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Replicating the Russell Indexes:

We take a second look at how our S&P Combo Futures strategy tracked during the financial crisis.

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In this article, we re-examine the strategy of using a combination of liquid S&P 500 and S&P MidCap 400 futures to replicate Russell 1000 and Russell 3000 Index exposure. As you'll see, historically, the strategy has proven to be robust even in less favorable market conditions, such as during the recent financial crisis.

Our initial examination of hedging Russell index exposure with our suite of S&P futures predated the financial crisis. Recent inquiries as to the performance of the strategies led us to revisit the topic. A couple of factors that were insignificant prior to the financial crisis cannot be taken for granted now, such as the tracking error of the liquid S&P futures relative to the underlying indexes and the fluctuation of the implied financing costs for these different contracts.

Interestingly, our analysis showed that the desirable tracking performance of the S&P 500 and S&P MidCap 400 combination held up remarkably well in the throes of the crisis. In fact, some of the effects of the crisis helped the combination strategy considerably. We will go into details of the effects later in this article.

Ground rules for our analysis

Our original strategy called for a portfolio of instruments tracking the S&P 500 and the S&P MidCap 400 to replicate the performance of the more expansive Russell 1000 and Russell 3000 Indexes. These portfolios are "passive" in the sense that they are only rebalanced on a monthly basis. At the end of each month, the portfolio weights are brought back to the intended levels.

Our new study retains this feature, in that the basket of futures will be rebalanced at the end of every month, and rolled from quarter to quarter in a simple manner.

For comparison purposes, we constructed the tracking performance based on the following three strategies:

1. *Dollar-for-Dollar: Hedging using S&P 500 futures (the simplest strategy)*
   For each dollar's worth of exposure to Russell 1000 or Russell 3000, we acquire one dollar's worth of exposure to S&P 500 using E-mini S&P 500 futures.

2. *S&P 500 futures Only: Adjusting for volatility differences*
   Note that the Russell 1000 and Russell 3000 Indexes, in particular, are more volatile than the S&P 500 Index. The dollar-for-dollar hedging strategy would be inadequate owing to this volatility difference. As such, the volatility-adjusted S&P 500-only strategy would use the appropriately determined hedge ratio to try to replicate the Russell 1000 and Russell 3000 indexes, deploying more S&P 500 exposure than on the dollar-for-dollar basis in the first strategy. The hedge ratio for the Russell 1000 Index exceeds 1 marginally, while the hedge ratio for the Russell 3000 Index is more significant at 1.013, or 1.3 percent over-hedging[1].

3. *Combination of S&P 500 and S&P MidCap 400 futures (the strategy we have advocated in the past)*
   As we alluded to earlier, this strategy proved to be very resilient during the crisis. The premise is rather straightforward: While the top 500 stocks take up most of the weights in the Russell 1000 and Russell 3000 Indexes, the next 500 or 2,500 stocks in these indexes can have markedly different performance than the top 500 stocks in the index. As such, adding S&P MidCap 400 contracts to the portfolio – presumably tracking these next 500 or 2,500 stocks better than the S&P 500 Index – would help the over-tracking error. Indeed, we found that to be the case.

[1] We recognize that some users may not be permitted to deploy a replicating strategy with inherent leverage. It is still worth understanding, however, the logic behind the strategy and using it for comparison purposes.

One thing to be cognizant of with index futures strategies is the treatment of the cash balance. We're assuming that the entire cash balance was deposited into money market instruments that yield effective overnight fed funds rates. We recognize that asset managers' choices of money market instruments vary and will yield slightly different results. We chose the effective overnight Fed Funds rate as we consider it to be a relatively conservative target. For those with access to higher yielding money market instruments, you will be able to outperform our experiment.

For our analysis, we used a static set of hedge ratios, as follows:

	S&P 500 Only	Volatility-Adj. S&P 500 Only	S&P 500 and S&P MidCap 400 Combo
Russell 1000	S&P 500: 1.000	S&P 500: 1.002	S&P 500: 0.893 MID: 0.104
Russell 3000	S&P 500: 1.000	S&P 500: 1.013	S&P 500: 0.821 MID: 0.181

Source: CME Group

Our analysis showed that the desirable tracking performance of the S&P 500 and S&P MidCap 400 combination held up remarkably well in the throes of the crisis.

For example, to hedge $1.00 of Russell 3000 exposure, the entire $1.00 is assumed to have been deposited in money market instrument, and $0.821's worth of S&P 500 exposure and $0.181's worth of S&P MidCap 400 exposures to have been deployed with futures.

These hedge ratios are determined by (multiple) regression(s) based on the daily returns of the indexes in the last five years. We deliberately kept the ratios constant through the sample for illustrative purposes. For those who would like to have adaptive hedge ratios based on only (then) recent data, the experiment can easily be repeated.

Further, we will rebalance every month – that is, the composition of the futures positions will be brought back to these hedge ratios at the conclusion of each month, as a starting point for the following months' performance.

Monthly tracking errors

Now that we have set the ground rules for our analysis, let's look at the tracking performance. Exhibits 1 and 2 show the performances of the three strategies relative to those of the Russell 1000 and Russell 3000, respectively. Right away, we can visually conclude that the combo strategy worked just fine during the financial crisis. The performance of the combo strategy is quite indistinguishable from that of Russell 3000 Index, even during the financial crisis.

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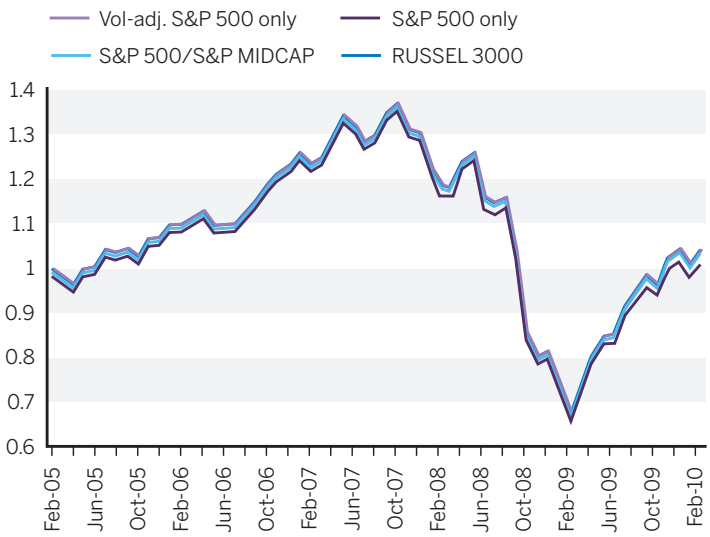
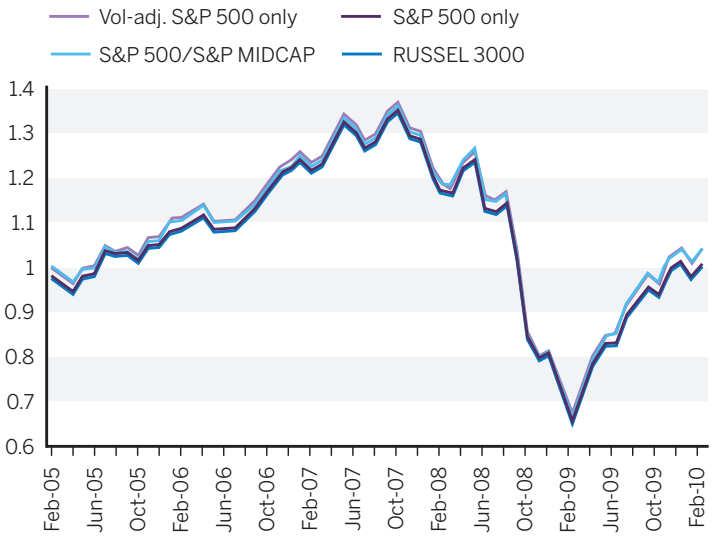
EXHIBIT 1. PERFORMANCE OF THE THREE HEDGING STRATEGIES VS. THE RUSSELL 1000 INDEX



Source: CME Group

EXHIBIT 2. PERFORMANCE OF THE HEDGING STRATEGIES VS. THE RUSSELL 3000 INDEX



Source: CME Group

The table in Exhibit 3 provides a closer examination of the results, with summary statistics for the tracking errors. From this data several observations can be made:

- Notice that the standard deviation of the tracking errors during the financial crisis was higher than during the entire sample. This is hardly unexpected. Given the higher volatility of the market, we would not expect the hedging strategies to track as well.

- Variability of the tracking errors of the combo strategy was lower than those of the other strategies, both in the full sample and during the crisis. Again, this is not much of a surprise.

- The most intriguing part was that the average tracking error was smaller during the crisis than in the entire sample for the combo strategy, whereas the opposite was true for S&P 500-only strategies.

It is possible that the favorable average performance result was a coincidence. After all, the standard deviation of the tracking error is so large relative to the average, that the difference in the average performance is statistically insignificant.

There does appear to be some structural reason that would simultaneously explain the deterioration of S&P 500-only strategies and the relatively good performance of the combo strategy, as we will now examine.

EXHIBIT 3. MONTHLY TRACKING ERROR STATISTICS, IN BASIS POINTS

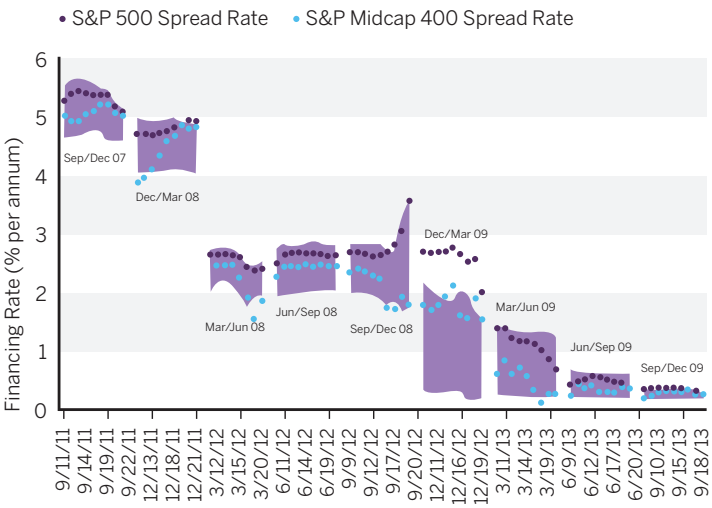
	S&P 500 Only	Volatility-adj. S&P 500 Only	S&P 500/ S&P MidCap Combo	S&P 500 Only	Volatility-adj. S&P 500 Only	S&P 500/ S&P MidCap Combo
	Full Sample Period (Mar 2005 – Feb 2010)			Financial Crisis (Jan 2008 – Dec 2009)		
Russell 1000						
Avg. Monthly Tracking Error	-5.55	-5.58	-2.06	-7.51	-7.73	-1.61
Std Deviation	28.23	27.94	17.05	38.50	37.98	23.05
Russell 3000						
Avg. Monthly Tracking Error	-6.54	-6.35	-0.37	-9.85	-10.96	-0.25
Std Deviation	39.49	41.25	17.15	51.92	48.95	21.56

Effects of the implied financing rate

Exhibit 4 shows the implied financing rate for S&P 500 and S&P MidCap 400 futures relative to each other as well as to 3-month LIBOR and Fed Fund rates. The data was derived from the spread pricing during the quarterly roll period – given that the quarterly roll was based mostly on interest rate consideration, it was a less noisy measure of the quantity.

EXHIBIT 4. IMPLIED FINANCING RATE OF S&P 500 AND S&P MIDCAP 400 INDEX FUTURES RELATIVE TO INTEREST RATE BENCHMARKS, THROUGH THE FINANCIAL CRISIS

Implied financing rate is measured based on quarterly rolls. Shaded areas represent the difference between 3-month LIBOR and Fed Funds (based on Fed Funds futures for the period).



As you may recall, S&P 500 futures typically were traded at the vicinity of LIBOR. The financial crisis brought with it a tremendous amount of dislocation between LIBOR and the Fed Funds rates. As Exhibit 4 shows, the difference between LIBOR and Fed Funds was upwards of 175 basis points per annum at times!

While S&P 500 was still largely traded at a slight discount to LIBOR, the implied financing rate was quite significantly higher than Fed Funds. In fact, since we assume that our cash balance was deposited into money market instruments yielding the overnight effective Fed Funds rate, the S&P-only strategies would clearly suffer from the funding disadvantage.

Clearly, with S&P MidCap 400 futures traded at a lower implied financing rate and closer to the Fed Funds rate, we would expect the combination strategy to outperform just on the funding difference alone. A back of the envelope calculation would show that a funding difference of 100 basis points per annum and a portfolio weight shift of 18 percent away from S&P 500 into S&P MidCap 400 contracts would account for 1.5 basis point per month in outperformance.

This calculation also makes it clear that the funding differential alone could not completely explain the difference in the performance. Recall that the funding difference between the two contracts was averaging tens of basis point per annum, nowhere near the 100 basis points in the crude calculation.

Further, with the financial crisis fading, the LIBOR rate is once again converging with Fed Fund rate. As such, we might not be able to count on the funding difference as a source of outperformance. The difference must be accounted for by something else.

Volatility of the S&P 500/S&P MidCap 400 spread and rebalancing

As we mentioned when setting out the ground rules, we are assuming that there is a rebalancing at the conclusion of every month. This rebalancing would always lead us to do the following:

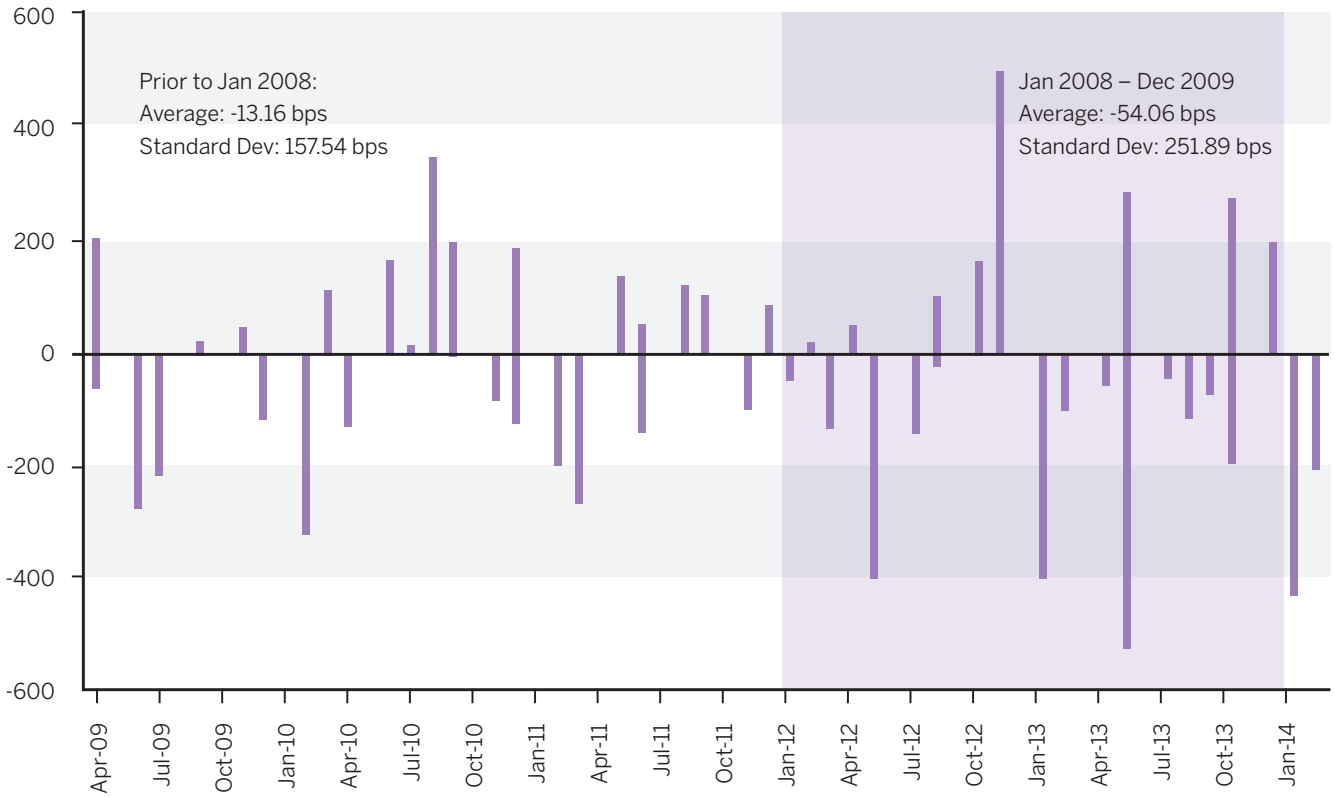
If S&P 500 outperforms S&P MidCap 400 Index during the current month, the weight of S&P 500 in the portfolio would have drifted above the prescribed ratio. As such, rebalancing would call for selling some S&P 500 futures and buying some S&P MidCap 400 futures.

Conversely, if S&P 500 underperforms S&P MidCap 400 during the current month, the reverse must be true. Thus, rebalancing would call for selling some S&P MidCap 400 futures and buying some S&P 500 futures.

A succinct way to describe this rebalancing act is that we will routinely sell the over-performing asset in favor of buying the under-performing one. If the performance differential during a stretch is very highly volatile but ultimately balances out, this could be a very profitable exercise.

Exhibit 5 shows the monthly performance differences between S&P 500 and S&P MidCap 400 index futures. Inspecting the chart, it is quite noticeable that the "swing" in the relative performance between the two became even more volatile during the crisis. The standard deviation of the monthly difference went from 157 to 252 basis points.

EXHIBIT 5. RELATIVE PERFORMANCE OF E-MINI S&P 500 AND S&P MIDCAP 400 FUTURES



That the relative performance during the crisis was even less stable only serves to further underscore the need to construct the combination hedge – after all, the two contracts are covering different market cap spaces. If the performances of stocks in these two market cap spaces have larger deviation during this period, the combination strategy ought to be able to track the broader Russell indexes better. And it did!

Further, the bigger swing during this period also led to bigger gains due to periodic rebalancing. The magnitude of rebalancing is tied to the performance differential. Thus, when the S&P MidCap 400 Index underperformed the S&P 500 Index during the current month, a larger portion of the S&P 500 Index needed to be sold in favor of additional S&P MidCap 400 exposure. When the performance swings the other way in the future – with equally exaggerated magnitude, the additional S&P MidCap 400 exposure would be liquidated and S&P 500 positions put back on. In the meantime, the trades amounted to a "buy low, sell high" tactic dictated by the overall combination strategy. The larger the volatility of the relative performance in a period, the more pronounced the gain. Of course, this is nothing new – asset managers with mandates to rebalance their overall portfolio according to target weights know this very well.

Conclusion

While there is, of course, no guarantee that past performance will translate into future results, we have seen how well the S&P 500/S&P MidCap 400 combination strategy for hedging the broader market index has worked through one of the most turbulent market environments in recent history. The main takeaway from our exercise should be that the strategy proved to be very robust. We also have laid out a couple of plausible reasons for the performance. Hopefully they will generate fresh ideas for using these instruments in the future.

For more information or questions related to this strategy, e-mail us at **EQresearch@cmegroup.com.**

To download a copy of the original hedging analysis or other strategies, visit the Equity Index Research Center at **www.cmegroup.com/equityindexresearch.**

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