Return Interval Selection and CTA Performance Analysis

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Abstract

The impact of return interval selection (e.g., daily, weekly, or monthly) on the estimation of an asset's systematic risk (beta), total risk (variance), and return performance has received considerable attention in financial literature. Results for stocks and bonds indicate that a security's beta, variance, and return performance can be substantially affected by the return interval used in risk and return estimation. For managed futures, however, little is known of the impact of return interval on risk and return estimation. This is important, since for most public commodity funds, as well as hedge funds, returns are reported at most weekly and often only monthly. If return nterval impacts exist such that the return distributions are not independently distributed, risk and return estimates derived from monthly data may not represent the underlying risk and return patterns of shorter investment periods.

In this paper, for a limited sample of six commodity trading advisors (CTAs), risk and return measures (e.g., beta, variance, information ratios) are compared using daily, weekly, and monthly return intervals. Results indicate that *relative risk and return rankings,* when computed from monthly data, do not differ substantially from those generated by daily or weekly return value reporting. At the same time, results presented indicate that while changes in investment style are captured using monthly data, intermonth data captures such changes sooner such that differences *in return forecast error* do exist, and depending on investor risk tolerances, may be regarded as significant. Thus, for the large investor seeking to actively monitor its investments, either segregated accounts or weekly reporting of commodity fund or commodity trading advisor data may be regarded as a necessary investment requirement.

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1. Introduction

In the past decade, the growth of public investment funds has resulted in investors requiring a growing amount of information as to the performance of investment managers and the risk and return properties of their investment vehicles. For stocks and bond funds, information on manager and fund performance is provided by both private consulting firms (e.g., Frank Russell, Evaluation Associates) as well as by information sources oriented towards the investing public (e.g., Morningstar). For managed futures (investment products in which managers primarily trade in futures and options markets) similar private consulting and public information sources (e.g., Managed Account Reports (MAR), Barclay, Stark and TASS) exist which offer information on manager (commodity trading advisor (CTA)) profiles as well as commodity fund performance. Data providers for managed futures, including Managed Accounts Reports, Barclay, and TASS, as well as popular data providers for hedge funds such as Managed Accounts Reports and Hedge Fund Research, all provide data on a monthly basis. Only for large investors who are capable of obtaining segregated accounts, in which they have access to the actual investments, can performance be determine on a daily basis.

Since most managed futures investors have access to risk and return information based primarily on monthly return data, the similarity of managed futures performance results determined using daily, weekly or monthly return intervals data is important, However, little research exists on the impact of return interval on performance measurement for managed futures.[1] This is especially important for managed futures since, while stock and bond mutual fund managers' ability to change investment style is limited by institutional and governmental rules, commodity trading advisors may easily change asset markets or trading styles such that, for managed futures, research is required on the degree to which reported performance results obtained using monthly data is consistent with that obtained from intramonth return intervals.

In this paper, for a limited sample of six commodity trading advisors (CTAs), traditional risk and return measures (e.g., beta, variance, information ratio) are compared using daily, weekly, and monthly return intervals. Results indicate that *relative risk and return rankings*, when computed from monthly data, do not depart substantially from those generated by daily or weekly reporting. At the same time, results presented indicate that, while changes in investment style are captured using monthly data, intermonth data captures changes in risk patterns sooner such that differences in *return forecast error* do exist and, depending on investor risk tolerances, may be regarded as significant. Thus, for the large investor, seeking to actively monitor their investment, either segregated accounts or weekly reporting of fund data may be regarded as a necessary investment requirement.

II. Effect of Interval Selection on Risk/Return Measurement

Theoretically, if returns are independent and identically distributed through time, weekly or monthly return and risk estimates (e.g., variance) will be a linear function of the risk and return parameters determined using daily risk and return estimates.[2] That is, assuming 250 trading days in a year, the annual return will be approximately 250 times the daily return-, while the variance is 250 times the daily estimated variance (the annualized standard deviation is the square root of 250 times the daily estimated standard deviation). Since risk performance measures such as beta and information ratios are simple transformations of standardized relative return movements, their expected values should not be substantially affected by choice of daily, weekly, or monthly data.[3]

While the purpose of this paper is not to review all the mathematics behind the effect of return interval selection on risk parameter estimation, the impact of interval selection on the estimation of a security's beta, correlation and standard deviation has received considerable attention in the financial literature. For stocks, for instance, Cohen et al. [1985] have indicated that the estimate of beta increases (decreases) as return intervals are lengthened for stocks judged riskier (less risky) than the market. In contrast for bonds, Hill and Schneeweis [1979] have found that the impact of choice of bond index and the return interval selection results in bond beta increasing as intervals are lengthened for bonds which are judged less risky than its benchmark. In the following sections, in the context of CTAs, the impact of return interval selection and benchmark selection are examined for their potential impact on risk and return estimation and return forecast accuracy.

III. Return Interval Impacts on CTA Risk and Return Estimation and Forecast Error

In this paper, for a sample of six CTAs, daily, weekly, and monthly returns are computed for the period June, 1994 through April 1995. Return are derived as follows:

$$R_{i,T} = LN\left(NAV_{i,T} / NAV_{i,T-1}\right) \qquad (1)$$

where,

$R_{i,T}$ = Return CTA i in period T

$NAV_{i,T}$ = Total asset value for CTA i in period T

The corresponding standard deviations, variance ratios, information ratios (return/standard deviation) and correlation are also calculated. Lastly, the CTA betas (relative to either an equal weighted portfolio of the sample CTAs or the S&P 500) are determined. Moreover, the daily, weekly, and monthly annualized returns and standard deviation as well as the information ratio and betas for the alternative return intervals are given for the Fidelity Magellan fund as a basis for equity market mutual fund comparison of return interval selection on risk and return stability. Lastly, for the CTAs, moving betas are also estimated for both weekly and monthly data (e.g., twenty-six week and six month rolling windows), The estimated CTA betas are then used along with a perfect forecast of next week's CTA portfolio return to measure the weekly absolute forecast error as follows:

$$\text{Absolute Error} = \text{Absolute Value } [R_{i,t} *(B_{i.,T-.1} * R_{ctap,T})] \qquad (2)$$

where,

$R_{,i,T}$ = Return for CTA i in week T

$R_{ctap,T}$ = Return for CTA portfolio in week T

$B_{i,T-1}$ = Beta for CTA i in period T- 1 estimated from six months (twenty-six weeks) respectively

IV. Risk and Return Estimation Using Daily, Weekly, and Monthly Reporting Periods

Simply put, if the return distribution underlying CTA performance is independent and identically distributed through time, one would expect that for a weekly return interval the average rate of return (standard deviation) would be approximately 5 (square root of 5) times the daily return (standard deviation) and that the monthly return would be approximately 22 (square root of 22) times the daily return.[4] Similarly, for monthly data, the return should be approximately 4 (square root of 4) times the weekly return (standard deviation).[5] In Table I and Figure 1, for the time period analyzed the daily, weekly, and monthly returns and standard deviations annualized by the proper multiple are shown. As shown in Table 1 and Figure 1, the CTAs', as well as the S&P 500's and Magellan fund's, annualized returns are not significantly different when determined using daily, weekly, or monthly returns. The F test between the relative annualized variances also indicate annualized variances are generally similar when determined from daily, weekly, or monthly data. As shown in Cohen et al. [1985] if an asset has significant positive (negative) first order autocorrelation, annualized variance estimates from longer term return intervals will be greater (less) than annualized variance estimates from shorter term return intervals. The F-tests (relative variances) results across various return intervals are consistent with the generally low levels of autocorrelation shown in Table 2.[6] Given the lack of a measurable interval effect on return or variance estimates, the information ratio (mean return/standard deviation) similarly shows a consistent pattern for each CTA's daily, weekly, and monthly return interval.[7]

Insert Table 1 and Table 2 and Figure 1 about Here

While return, standard deviation, and information ratios are consistent across return intervals, for beta, the choice of benchmark index impacts the CTA beta levels and stability. When a CTA based benchmark index is used, all CTA betas are positive, while when the S&P 500 is used all CTA betas are negative. For CTAs, results in Table I also indicate relative beta stability determined using a designed CTA index while less stability is evident when the S&P 500 is used as the comparison index. When a CTA based benchmark is use, there are no significant differences in the reported betas and the largest difference between a daily return interval based beta and that determined using a monthly return interval is .35 (CTA2). In contrast when a S&P 500 based benchmark is used to determine CTA betas, several large difference exist between daily, weekly and monthly return interval based betas. For instance, for CTA5, the daily based S&P 500 based beta is - 1. 17, while the monthly based S&P 500 based beta is .22. In contrast, for the Magellan fund little stability is found when the CTA index is used (the beta ranges from .14 to -.23), while beta stability is evident when the S&P 500 index is used (the beta ranges 1. 14 to 1. 29).

An additional problem in comparing horizon adjusted variance or beta estimations is that these adjustments may not fully capture jumps (or other threshold-related changes) in a manager's underlying risk/return tradeoff or style that may be otherwise captured using intermonth or interweek data. For instance, in Figure 2 the cumulative return performance indices for each CTA and the corresponding performance indices for an equally weighted CTA Portfolio, and the S&P 500 are given for weekly data for the period 6/1/94 through 4/28/95. Figure 2 indicates that for the time period of analysis various CTAs adjusted their style relative to the S&P 500. For instance, in the first several months of 1995, the CTAs all grew in value (similar to the S&P 500). It is interesting to note that after March, 1995 CTA1 and CTA2 performance declined while the performance of CTAs 3, 4, 5, and 6 continued to rise.

Insert Figure 2 about Here

These differential patterns of returns among the CTAs also indicate possible changes in investment styles such that past return or risk measures may not provide adequate forecasts of ffiture return performance. In Figure 3, weekly and monthly betas determined from twenty-six weeks or six months of prior weekly or monthly data respectively (starting in 11/30/94) indicates dramatic shifts in CTA betas.[8] From monthly data, CTA1 and CTA3 both experience dramatic downward shifts in beta in early 1995, while CTAs' 4 through 6, monthly betas indicate an upward shift in beta. For weekly data, however, betas remain relatively stable over the time period measured.

Insert Figure 3 about Here

Return Forecast Error

Since beta based measures of risk are important inputs in asset allocation and performance comparison, it is also important to know how return interval effects these beta based return forecast. As illustrated in Figure 3, CTA beta determined using monthly and weekly return intervals over similar estimation periods may differ when estimated at various points of time. The relative impact of these beta shifts on absolute mean forecast error (see equation (2)) is shown in Table 3 and Figure 4. As shown in Table 3, the betas derived from twenty-six weeks of prior weekly data provides a lower absolute weekly mean error than that provided by betas derived from six months of prior monthly data. The errors are significantly lower, enough so that, for the large investor, either segregated accounts or weekly reporting on fund data may be regarded as a necessary investment requirement.

Insert Table 3 and Figures 4 about Here

V. Conclusions

In this paper, for a limited sample of six commodity trading advisors (CTAs), conventional risk and return measures (e.g., beta, correlation, information ratios) are compared using daily, weekly, and monthly data. Results indicate that relative risk and return rankings are not substantially affected by use of daily or weekly value reporting. At the same time, results presented indicate that while changes in investment style are captured using monthly data, intrarnonth data captures such changes sooner such that differences in *return forecast error do* exist and, depending on investor risk tolerances, may be regarded as significant.

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Endnotes

[1] Due to data availability, previous research in managed futures (e.g., Chance, 1995; Elton et al., 1987; Irwin et al., 1994; Schneeweis 1996) have been conducted exclusively using monthly data.

[2] This is not exactly true since we are dealing with *estimated* values; technically speaking, the probability limit of a function of an estimate is equal to that function of the probability limit of the estimate, *but only asymptotically* (Slutsky's theorem); or we must use maximum likelihood estimate, which requires that we know (or merely assume) the form of the underlying distribution from which returns are generated (e.g., Gaussian), and appeal to the invariance (to a functional transformation) property of ML estimators in finite samples. Beyond this note, we assume away any complications associated with these matters.

[3] For a full discussion of interval effects on security risk estimation see Cohen et al. [1985].

[4] This assumes that there are approximately 5 trading days in a week and approximately 22 trading days in a month. as well as approximately 4 weeks in a month. In this paper the actual net asset

values of the CTA positions at common points were used to obtain weekly and monthly returns which corresponded with the daily return cycle.

[5] Monthly, weekly, and daily returns are annualized by multiplying by 12, 52, and 250 respectively. Monthly, weekly and daily variances are annualized by multiplying by the square root of 12, 52, and 250 respectively.

[6] The 5% critical values are 1.5 for daily/weekly, 2.3 for daily/monthly, and 2.4 for weekly/monthly.

[7] However, the results shown in Table 1 reflect the variance pattern that results from taking the daily, and weekly variances and applying traditional multiples to annualize daily, weekly, and monthly variances before calculating the relative F-Statistics. To the degree than these traditional multiples (e.g., 250 days, 52 weeks, and 12 months) do not reflect the actual relative trading days or that the use of weekly or daily data over a set time period may not match exactly the month end valuations, error may be introduced into the reported F-states.

[8] A investments beta is equal to the correlation times the relative standard deviations such that if the asset's variance is stable an increase in beta is equivalent to an increase in correlation.