# Assignment 9

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## Problem 1: Closed-end fund discount (50 points)

Suppose a closed-end fund invests in a portfolio of stocks with return $R_t = R_f + \beta(R_{M,t} - R_f) + \epsilon_t$. The fund pays a constant dividend yield $\delta$ of the total NAV to the closed-end fund investors by liquidating a fraction of its portfolio at market value every period. It also pays a management fee (including payments to the managers and annual expenses such as custody fees etc...) a fraction $f$ of the the total NAV every period to the fund manager by liquidating a fraction of its holdings every period. The starting value of the fund is $V_0$. The expected return on the market is $E[R_M] = \mu_M$.

1. Compute the dynamics of the NAV of the fund.

2. Assume that the CAPM holds and thus that the discount rate to apply to the fund's cash flows is the CAPM-expected return on the underlying portfolio held by the fund. Compute net present value of the cash-flows paid out to the investor. Compute the net present value of the fees earned by the manager. (hint: note that $E_t[1+R_{t+1}]/(1+k) = 1$ where $k$ is the CAPM discount rate.) Do the values for the investor and for the manager depend on the systematic or the idiosyncratic risk of the underlying closed-end fund portfolio? Give some intuition.

3. The observed discount on the Tri-Continental Corporation closed-end fund over a 26-year period was 14.4%. The average annual manager's fee was 0.44% of the NAV, and the dividend yield 2.27%. Based on these numbers compute the average closed-end fund discount implied by your formula above.

4. Do you think management fees are a good explanation for the closed-end fund discount puzzle?

## Problem 2: Reversal and Momentum Strategies(50 points)

In this exercise we will replicate the momentum and reversal factors.

1. Download data on the same stocks you used in the previous problem set, i.e. the XXX stocks that have been traded each day between 1980 and 2019. Download the same market return and risk-free rate that you also used in the last assignment.

2. Every month form 10 groups of stocks based on the last month return. Portfolio 1 is the decile of stocks that had the lowest return the previous month and portfolio 10 is the decile of stock that had the highest return last month. Then compute the return to a *Reversal* strategy that goes long portfolio 1 and shorts portfolio 10.
3. Compute the average return, the volatility, and the Sharpe ratio of that Reversal strategy, using equal weighted average returns for within P1 and P10
4. Regress the return of the Reversal strategies on the market return. Interpret the regression results. Is the strategy's alpha consistent with the CAPM? What can explain the performance of such as strategy?
5. Every month form 10 groups of stocks based on the 2-month lagged 11 month return (so this is the return from t-12 to t-2 month). Note that dropping the most recent 2-months insures that the signal does not overlap with the Reversal signal just investigated. So Portfolio 1 in month t is the decile of stocks that had the lowest t-12 to t-2 returns and portfolio 10 is the decile of stock that had the highest return t-12 to t-2 return. Then compute the return to a *Momentum* strategy that goes long portfolio 10 and shorts portfolio 1.
6. Compute the average return, the volatility, and the Sharpe ratio of that Momentum strategy, using equal weighted average returns within P1 and P10.
7. Regress the return of the Momentum strategy on the market return and on the Reversal strategy return from the previous question. Interpret the regression results. Is the strategy's alpha consistent with the CAPM? What can explain the performance of such as strategy?
8. What Maximum Sharpe ratio can you obtain if you combine your Momentum and Reversal strategies with the Market portfolio? What is the optimal portfolio composition

with these three strategies?