

A Life Cycle Analysis of Performance and Growth in the Mutual Fund Industry

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Abstract

I propose a life cycle framework to explain observed dynamics in mutual fund performance and net fund flows. I show that mutual funds develop through life cycle stages of incubation, high growth, low growth, maturity, and decline. Across these life cycle stages, fund performance and net fund flows are monotonically decreasing, and there are inter-stage changes in total net assets, expense ratios, asset turnover, market betas, and portfolio industry concentration. I also find evidence that changing a fund's investment objective can be effective in rejuvenating asset growth and thus repositioning the fund to earlier stages of its life cycle. This rejuvenation and repositioning as a result of a change in the investment objective is especially likely to occur when the fund is in a decline stage. However, the strategy of adding portfolio managers appears to have no rejuvenation effect.

JEL Classification: G11; G20; L2; L22

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1. Introduction

The literature of industrial organization shows that firms undergo different life cycle stages as they grow and that corporate life cycle stages affect operational performance: the profitability declines as firms enter the later stages of their life cycles.¹ Drawing upon studies of corporate growth, I propose a mutual fund life cycle model that encompasses stages of incubation, high growth, low growth, maturity, and decline. Within this life cycle framework, I study fund performance, net fund flows, and fund characteristics such as size, expense ratios, asset turnover, market betas, and portfolio industry concentration. In addition, I examine and evaluate alternative strategies fund families have pursued to rejuvenate their growth.

Although studies of mutual funds denote that fund age affects fund performance, this issue has not been addressed within a well-developed life cycle framework. And no article in the literature provides empirical evidence that mutual funds undergo life cycle stages. Thus, to achieve a better understanding of the evolution of fund life cycle, I seek to answer two research questions. First, do mutual funds have life cycle stages? I argue that a fund's life cycle evolution is driven by the managers' relative size of investment opportunity set, which depends on fund size, the managers' skills, and the investment opportunities available in the market. Other things being equal, the relative size of an investment opportunity set decreases when a fund's total net assets increase. Faced with fewer investment opportunities, fund managers are likely to see profits decline, which in turn lead to decreases in fund inflows. Thus, asset growth declines, and the fund develops into its later life cycle stages.

The second question investigates whether strategies are available that fund managers can pursue to rejuvenate fund growth and thus reposition funds back to earlier stages in their life cycles. I examine two alternative strategies, changing the investment objectives or hiring more portfolio managers. These two strategies may enhance a fund's human resources and capability to

¹ See Quinn and Cameron (1980) and Miller and Friesen (1984) for a literature review on various corporate life cycle models.

identify additional investment opportunities and therefore improve fund performance, which in turn leads to more fund inflows. This investigation could provide some insights into how fund families strategically affect fund operation and growth.

In my empirical examination, I look at a sample of 1,349 U.S. open-end mutual funds that covers a time period from January 1961 through December 2005. I construct a composite score measure to classify each fund's life cycle stages, using a fund's age and its one-year and three-year moving average growth rates. Exploring the explanatory power of alternative life cycle stage measures on the variations of monthly fund returns, I find that the composite score measure provides information beyond that contained in another measure constructed with fund age alone.

I perform both univariate and multivariate analysis on fund performance over life cycle stages. The results indicate that the life cycle effect on fund performance is both economically and statistically significant, with the magnitude monotonically increasing over life cycle stages. When a fund develops from high-growth to low-growth stages, its risk-adjusted monthly returns drop by 49 basis points. When it reaches the mature stage, the returns drop by 10 more basis points. The returns drop again by 34 basis points when the fund descends to the stage of decline. In addition, net monthly returns and S&P 500 excess returns are also monotonically decreasing over the stages of the life cycle. These findings are consistent with the proposed mutual fund life cycle model in that mutual funds experience poorer performance across the life cycle stages. I also find that monthly net fund flows decline monotonically over life cycle stages. Furthermore, there are inter-stage difference in total net assets, expense ratios, asset turnover, market betas, and portfolio industry concentration.

My paper also sheds light on economies of scale in the mutual fund industry. Earlier studies find that an increase in fund size leads to poorer fund performance, and these studies assume that the marginal effect of size is constant over a fund's life cycle. I extend these studies by examining the effect of the dynamics of scale over the stages of funds' life cycle. The empirical findings indicate that a marginal increase in size significantly affects fund performance at the high-growth

stage when the average fund size is relatively smaller. In the case of a \$10 million increase in total net assets, the risk-adjusted monthly returns will drop by 17 basis points. When a fund is in the low-growth or mature stage, the same amount of increase in size lowers the returns by only 4 basis points. I do not find an effect of scale at the stage of decline.

Finally, I investigate the effectiveness of alternative strategies that fund families have pursued to rejuvenate fund growth. I compare the one-year and two-year stage transition matrices of the funds that neither changed investment objectives nor hired more portfolio managers with those that hired more managers and those that changed investment objectives. The stage transition probabilities show that when a fund is in the mature or decline stage, a change in its investment objective is likely to rejuvenate fund growth and in the next year reposition the fund to an earlier life cycle stage. However, hiring more portfolio managers is less effective as a way to rejuvenate fund growth. I also run a multinomial logistic regression of stage transition to further explore these two strategies. The regression results indicate that no rejuvenation effect is gained by changing the investment objectives when funds are in high-growth, low-growth, or mature stages. However, funds in decline are more likely to reposition to earlier life cycle stages after changing their investment objectives. The regression results also suggest that hiring more portfolio managers does not rejuvenate fund growth.

This paper proceeds as follows. Section 2 proposes a five-stage mutual fund life cycle model. Section 3 develops the hypotheses. Section 4 addresses the data and reports the descriptive statistics. Section 5 presents the results of multivariate analysis on the relations between fund performance and life cycle stages. Section 6 investigates the effectiveness of alternative strategies that fund families pursue to rejuvenate fund growth. Section 7 presents the robustness tests and Section 8 concludes the paper.

2. Mutual fund life cycle model

In this section, I propose a five-stage mutual fund life cycle model, which explains how mutual funds evolve over life cycle stages.

2.1. Incubation stage

Fund families determine a mutual fund's start. According to Arteaga, Ciccotello and Grant (1998), fund families use two types of strategies to develop new funds. The first of these is fund incubation. Fund families raise seed money internally to start a number of small funds and run them in private. After running these seed funds for awhile, fund families will open those funds with good track records to the public but terminate the poorly performing funds. The second strategy to develop a new fund is selective attention. Under this strategy, fund families launch new funds to the public without an incubation period and devote extra attention to the new funds during their early life cycle stages. The attention from fund families includes subsidizing operating expenses and more than a proportional allocation of profitable investment opportunities. Khorana and Servaes (1999) find that fund families will open new funds when the potential to generate additional fee income is substantial.

Fund families also determine the characteristics associated with a new fund. Massa (1998, 2003) argues that fund families open a series of funds with various styles and fee structures to exploit investor heterogeneity and increase market coverage. Nanda, Narayanan, and Warther (2000) develop a model in which managers set the mutual fund fee structures to maximize the captured rent, taking into account the effect on fund flows. Bar, Kempf and Ruenzi (2005) show that the choice of management is a strategic decision made at the fund family level. Fund families also have power over fund governance as documented by Tufano and Sevick (1997), who show that fund sponsors select new funds' initial independent board members who accept high fees from the sponsors and in turn may fail to act in the best interests of fund investors.

2.2. High growth stage

After opening to the public, new funds generally begin a high-growth phase that is associated with good performance and large net fund inflows. Blake and Timmermann (1998) study 2,300 U.K. open-ended mutual funds and find evidence that funds weakly outperform their peers during their first year after public offerings. Two factors may contribute to the high returns achieved at the high-growth stage. First, funds at this stage are small. Portfolio managers only invest in the industries and stocks for which they have the most information advantage, and the information advantage brings forth high returns (see, Kacperczyk, Sialm, and Zheng (2005)). Second, fund families subsidize new funds and give them preference in the allocation of resources. Zweig (1996) and Arteaga, Ciccotello and Grant (1998) mention that new funds obtain from fund families preferential allocations of underpriced IPOs. Gaspar, Massa, and Matos (2006) investigate strategic cross-fund subsidization within families and find that fund families allocate relatively more underpriced IPOs to high fee, high performance, and young funds. Since young funds have relatively smaller assets, a favorable allocation of profitable investment opportunities leads to superior performance.

2.3. Low growth stage

Funds in the low-growth stage are older and larger than those in the high-growth stage. As a fund's assets grow up, the relative size of the investment opportunity set shrinks. The portfolio's industry concentration gradually decreases as portfolio managers exhaust good investment opportunities in the industries they know the best and increase investments in industries with which they are less familiar. As a result, a fund's returns are relatively lower than those received at its high-growth stage, and consequently, the fund's inflows decrease. Because the assets under management are more diversified, the portfolio's market beta is closer to one than when the fund was in the high-growth stage.

2.4. Maturity stage

Funds in the mature stage are, on average, older and larger than those in the growth stages. The increasing complexity of the investment task from growing assets leads to increasing transaction costs because of the lessened flexibility that comes with holding larger positions (see, e.g., Perold and Salomon, 1991; Beckers and Vaughan, 2001; Pollet and Wilson, 2006; Edelen, Evans, and Kadlec, 2006). As managers continue to invest in those identified good opportunities (undervalued stocks), large amounts of accumulated purchasing of the same stocks will increase the prices and decrease the expected returns. Wermers (2003) find strong evidence that flow-related additions to existing positions push up stock prices, especially among growth-oriented funds. Prior studies also find that the aggregate purchase of the same stock by many funds will increase the price of the stock and lower its expected returns. Hong, Kubik and Stein (2005) show that a fund manager is more likely to buy or sell a particular stock if other managers in the same city are buying or selling that stock. Wermers (1999) find empirical evidence that mutual fund herding speeds up the incorporation of new information in stock prices.

A manager's incentive to retain more assets under management also contributes to poorer fund performance over the life cycle stages of the fund. Jensen's (1986) free cash flow theory suggests that managers of the firms with large free cash flows are more likely to diversify in value-destroying projects after they exhaust all investment opportunities. This is analogous to the mutual fund industry. Because the management fee is a percentage of the total assets under management, when managers have exhausted all lucrative investment opportunities and have "free" money at hand, they have a propensity for over-investment and begin to adopt passive investment strategies. Berk and Green (2002) and Chen, Hong, Huang, and Kubik (2004) argue that as funds age and grow, managers invest a larger portion of fund assets in benchmark portfolios. Chen et al. (2004) argue that the rationale behind this behavior is that after funds reach a certain size, managers no longer care about maximizing fund returns. A potential explanation

for managers' losing interest in maximizing returns is that managers realize they are unable to find more profitable investment opportunities.

Funds obtain lower average returns in the mature stage than in the low-growth stage because of larger trading costs, declining-profit opportunities, and overinvestment. As a result, the average fund inflows are less than they were in the growth stages but fund outflows are higher. Some funds choose to close to avoid these scale diseconomies. Nevertheless, earlier studies find that closing a fund does not protect its performance in the next period (see, e.g., Zhao, 2004; Bris et al. 2007). One possible explanation for their findings is that by the time a fund closes, its size is already too large.

2.5. Decline stage

Because of large trading costs, absence of profitable opportunities, and serious overinvestment, mutual funds experience extremely poor performance and large cash outflows, which leads to a stage of decline. Because fund families have incentives to create and market “star” funds and to eliminate poorly performing funds, they are likely to terminate small funds with declining returns.²

Mutual funds do not necessarily progress in a common sequence through stages of incubation, high growth, low growth, maturity, and decline. Studies on the life cycles of firms agree that firms do not necessarily follow the same sequence of stages (see, e.g., Miller and Friesen, 1984; Scott and Bruce, 1987; Hanks, 1990; Kiriri, 2006). Prior studies also suggest that as firms grow up, the number of investment opportunities declines and that firms in the mature stage are in need of new products and growth opportunities (see, e.g., Lippitt and Schmidt, 1967; Mueller, 1972; Grabowski and Mueller, 1975; Miller and Friesen, 1984). Fund families can

² For a discussion of mutual fund exit strategy such as merger and liquidation, see Jayaraman et al. (2002), Zhao (2005), and Ding (2006).

pursue some strategies to rejuvenate fund growth. Thus, a new growth stage could follow a stage of maturity or a stage of decline.

3. Hypothesis Development

Funds in the early stages of their life cycles are usually small. Managers do not have enough money to fully exploit all of the good investment opportunities they can identify, and the relative size of the investment opportunity set is much larger than one. Portfolio managers invest in the best investment opportunities with the highest expected returns. Thus, in their early stages, mutual funds achieve supreme performance. As the fund grows larger, managers exhaust their best investment opportunities and invest in the second-best. The average returns decrease accordingly, and the fund's rate of growth declines. In the mature stage, managers exhaust all identified investment opportunities, and the relative size of the investment opportunity set approaches one. Fund performance is poorer than it was in the growth stage because of the investments in declining-profit opportunities. As a result, investors begin to withdraw money from the fund. In the stage of decline, the relative size of the investment opportunity set goes below one. Managers have to overinvest and adopt a passive investment strategy, which gives rise to much lower returns followed by larger amounts of cash outflows. I posit that older life cycle stages are associated with poorer fund performance.

Prior studies such as Chen et al. (2004) find that an increase in size leads to lower fund performance. These studies assume that the marginal effect of size is constant over a fund's life cycle. However, this assumption may not be valid because funds vary in size over their life cycles and the same amount of increase in assets on a larger base should have a smaller effect on performance. The mutual fund life cycle model predicts that fund size is relatively smaller in the high-growth stage, but relatively larger in the older stages. Therefore, I expect that the marginal effect of size is strong in the high-growth stage, but weaker in the older stages.

When a fund reaches the later stages in its life cycle, performance is poorer, and asset growth declines. Fund families may pursue some strategies to reboot fund growth because management compensation is a percentage of the assets under management. Canals (2001) argues that "... managers should look at corporate growth from a dual perspective: the internal dimension of resources and capabilities and the external dimension of markets and customers." To obtain growth from the external dimension of markets and customers, fund families seek to attract more fund inflow by pursuing such strategies as increased advertising, reduced fees, and the creation of multiple share classes. Prior studies such as those by Sirri and Tufano (1996), Jain and Wu (2000), and Barer, Odean, and Zheng (2005) find that increasing marketing expenses can attract more fund inflows. Christoffersen (2001) find evidence that poorly performing funds waive fees to adjust net returns to investors. As described in Nanda, Wang, and Zheng (2004), mutual funds tend to create multiple share classes to attract more investors.

This paper focuses on the internal dimension of growth: resources and capabilities. Fund families may pursue some strategies to increase the fund's resources and also enhance its capabilities to identify additional investment opportunities. One potential strategy is to hire more portfolio managers, a step that may help generate more investment ideas. Another potential strategy is to change the investment objective. By changing a fund's investment objective, managers could have an expanded investment opportunity set and more flexibility in choosing stocks. I hypothesize that these two strategies can improve fund performance and then rejuvenate fund growth to earlier life cycle stages.

4. Data description

4.1. Data sources

I create the main data set by merging the survivorship-bias-free mutual fund database from the Center for Research in Security Prices (CRSP) with the Thomson Financial (CDA/Spectrum) mutual fund holding database and the CRSP stock database. The CRSP mutual fund database

includes information on mutual fund monthly returns, total net assets, inception dates, fee structure, fund investment objectives, asset turnover ratios, managers' names (begins 1992), management company names (begins 1993), and other fund characteristics. The CDA/Spectrum database provides quarterly or semiannual reported stockholdings of U.S. mutual funds. I merge these two databases using MFLINKS from Wharton Research Data Services (WRDS). I link each stock in the portfolios to the CRSP stock database to find its industry classification code (SIC) and the closing price in each calendar quarter. Less than 0.5% of all holding-stock observations lack a SIC code. I use the number of distinct four-digit SIC codes as a proxy for a given portfolio's industry concentration in each calendar quarter. Because one fund could have multiple share classes, I compute the total net assets of a fund as the summation of the total net assets in each share class. Weighting each share class by its total net assets, I obtain the value-weighted averages of monthly net returns, expense ratios, asset turnover ratios, and fee structures at the fund level.

I specify that each fund in the sample must have operated for at least 10 years. There are two reasons for this specification. First, funds with a short history may be unlikely to reflect life cycle changes because such short-lived funds may have "abnormal" growth patterns. Second, including funds that die young may introduce a bias that early life cycle stages lead to poor performance and to fund termination. I eliminate the balanced, bond, index, international, and sector funds because I focus on actively managed equity funds that invest mainly in the U.S. stock market. I used the Wiesenberger (WI) fund type code, the ICDI fund objective code, and Standard & Poor's detailed objective code to categorize funds as Growth fund, Growth and Income fund, and Income fund, as described in Appendix 1.³ My final sample of 1,349 mutual funds covers the

³ The Wiesenberger Fund Type Code (WI) is available through 1993. The ICDI Fund Objective Code (ICDI) is available from 1993 through July 2003. Standard & Poor's detailed objective code (S&P) begins in 1993, and formerly was the Strategic Insight Objective code.

period from January 1961 to December 2005, and fund holding data covers the period from January 1980 to December 2005.

In addition to the reported monthly returns, I also examine the S&P 500 excess returns and abnormal returns adjusted by Carhart (1997) four factors. I employ time series regression with Carhart (1997) four-factor model to calculate loadings on different risk factors, using lagged 24 monthly returns. And then, using these lagged loadings, I obtain risk-adjusted returns for the next period.

I construct LogTNA as the natural logarithm of one plus total net assets (TNA). LogFamily is the natural logarithm of one plus the size of the family the fund belongs to. Age is the number of years since the inception of the mutual fund. Total load is the total front-end, deferred, and rear-end load charged by the fund. Flows are monthly net fund flows into the mutual fund divided by the TNA. It equals $[TNA_t - TNA_{t-1} \cdot (1 + r_t)] / TNA_t$, where r_t is the net return at month t . Industry number is the number of the distinct four-digit SIC code in the portfolio. Stock number is the number of all domestic stocks in the portfolio. Manager number captures the number of portfolio managers running the fund. For those funds listed as “team,” “committee,” or “multiple,” I follow Chen et al. (2004) and set the manager number to four.⁴ Thus, the manager number takes on a value of one, two, three, or four.

4.2. Life cycle stage measure

Using a good instrument for a mutual fund’s life cycle is critical in empirical research. Prior studies usually treat age as a proxy for a fund’s life cycle. However, the validity of age alone as a good life cycle proxy is questionable. According to Churchill and Lewis (1983), the age alone of an organization is unlikely to provide a valid reflection of its life cycle stages. Using age to proxy a fund’s life cycle implicitly assumes that all funds have the same speed of development, which is

⁴ I also set the manager number to five, and the empirical results are not sensitive to this change.

unreasonable. For example, at age 10, Fund A reaches \$100 million in size and experiences low returns and low growth because its manager has exhausted all investment opportunities. In contrast, at age 10, Fund B reaches \$200 million and still achieves high returns and high growth because its manager is more skilled than Fund A's manager at finding good investment opportunities. Obviously, the two funds with the same age have opportunity sets of different relative size and are in different stages of their life cycles. Therefore, using age as a life cycle proxy can mix the information provided by funds located at different life cycle stages. Another disadvantage of using age is that it is hard to determine which age corresponds to which life cycle stage without additional information provided by other variables. Similarly, two funds of the same size can be in different life cycle stages if they have different relative size of opportunity sets and different growth rates. Therefore, size per se also fails as a good life cycle proxy.

I construct a composite score measure to classify life cycle stages, using a fund's age and its one-year and three-year moving average growth rates. The mutual fund life cycle model predicts that a fund experiences decreasing asset growth over the stages of its life cycle, and therefore, a fund's growth rate includes some information on the relative size of the investment opportunity set and corresponding life cycle stages. I adjust a fund's annual growth rate by annual market return to exclude the influence of market movement on fund value, and use the three-year moving average growth rate to smooth the evolution process.⁵ Then, I rank all fund-year observations into four quartiles in terms of age, growth, and moving average growth, respectively. In each ranking process, I require the first quartile to have the smallest value.

Next, I match each fund-year observation in terms of the three variables mentioned above to the cells in the table illustrated in Appendix 2. Any matching cell will gain one point and other cells gain zero. I sum all points within the same stage column to obtain a composite score for each stage. The stage column that scores highest will assign the corresponding life cycle stage to

⁵ Provided by CRSP, this market return is a value-weighted return of a portfolio of all stocks in the NYSE, AMEX, and NASDAQ.

the given fund year. In a case in which three stages have the same highest score, I choose the stage in the middle. When two neighboring stages have the same highest score, I look at the stage of the last year and choose the one closer to the last-year stage. If all four stages have the same score, I assign the last-year stage to the current fund year.

4.3. Descriptive statistics

After using the composite-score measure to classify the life cycle stage for all fund-years, I calculate the percentage of funds located at different life cycle stages for each fund age as demonstrated in Figure 1.

[Insert Fig. 1 here]

The graph shows that, in general, funds are located at the high-growth stage when they are young and progress to later life cycle stages as they age. However, old funds do not all stay at the stages of maturity or decline. For funds that are 20 years old, about 5% are in the high-growth stage, 17% in the low-growth stage, 37% in the mature stage, and only 41% in the stage of decline. These findings suggest that age is not a good proxy for life cycle stages.

I also explore the stage transition matrices presented in Table 1 to gain more insight into the process of mutual fund life cycle evolution. P1, P4, and P9, respectively, indicate the stage transition matrices in the second, fifth, and tenth years.

[Insert Table 1 here]

For funds located in the high-growth stage, 71% remain in the same stage in the next year, 24% drop to the low-growth stage, 3% go to the mature stage, and only 2% devolve to the decline stage. After four years, only 30% of the funds remain in the high-growth stage, 37% fall to the low-growth stage, 22% reach the mature stage, and 10% devolve to the stage of decline. After nine years, only 14% of the funds remain in the high-growth stage, 29% are in the low-growth

stage, 34% devolve to the mature stage, and 23% drop to the decline stage. These stage transition patterns indicate that funds progress smoothly from early to late life cycle stages.

Table 1 also indicates that declining funds do not necessarily stay forever in the decline stage. Some of the declining funds are able to be rejuvenated and repositioned to earlier life cycle stages. The percentage of declining funds that remain in the decline stage after one year is 76%. This number drops to 44% after four years and to 32% after nine years. This evidence suggests that declining funds can revive and that there is no such thing as a common life cycle stage sequence for all funds.

Table 2 presents the descriptive statistics of sample funds in each life cycle stage. All variables are winsorized at one and at the 99th percentile.

[Insert Table 2 here]

I observe that the distributions of some variables are highly skewed. For example, the mean of TNA in the high-growth stage is \$447 million, but the median is only \$105 million. In other stages the means of TNA are much higher than the medians, too. Therefore, I focus on medians in the following analysis. Net monthly returns, S&P 500 excess returns, and four-factor adjusted returns are all monotonically decreasing over life cycle stages, as demonstrated in Figure 2. The median test shows that the performance shifts between stages are statistically significant at the 1% level. Prior studies such as Chevalier and Ellison (1997) and Bar et al. (2005) find that young funds are more likely than old funds to take high risks. The risk-taking behavior of fund managers, however, cannot explain the monotonically decreasing four-factor adjusted returns. The decreasing performance observed is consistent with the hypothesis that funds obtain lower returns when they reach the older stages in their life cycles.

[Insert Fig. 2 here]

Table 2 also indicates that mutual funds charge different expenses ratios in different life cycle stages. The median expense ratios vary from 1.26% in the high-growth stage to 1.17 % in the low-growth, 1.14% in the mature stage, and 1.25% in the stage of decline. The median test shows that the changes in expense ratios between stages are statistically significant. This finding is consistent with prior studies that find expense ratios decrease with fund size (see, e.g., Malhotra and McLeod, 1997; Lazko, 1999; Rea, Reid, and Millar, 1999; LaPlante, 2001; Warner and Wu, 2006).

The annual asset turnover ratios decrease over the high-growth, low-growth and mature stages. This pattern implies that larger fund size leads to less flexibility in changing holding positions, and hence managers have less incentive to trade. However, in the decline stage the asset turnover jumps to 0.74, which is higher than in the high-growth stage. Given the fact that the fund size in the decline stage is larger than it is in the high-growth stage, the higher turnover ratio in the decline stage suggest that managers are changing their holdings more frequently. Figure 3 shows the dynamics of turnover ratios over life cycle stages.

[Insert Fig. 3 here]

Figure 4 illustrates another finding from Table 2, specifically that monthly net fund flows are monotonically decreasing over life cycle stages. In the low-growth stage, funds achieve positive S&P 500 excess returns but negative four-factor adjusted returns. However, investors respond with positive net fund flows. This evidence suggests that fund investors do not use risk-adjusted returns to evaluate fund performance, which is consistent with the findings in Gruber (1996), Sirri and Tufano (1998), and Delguercio and Tkac (2002).

[Insert Fig. 4 here]

I also observe from Table 2 that the portfolio industry concentration, the number of stocks in the portfolio, and the market betas shift between life cycle stages. Median tests show that almost

all of these shifts are statistically significant. Table 3 presents correlations between the main variables. I notice that there is a high correlation coefficient, 0.66, between logTNA and Logfamily.

[Insert Table 3 here]

4.4. Life cycle effect vs. scale effect

Although Table 2 indicates that the average fund size increases from the high-growth to mature stage and that the size in the decline stage is much larger than in the high-growth stage, it is premature to conclude that the increasing scale of size is the only reason for the decreasing performance over stages observed in Figure 2. In the mutual fund life cycle model, the declining performance over stages is driven by the decreasing relative size of the investment opportunity set, which depends on fund size, managerial skills, and the opportunities available in the market. The increasing scale cannot fully explain the life cycle effect on performance.

To distinguish scale effect from life cycle effect, I conduct the following data mining. Within each life cycle stage, I rank fund-month observations in terms of size and group them into quartiles, with the fourth quartile as the largest. To exclude the effect of scale, I choose the fourth quartile in the high-growth stage, the third quartile in the low-growth stage, and the second quartile in both the mature and decline stages so that the average size of the sample funds is decreasing over the stages. And then I calculate the medians and means of the monthly returns of these chosen quartiles and report the results in Table 4.

[Insert Table 4 here]

I observe that all three measures of fund performance are monotonically decreasing over the chosen quartiles. Because the average fund size of the chosen quartiles is monotonically decreasing, the scale effect is not responsible for the poorer performance observed over the life

cycle stages. This finding suggests that, in addition to scale, there are other factors that affect fund life cycle evolution.

5. Mutual fund performance and life cycle stages

5.1. Regression of four-factor adjusted returns

I run pooled OLS and random effect panel regressions to further investigate the relationship between fund performance and life cycle stages. I regress monthly four-factor adjusted returns on dummies of life cycle stages, fund size, the interactions of stage dummies with fund size, and other fund characteristics. Following Petersen (2005), I correct for the fund effect and the time effect in the pooled OLS regression. The regression specification is

$$R_{i,t} = \alpha + \sum_{k=2}^4 D_k LifeCycle_{i,t-1,k} + \beta_1 LogTNA_{i,t-1} + \sum_{k=2}^4 \delta_k LogTNA_{i,t-1} \times LifeCycle_{i,t-1,k} + \gamma X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where R is the four-factor adjusted return. $LogTNA$ is the natural logarithm of one plus TNA. $LifeCycle_k$ consists of three dummy variables that indicate the low-growth, mature, and decline stages. \mathbf{X} is a set of control variables that includes asset turnover, expense ratios, total loads, fund flows, etc. Table 5 presents the regression results.

[Insert Table 5 here]

In Model 1, the coefficients of LowGrowth, Maturity, and Decline are -49.235 , -59.517 , and -93.633 , respectively. The Wald test shows that these coefficients are statistically different from each other at the 1% level. These findings indicate that the life cycle effect on fund performance is monotonically increasing across stages. The observed increasing life cycle effect is consistent with my mutual fund life cycle model in that when a fund develops over life cycle stages, the relative size of the investment opportunity set shrinks and performance declines.

Next, I examine the interactions between fund size and the life cycle stages. In the high-growth stage (as the reference group), fund size has a negative effect on performance and is statistically significant at the 1% level. For a \$10 million increase in size, a four-factor adjusted return will decrease by about 17 basis points a month.⁶ The Wald test rejects the null that the sum of the coefficient of LogTNA and the coefficient of LogTNA*LowGrowth is zero. The test rejects another null that the sum of the coefficient of LogTNA and the coefficient of LogTNA*Maturity is zero. The Wald test also indicates that the sum of the coefficient of LogTNA and the coefficient of LogTNA*Decline is zero. These findings imply that the marginal effect of size is the strongest in the high-growth stage but weaker in the later life cycle stages.

Other findings are that expense ratios are negatively related to performance, but asset turnover, flows and total load are not. These relations are consistent with the findings in Chen et al. (2004). The results of a random effect regression (Model 2) are very close to those of pooled OLS regression, except that the coefficients of turnover and total load are statistically significant.

In Model specifications 3 and 4, I include two more control variables, family size and manager number. Because there is a high correlation between Logfamily and LogTNA, I use in the regression the component of Logfamily that is orthogonal to the vector of LogTNA.⁷ The results of the regression show that both its coefficients and its statistical significance are almost the same as in Model 1 and Model 2. The results of Model 3 indicate that family size does not affect risk-adjusted returns, although the results of the random effect model suggest it does. Contradicting the findings in Chen et al. (2004), I find that manager number does not affect fund performance.

⁶ The marginal effect = $(-7.235) \times \text{Log}(1+10) = -17$.

⁷ I regress Logfamily on LogTNA and sum the resulting error terms with the constant to obtain the component of Logfamily that is orthogonal to LogTNA.

5.2. Composite score measure vs. age measure

In this section I investigate whether my composite score measure is better than fund age to proxy for mutual fund life cycles. I construct another life cycle measure using age alone. I rank all fund-year observations by age into four quartiles, with the first quartile having the youngest age. Fund years at the first quartile are assigned to the high-growth stage, while those at the fourth quartile are assigned to the decline stage. Table 6 presents the results of regression of monthly returns on life cycle stages classified with alternative life cycle stage measures.

[Insert Table 6 here]

In Model 1, in which the composite-score measure is used, the coefficients of fund size, life cycle stages and interactions between size and life cycle stages are all statistically significant at the 1% level. In Model 2, in which the age measure is used, the coefficient of LowGrowth is only significant at the 10% level, and the coefficient of $\text{LogTNA} * \text{LowGrowth}$ is not statistically significant at the 10% level. To further explore whether the composite-score measure provides information beyond that contained in the age measure, I conduct the following J-test procedure for testing between the two non-nested regression models.⁸

First, I estimate Model 1 and Model 2 in Table 6 and calculate the corresponding sets of fitted values. Then I run a regression based on Model 1, using the fitted value from Model 2 as the added explanatory variable. I also run a regression based on Model 2 using the fitted value from Model 1 as the added explanatory variable. The null hypothesis is that the composite score measure provides more information than the age measure, and Model 1 fits the data better. I expect that, when the fitted value from Model 1 is added to Model 2, the coefficient of the fitted value is significantly different from zero. I also expect that the coefficient of the fitted value from Model 2 is not significantly different from zero when the fitted value is added to Model 1. If both

⁸ For a discussion of the J-test procedure, see Davidson and MacKinnon (1981) and McAleer (1995).

coefficients of the two fitted values are significantly different from zero, then each measure provides some information not present in the other. If both coefficients are insignificant, then both measures provide similar information, and neither measure is superior to the other. Table 7 presents the J-test results.

[Insert Table 7 here]

For the regression based on Model 2, the coefficient of the fitted value from Model 1 is 1.101 and different from zero at the 1% significance level. For the regression based on Model 1, the coefficient of the fitted value from Model 2 is -0.179 and insignificantly different from zero. These results suggest that the composite score measure provides information beyond that contained by the age measure.

6. Rejuvenation strategy

In this section, I investigate the effects on life cycle evolution of changing fund investment objectives or hiring more portfolio managers. The sample used includes 1,135 funds that cover a time period from 1993 through 2005. In this sample, 223 funds neither changed their investment objectives nor hired more managers within the time period. Among the 205 events of changing objectives, I use 183 events that have second- and third-year observations. There are 939 incidents of adding managers from which I use 672 events that have second- and third-year observations.

6.1. Stage transition matrices

I compare the one-year and two-year stage transition matrices of funds that neither changed their investment objectives nor hired more portfolio managers (as a reference group) with those that hired more portfolio managers and those that changed the investment objectives. If these rejuvenation strategies work, compared with the reference group, funds that changed their

investment objectives or hired more managers should in the next one or two years have higher transition probabilities to earlier life cycle stages.

Table 8 presents the stage transition matrices of funds that neither hired more managers nor changed fund objectives (no-strategy funds in Panel A), those of funds that changed the investment objectives (in Panel B), and those of funds that hired more portfolio managers (in Panel C). P1 and P2 indicate the stage transition matrices in the second year and the third year, respectively.

[Insert Table 8 here]

Comparing Panel A and Panel B, I find that when funds are in the low-growth stage, changing their investment objectives has little effect on the probabilities of transition to earlier life cycle stages. However, when funds are in the mature or decline stages, changing the investment objectives seems to increase the probability of developing into earlier life cycle stages. When funds are in the mature stage, 14% of the funds in Panel B evolve to earlier stages in the next year vs. 8% in Panel A; 24% of the funds in Panel B evolve to earlier stages in the third year vs. 13% in Panel A. In the decline stage, 35% of the funds in Panel B evolve to earlier stages in the next year vs. 20% in Panel A; 49% of the funds in Panel B evolve to earlier stages in the third year vs. 33% in Panel A.

The strategy of hiring more portfolio managers seems less effective in rejuvenating fund growth. Comparing Panel A and Panel C, I observe no difference in the rejuvenation probabilities appears when funds are in the low-growth stage. In the mature stage, 12% of the funds in Panel C evolve to earlier stages in the next year vs. 8% in Panel A; 19% of the funds in Panel C evolve to earlier stages in the third year vs. 13% in Panel A. At the decline stage, 22% in Panel C evolve to earlier stages in the next year vs. 20% in Panel A; 38% in Panel C evolve to earlier stages in the third year vs. 33% in Panel A.

6.2. Multinomial logistic regressions

I run a multinomial logistic regression to further investigate the effectiveness of the two strategies. The dependent variable has a category value of 0, 1, and 2, respectively, which indicates transition in the next year to the same, earlier, or later life cycle stages. Independent variables include dummies of life cycle stages, dummies of alternative strategies, interactions between strategies and stages, fund size, expense ratios, total load, and asset turnover ratios. The regression specification is

$$\begin{aligned}
 y_{i,t} = & \alpha + \sum_{k=2}^4 D_k LifeCycle_{i,t-1,k} \\
 & + \beta_1 Obj_{i,t-1} + \sum_{k=2}^4 \beta_k Obj_{i,t-1} \times LifeCycle_{i,t-1,k} \\
 & + \delta_1 Mgr_{i,t-1} + \sum_{k=2}^4 \delta_k Mgr_{i,t-1} \times LifeCycle_{i,t-1,k} + \gamma X_{i,t-1} + \varepsilon_{i,t}
 \end{aligned} \tag{2}$$

where $LifeCycle_k$ are stage dummies for low-growth, mature and decline stages. Obj is the dummy variable for changing the investment objectives. Mgr is the dummy variable for hiring more managers. X is a set of control variables that includes fund size, expense ratios, total load, and asset turnover ratios. In this regression model, the reference group consists of the high-growth funds that neither changed investment objectives nor hired more portfolio managers. Table 9 presents the regression results.

[Insert Table 9 here]

Because I interact life cycle stage dummies with strategy dummies in the regression model, I am able to find the marginal effect of each strategy in every life cycle stage.⁹ In Model 1, the

⁹ I also included Objective*Manager and its interaction with stage dummies in an alternative model specification. However, I cannot ascertain the joint effect of the two strategies because the small number of observation leads to a collinearity problem.

coefficient of LowGrowth is 19.428 and that of Objective*LowGrowth is -38.806 . The difference between the two coefficients indicates that, compared with no-strategy and low-growth funds, low-growth funds that change their investment objectives are more likely to remain at the same stage than to develop in the next year into the high-growth stage. This finding suggests that changing investment objectives will not rejuvenate fund growth when the fund is at the low-growth stage. The coefficient of Objective*Maturity is not statistically significant at the 10% level, which suggests that the probabilities of the transition of mature funds to earlier or the same stage is independent of whether the funds change their investment objectives. The coefficient of Objective*Decline is 0.821 and statistically significant at the 1% level, which indicates that compared with no-strategy declining funds, declining funds that change investment objectives are likelier to rejuvenate to earlier life cycle stages than they are to remain in the decline stage. Hiring more portfolio managers seems to carry no rejuvenation effect because none of the coefficients of the interactions between the adding of manager and life cycle stages are statistically significant.¹⁰

In Model 2, the coefficient of Objective*LowGrowth is negative and statistically significant. This finding indicates that, compared with no-strategy and low-growth funds, low-growth funds that change their objectives are more likely to remain in the same stage than to develop into later stages. There is weak evidence that if they hire more managers, low-growth funds are more likely to develop to later stages than to remain in the same stage. However, the negative coefficient of Manager*Maturity indicates that, compared with no-strategy and mature funds, mature funds that hire more managers are more likely to remain in the mature stage than to fall into the decline stage.

¹⁰ In another multinomial logistic model, I included the interaction of Manager*Decline. The coefficient of this interaction is not statistically significant at Model 1, but its standard errors and t-statistics are not reported in Model 2.

Overall, hiring more portfolio managers does not seem to affect fund rejuvenation. In contrast, there is a strong rejuvenation effect from changing investment objectives when the funds are in the decline stage. I run a multinomial logistic regression of the third-year stage transition and do not find evidence that this rejuvenation effect can last for two years. The empirical findings suggest that changing the investment objectives can only temporarily expand the investment opportunity set. Even if managers find additional good investment opportunities after embarking on this strategy, very soon they will face new constraints on investments.

7. Robustness

7.1. Regression of three-month cumulative returns

To exclude the possibility that the results of the regression of monthly returns are driven by the frequency of the monthly data, I use three-month cumulative four-factor adjusted returns as the independent variable in the regression. The results are reported in Table 10.

[Insert Table 10 here]

In Model 1, the effect of life cycle on performance is both economically and statistically significant, with the negative effect monotonically increasing from the low-growth to the decline stage. The coefficient of LowGrowth is -152 ; the coefficient of Maturity is -179 ; the coefficient of Decline is -278 . I run a Wald test and find that these coefficients are statistically different at the 1% level. The differences in the coefficients of interaction between size and stage dummies indicate a decreasing negative effect of size on performance over stages. Overall, the results of the regression of three-month cumulative returns have similar implications as those of the regression of monthly returns.

7.2. Alternative life cycle measure

Using growth rate, three-year average growth rate, and fund age, I construct a composite rank as another measure to classify life cycle stages. Based on the method of Liu (2006), I rank all fund years from 1 (low) to 100 (high) percentile with respect to the market-adjusted growth rate. Funds in the lower percentile have higher growth rates. I also rank the three-year average growth using the same procedure. Next, I rank fund-years with respect to fund age. Funds in the lower percentile are younger. And then I calculate a composite rank as the average of the three percentile rankings. Fund-years with a composite rank of less than 25% will be assigned to the high-growth stage, those between 25% and 50% are assigned to the low-growth stage, those between 50% and 75% to the mature stage, and those of more than 75% to the stage of decline.

After classifying life cycle stages using the composite rank measure, I perform a univariate analysis and obtain results similar to those reported in Table 2. Furthermore, the multivariate analysis shows that although the magnitude of the life cycle effect is different from that observed in Table 5, the signs and statistical significance are almost the same.

8. Conclusion

I propose a mutual fund life cycle model that encompasses stages of incubation, high growth, low growth, maturity, and decline. This model provides a framework under which we can study many issues in the mutual fund industry such as fund performance, performance persistence, managerial behaviors, and fund family strategies. I look at a sample of 1,349 U.S. open-ended mutual funds and find strong empirical evidence that is consistent with the mutual fund life cycle model.

There are inter-stage differences in fund size, expense ratios, market betas, and portfolio industry concentration. Asset turnover decreases over the high-growth, low-growth, and mature stages, but increases abnormally at the stage of decline. Net fund flows are monotonically decreasing over the life cycle stages. Furthermore, the fund life cycle affects fund performance. Across life cycle stages, the net returns, S&P 500 excess returns, and risk-adjusted returns are

monotonically decreasing. I explore further and verify that the scale effect is not the only force that drives the poorer performance observed over life cycle stages. I also find that the marginal effect of size is strongest in the high-growth stage but weaker in the later life cycle stages.

Finally, I investigate the effectiveness of strategies pursued by fund families to rejuvenate fund growth. The empirical evidence indicates that when a fund is in the decline stage, changing its investment objective is likely to increase the probabilities of transition in the next year to earlier life cycle stages. There is no evidence, however, that this rejuvenation effect will last for two years. It seems that hiring more portfolio managers is not effective in rejuvenating fund growth.

Appendix 1

Mutual fund investment objective categorization

Fund Investment Objective	Objective Code
Growth	WI: SCG AGG G LTG MCG G-S S-G GRO ICDI: AG AGG LG SP: SCG AGG GRO
Growth and Income	WI: GCI G-I G-I-S G-S-I I-G I-G-S I-S-G S-G-I S-I-G GR ICDI: GI TR SP: GRI ING GMC
Income	WI: I I-S IEQ ING ICDI: IN SP: ING

WI: Wiesenberger fund type code
ICDI: CRSP ICDI fund objective code
SP: Standard & Poor's detailed objective code

Appendix 2

Mutual fund life cycle stage score table

Variable	High Growth	Low Growth	Maturity	Decline
Age	quartile 1	quartile 2	quartile 3	quartile 4
Growth	quartile 4	quartile 3	quartile 2	quartile 1
3-Year Growth Moving Average	quartile 4	quartile 3	quartile 2	quartile 1
Stage Score				

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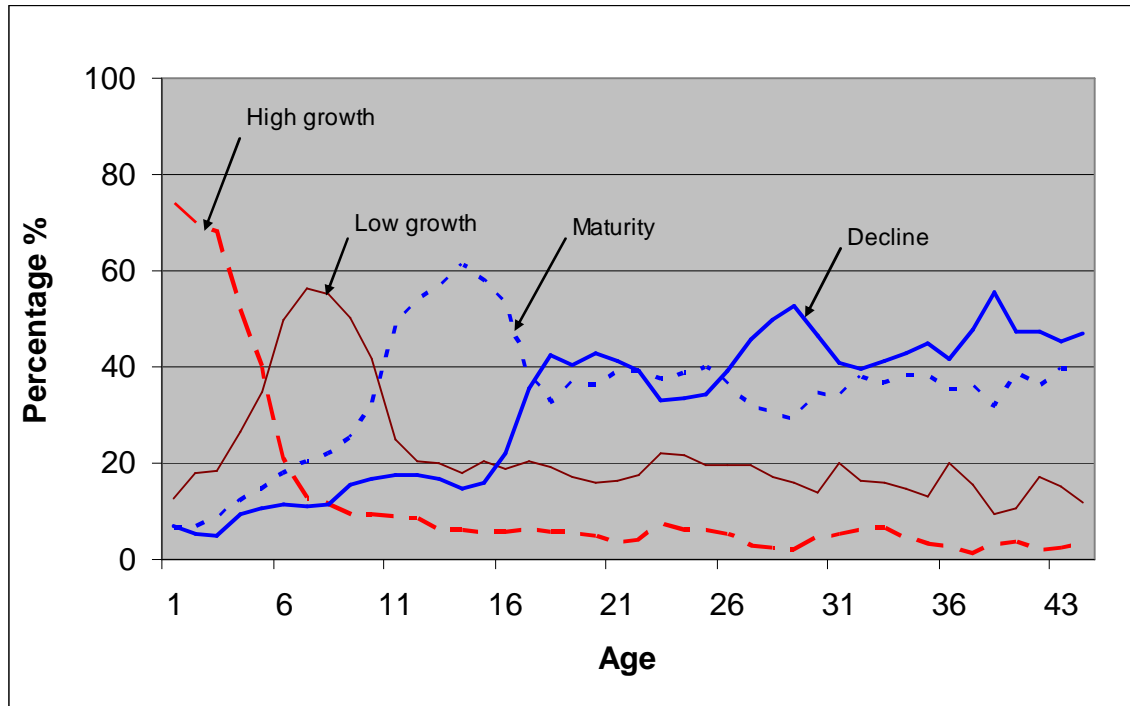


Fig. 1. Percentage of funds located at different life cycle stages over age. The sample covers a time period from 1961 through 2005.

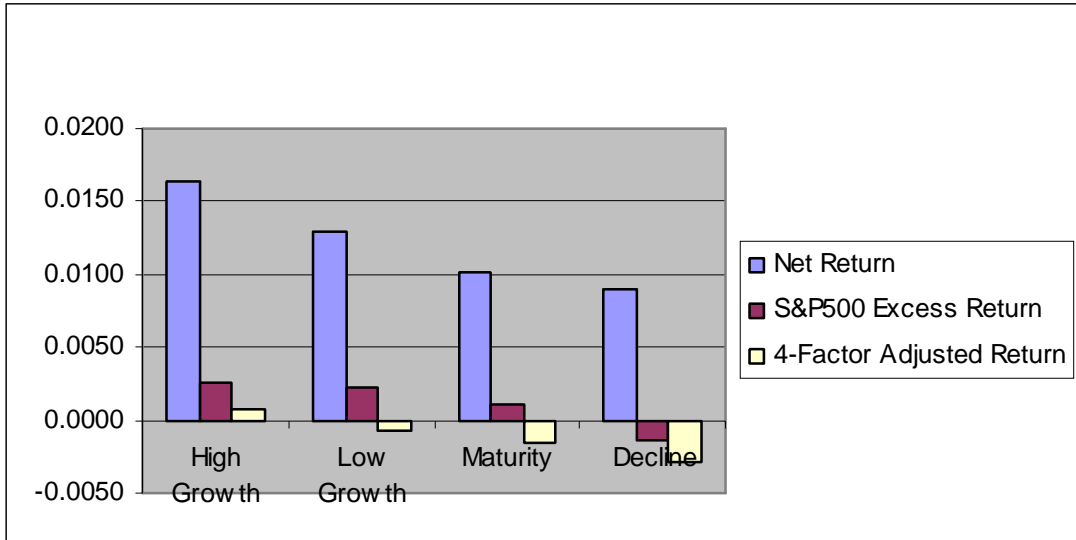


Fig. 2. Mutual fund monthly performance over life cycle stages. Net return is the reported monthly return. S&P 500 excess return is the net return adjusted by S&P500 index return. 4-factor adjusted return is the net return adjusted by Carhart (1997) four factors.

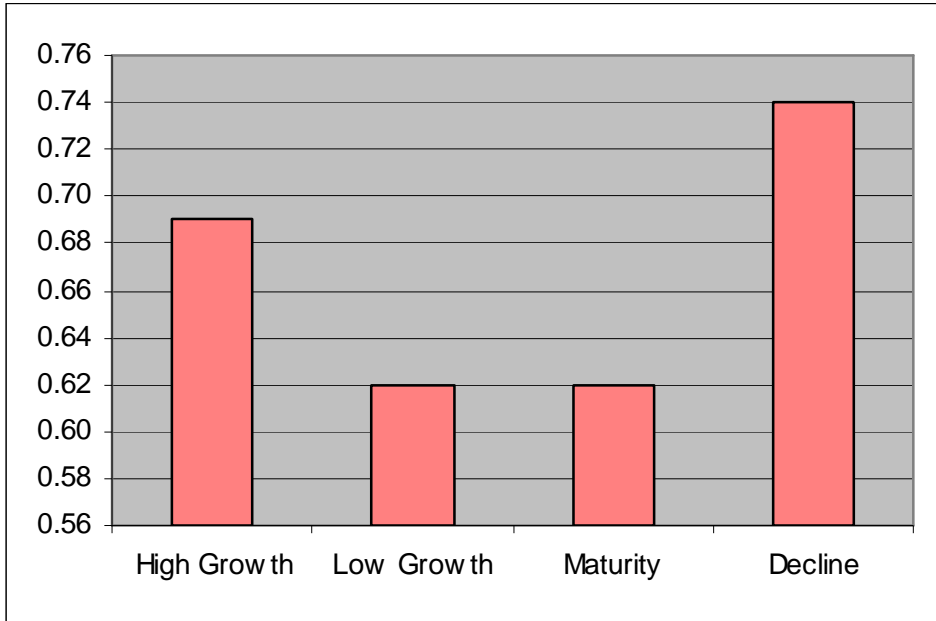


Fig.3. Mutual fund annual turnover ratio over life cycle stages. Turnover ratio equals the minimum of aggregated sales or aggregated purchases of securities divided by the average 12-month total net asset of the fund.

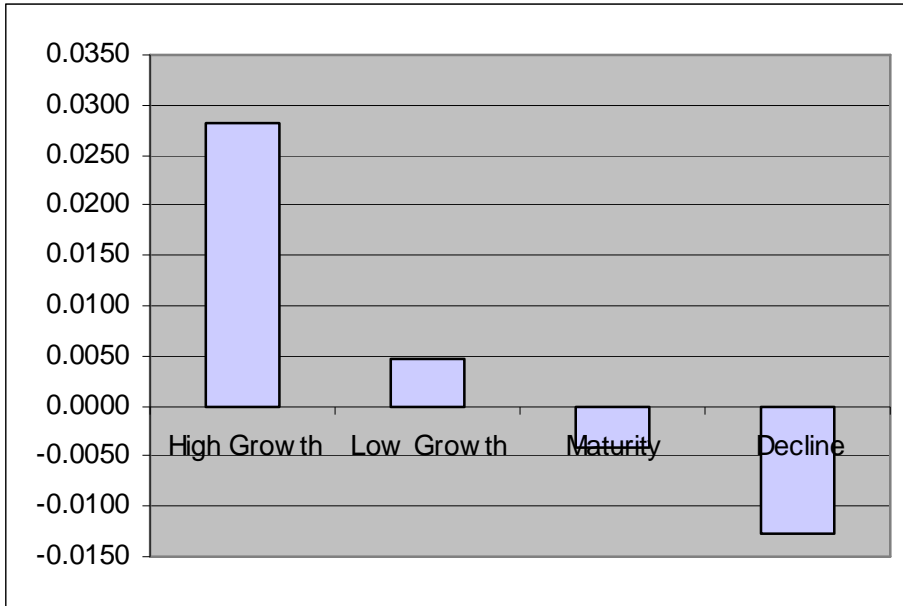


Fig. 4. Mutual fund monthly flow ratio over life cycle stages. Monthly flow ratio equals the new investment into the fund over a month divided by the total net asset at the end of each month.

Table 1

Life cycle stage transition matrices

This table reports the stage transition matrices of all sample funds that cover a time period from 1961 to 2005. P1, P4, and P9, respectively, indicate the stage transition matrix in the second, fifth, and tenth year. Each row shows the transition probabilities to the stage of high growth, low growth, maturity, and decline.

		High Growth	Low Growth	Maturity	Decline
P1	High Growth	0.71	0.24	0.03	0.02
	Low Growth	0.06	0.69	0.21	0.04
	Maturity	0.02	0.09	0.72	0.17
	Decline	0.02	0.07	0.15	0.76
		High Growth	Low Growth	Maturity	Decline
P4	High Growth	0.30	0.37	0.22	0.10
	Low Growth	0.11	0.35	0.36	0.18
	Maturity	0.07	0.20	0.43	0.31
	Decline	0.07	0.18	0.32	0.44
		High Growth	Low Growth	Maturity	Decline
P9	High Growth	0.14	0.29	0.34	0.23
	Low Growth	0.11	0.26	0.36	0.27
	Maturity	0.09	0.24	0.36	0.31
	Decline	0.09	0.24	0.35	0.32

Table 2

Mutual fund prescriptive statistics

This table reports prescriptive statistics for the funds in the sample. N is the number of observation. Net return is the reported monthly net return. S&P500 excess return is the monthly return adjusted by the return of S&P500 index. 4-factor adjusted return is the monthly return adjusted by Carhart (1997) four factors. 4-factor market beta is the loading on the market factor using Carhart (1997) four-factor model. Expense ratio is the total annual management fees and expenses divided by total net asset. Turnover is the annual fund turnover. Total net asset is the net asset of the fund after all expenses. Monthly fund flows is the new fund flow into the fund over a month divided by the TNA. Total load is the total front-end, deterred and rear-end charges divided by new investments. Industry number is the number of distinct four-digit SIC code in the portfolio. Stock number is the number of domestic stocks in the portfolio. The sample covers a time period from January 1961 through December 2005. All variables are winsorized at one and the 99th percentile.

Variable	N	Mean	Median	Max	Min
Panel A: High Growth Stage					
Net Return	42372	0.0153	0.0163	0.1517	-0.1362
S&P500 Excess Return	42372	0.0039	0.0025	0.1185	-0.0918
4-Factor Adjusted Return	23764	0.0017	0.0008	0.0869	-0.0671
4-Factor Market Beta	23764	0.97	0.97	1.59	0.09
Expense Ratio	42363	0.0129	0.0126	0.0295	0
Turnover	35270	0.91	0.69	4.73	0.02
Total Net Asset (million)	42402	447	105	6359	0.824
Monthly Fund Flows	36185	0.0547	0.0282	0.7481	-0.1316
Total Load	59890	0.0142	0	0.0850	0
Industry Number	9199	55	43	243	5
Stock Number	9201	84	60	500	10
Panel B: Low Growth Stage					
Net Return	55773	0.0105	0.0130	0.1390	-0.1393
S&P500 Excess Return	55767	0.0032	0.0023	0.1097	-0.0897
4-Factor Adjusted Return	43379	-0.0005	-0.0007	0.0733	-0.0670
4-Factor Market Beta	43379	0.98	0.98	1.57	0.07
Expense Ratio	55786	0.0122	0.0117	0.0258	0
Turnover	51595	0.81	0.62	3.79	0.03
Total Net Asset (million)	55798	1029	223	1770406	2.425
Monthly Fund Flows	48901	0.0078	0.0048	0.2087	-0.1219
Total Load	75000	0.0170	0	0.0850	0
Industry Number	12946	60	47	316	4
Stock Number	12948	92	65	694	5

(Table 2 continued)

Variable	N	Mean	Median	Max	Min
Panel C: Maturity Stage					
Net Return	51485	0.0075	0.0101	0.1314	-0.1388
S&P500 Excess Return	51485	0.0013	0.0011	0.0987	-0.0915
4-Factor Adjusted Return	40217	-0.0016	-0.0016	0.0711	-0.0717
4-Factor Market Beta	40217	0.98	0.97	1.62	0.14
Expense Ratio	51493	0.0119	0.0114	0.0270	0
Turnover	48034	0.79	0.62	3.46	0.02
Total Net Asset (million)	51517	1258	223	23944	2.37
Monthly Fund Flows	43726	-0.0053	-0.0041	0.1077	-0.1108
Total Load	72318	0.0173	0	0.0850	0
Industry Number	13057	54	44	257	3
Stock Number	13057	82	59	510	3
Panel D: Decline Stage					
Net Return	33751	0.0061	0.0090	0.1333	-0.1525
S&P500 Excess Return	33751	-0.0025	-0.0013	0.0973	-0.1130
4-Factor Adjusted Return	27786	-0.0035	-0.0029	0.0739	-0.0935
4-Factor Market Beta	27786	1.00	1.00	1.69	0.13
Expense Ratio	33767	0.0136	0.0125	0.0483	0
Turnover	31513	0.94	0.74	4.20	0.03
Total Net Asset (million)	33775	820	177	12401	0.784
Monthly Fund Flows	29652	-0.0185	-0.0128	0.0957	-0.1887
Total Load	44412	0.0183	0	0.0850	0
Industry Number	8545	47	42	184	2
Stock Number	8546	67	57	322	3

Table 3

Correlation matrix

This table reports the correlation coefficient between variables. 4-factor adjusted return is the monthly return adjusted by Carhart (1997) four factors. LogTNA is the natural logarithm of (1+ total net assets). Industry number is the number of distinct four-digit SIC code in the portfolio. Stock number is the number of stocks in the portfolio. LogFamily is log of (1+ family total assets). Expense ratio is the total annual management fees and expenses divided by total net asset. Turnover is the annual fund turnover. Flows are the monthly new fund flow divided by TNA. Total load is the total front-end, deferred and rear-end charges divided by new investments. The sample covers a time period from January 1961 through December 2005.

	4-Factor adjusted return	LogTNA	Industry number	Stock number	LogFamily	Expense Ratio	Turnover	Flows	Total load
4-Factor adjusted return	1								
LogTNA	-0.01	1							
Industry number	0.01	0.29	1						
Stock number	0.01	0.29	0.97	1					
LogFamily	0.00	0.68	0.30	0.28	1				
Expense Ratio	-0.03	-0.38	-0.21	-0.19	-0.34	1			
Turnover	-0.01	-0.07	-0.01	0.00	0.03	0.19	1		
Flows	0.06	0.02	0.02	0.02	0.02	0.02	0.00	1	
Total load	-0.03	0.13	-0.02	-0.03	0.21	0.31	0.01	0.02	1

Table 4
Life cycle effect

This table reports the means and medians of monthly returns of different size quartiles over life cycle stages. The sample covers a time period from January 1961 through December 2005. Net return is the reported monthly return. S&P500 excess return is the net return adjusted by S&P500 index return. 4-Factor adjusted return is the net return adjusted by Carhart (1997) four factors.

Stage	Quartile	TNA		Net Return		S&P500 Excess Return		4-Factor Adjusted Return	
		median	mean	median	mean	median	mean	median	mean
High Growth	4	1536	2221	0.0172	0.0151	0.0028	0.0048	0.0002	0.0009
Low Growth	3	502	532	0.0133	0.0099	0.0021	0.0029	-0.0009	-0.0007
Maturity	2	179	189	0.0104	0.0073	0.0010	0.0010	-0.0015	-0.0016
Decline	2	126	132	0.0092	0.0059	-0.0010	-0.0023	-0.0028	-0.0030

Table 5

Mutual fund monthly returns and life cycle stages

This table reports results from estimating pooled OLS model with standard errors clustered on fund and time and random effect model. The sample covers a time period from January 1961 through December 2005. The dependent variable is the net return adjusted by Carhart (1997) four factors. LowGrowth, Maturity, and Decline are dummy variables for life cycle stages. LogTNA is the natural logarithm of (1+ total net assets). LogFamily is log of (1+ family total assets). Manager number is the number of portfolio managers. Expense is the expenses ratio. Turnover is the annual fund turnover. Flows are the monthly new fund flow divided by TNA. Total load is the total front-end, deferred and rear-end charges. P-value is reported in the parentheses under the coefficients. All independent variables are lagged for one period. *, **, ***, respectively, denote significant differences from zero at the 10%, 5%, and 1% level.

Variable	Model 1	Model 2	Model 3	Model 4
	OLS two-way cluster	Random Effect	OLS two-way cluster	Random Effect
LowGrowth	-49.235 *** (0.00)	-48.533 *** (0.00)	-49.355 *** (0.00)	-47.740 *** (0.00)
Maturity	-59.517 *** (0.00)	-59.815 *** (0.00)	-59.331 *** (0.00)	-58.708 *** (0.00)
Decline	-93.633 *** (0.00)	-92.612 *** (0.00)	-94.991 *** (0.00)	-93.486 *** (0.00)
LogTNA	-7.235 *** (0.00)	-8.657 *** (0.00)	-7.147 *** (0.00)	-8.408 *** (0.00)
LogTNA*LowGrowth	5.645 *** (0.00)	5.568 *** (0.00)	5.668 *** (0.00)	5.438 *** (0.00)
LogTNA*Maturity	5.437 *** (0.00)	5.590 *** (0.00)	5.402 *** (0.00)	5.405 *** (0.00)
LogTNA*Decline	8.452 *** (0.00)	8.552 *** (0.00)	8.683 *** (0.00)	8.662 *** (0.00)
LogFamily			0.547 (0.33)	1.331 *** (0.00)
Manager number			-0.784 (0.37)	-0.529 (0.36)
expenses	-14.658 *** (0.00)	-16.339 *** (0.00)	-13.648 *** (0.00)	-14.684 *** (0.00)
Turnover	0.143 (0.77)	0.336 *** (0.00)	0.090 (0.85)	0.252 ** (0.03)
Flows	0.166 (0.60)	0.124 (0.32)	0.170 (0.60)	0.126 (0.32)
Total load	0.453 (0.28)	0.763 ** (0.02)	0.318 (0.48)	0.563 (0.11)
Constant	72.165 *** (0.00)	79.444 *** (0.00)	72.482 *** (0.00)	77.912 *** (0.00)
Objective control	Yes	Yes	Yes	Yes
Observations	132719	132719	130597	130597

Table 6

Mutual fund monthly returns and life cycle stages classified by two alternative measures

This table reports results from estimating pooled OLS model with standard errors clustered on fund and time. The sample covers a time period from January 1961 through December 2005. The dependent variable is the net return adjusted by Carhart (1997) four factors. LowGrowth, Maturity, and Decline are dummy variables for life cycle stages. LogTNA is the natural logarithm of (1+ total net assets). LogFamily is log of (1+ family total assets). Manager number is the number of portfolio managers. Expense is the expenses ratio. Turnover is the annual fund turnover. Flows are the monthly new fund flow divided by TNA. Total load is the total front-end, deterred and rear-end charges. P-value is reported in the parentheses under the coefficients. All independent variables are lagged for one period. *, **, ***, respectively, denote significant differences from zero at the 10%, 5%, and 1% level.

Variable	Model 1 Score Measure	Model 2 Age Measure
LowGrowth	-49.355 *** (0.00)	-21.703 * (0.07)
Maturity	-59.331 *** (0.00)	-37.643 *** (0.00)
Decline	-94.991 *** (0.00)	-45.331 *** (0.00)
LogTNA	-7.147 *** (0.00)	-4.136 ** (0.04)
LogTNA*LowGrowth	5.668 *** (0.00)	1.612 (0.45)
LogTNA*Maturity	5.402 *** (0.00)	4.102 ** (0.03)
LogTNA*Decline	8.683 *** (0.00)	4.819 ** (0.02)
LogFamily	0.547 (0.33)	0.518 (0.38)
Manager number	-0.784 (0.37)	-0.997 (0.26)
expenses	-13.648 *** (0.00)	-14.923 *** (0.00)
Turnover	0.090 (0.85)	0.003 (0.99)
Flows	0.170 (0.60)	1.160 *** (0.00)
Total load	0.318 (0.48)	0.298 (0.52)
Constant	72.482 *** (0.00)	45.505 *** (0.00)
Objective control	Yes	Yes
Observations	130597	130597

Table 7

J-test result

The table presents the J-test results of the regression model using the composite-score measure vs. the regression model using age measure. First, I estimate model 1 and model 2 in Table 6 and calculate the corresponding sets of fitted values. Then I run regression based on model 1, using the fitted value from model 2 as the added explanatory variable. I also run regression based on model 2 using the fitted value from model 1 as the added explanatory variable. P-value is reported in the parentheses under the coefficients. *, **, ***, respectively, denote significant differences from zero at the 10%, 5%, and 1% level.

Variable	Model 1 Score Measure	Model 2 Age measure
Fitted value from Model 1		1.101 *** (0.00)
Fitted value from Model 2	-0.179 (0.50)	

Table 8

Life cycle stage transition matrices

This table reports the stage transition matrices of sample funds that neither changed investment objective nor hired more portfolio managers, funds that changed objectives only, and funds that hired more managers only. The sample covers a time period from 1993 to 2005. P1 and P2 indicate the stage transition matrices in the second and the third year, respectively. Each row shows the transition probabilities to the stage of high growth, low growth, maturity, and decline.

Panel A: Neither changing objective nor hiring more managers									
P1					P2				
	High growth	Low growth	Maturity	Decline		High growth	Low growth	Maturity	Decline
High growth	0.66	0.28	0.04	0.02	High growth	0.45	0.39	0.12	0.05
Low growth	0.04	0.71	0.21	0.04	Low growth	0.06	0.53	0.32	0.10
Maturity	0.01	0.07	0.73	0.19	Maturity	0.02	0.11	0.57	0.29
Decline	0.02	0.05	0.13	0.81	Decline	0.03	0.09	0.21	0.67

Panel B: Changing objective									
P1					P2				
	High growth	Low growth	Maturity	Decline		High growth	Low growth	Maturity	Decline
High growth	0.62	0.32	0.02	0.04	High growth	0.30	0.45	0.21	0.04
Low growth	0.03	0.74	0.22	0.01	Low growth	0.10	0.44	0.35	0.11
Maturity	0.02	0.12	0.71	0.16	Maturity	0.02	0.22	0.51	0.25
Decline	0.03	0.09	0.23	0.66	Decline	0.03	0.20	0.26	0.51

Panel C: Hiring more managers									
P1					P2				
	High growth	Low growth	Maturity	Decline		High growth	Low growth	Maturity	Decline
High growth	0.64	0.31	0.03	0.03	High growth	0.40	0.46	0.10	0.04
Low growth	0.04	0.71	0.22	0.04	Low growth	0.08	0.48	0.31	0.12
Maturity	0.03	0.09	0.67	0.21	Maturity	0.03	0.16	0.51	0.30
Decline	0.03	0.05	0.14	0.78	Decline	0.04	0.09	0.25	0.63

Table 9

Multinomial logistic regression of the second year stage transition

This table reports that result of a multinomial logistic regression of the second year stage transition, to investigate the effects alternative strategies on stage transition probabilities. The dependent variable has a categorical value of 0, 1, and 2, which indicate next-year transition to the same, earlier, and later life cycle stages, respectively. LowGrowth, Maturity and Decline are dummies for life cycle stages. Objective is a dummy variable that equals 1 when the fund changes its investment objective, and 0 otherwise. Manager is a dummy variable that equals 1 when the fund hires more portfolio managers, and 0 otherwise. I control for fund size, expense ratio, turnover, total load, and fund objective. P-value is reported in the parentheses under the coefficients. *, **, ***, respectively, denote significant differences from zero at the 10%, 5%, and 1% level.

Variable	Model 1 Improve vs. remain	Model 2 Worse vs. Remain
LowGrowth	19.428 *** (0.00)	-0.378 *** (0.01)
Maturity	20.207 *** (0.00)	-0.771 *** (0.00)
Decline	20.764 *** (0.00)	-40.007 *** (0.00)
Objective*HighGrowth	-19.123 *** (0.00)	-0.191 (0.65)
Objective*LowGrowth	-38.806 *** (0.00)	-1.189 ** (0.03)
Objective*Maturity	-0.602 (0.46)	0.073 (0.85)
Objective*Decline	0.821 *** (0.00)	-2.361 *** (0.00)
Manager*HighGrowth	0.167 (0.81)	1.159 (0.17)
Manager*LowGrowth	0.406 (0.34)	1.441 * (0.10)
Manager*Maturity	1.648 (0.14)	-39.777 *** (0.00)
Objective control	Yes	Yes
Pseudo R2	0.11	0.11
Observations	5852	5852

Table 10

Mutual fund three-month returns and life cycle stages

This table reports results from estimating pooled OLS model with standard errors clustered on fund and time and random effect model. The sample covers a time period from January 1961 through December 2005. The dependent variable is the three-month cumulative net return adjusted by Carhart (1997) four factors. LowGrowth, Maturity, and Decline are dummy variables for life cycle stages. LogTNA is the natural logarithm of (1+ TNA). LogFamily is log of (1+ family total assets). Manager number is the number of portfolio managers. Expense is the expenses ratio. Turnover is the annual fund turnover. Flows are the monthly new fund flow divided by TNA. Total load is the total front-end, deferred and rear-end charges. P-value is reported in the parentheses under the coefficients. All independent variables are lagged for one period. *, **, ***, respectively, denote significant differences from zero at the 10%, 5%, and 1% levels.

Variable	Model 1	Model 2	Model 3	Model 4
	OLS two-way cluster	Random Effect	OLS two-way cluster	Random Effect
LowGrowth	-152.00 *** (0.00)	-134.07 *** (0.00)	-156.0 *** (0.00)	-137.0 *** (0.00)
Maturity	-179.00 *** (0.00)	-162.73 *** (0.00)	-183.0 *** (0.00)	-170.2 *** (0.00)
Decline	-278.00 *** (0.00)	-250.54 *** (0.00)	-294.0 *** (0.00)	-274.2 *** (0.00)
LogTNA	-22.24 *** (0.00)	-35.59 *** (0.00)	-22.40 *** (0.00)	-32.69 *** (0.00)
LogTNA*LowGrowth	17.60 *** (0.00)	15.61 *** (0.00)	18.22 *** (0.00)	15.66 *** (0.00)
LogTNA*Maturity	16.67 *** (0.00)	15.67 *** (0.00)	17.11 *** (0.00)	16.04 *** (0.00)
LogTNA*Decline	25.94 *** (0.00)	24.24 *** (0.00)	27.90 *** (0.00)	26.34 *** (0.00)
LogFamily			1.602 (0.27)	7.780 *** (0.00)
Manager number			-3.329 (0.11)	-1.417 (0.23)
expenses	-40.27 *** (0.00)	-45.14 *** (0.00)	-38.84 *** (0.00)	-42.91 *** (0.00)
Turnover	0.025 (0.75)	0.141 *** (0.00)	0.013 (0.87)	0.120 *** (0.00)
Flows	-0.253 (0.35)	-0.400 *** (0.00)	-0.225 (0.41)	-0.385 *** (0.00)
Total load	0.979 (0.34)	3.227 ** (0.00)	0.656 (0.58)	2.452 *** (0.00)
Constant	216.87 *** (0.00)	273.41 *** (0.00)	223.7 *** (0.00)	263.4 *** (0.00)
Objective control	Yes	Yes	Yes	Yes
Observations	130522	130522	125017	125017