**A Conditional Variance Approach to Commodity ETF Tracking Error**

There is numerous empirical support for the diversifying benefits of commodities within a portfolio (e.g. Anson 1999, Belousova and Dorfleitner 2012, Bodie 1983) but historically only sophisticated investors have been able to take advantage of this. Commodity-backed ETFs allow retail investors to gain commodities exposure without being subject to unforecastable cash flows in the form of margin calls, the relatively large size of future’s contracts, and “rolling” a contract forward upon expiration. These benefits make commodity-backed ETFs and other commodity-based Exchange Traded Products (ETPs) a growing segment both in terms of product offerings and dollars invested. As of November 8, 2020, the ten largest commodity ETFs have over $135 billion dollars under management.[[1]](#footnote-1)

A major concern of ETP investors is tracking error between the ETP and the underlying assets or target exposure. Tracking error is a form of uncompensated risk and if sufficiently large, can have significant adverse effects on a portfolio. While tracking errorhas been studied extensively in equity ETFs, the recent dislocation in bond ETFs[[2]](#footnote-2), as well as the historic volatility around the United States Oil Fund (USO)[[3]](#footnote-3), has highlighted the need for further research in other asset classes.

There is multiple definitions of tracking error, but it is often defined as the difference in returns between ETF price and Net Asset Value (NAV.) As Davidson *et al.* point out definition is not sufficient, as NAV can differ substantially from the benchmark or stated investment goals of the fund, as is apparent in earlier research on equity ETFs. (Davidson *et al.* 2013, Blume and Edelen 2004) Unlike other ETPs, the ETFs we study do not track in index, but instead a basket of futures contracts. Using the stated target weightings of the ETF and the roll schedule, we construct benchmark asset baskets for the ETF using future’s data.

Previous research identify multiple aspects which influence the average tracking error in commodity ETPs, such as whether the ETP tracks a single or basket of commodities, the replication method employed, or the issuer. (e.g. Dorfleitner *et al.* 2016, de Sousa 2014) The focus on averages provides useful information for investors, but as many papers conclude;( Bialkowski *et al.* 2018, Ramos 2015, Davidson *et al.* 2013) tracking error varies significantly over time. The methodology we propose includes factors which may on average increase tracking error, but also considers the time varying nature of both the average tracking error and the variance of the tracking error.

We employ the standard OLS procedure developed by Mincer and Zarnowitz (1969) in the context of analyzing forecast performance. This procedure is commonly used throughout the literature to investigate systematic bias in returns between the ETF and the asset basket. Having fit the model, we investigate the residuals: the non-systematic tracking error, using a conditional heteroskedastic approach. We find evidence of ARCH effects in the residuals and attempt to explain them using multiple external variables informed by the literature and economic theory. We explore multiple GARCH model specifications including asymmetric model types.

Preliminary results suggest that several variables have a statistically significant effect on the mean and variation of non-systematic tracking errors. These results may prove useful to investors in understanding the nature and causes of tracking error.

Our research is relatively unique in its focus on commodity ETFs, an under-studied portion of the ETP universe, our methodological approach, and our focus on daily, rather than average tracking error. Our work is further differentiated by the reconstruction of asset baskets, which despite the strong rational for doing so, is rarely done in commodity ETP literature.

**References**

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1. https://etfdb.com/etfs/asset-class/commodity/ [↑](#footnote-ref-1)
2. https://www.etftrends.com/etf-strategist-channel/why-bond-etfs-are-being-dislocated-from-their-indices-nav/ [↑](#footnote-ref-2)
3. https://www.etfstrategy.com/uso-oil-etf-faces-sec-enforcement-action-united-states-oil-fund-uso-39495/ [↑](#footnote-ref-3)