash settled, on expiration we settle any options that are in-the-money with cash and at the same time either buy or sell equity securities equal to the notional value of the options
  - Trade information below is based on 3-month options[1]:
    - S&P equal to 1154
    - Sell calls with a strike of 1270 for 20
    - Sell puts with a strike of 1038 for 37.5
    - Total option premium received equal to 57.5 or 4.98%

At Expiration			
Market Moves Up		*Market Moves Down*	
S&P 500	1300	**S&P 500**	1000
Value of Calls	1270 - 1300 = (30)	**Value of Calls**	0
Value of Puts	0	**Value of Puts**	1000 - 1038 = (38)
Cash Equivalent Position		**Cash Equivalent Position**	
Sell S&P 500	1300	Buy S&P 500	1000
Value of Calls	-30	Value of Puts	38
Premium Received	57.5	Premium Received	-57.5
Equal to selling SPX at	**1327.5**	**Equal to buying SPX at**	**980.5**

[1] As of Sept. 9, 2011, the option premium will vary from period to period

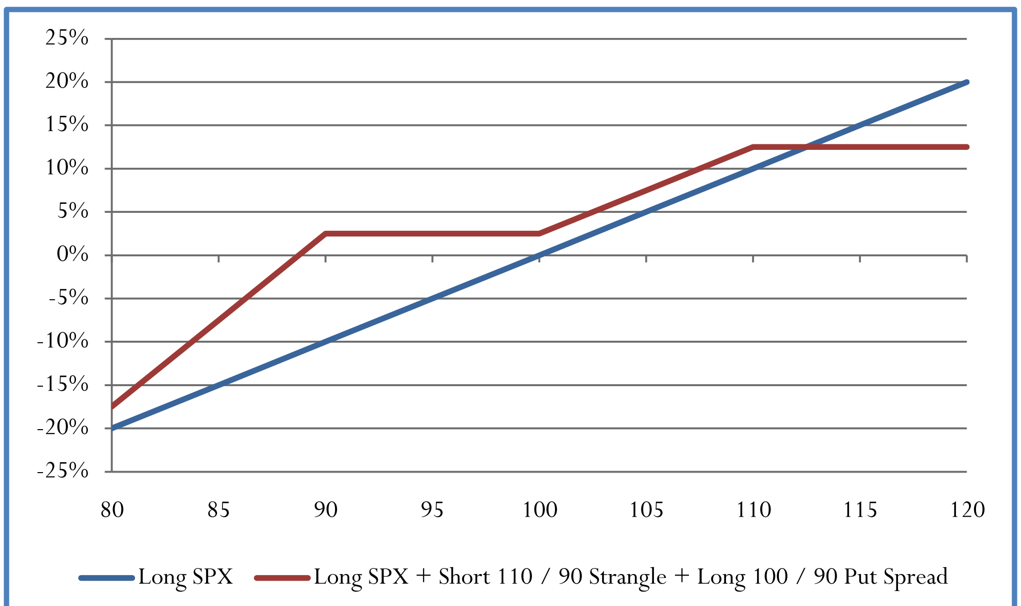
Benefits of Having Options

- The premium that is received from selling out-of-the-money options which correspond to our rebalancing price targets can either be kept and monetized

- Could be redeployed to buy downside protection when concerns about market risks are elevated

- Put Spread = the buying or selling of a put at one strike and entering into an offsetting put at a lower strike in an equivalent notional amount

- The graph below illustrates the payoffs from owning the S&P 500 outright and owning the S&P 500 + selling a strangle (a 3-month 10% out of the money call and put) + buying a put spread (buying a 3-month at-the-money put + selling a 3-month 10% out-of-the-money put)[1]



[1] As of Sept. 9, 2011, the option premium will vary from period to period