The Impact of Exchange Traded Funds on Intraday Correlations
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Abstract. The proliferation of exchange traded funds over the past decade has raised concern around the impact they are having on single stock volumes, volatility, and correlation. As ETFs become more liquid, the concern is that creations, redemptions, and hedging will inflate intraday single-stock correlations, making stock picking and active management that much more difficult. Traditionally, correlation is measured using daily returns, and is rarely studied on an intraday basis. In this piece, we will dispel some of the myths surrounding ETF volumes and take a deeper dive into what impact, if any, they are having on intraday correlations. We also dig deeper into intra-sector correlations and break the trading day into smaller buckets to study if correlation is higher, or lower, towards the end of the day.

Upon completing our analysis of intraday correlations for the 25 largest and smallest companies in the S&P 500, we found a relationship emerged between correlation and ETF volumes. We also found that correlation is elevated during the last hour of the trading day.

I. Background

One of the biggest misconceptions about ETF volumes is that they have grown significantly over the past several years. The truth about ETF volumes is that they were at some of their lowest levels in recent memory earlier this year, and despite a recent run up, are no higher than they were prior to the collapse of Lehman. In fact, ETF volumes peaked (as a % of total volume) amidst the credit crisis, averaging 22% of total volume from December 2008 to May 2009.

Since then, the only time we’ve seen anything close to those types of ETF volumes was in the summer and fall of 2011, when the S&P dropped 20% on US budget concerns. From a share turn-over perspective, average daily ETF volumes have been down YoY in three of the past five years and grew less than 10 basis points in 2011. In fact, ETF volumes alone experienced worse YoY growth than the broader equity market in 2010, 2011, and in the first quarter of 2013. All these numbers are compounded by the fact that the amount of ETFs trading in the US has doubled over the past 5 years.
II. Methodology

Even on a close-to-close basis, correlation calculations can be computationally intensive. As such, most implied and realized correlations are measured using a subset of an index. For example, Bloomberg and CBOE use the 50 largest members of the S&P 500 to measure correlation for that particular index; a methodology that we believe is inherently flawed. For our study, we will also use the S&P 500 as our benchmark index, but we will look at correlation metrics for the 25 largest and 25 smallest companies in the index. We use this methodology because the S&P 500 is a float-adjusted, market cap weighted index; thus the largest 50 companies in the index impact performance more than any other members. In fact, the largest 50, or 10% of the stocks in the S&P 500, make up an astounding 48% of the index by weight.

Once our universe is selected, we measure the return of each stock over 10 minute periods during the trading day (excluding half days), creating one intraday correlation number for each stock relative to the SPYs. Using 10 minute intervals provides us with 39 individual data points, which is similar to the amount of data that would go into a 2-Month close-to-close calculation. Given that the premise of this piece is ETF volumes, we will also pull out a subset of the three largest SPDR Select Sector ETFs by ADV and measure stock-to-ETF correlations accordingly. With the increased emphasis on the end of the trading day this year, we wrap the piece up with a discussion on whether correlation is higher during the last hour of the trading.

II. Data Analysis

To put today’s numbers into perspective, we went back and calculated intraday correlation since January 2011. We were surprised to find that correlations for the bottom 25 stocks in the index is rarely far off that of the 25 largest stocks (Fig. 1).

![Intraday Correlation Each Day Since 2011](Fig. 1)

We then combined both groups, and smoothed the data out over monthly time intervals, to paint a clearly picture on the evolution of intraday correlation (Fig. 2).

![Intraday Correlation By Month](Fig. 2)
This January, S&P 500 intraday correlations were at their lowest levels over the past two years. We saw a similar drop in implied and realized correlation on a close-to-close basis, though intraday correlations have rebounded and close-to-close correlations have not. Unsurprisingly, intraday correlations peaked during periods of macro stress in August, which corresponds to a peak in volatility and an up-tick in ETF volume. Fig. 3 shows intraday correlations as a function of ETF volumes for each day since January 2011.

The relationship over the past two years appears very steep as well, showing how sensitive intraday correlations are to an uptick in ETF volumes. Keeping this in mind, we drilled down to the sector level within the S&P 500 to see how strong intra-sector correlations are and if they too have a relationship to ETF volumes.

As mentioned earlier, we will focus on the three most liquid SPDR Select Sector ETFs and their members: the XLF (Financials), XLI (Industrials), and XLE (Energy). Given what we’ve learned about the relationship between the smallest and largest 25 stock’s intraday correlation, we will look only at the top 10 stocks in each fund for this portion of the study. Over the past two years, correlation has been strongest amidst stocks in the XLE, with members of the XLF ranking the least correlated of the three sectors on an intraday basis.

Forgoing any rigorous tests for outliers or multicolinearity with variables such as volatility, we can say that, to a reasonable degree of certainty, intraday correlations increase on days where ETF volumes make up a larger % of US volumes. This helps explain why correlations were relatively low in the first quarter of 2013; because (despite what we may think) ETF volumes were at their lowest levels over the past 5 years.
It should come as little surprise that intra-sector correlations are much high than broader market correlations. However, the linear relationship between each ETF’s volume and the correlation of its members is very loose relative to Fig. 3. The R-Squared values for intra-sector correlations as a function of their ETF’s volume is half that of the .48 R-Squared value from the data that went into Fig. 3.

The last thing we’ll look at is 5-Minute correlation in the last hour of the trading day. During the first quarter, we put together several pieces noting the drift in volume towards the end of the day. In fact, an average of 28% of the day’s volume trades in the last hour of the trading day for our S&P 500 universe. We wanted to study what impact, if any, this had on intraday correlations. Fig. 4 ranks the spread between correlation in the last hour and correlation from the rest of the day for the first quarter of 2013. Correlation was higher in the last hour of the day 75% of the time last quarter, with a much wider range than on the days correlation was lower (.27 vs .09 respectively).

III. Conclusions

Intraday correlations are at levels no higher than they have been over the past several years. In fact, this January, intraday correlations were at their lowest levels over the 27 months we studied. That being said, it is apparent that a positive relationship exists between ETF volumes and intraday correlation, which will likely play a larger role if ETF volumes begin to make up a larger portion of US Equity volumes.

Interestingly, though intra-sector correlations are higher than broader market correlations, there is not a very strong relationship between those sector correlations and volume in the corresponding SPDR Select sector ETF. As the end of the day continues to become more and more relevant from a volume standpoint, we are seeing correlation move higher in the last hour of trading. Last quarter, correlation was higher in the last hour 75% of the time for an average increase of 15%.
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