

## SECOR EQUITY DOWNSIDE HEDGING PROGRAMS

### *Analyzing Direct Equity Hedging Strategies*

*By Dmitri Smolansky*

Asset owners can select from numerous options to hedge their equity portfolios, but they are presented with abundance of confusing information making it difficult to select the most appropriate hedging strategy. The confusion is often caused by differences in assumptions made by different research teams. This note attempts to set the framework for analyzing simple hedging strategies that are relevant to asset owners. We also provide information about performance of these strategies under different sets of market conditions and find some evidence suggesting that relatively simple rules of thumb could help investors in setting conditions for taking profits in their hedging portfolios.

#### Strategies Analyzed

We analyze four systematic hedging strategies:

1. Buying of 10% out-of-the-money (OTM) puts (10% Put)
2. Buying of 5% OTM puts (5% Put)
3. Buying of at-the-money (ATM) puts and selling 10% OTM puts (0\_10 Spread)
4. Buying of 5% OTM puts and selling 15% OTM puts (5\_15 Spread)

We will refer to (1) and (2) as outright put buying or simply as put buying and we will refer to (3) and (4) as Spread strategies.

For all of the above strategies we assume that on every quarterly option expiration day we buy

(and sell in case of Spreads) a number of listed annual Put contracts corresponding to a  $\frac{1}{4}$  of the protected notional amount, and then hold these contracts until expiration. Thus, at every rebalancing our hypothetical portfolio would consist of an equal number of 3, 6, 9 and 12-month puts.

We believe that these strategies are reasonably representative of investors' choices among put-based strategies and that conclusions about many other strategies not included in this note can be approximately drawn from the analysis presented.

#### Two types of historical back-tests

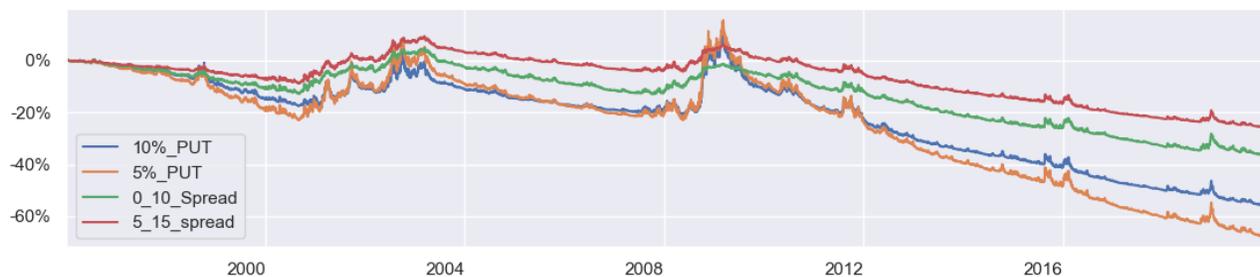
We provide two sets of back-tested results. We start by analyzing performance of put strategies assuming constant notional capital at each rebalancing. While few investors manage tail-risk portfolios assuming a constant notional, this assumption allows us to evaluate characteristics of put strategies without considering the impact of notional amount adjustments. We believe this approach to be superior to the one where sizing of a put portfolio is adjusted based on recent performance of puts, i.e. increasing after put prices appreciated and decreasing after they depreciated. This approach also allows to analyze performance of hedging strategies during specific periods independently of the impact of portfolio sizing.

The second portion of our analysis is focused on analyzing the impact of hedging strategies on a portfolio consisting of both S&P500 Index and puts. It is important to realize that asset owners do not view put buying as a stand-alone strategy. Furthermore, in order to implement a hedging strategy an investor needs to liquidate a portion of the equity holdings, spend some cash on buying puts and use additional cash as margin for futures to achieve the desired equity Beta in the

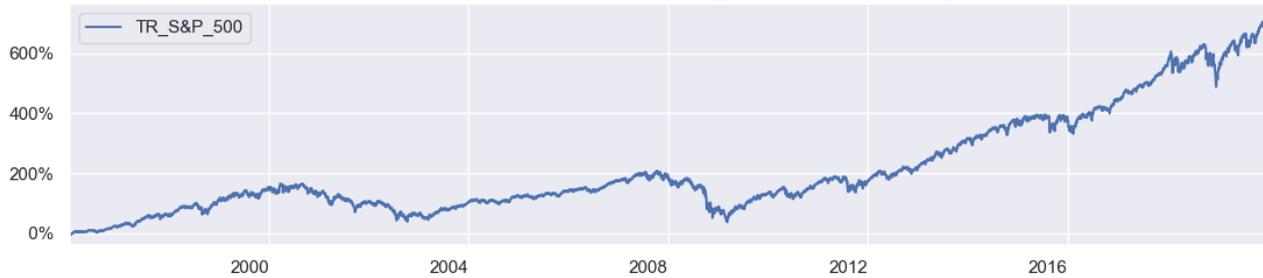
portfolio. Importantly, in such a portfolio the size of put exposures would be adjusted depending on the size of the overall portfolio. These are important assumptions for a realistic hedging strategy back-test, and they have significant implications for analyzing benefits and limitations of the strategies, particularly during significant selloffs and recoveries akin to global financial crisis (GFC).

### Analysis using Constant Notional Amount

Option strategies hypothetical cumulative returns, 1/4/1996 – 12/31/2019



S&P500 Cumulative Performance (01/04/1996 – 12/31/2019)



Source: SECOR Analytics, Optionmetrics

The charts above show cumulative performance of the four put strategies in our analysis and corresponding performance of S&P500 during the same period, while Table 1 summarizes their return statistics. Annualized return of these

strategies is often interpreted as expected cost of hedging. Thus, expected “cost” of 10% OTM put buying strategy would be 2.32% per year, while ATM vs 10% OTM Put spread is expected to cost 1.51% per year.

Table 1. Hypothetical hedging return profile assuming constant notional, 1/4/1996 – 12/31/2019

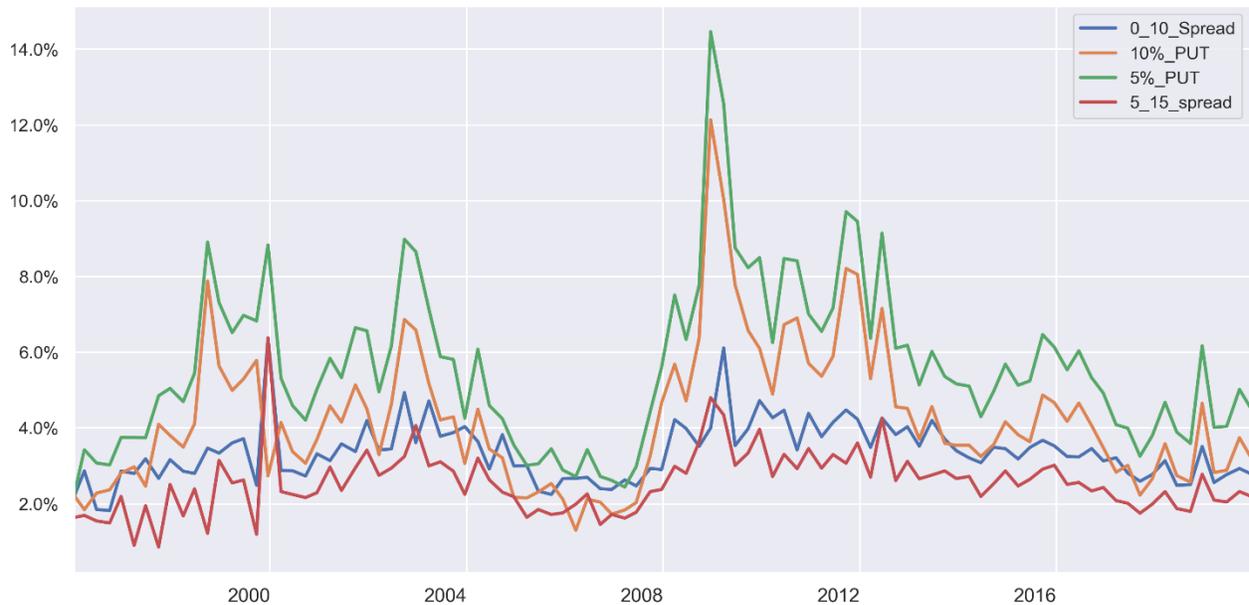
	10% PUT	5% PUT	0_10 Spread	5_15 Spread	S&P500
<b>Annualized Return</b>	-2.32%	-2.82%	-1.51%	-1.07%	9.19%
<b>Standard Deviation</b>	6.90%	8.11%	3.34%	2.90%	18.92%

Source: SECOR Analytics, Optionmetrics

It is not surprising that the more aggressive Put buying programs are much costlier over time as compared with Spread strategies, particularly in the aftermath of GFC. The reason for the particularly poor post-GFC performance is that option premium remained elevated during the

2009-2016 period (see chart below) as demand for hedging remained relatively high despite the strong equity market performance. Even at the beginning of 2020, after a 30% rally in 2019, 5% OTM put option is significantly more expensive than it was during the 2005-2006 period.

Premium paid by hypothetical hedging strategies, 1/4/1996 – 12/31/2019



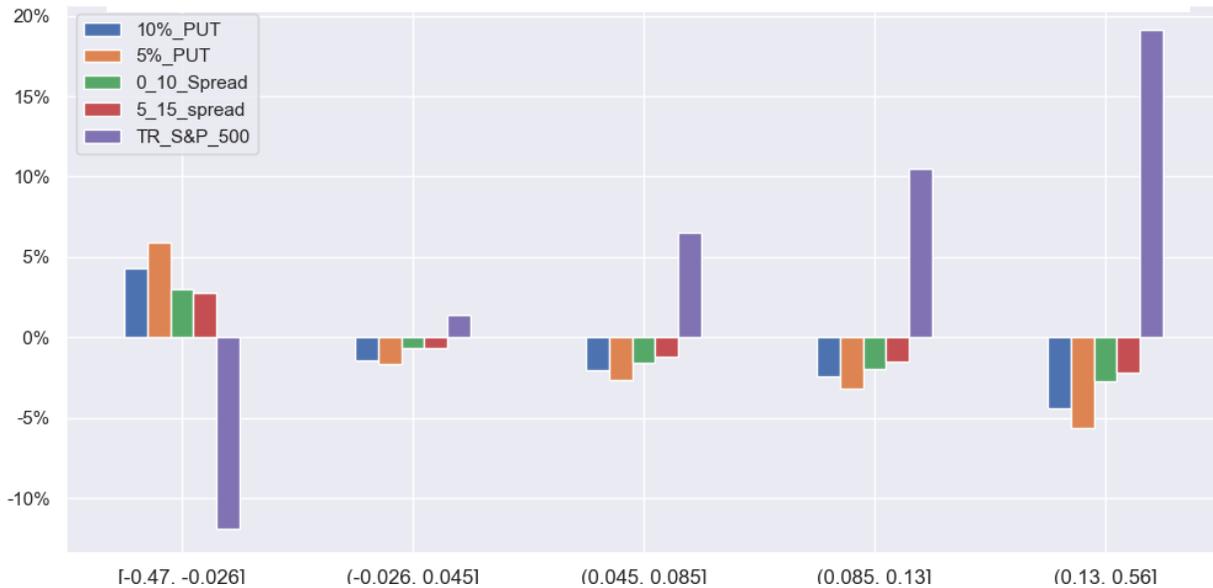
Source: SECOR Analytics, Optionmetrics

### Performance of hedging strategies in different environments

The chart on the following page shows 6-month performance of hedging strategies by quintiles of 6-month S&P500 returns. We can observe that the strategies deliver positive returns only when

S&P500 returns are in the bottom 20% of all periods, i.e. if hedging strategies are implemented for an extended period of time, investors should be prepared to suffer negative carry 80% of the time.

Option strategies 6-month hypothetical returns by quintile of 6-month S&P500 returns, 1/4/1996 – 12/31/2019



Source: SECOR Analytics, Optionmetrics

We can also observe from the chart above that 0\_10 Spread underperforms the 5\_15 Spread during rallies (most likely because the cost of entering the spread is higher), but contributes very little extra during selloffs. Thus, this chart suggests that 5\_15 Spread is a more attractive hedging strategy than the 0\_10 Spread.

While the size of expected returns during different environments is an important measure, we find it very useful to evaluate percentage of equity losses which investors should be expecting to offset by implementing each of the strategies. Table 2 summarizes these statistics by ranges of equity market returns. It clarifies important aspects of each of the strategies.

Table 2. Percent offset of losses provided by hypothetical hedging strategies, by S&P500 return ranges, 1/4/1996-12/31/2019

S&P 6M Return Range	Average % of Loss Offset			
	10% PUT	5% PUT	0_10 Spread	5_15 Spread
(-100, -0.25]	60%	70%	18%	20%
(-0.25, -0.15]	37%	56%	30%	31%
(-0.15, -0.1]	28%	44%	30%	27%
(-0.1, -0.05]	15%	31%	30%	23%

Source: SECOR Analytics, Optionmetrics

First, it is clear that during deep, sharp selloffs only outright puts cover a large portion of losses since Spreads stop providing protection after equity markets cross the strike of the sold put. It also shows that Spreads perform sufficiently well

during milder selloffs – up to approximately 20%-25%. Thus, when selecting hedging strategies, investors should carefully evaluate market scenarios and the set of risks against which they are seeking protection. For example, an investor

expecting a higher than usual probability of a 10%-20% selloff, but a low probability of a crisis akin to GFC, could select a Spread strategy, while an investor concerned with a sharp selloff in a 20%-30% range could be better off with outright puts.

Table 3 below shows performance of our hedging strategies during significant market selloffs of the last 20 years. These selloffs differed in their duration and severity, and the results confirm important points made earlier.

Table 3. Performance of hypothetical hedging strategies during different market selloffs

Sell-off Period	Start Date	End Date	Period Cumulative Return				
			10%_PUT	5%_PUT	0_10_Spread	5_15_spread	S&P500
Tech bubble	9/1/2000	10/9/2002	20.9%	31.3%	17.0%	17.5%	-47.3%
'08 Financial Crisis Stage1	10/1/2007	9/30/2008	5.2%	8.3%	7.1%	4.8%	-22.0%
'08 Financial Crisis Stage2	10/1/2008	2/28/2009	23.2%	25.0%	3.9%	4.8%	-36.1%
European Debt Crisis	5/1/2011	10/1/2011	4.4%	5.3%	2.2%	1.7%	-16.3%
China Growth Concerns	5/1/2015	2/1/2016	-1.3%	-1.0%	1.1%	-0.1%	-5.5%
Q4 2018	10/2/2018	12/24/2018	5.3%	8.1%	6.5%	4.5%	-19.2%

Source: SECOR Analytics, Optionmetrics

Spread strategies worked reasonably well during long-lasting or mild selloffs (Tech bubble unwind, China growth concerns, first stage of GFC), but provided limited relief during sharp selloffs such as Stage 2 of GFC. There were two main reasons for it. First, during long selloffs puts which are closer to the money often expire with a profit and the further out-of-the-money puts may expire worthless, while during sharp, deep selloffs both puts may expire in the money. Second, by the start of Stage 2 of GFC some of the further out-of-the-money puts were already in the money and, as a result, the Spreads provided no additional protection. This illustrates that even with quarterly rebalancing, hedging strategies

are very path dependent. Another example is performance in the most recent (Q4 2018) selloff: as option expiration was a few days before market bottomed, the spread strategies benefited since the long leg expired in the money while the short leg expired out of the money.

Given that many strategists are expecting a range-bound market in 2020, in Table 4 we provide performance of the strategies when 6-month equity returns are not far from zero. It seems pretty clear that in a range-bound market Spread strategies tend to outperform outright put buying strategies.

Table 4. Performance of hypothetical hedging strategies in a range-bound market

S&P 6M return range	Annualized 6-month Return			
	10%_PUT	5%_PUT	0_10 Spread	5_15 Spread
<b>[-10%, 0%]</b>	0.2%	1.4%	2.4%	1.5%
<b>[-5%, 0%]</b>	-1.5%	-1.1%	0.8%	0.1%
<b>[0%, 5%]</b>	-3.1%	-3.9%	-1.9%	-1.6%
<b>(0%, 10%)</b>	-3.8%	-4.9%	-2.7%	-2.2%

Source: SECOR Analytics, Optionmetrics

We are often asked whether investors should base their hedging decision on the levels of implied volatility. Table 5 demonstrates that

while low levels of implied volatility provide limited guidance about relative performance of hedging strategies, in a high volatility

environment, investors would benefit from either switching out of their outright put positions into spreads or from outright closing the hedges. Large losses associated with outright

puts are likely related to the fact that by the time volatility hits such elevated levels, puts are deeply in the money and are highly sensitive to market reversals.

Table 5. Six-month performance of hypothetical hedging strategies by level of implied volatility at the beginning of the period

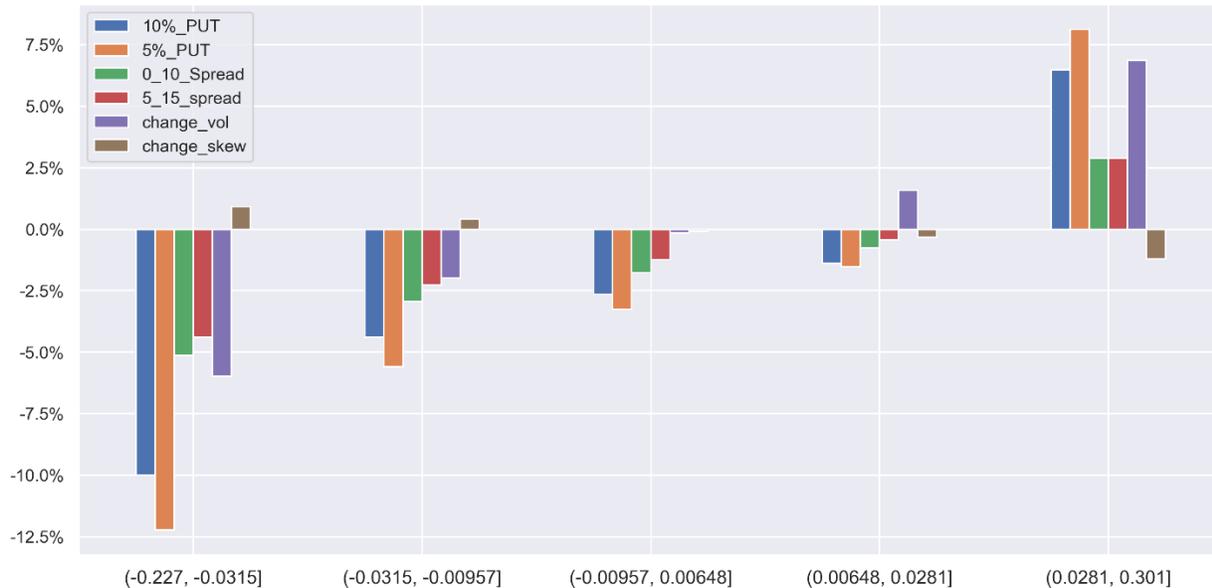
<i>Implied Volatility range</i>	<b>Annualized 6-month Return</b>			
	<b>10%_PUT</b>	<b>5%_PUT</b>	<b>0_10_Spread</b>	<b>5_15_spread</b>
(0, 0.12]	-1.5%	-2.2%	-2.1%	-1.5%
(0.12, 0.16]	-1.7%	-2.4%	-1.9%	-1.4%
(0.16, 0.2]	-2.7%	-3.6%	-2.2%	-1.7%
(0.2, 0.3]	-1.1%	-1.1%	-0.6%	-0.2%
(0.3, inf]	-14.9%	-16.8%	-4.7%	-4.5%

Source: SECOR Analytics, Optionmetrics

Finally, the chart below shows performance of each strategy by quintile of changes in volatility. Not surprisingly, the strategies make money

when volatility increases sharply, and tend to lose money when volatility falls or remains stable.

6-month contemporaneous return of hypothetical hedging strategies by quintile of implied volatility changes, 1/4/1996 – 12/31/2019



Source: SECOR Analytics, Optionmetrics

## Back-test 2. Impact of hedging programs on portfolio performance

This back-test was designed to evaluate impact of including put strategies in an equity portfolio. We have made the following assumptions:

1. Investor allocation to physical equities would have to be reduced by the amount required for option premiums and an additional 3% to post as margin for futures positions replicating Beta exposure;
2. Investor buys S&P500 futures with notional amount of reduction of allocation to physical equities;
3. Futures returns were approximated by S&P500 total return minus 3-month LIBOR (this is a good approximation of actual futures returns and allows us to ignore the fact that futures and physical market close at different time);

4. Cash balance earns 3-month LIBOR minus 50bps.
5. The size of option positions is adjusted at each quarterly rebalancing to correspond to the notional amount of the overall portfolio (Puts plus physical equities plus futures).

Table 5 summarizes results of this analysis. It is interesting to observe the difference between Table 1 and Table 6. Because of the very large reduction in Drawdowns using outright Put buying program, the negative impact of hedging on cumulative return of the overall portfolio that includes outright put buying is much smaller (40-50 BPS per year) than what we would expect by simply using average returns of hedging programs! The benefit to Put spreads is much smaller: ~20 BPS per year as reduction in drawdowns was more modest.

Table 6. Hypothetical impact of hedging on portfolio performance

	S&P500+10% PUT	S&P500+5% PUT	S&P500+0_10 Spread	S&P500+5_15 Spread	S&P500
Annualized Return	7.3%	6.9%	7.9%	8.3%	9.2%
Standard Deviation	12.7%	11.4%	15.9%	16.2%	18.9%
Max Draw-down	34.2%	30.6%	48.9%	49.5%	55.3%
Reduction in Return	-1.90%	-2.30%	-1.32%	-0.88%	
% reduction in St.Dev.	33%	40%	16%	14%	
% reduction in Drawdown	38%	45%	12%	10%	

Source: SECOR Analytics, Optionmetrics

## Conclusion

We hope that this note provides investors with valuable information about selecting put-based hedging programs. The most important conclusions from our analysis are:

- True cost of hedging programs can be lower after considering savings resulting from strong performance in drawdowns and the resulting impact on geometric returns;
- Outright Put buying strategies provide significantly better protection during extreme market events, but Spreads provide

considerable savings in range-bound environments;

- Outright Put buying is a preferred strategy in sharp shorter-term selloffs, while Spreads should be preferred in prolonged or shallow selloffs;
- When volatility reaches a high level (25%-30%), investors in outright Put programs should consider rebalancing into Spread programs or reducing size of their hedges.

Finally, we would like to point out that the above conclusions were based only on our analysis of returns of options on S&P500. In our future

research we intend to expand this analysis to other markets to confirm or disprove our conclusions.

#### Disclaimer

Except where otherwise indicated, the information contained in this presentation is based on matters as they exist as of the date of preparation of such material and not as of the date of distribution or any future date and SECOR does not undertake any obligation to update the information contained herein as of any future date. This document does not constitute advice or a recommendation or offer to sell or a solicitation to deal in any security or financial product. It is provided for information purposes only and on the understanding that MARS has sufficient knowledge and experience to be able to understand and make its own evaluation of the proposals and services described herein, any risks associated therewith and any related legal, tax, accounting or other material considerations.

Any illustrative models or investments presented in this document are based on a number of assumptions and are presented only for the limited purpose of providing a sample illustration. Any sample illustration is inherently subject to significant business, economic and competitive uncertainties and contingencies, many of which are beyond SECOR's control. Any sample illustration may not be reflective of any actual investment purchased, sold, or recommended for investment by SECOR and are not intended to represent the performance of any investment made in the past or to be made in the future by any portfolio managed or advised by SECOR. Actual returns may have no correlation with the sample illustration presented herein, and the sample illustration is not necessarily indicative of an investment that SECOR will make. It should not be assumed that SECOR's investment recommendations in the future will accomplish its goals or will equal the illustration provided herein.

Any hypothetical information contained herein does not represent the results of actual trading using client assets but were achieved by means of the retroactive application of a model. Any hypothetical performance presented was compiled after the end of the period depicted and does not represent the actual investment decisions of SECOR. Hypothetical performance results have many inherent limitations, some of which are described below. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently achieved by any particular trading program.

One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or adhere to a particular trading program in spite of trading losses are material points which can also adversely affect actual trading results. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results and all of which can adversely affect actual trading results. The results do not reflect the effect of material economic and market factors on decision-making. Any hypothetical performance is not necessarily indicative of future performance, which could differ substantially.

The S&P 500 or Standard & Poor's 500 Index is a market-capitalization-weighted index of the 500 largest U.S. publicly traded companies. Indexes are unmanaged, do not reflect the deduction of fees and expenses, and are not available for direct investment.