Empirical Asset Pricing: Mutual Fund

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Mutual Fund

- Mutual fund is a type of investment company that pools money from many investors to purchase securities.

- Mutual funds are operated by professional money managers, who invest the fund's capital and attempt to produce capital gains and income for the fund's investors.

- The asset management industry is huge, and has increase enormously since the 2008 financial crisis. AUM at the top-400 global asset managers is $75 trillion at the end of 2018. This is up from $32 trillion at the end of 2009.

Question

- Whether mutual fund managers have skill?
- In other words, whether mutual fund mangers could systematically beats market or , in general, a passive investment strategy?
- Which benchmark?
- We have SP500, CRSPvw (NYSE, NASDAQ, AMEX), low-cost style funds (value funds, growth funds), ETFs, smart-beta products.
- How the growth of the passive strategies affects the efficiency of markets?
- Who provides the efficiency when everyone is passive (Stiglitz paradox, again. Of course, a new version)?
- Industrial organization in mutual fund industry.

Berk and Green (2004)

- This is one seminal theory work in mutual fund literature. Several important questions could be summarised from it.
- Do mutual fund managers have before fee alpha or after fee alpha?
- All funds earns zero alpha after fee $E_t[r_{t+1}] = 0$, which means the fund managers just.
- Is alpha a good measure for the fund manager skill?
- No, alpha is a very bad measure for skill. In the long-run, only AUM is the good measure for skill.

Berk and Green (2004) (Cont')

- MF managers are informed, with skill α^i, which is the degree to out-perform a benchmark (SP500).
- Fund before fee return is $R_t^i = \alpha i + \epsilon_t^i$.
- Skill distribution $\alpha^i \sim \mathcal{N}(\phi_0, \gamma^{-1})$.
- Luck distribution $\epsilon_t^i \sim \mathcal{N}(0, \omega^{-1})$.
- Trading cost $C(q)$, where q is the AUM: $C'(\cdot) > 0$, $C''(\cdot) > 0$.
- Intuition: The larger the fund's AUM, the larger the trading impact, the smaller the information advantage.
- After fee return: $r_{t+1} = R_{t+1} - \frac{C(q_t)}{q_t} - f = R_{t+1} - c(q_t)$.

Berk and Green (2004) (Cont')

- Investor would infer α^i from historical performance in Bayesian fashion from data $\{R_s\}_{s=0}^{t}$.
- Investor's fund supply is perfectly elastic, who will withdraw all asset with negative expected excess returns.
- Funds incur a fixed operational cost F. When revenues cannot cover the fixed cost, the fund exits voluntarily.
- When there is fund that exits, new fund are drawn from a skill distribution.

Berk and Green (2004) (Cont')

- In equilibrium, $E_t[r_{t+1}] = 0$. All funds earn zero expected excess return after fees.
- The core trade-off:
  1. funds with high-skill managers will have more positive realized excess return, and investors would upward the skill belief $\hat{\alpha}^i$.
  2. Accordingly, there will be more fund inflow to boost the AUM.
  3. High AUM will incure high cost.
  4. Until, the manager's alpha will be fully deteriorated by the increasing costs.
- Implication:
  1. No alpha does not mean no skill.
  2. AUM is a good measure for skill.
  3. fund in/out flow is a convex function of return or α:

$$\frac{q_t - q_{t-1}}{q_t} = \frac{r_t}{f}\left(\frac{\omega}{\gamma + t\omega}\right) + \frac{r_t^2}{4f^2}\left(\frac{\omega}{\gamma + t\omega}\right)^2.$$

Test the skill of mutual fund managers

- Actually, it is very very very difficult to differentiate skill and luck in portfolio performance.

- Standard performance analysis usually employs a monthly FF 3-factor, Carhart 4-factor, HXZ 4-factor etc.:

$$R_t^i - R_t^f = \alpha^i + \beta_1^i MKT_t + \beta_2^i SMB_t + \beta_3^i HML_t + \beta_4^i MOM_t + \epsilon_t^i,$$

  in the literature, there is very weak evidence for positive alpha, not only for after-fee alpha, as predicted by BG(2004), but also before-fee alpha.

Test the skill of mutual fund managers

- Intuition:
  1. if there is only two types of investors passive and active.
  2. Passive investors by definition earn zero alpha.
  3. Active investor only have zero alpha before fee left on the table.
  4. Things could be different when we have household investors and individual investors in the marekt, who usually have negative alpha.

Treynor and Mazuy (1966)

- Treynor and Mazuy (1966) is an very early paper that studies the mutual fund performance.
- Their main contribution is to introduce the Treynor-Mazuy measure of mutual fund performance.
- Nowadays, when we study mutual fund performance, we still use this their methodological framework.

$$\text{Treynor Ratio} = \frac{r_p - r_f}{\beta_p}.$$

Performance Attribution

- One very popular method is to employ the Brison framework in industry.
- The other method is to use the multi-factor framework.

$$R_t = \alpha + \beta_1 F_{t,1} + \beta_2 F_{t,2} + \cdots + \beta_n F_{t,n} + \epsilon.$$

- In this class, we will use the α to capture the mutual fund's ability.
- The β will be used to capture the mutual fund's risk.
- The ϵ will be used to capture the mutual fund's luck.
- The F_i will be used to capture the "factor" like FF3, FF3+MOM, or FF5.

Which benchmark? Daniel et al. (1997)

- DGTW (1997) argues that directly employ the return loading regression is not accurate enough.
- They also employ the mutual fund holding data.
- They use holding data of single stock to directly capture the average characteristics of the mutual fund's portfolio.

$$\text{Portfolio characteristics} = \sum_{i=1}^{n} w_i x_i. \quad x_i = \text{BM, ME, MOM.}$$

Which benchmark? Daniel et al. (1997)

- DGTW (1997)'s true contribution is to create a benchmark.
- They sort stock by ME, BM and MOM. Calculate the return of each portfolio.
- They use the return of each portfolio as the benchmark.
- The mutual fund is assigned to each benchmark according to their portfolio characteristics.
- The mutual fund performance is the difference between the mutual fund's return and the benchmark's return.

Busse, Jiang and Tang (2020)

- BJT (2020) find that mutual fund risk exposure and average characteristics share only 0.6 correlation.
- They argue that the benchmark should employ both risk exposure and average characteristics.
- They name their method as double adjusted α.

Alpha?

- After we conclude that we have get the right benchmark, the next question is could the mutual fund manager beat the benchmark?
- There are great amount of literature that study this question.
- The most famous one is the Fama and French (2010) and Kosowski et al. (2006).

Alpha? Fama and French (2010)

- Fama and French (2010) create one value-weighted portfolio of actively managed U.s. equity mutual funds.
- They find that the VW AMF is very close to the market portfolio and earns zero alpha.
  1. The VW AMF has a MKT beta of nearly 1 and an alpha of 0.00.
  2. The VW AMF has a R-squared around 99%.
  3. Carhart alpha is -0.05% per year before fees, 0.15 sd below 0. Carhart alpha is -1.00% per year after fees, 3.0 sd below 0.

Alpha? Fama and French (2010)

Table II

Intercepts and Slopes in Variants of Regression (1) for Equal-Weight (EW) and Value-Weight (VW) Portfolios of Actively Managed Mutual Funds

The table shows the annualized intercepts ($12 * a$) and t-statistics for the intercepts ($t(Coef)$) for the CAPM, three-factor, and four-factor versions of regression (1) estimated on equal-weight (EW) and value-weight (VW) net and gross returns on the portfolios of actively managed mutual funds in our sample. The table also shows the regression slopes (b, s, h, and m, for $R_M - R_f$, SMB, HML, and MOM, respectively), t-statistics for the slopes, and the regression R^2, all of which are the same to two decimals for gross and net returns. For the market slope, $t(Coef)$ tests whether b is different from 1.0. Net returns are those received by investors. Gross returns are net returns plus $1/12^{th}$ of a fund's expense ratio for the year. When a fund's expense ratio for a year is missing, we assume it is the same as other actively managed funds with similar assets under management (AUM). The period is January 1984 through September 2006. On average there are 1,308 funds and their average AUM is $648.0 million.

	$12 * a$						
	Net	Gross	b	s	h	m	R^2
EW Returns							
Coef	−1.11	0.18	1.01				0.96
$t(Coef)$	−1.80	0.31	1.12				
Coef	−0.93	0.36	0.98	0.18	−0.00		0.98
$t(Coef)$	−2.13	0.85	−1.78	16.09	−0.24		
Coef	−0.92	0.39	0.98	0.18	−0.00	−0.00	0.98
$t(Coef)$	−2.05	0.90	−1.78	16.01	−0.25	−0.14	
VW Returns							
Coef	−1.13	−0.18	0.99				0.99
$t(Coef)$	−3.03	−0.49	−2.10				
Coef	−0.81	0.13	0.96	0.07	−0.03		0.99
$t(Coef)$	−2.50	0.40	−5.42	7.96	−3.22		
Coef	−1.00	−0.05	0.97	0.07	−0.03	0.02	0.99
$t(Coef)$	−3.02	−0.15	−5.03	7.78	−3.03	2.60	

Skill of Luck? Fama and French (2010)

- The main challenge is to distinguish skill from luck.
- FF(2010) argue that the main difference between skill and luck is the persistence.
    1. Rank fund into deciles based on their past alpha.
    2. Track each how well each decile does over next 1, 3, ..., 24 month. However sort on short-term past performance is largely sorting on noise.
    3. They employ the bootstrap method simulate pesudo return from long histories of individual fund return.
- They conclude that less than 1% fund's alpha is from skill.

Skill of Luck? Kosowski, Timmermann, Wermers, and White (2006)

- Kosowski et al. (2006) find one different result from FF (2010).
- They conclude that around 10% of the mutual fund's alpha is from skill.
- Their methods are very similar.
- FF (2010) argue that KTWW (2006)'s results are due to the survivorship bias of their filters.

Harvey and Liu (2021)

- Harvey and Liu (2021) argue that
  1. FF (2010) may cause false negative error (type II error).
  2. KTWW (2006) may cause false positive error (type I error).
- The difference is because of their bootstrap method.

Barras, Scaillet and Wermers (2010)

- BSW(2010) apply the false discover rate into mutual fund analysis.
- Even if we find one mutual fund has significant alpha, our test could still suffer from false positve error.
- After correcting the type II error, there are only 1% mutual fund could generate superior peformance.

Andrikogiannopoulou and Papakonstantinou (2019)

- AP (2019) argue that mutual fund performance is a very weak information-to-noise-ratio measure.
- 65% MF with economically large alphas around $\pm 2\%$ of are classified as zero alpha.
- Simply applying false discover rate method could induce lack of power issue.

Barras, Scaillet and Wermers (2022)

- BSW (2010) is somewhat problematic.
- However, the problem is not as serious as it appears.
- BSW(2022) also find one way to improve the BSW(2010).

Conclusion

- Mutual Fund's alpha is a very complicated issue.
- We will cover more issues about performance persistence, stock-picking v.s. market-timing and mutual fund flow.
- We will continue the topic next class