

# STANDARD & POOR'S

## Standard & Poor's Currency-Hedged Index Series

### *Tools to Manage Currency Risk in International Portfolios*

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- A currency-hedged index is designed to represent returns for those global index investment strategies that involve hedging currency risk, but not the underlying constituent risk. Investors employing a currency-hedged strategy seek to eliminate the risk of currency fluctuations and are willing to sacrifice potential currency gains.
- Standard & Poor's currency-hedged indices are calculated by hedging beginning-of-period balances using rolling one-month forward contracts. Currency-hedged indices are available in major currencies for most Standard & Poor's global indices, including the S&P 500 and the S&P Hedge Fund index.
- The hedge ratio is the proportion of the portfolio's currency exposure that is hedged. The standard currency-hedged index series uses a hedge ratio of 100%.
- The hedge ratio can be varied to arrive at index portfolios that are over- and under-hedged to varying degrees. In contrast to a 100% hedged standard index that seeks to eliminate currency risk and seek passive market exposure, these over- or under-hedged portfolios seek to take active currency risks to varying degrees based on the portfolio manager's view of future currency movements. Standard & Poor's calculates custom indices based on different hedge ratios.
- This paper documents the methodology of Standard & Poor's currency-hedged index series and demonstrates the outcomes of different hedging strategies.

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*The hedge ratio is the proportion of the portfolio's currency exposure that is hedged. The standard hedged index series has a hedge ratio of 100%.*

## A Currency-Hedged Index

A currency-hedged index is designed to represent returns for those global index investment strategies that involve hedging currency risk, but not the underlying constituent risk.<sup>1</sup> Investors employing a currency-hedged strategy seek to eliminate the risk of currency fluctuations and are willing to sacrifice potential currency gains. By selling foreign exchange forward contracts, global investors are able to lock in current exchange forward rates, and manage their currency risk. Profits (losses) from the forward contracts are offset by losses (profits) in the value of the currency, thereby negating exposure to the currency.

## Calculating a Currency-Hedged Index

<b>Currency Return</b>	= (End Spot Rate / Beginning Spot Rate) – 1	(1)
<b>Unhedged Return</b>	= (1+Local Total Return)*(1+Currency Return) – 1	(2)
<b>Currency Return on Unhedged Local Total Return</b>	= (Currency Return) * (1+Local Total Return)	(3)
<b>Forward Return</b>	= (Beginning 1 month Forward Rate / Beginning Spot Rate) – 1	(4)
<b>Hedge Return</b>	= Hedge Ratio * (Forward Return – Currency Return)	(5)
<b>Hedged Index Return</b>	= Local Total Return + Currency Return on Unhedged Local Total Return + Hedge Return	(6)
<b>Hedged Index Level</b>	= Beginning Hedged Index Level * (1 + Hedged Index Return)	(7)

Details of the formula used in computing Standard & Poor's currency-hedged indices are given in Appendix 1. Available hedged indices and their base dates are listed in Appendix 2. It involves hedging beginning-of-period balances using rolling one-month forward contracts. Daily hedge returns are computed by interpolating between the spot price and forward price.

## The Hedge Ratio

The hedge ratio is simply the proportion of the portfolio's currency exposure that is hedged.

- **Standard Currency-Hedged Index:** In a standard currency-hedged index, we simply wish to eliminate the currency risk of the portfolio. Therefore, for purposes of the standard currency-hedged index return series, the hedge ratio is 100%.
- **No Hedging:** An investor who expects upside potential for the local currency of the index portfolio versus her home currency, or does not wish to eliminate currency risk of the portfolio, will use an unhedged index. In this case, the hedge ratio is 0, and the index simply

<sup>1</sup> By currency risk, we simply mean the risk attributable to the security trading in a currency different from the investor's home currency. This definition does not incorporate risks that exchange rate changes can have on an underlying security's price performance.

*In contrast to a 100% currency-hedged standard index that seeks to eliminate currency risk and seek passive equity exposure, over- or under-hedged portfolios seek to take active currency risks to varying degrees based on the portfolio manager's view of future currency movements.*

*Standard & Poor's calculates indices with different hedge ratios as custom indices.*

becomes the standard index calculated in the investor's home currency. Such indices are available in major currencies as standard indices for most Standard & Poor's indices.

- ❑ **Over Hedging:** An investor who expects significant upside potential for her home currency versus the local currency of the index portfolio might choose to double her currency exposure. In this case, the hedge ratio will be 2.
- ❑ **Under Hedging:** An investor who expects some upside potential for the local currency of the index portfolio versus her home currency, but wishes to eliminate some of the currency risk, might choose to have half her currency exposure hedged using a 0.5 hedge ratio.
- ❑ **Optimal Hedging:** In order to have minimum variability in the value of the currency-hedged portfolio, standard variance minimization suggests the following hedge ratio:

$$\text{Hedge Ratio} = \frac{\text{Covariance of the portfolio return to forward return}}{\text{Variance of Forward Return}}$$

The above hedge ratio minimizes total risk of a hedged portfolio.

Standard & Poor's calculates indices with hedge ratio different from 1 as custom indices.

### **A More Intuitive Approach**

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Let us break down Equation (6) into its components with hedge ratio as 1:

$$\text{Hedged Index Return} = \text{Local Total Return} + \text{Currency Return} * (1 + \text{Local Total Return}) + \text{Hedge Return} \quad (8)$$

Rearranging Equation (8),

$$\text{Hedged Index Return} = (\text{Local Return} + 1) * (1 + \text{Currency Return}) - 1 + \text{Hedge Return} \quad (9)$$

Combining Equation (9) with Equation (2),

$$\text{Hedged Index Return} = \text{Unhedged Index Return} + \text{Hedge Return} \quad (10)$$

Combining Equation (10) with Equation (5) and taking hedge ratio as 1,

$$\text{Hedged Index Return} = \text{Unhedged Index Return} + \text{Forward Return} - \text{Currency Return} \quad (11)$$

Equation (11) is more intuitive since when you do a 100% currency hedge of a portfolio, you sacrifice the gains (or losses) on currency in return for gains (or losses) in a forward contract.

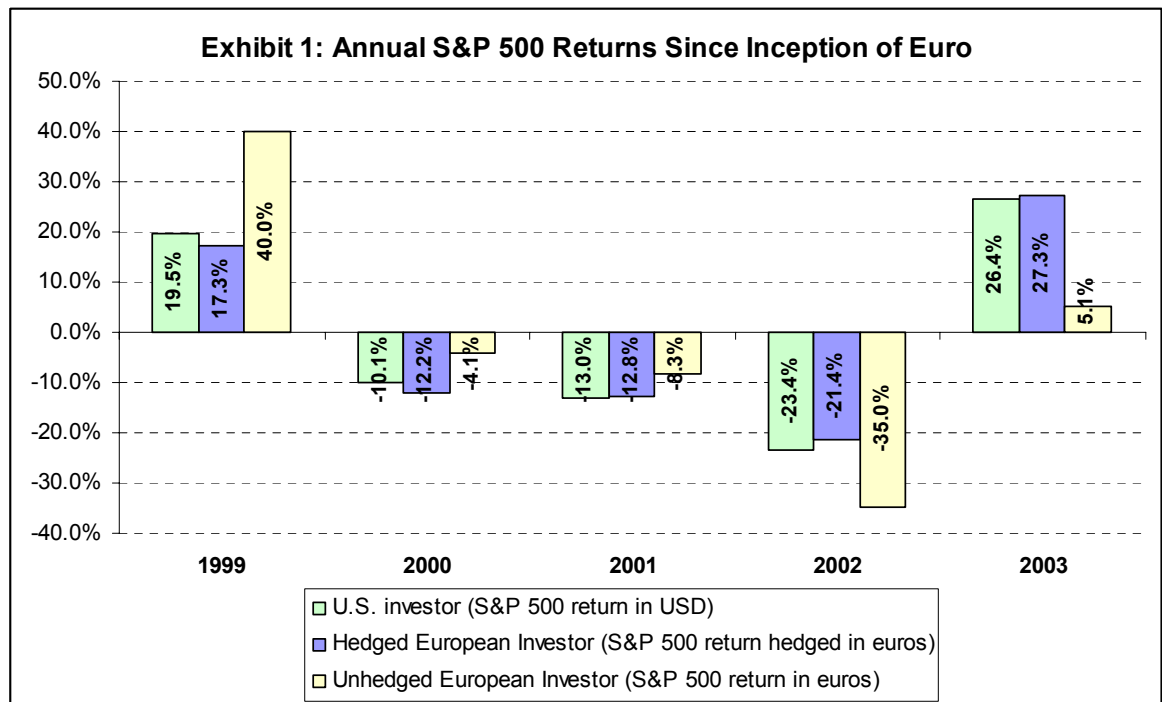
## Currency Hedging Outcomes

### Standard Currency Hedging To Eliminate Currency Exposure

*The results of a currency-hedged index strategy versus that of an unhedged strategy would vary depending upon the movement of the exchange rate between the local currency and home currency of the investor.*

The standard currency hedging process involves eliminating currency exposure using a hedge ratio of 1. Exhibit 1 shows the return of S&P 500 index since the inception of the euro till end-2003 for a U.S. investor, an European investor who did not hedge currency exposure, and a European investor who hedged her USD exposure. Exhibit 1 can be used to illustrate two key points:

1. The currency-hedged index does not necessarily give a return exactly equal to the return of the index available to local market investor. This is because Equation (6) has two additional terms, currency return on local total return, and hedge return. These two terms usually add to a non-zero value because the monthly rolling of forward contracts does not result in a perfect hedge.<sup>2</sup> Further, the local total return between two readjustment periods remains unhedged.<sup>3</sup> However, hedging does ensure that these two returns remain fairly close. For example, in 2003, the S&P 500 return available to U.S. investors was 26.4% while the S&P 500 return available to European investors who had hedged their USD exposure was 27.3%.
2. The results of a currency-hedged index strategy versus that of an unhedged strategy would vary depending upon the movement of the exchange rate between the local currency and home currency of the investor. For example, a depreciating euro in 1999 resulted in an unhedged S&P 500 return of 40.0% for European investors, while those European investors who hedged their USD exposure experienced a return of 17.3%. Conversely, in 2003 an appreciating euro in 2003 resulted in an unhedged S&P 500 return of 5.1% for European investors, while those European investors who hedged their USD exposure experienced a return of 27.3%.



Source: Standard & Poor's. Index returns are shown for illustration purposes. These do not include any frictional costs of investment.

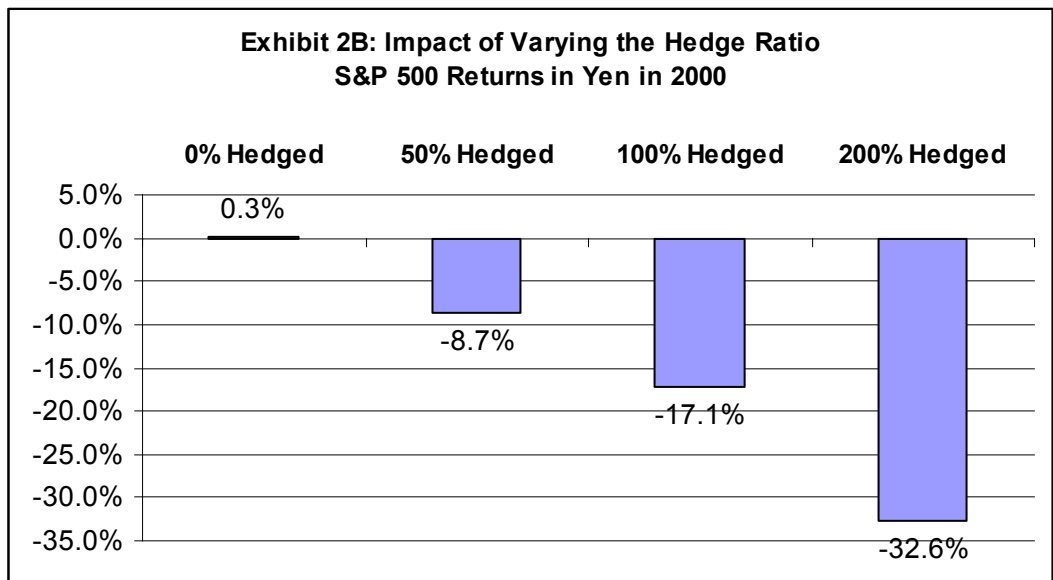
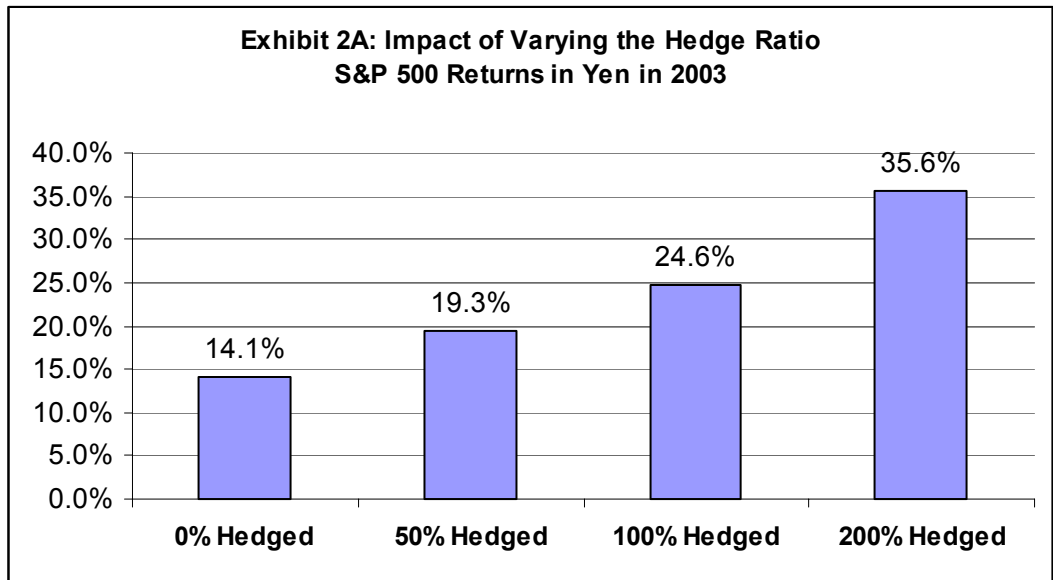
<sup>2</sup> Using daily rolling forwards is impractical from both operational and costs point of view.

<sup>3</sup> See Equation (3).

**Varying the Hedge Ratio to Make Bets on Currency Movements**

*The results of a currency-hedged index strategy versus that of an unhedged strategy would vary depending upon the movement of the exchange rate between the local currency and home currency of the investor.*

As demonstrated previously, the hedge ratio can be varied to arrive at index portfolios that are over- and under-hedged to varying degrees. In contrast to a 100% hedged standard index that seeks to eliminate currency risk and seek passive market exposure, these over- or under-hedged portfolios seek to take active currency risks to varying degrees based on the portfolio manager's view of future currency movements. Exhibit 2 shows the impact of hedging S&P 500 returns in Japanese yen to varying degrees. From the starkly different outcomes of 2000 (when the yen depreciated versus USD) and 2003 (when the yen appreciated versus USD), it can be seen that varying the hedge ratio can result in result in vastly different investment outcomes for the same underlying passive equity portfolio.



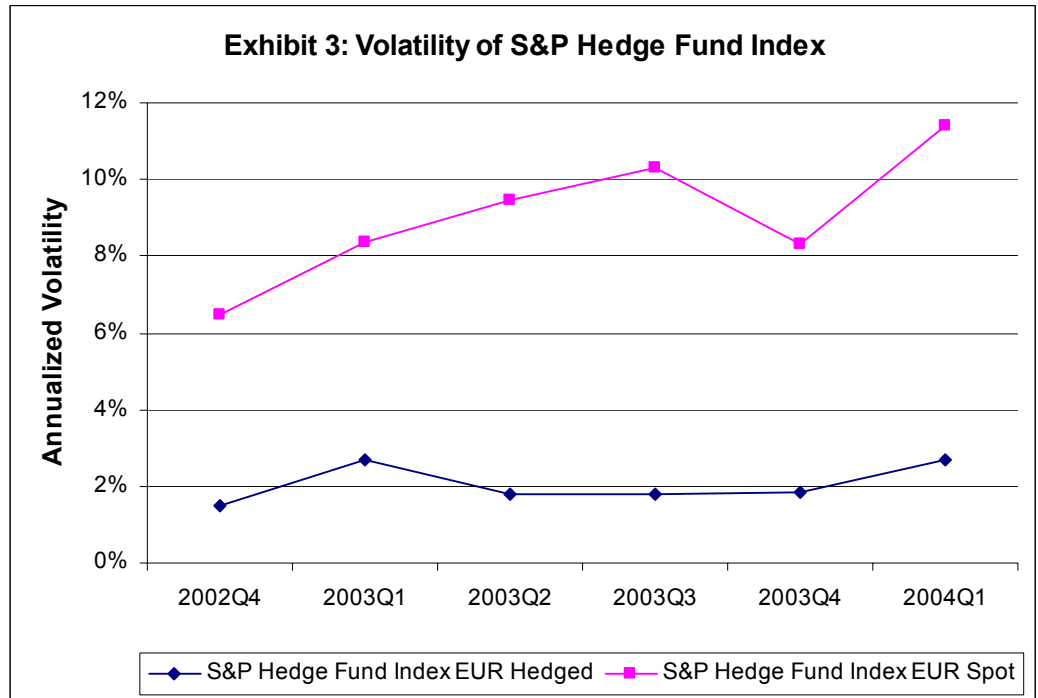
Source: Standard & Poor's. Index returns are shown for illustration purposes. These do not include any frictional costs of investment.

**Impact on Volatility**

*The volatility of the hedged index is a function of the volatility of the unhedged index return, the forward return, and the currency return, and their pair-wise correlations.*

From Equation (11), we can see that the volatility of the hedged index is a function of the volatility of the unhedged index return, the forward return, and the currency return, and their pair-wise correlations. These variables will determine whether the hedged index return series' volatility is greater than, equal to, or less than the volatility of the unhedged index return series.

Exhibit 3 plots the returns of S&P Hedge Fund index in euros for both hedged and unhedged currency exposures. Clearly, the unhedged and hedged index returns experienced sharply different volatilities due to the interplay of the variables mentioned before.



Source: Standard & Poor's. Index returns are shown for illustration purposes. These do not include any frictional costs of investment.

## Appendix 1: Mechanics of Index Computation

### Monthly Return Series

Let $m$	= 0,1,2... be an index for end of the month $m$ .
$SPI\_EH$	= S&P Currency-Hedged Index
$SPI\_E$	= S&P Index in foreign currency
$SPI\_EH_0$	= the level of the S&P Hedged Index at the end of last month
$HR$	= hedge return (%)
$S$	= spot rate in foreign currency per local currency (FC/LC)
$F$	= forward rate in foreign currency per local currency (FC/LC)

For the end of month 1,

$$SPI\_EH_1 = SPI\_EH_0 * \left( \frac{SPI\_E_1}{SPI\_E_0} + HR_1 \right)$$

So in general for the end of month  $m$ ,

$$SPI\_EH_m = SPI\_EH_{m-1} * \left( \frac{SPI\_E_m}{SPI\_E_{m-1}} + HR_m \right)$$

where,

$$HR_m = \frac{S_{m-1}}{F_{m-1}} - \frac{S_{m-1}}{S_m}$$

### Daily Return Series

For each month  $m$ , there are  $d = 1,2,3...D$  calendar days so  $md$  is day  $d$  for month  $m$  and  $m0$  is the last day of the month  $m-1$ .

So for the first day of month  $m$ ,

$$SPI\_EH_{m1} = SPI\_EH_{m0} * \left( \frac{SPI\_E_{m1}}{SPI\_E_{m0}} + HR_{m1} \right)$$

So in general for day  $d$  of month  $m$ ,

$$SPI\_EH_{md} = SPI\_EH_{m0} * \left( \frac{SPI\_E_{md}}{SPI\_E_{m0}} + HR_{md} \right)$$

where

$$HR_{md} = \frac{S_{m0}}{F_{m0}} - \frac{S_{m0}}{S_{md} + \left( \frac{D-d}{D} \right) * (F_{md} - S_{md})}$$

Local currency is the primary currency of calculation of the index. Note that in Equations (1) and (3) of the main text, we have used the LC/FC quotes. Also, in this formula sheet, using the index in foreign currency directly gives the unhedged index return for the first part of Equation (11).

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**Appendix 2: Available Standard & Poor's Currency-Hedged Indices**


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<b>Index</b>	<b>Currency</b>	<b>Base Date</b>
S&P 500	EUR	9/29/1989
S&P 500	GBP	9/29/1989
S&P 500	JPY	9/29/1989
S&P Asia 50	USD	7/31/2003
S&P Asia 50	EUR	7/31/2003
S&P Asia 50	GBP	7/31/2003
S&P Asia 50	JPY	7/31/2003
S&P/ASX 50	USD	12/31/1997
S&P/ASX 50	EUR	12/31/1998
S&P/ASX 50	GBP	12/31/1997
S&P/ASX 50	JPY	12/31/1997
S&P Europe 350	USD	12/31/1998
S&P Europe 350	EUR	12/31/1998
S&P Europe 350	GBP	12/31/1998
S&P Europe 350	JPY	12/31/1998
S&P Euro	USD	12/31/1998
S&P Euro	GBP	12/31/1998
S&P Euro	JPY	12/31/1998
S&P/TOPIX 150	USD	12/31/1997
S&P/TOPIX 150	EUR	12/31/1998
S&P/TOPIX 150	GBP	12/31/1997
S&P Hedge Fund Index	EUR	9/30/2002
S&P Hedge Fund Index	GBP	9/30/2002
S&P Hedge Fund Index	JPY	9/30/2002
S&P Arbitrage Index	EUR	9/30/2002
S&P Arbitrage Index	GBP	9/30/2002
S&P Arbitrage Index	JPY	9/30/2002
S&P Directional/ Tactical Index	EUR	9/30/2002
S&P Directional/ Tactical Index	GBP	9/30/2002
S&P Directional/ Tactical Index	JPY	9/30/2002
S&P Event-Driven Index	EUR	9/30/2002
S&P Event-Driven Index	GBP	9/30/2002
S&P Event-Driven Index	JPY	9/30/2002
S&P Managed Futures Index	EUR	12/31/2002
S&P Managed Futures Index	GBP	12/31/2002
S&P Managed Futures Index	JPY	12/31/2002
S&P Equity Long/Short Index	EUR	3/31/2004
S&P Equity Long/Short Index	GBP	3/31/2004
S&P Equity Long/Short Index	JPY	3/31/2004
S&P Equity Long/Short US Index	EUR	3/31/2004
S&P Equity Long/Short US Index	GBP	3/31/2004
S&P Equity Long/Short US Index	JPY	3/31/2004
S&P Equity Long/Short Global Ex-US Index	EUR	3/31/2004
S&P Equity Long/Short Global Ex-US Index	GBP	3/31/2004
S&P Equity Long/Short Global Ex-US Index	JPY	3/31/2004

For more information, please go to [www.indices.standardandpoors.com](http://www.indices.standardandpoors.com)

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