Best-performing US mutual fund families from 1993 to 2008: Evidence from a novel two-stage DEA model for efficiency decomposition

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ABSTRACT

When analyzing relative performance, especially at the institutional level, the traditional data envelopment analysis (DEA) models do not recognize vastly different and important activities as separate functions and therefore cannot identify which function may be the main source of inefficiency. We propose a novel two-stage DEA model that decomposes the overall efficiency of a decision-making unit into two components and demonstrate its applicability by assessing the relative performance of 66 large mutual fund families in the US over the period 1993–2008. By decomposing the overall efficiency into operational management efficiency and portfolio management efficiency components, we reveal the best performers, the families that deteriorated in performance, and those that improved in their performance over the sample period. We also make frontier projections for poorly performing mutual fund families and highlight how the portfolio managers have managed their funds relative to the others during financial crisis periods.

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1. Introduction

The mutual fund industry in the US is by far the largest such industry in the world, managing US$11.2 trillion in assets by the end of 2009. In this paper, we propose a novel data envelopment analysis (DEA) model to investigate the relative performance of 66 large (in terms of total funds) mutual fund families in the US over the 16-year period 1993–2008. Research on individual mutual fund performance is vast and is spread widely across different markets (Treynor, 1965; Sharpe, 1966; Jensen, 1968; Hendricks et al., 1993; Goetzmann and Ibbotson, 1994; Malkiel, 1995; Elton et al., 1996; Carhart, 1997; Blake and Morey, 2000). However, the focus on the performance at the mutual fund family level is limited only to a few (Tower and Zheng, 2008; Elton et al., 2007), possibly due to the complex nature of the analysis involved. This paper fills this gap by focusing on the relative performance of mutual fund families. This is an important area of study, as investors in mutual funds generally tend to invest in funds within the same mutual fund family rather than across a number of families. The reasons for investing within one mutual fund family include convenience in searching for investment opportunities and recordkeeping (Kempf and Ruenzi, 2008) and flexibility of switching funds without additional sales charges and restrictions imposed by the fund family (Elton et al., 2006, 2007).

We investigate the relative performance of large mutual fund families using a novel two-stage DEA model where the overall efficiency of a mutual fund family is decomposed into two components, namely, operational management efficiency and portfolio management efficiency; that is, we conceptualize fund family management as a two-stage process that consists of an operational management stage (stage 1) and a portfolio management stage (stage 2). Therefore, the overall efficiency of a fund family is a composition of operational management efficiency and portfolio management efficiency. The aim of decomposing the overall efficiency is to capture which of the two stages may have greater influence on the overall efficiency of the mutual fund family. Hence, our study is of interest to all stakeholders: the investors, the fund managers, and the management companies of mutual fund families.

Previous studies of mutual fund family performance consider overall return as the measure of performance. Kapur and Timmerman (2005) note that when the share market has performed very

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well, the absolute return-based performance of mutual funds is an unreliable measure of managerial ability. They acknowledge that during a bullish market, it is more appropriate to remunerate fund managers based on relative performance rather than on absolute performance. Cooper et al. (2004) argue that DEA, which is a non-parametric method, is ideal for assessing relative performance.[1] DEA models have the advantage of assessing performance in a multi-dimensional framework; that is, they can accommodate multiple inputs and multiple outputs.

For the efficiency decomposition, we propose a novel two-stage DEA model with i_1 inputs to stage 1, D intermediate measures, i_2 inputs to stage 2 (in addition to the intermediate measures), and s outputs from stage 2. The proposed model aligns with the network approach of Färe and Whittaker (1995). The novel aspect of our model stems from several methodological advances. Unlike previous work, we model efficiencies of both stages simultaneously and therefore our model adopts a non-standard approach. The proposed DEA model not only assesses the overall performance, it decomposes the overall efficiency into two components associated with the performance of each stage. Such decomposition of efficiency is not possible in the previous network approach of Färe and Whittaker (1995). Furthermore, our approach is not restrictive in terms of orientation as in Kao and Hwang's (2008) two-stage model, which is valid only under the constant returns-to-scale (CRS) assumption. Our approach can be applied under CRS as well as variable returns-to-scale (VRS) situations. Holod and Lewis (2011) propose a two-stage DEA model to resolve the deposit dilemma. However, their model is not capable of obtaining separate efficiency estimates for each stage. In addition to the decomposition of overall efficiency, another major difference between our model and that of Holod and Lewis (2011) is that our model allows new variables in the second stage as inputs in addition to the intermediate variables that link stages 1 and 2.

The proposed two-stage DEA model is applied to investigate the relative performance of the mutual fund families as follows. In the first stage, we focus on the operational management efficiency of each mutual fund family by considering how efficiently they make use of inputs, such as marketing and distribution expenses and management fees, in producing the output, which is the net asset value. In the second stage, we focus on portfolio management efficiency by estimating how efficiently the mutual fund families make use of inputs, such as fund size, standard deviation of the returns, turnover ratio, expense ratio, and net asset value, in producing the output, which is the average return of the fund family; that is, the mutual fund family application presented in this paper is an illustration of the general two-stage DEA model with $i_1 = 2$, $D = 1$, $i_2 = 4$, and $s = 1$. Although there is one output from the first stage and one output from the second stage in this particular application, the DEA model proposed in this paper works under multiple inputs, outputs, and intermediate measures.

In our formulation, we treat net asset value (NAV), which is the output variable of the first stage, as an input variable in the second stage; that is, net asset value is modeled as an intermediate variable that links stage 1 and stage 2. Holod and Lewis (2011) treat deposits in the same way in the two-stage DEA model they use in assessing bank performance. Brown et al. (2001) point out that even though relative performance appears to be the overriding concern of fund managers as well as their clients, considerably less attention is directed towards the equally important question of assessing the relative performance of portfolios. In this paper, we make a significant contribution to the literature on this issue by providing a methodology that is robust and flexible. Our modeling

approach is general and hence can be applied to assess the performance of other financial institutions as well. For instance, it can be applied to assess the operational management efficiency and portfolio management efficiency of finance sector institutions, such as insurance companies, banks and credit unions.

The rest of the paper is organized as follows. Section 2 discusses the background of our study. Section 3 provides a general description of the proposed two-stage DEA model. Specific details regarding the formulation of the DEA model are provided in Appendix A, and the model used for frontier projection is given in Appendix B. Section 4 is devoted to a discussion of the data, sample selection, and calibrating the input–output variables used in the DEA model. The results are presented in Section 5, and Section 6 concludes the paper.

2. Background

The mutual fund industry in the US has shown significant growth over the last 10 years, having almost doubled in size since 1999. By the end of 2009 (Investment Company Institute, 2010), the number of firms constituting the US mutual fund industry was approximately 600, with 53% and 74% of the assets under management controlled by the top 10 and top 25 firms, respectively, up from 44% and 68% in 2000. The US$11.2 trillion worth of funds managed by the US fund industry accounts for 48% of the total managed funds worldwide.

The research on the performance evaluation of individual mutual funds is vast, but very little attention has been given to the performance evaluation of fund families. In a recent study, Tower and Zheng (2008) assess the relative performance of mutual fund families directly, and therefore their assessment may be viewed as being one-dimensional. We assess performance in a multidimensional framework. Tower and Zheng evaluate the performance of 51 US mutual fund families over the 11-year sample period 1994–2005 and rank them according to (i) a trading index constructed with 11 market indices, (ii) Wilshire 5000 index returns, and (iii) returns on historical portfolios by taking into consideration different classes of mutual funds. Tower and Zheng's sample of mutual fund families is restricted to the families that held 75% of their assets in diversified equities and no more than 5% of their assets in foreign stocks throughout their life span. They excluded sector funds, international funds, global funds, balanced funds, and bond funds, and their analysis at the family level is carried out with equally weighted returns of individual funds included in the fund family portfolio.

In 1996, Barron's introduced the first-ever ranking of mutual fund families based on their performance (Budgar, 1996). Barron's ranking takes into consideration five investment categories—(i) domestic equity, (ii) world equity, (iii) mixed equity (stocks and bonds), (iv) taxable bonds, and (v) tax-exempted funds—and investigates how each fund is ranked against the other funds in the same category. Barron's obtains each family's return in the five categories weighted on the size of the individual funds and then takes the average as the performance measure of the entire family (Strauss, 1985; Reinker and Tower, 2004). Barron's ranking is dominated by domestic equity, as it has the largest weighting of about 49%.

The above-mentioned studies of mutual fund family performance consider overall return as the basic measure of performance. Further, they restrict the analysis by focusing on investment categories to scale down the complexity of the problem. Our approach to ranking mutual fund families is different from previous approaches in at least two important aspects. First, we evaluate the overall performance of a mutual fund family relative to the other families in the sample by combining several fac-

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[1] In the DEA literature, the terms "relative efficiency" and "relative performance" are used interchangeably.