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Abstract

Due to a lack of data availability, numerous empirical studies on mutual fund flows (e.g. Sirri/Tufano (1998)) analyze synthetically derived flow measures. We show how good these measures can explain actual flows. We compare the measures suggested in the literature with the actual net-flows of all German equity mutual funds. Our results show the appropriateness of the synthetic measures used in previous studies. Inference about the influence of past performance on flows is not biased by using synthetic instead of actual measures of fund flows. Thus, we offer a justification for the use of synthetic measures in performance flow studies.

1 Introduction

The examination of determinants of mutual fund flows has attracted considerable attention in the empirical literature. Most studies focus on the relationship between past performance and net-flows of new money (i.e. inflows - outflows).[1] Due to a lack of data availability, empirical studies regularly can not use actual net-flows into individual funds. Instead, they construct various synthetic measures of fund flows based on the total growth of the assets under management corrected for the internal growth due to the rate of return earned by the fund. These measures seem intuitive. Nevertheless, there is no study analyzing the appropriateness of these synthetic measures.

Our note fills this gap by examining how useful the different measures suggested in the literature are. We start by calculating measures of net-flows according to various methodologies suggested in the literature and correlate them with actual net-flows for a broad sample of German equity mutual funds for the years 1990 to 2003. Our results indicate that correlations between various synthetic flow measures and actual fund flows are very high and range from 90% to 97% for the various measures. This suggests that all synthetic measures used in the literature are good proxies for actual net-flows.

Then, we examine whether inferences drawn from regressions using synthetic measures are biased. To this end we conduct an examination of the performance flow relationship using standard techniques and the various synthetic measures of fund flows as well as actual net-flows as dependent variable. Again, our results indicate that all synthetic measures deliver results that are very similar to each other and very similar to the results we get using actual net-flows.

Overall our results justify the use of synthetic measures of fund flows in empirical studies. The remainder of this note is organized in five sections. Section 2 presents the various

[1] A comprehensive list would include about 100 studies. Examples are Ippolito (1992), Patel/Zeckhauser/Hendricks (1994), Chevalier/Ellison (1997), Sirri/Tufano (1998), Fant/O'Neal (2000), DelGuerico/Tkac (2002), Deaves (2004), Elton/Gruber/Busse (2004), O'Neal (2004), Barber/Odean/Zheng (2005).

synthetic measures of net-flows suggested in the literature. In Section 3 we introduce the data, Section 4 contains the correlation analysis and in Section 5 we present results from a performance flow study using different measures of synthetic and actual net-flows. Section 6 concludes.

2 Measures of Net-Flows

We now present the various synthetic measures of yearly net-flows suggested in the literature. These measures use the funds' total net assets (TNA) and returns for calculating a measure of relative net fund growth, i.e. relative growth due to new money flow. The synthetic measures that are usually applied in the literature differ with respect to the assumptions made concerning the date of fund flows during the year. It is either assumed that all new money accrues at the end, the beginning or the middle of the year or that flows are evenly distributed across months.

2.1 Synthetic Measures of Relative Net-Flows

We start by deriving the most commonly used measure, which assumes that all new money accrues at the end of year *t*. In this case, the TNA of fund *i* at the end of year *t*, $TNA_{i,t}$, is given by the TNA at the end of the previous year, $TNA_{i,t-1}$, plus the return on the assets during year *t* plus the flow of new money at the end of year *t*:

$$TNA_{i,t} = TNA_{i,t-1}\left(1+r_{i,t}\right)+TNAFlow(end)_{i,t} \quad (1)$$

where $TNAFlow(end)_{i,t}$ is the total dollar amount of net-flows of fund *i* in year *t* and $r_{i,t}$ is the return of fund *i* in year *t*. While data on net-flows is often not available, data on TNA and returns are reported in databases like CRSP or Morningstar. Absolute net-flows can be computed by rearranging and evaluating (1) even if only yearly TNA and return data is available:

$$TNAFlow(end)_{i,t} = TNA_{i,t} - TNA_{i,t-1} \cdot (1 + r_{i,t}) \tag{2}$$

This allows us to calculate our first synthetic measure of relative net-flows, $synFlow(end)_{i,t}$, by dividing absolute net-flows, $TNAFlow(end)_{i,t}$, by the TNA of fund *i* at the end of the pervious year, $TNA_{i,t-1}$:

$$synFlow(end)_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1 + r_{i,t})}{TNA_{i,t-1}}. \tag{3}$$

This measure is used e.g. by Barber et al. (2005), Cooper et al. (2004), Deaves (2004), Sirri and Tufano (1998), and Chevalier and Ellison (1997).

If we assume that all money accrues at the beginning instead of the end of year *t*, the rate of return earned on the new money has to be taken into account and (1) has to be modified accordingly:

$$TNA_{i,t} = TNA_{i,t-1} \cdot \left(1 + r_{i,t}\right) + TNAFlow(beg)_{i,t} \cdot \left(1 + r_{i,t}\right), \tag{4}$$

where $TNAFlow(beg)_{i,t}$ denotes the total dollar amount of net-flows in this case. Relative fund growth is now given by:

$$synFlow(beg)_{i,t} = \frac{TNAFlow(beg)_{i,t}}{TNA_{i,t-1}} = \frac{TNA_{i,t} - TNA_{i,t-1} \cdot (1 + r_{i,t})}{TNA_{i,t-1} \cdot (1 + r_{i,t})}. \tag{5}$$

This measure is used e.g. by Sirri and Tufano (1998).

If fund returns are available on a semi-annual basis at least, we can also assume that all money flows in and out at the middle of the year. In this case TNA of fund *i* at the end of year *t* is given by:

$$TNA_{i,t} = \left(TNA_{i,t-1}\right)\left(1 + r_{i,t}\right) + TNAFlow(mid)_{i,t}\left(1 + r_{i,t}^{Jul-Dec}\right), \tag{6}$$

where $TNAFlow(mid)_{i,t}$ denotes total dollar net-flows in the middle of year *t*. They now earn the return of the fund from the middle until the end of year *t*. This rate of return for fund *i* in

year t (from July until December) is denoted by $r_{i,t}^{Jul-Dec}$. Relative fund growth due to net-flows can now be calculated as:

$$synFlow(mid)_{i,t} = \frac{TNAFlow(mid)_{i,t}}{TNA_{i,t-1}} = \frac{TNA_{i,t} - TNA_{i,t-1} \cdot (1 + r_{i,t})}{TNA_{i,t-1} \cdot (1 + r_{i,t}^{Jul-Dec})}. \quad (7)$$

This measure is e.g. used by Ippolito (1992).

If monthly data on returns and TNA is available, we can also calculate a synthetic measure which assumes that new money flows into the fund evenly distributed across months. Following the logic from above, for each month m we calculate a synthetic growth rate and multiply these monthly rates to get the synthetic flow measure for fund i in year t:

$$synFlow(monthly)_{i,t} = \prod_{m=Jan}^{Dec} \left[\left[\frac{TNA_{i,t,m} - TNA_{i,t,m-1}(1 + r_{i,t,m})}{TNA_{i,t,m-1}} \right] + 1 \right] - 1, \quad (8)$$

where $TNA_{i,t,m}$ denotes the TNA of fund i at the end of month m in year t.[2]

2.2 Measure of Actual Relative Net-Flows

If data on actual monthly net-flows is available, the total growth rate of fund i in year t due to flow of new money can easily be calculated as:

$$ActualFlow_{i,t} = \prod_{m=Jan}^{Dec} \left(1 + \frac{ActualTNAFlow_{i,t,m}}{TNA_{i,t,m}}\right) - 1, \quad (9)$$

where $ActualFlow_{i,t}$ represents the relative growth of fund i in year t caused by money flow and $ActualTNAFlow_{i,t,m}$ is the difference between dollar money inflow and outflow of fund i during month m in year t. $TNA_{i,t,m}$ represents the assets under management of fund i at the beginning of month m in year t.

[2] We implicitly assume that money accrues at the end of each month. In (8), $TNA_{i,t,m-1}$ for $m=Jan$ denotes the TNA of fund i at the end of December in year $t-1$.

3 Data

We use data provided by the German Investment and Asset Management Association (BVI), the German equivalent of the Investment Company Institute (ICI) in the US. We focus on pure equity mutual funds. Our database includes monthly return and TNA data as well as information on segment classifications and various fund characteristics for all open-end mutual funds offered by the members of BVI.[3] Particularly, this data also includes actual net-flows of new money for each fund on a monthly basis. Dead funds are included in the database, so our sample is free of survivorship bias. Our data is available from 1990 to 2003. Overall, it contains 3.199 fund year observations.

4 Correlation Analyses

The data available to us allows us to directly compute actual net-flows according to (9) and to compare them to the synthetic measures defined in (3), (5), (7) and (8) in Section 2. Table 1 shows the correlation coefficients between the flow measure based on actual flow data and the various synthetic measures of money flow.

Please insert Table 1 here.

Our results show that all synthetic measures are highly correlated with the actual flow measure. The correlation between actual net-flows and the measures based on yearly TNA observations ranges from 90 to 94%. Of these, the measure assuming net-flows at the middle of the year, $synFlow(mid)_{i,t}$, has the highest correlation with actual relative flows, $ActualFlow_{i,t}$. Not surprisingly, the availability of monthly data leads to a significant improvement of the flow proxy. Our synthetic measure based on monthly TNA data,

[3] Over 99% of all assets under management in German mutual funds are managed by funds that belong to families who are members of the BVI.

$synFlow(monthly)_{i,t}$, offers the highest correlation with real flows. The correlation is nearly 97%. Thus, if monthly TNA data is available, this measure should be favoured.

5 Study on the Performance Flow Relationship

In this section we analyze whether different measures of net-flows lead to different conclusions in the context of a traditional performance flow study. To analyze the influence of the different measures introduced in Section 2, we in turn use all of them as dependent variable in the following performance flow regression, which is suggested in Sirri and Tufano (1998):

$$Flow_{i,t} = \sum_{k=1}^{5} b_k \cdot \text{Quintile}\, k_{i,t-1} + c \cdot \text{Controls} + e_{i,t}, \qquad (10)$$

where $Flow_{i,t}$ represents the actual flow measure or one of the synthetic measures of relative net-flows. To capture the supposed convexity of the performance flow relationship documented in the literature, we employ the piecewise linear regression technique also used by Sirri and Tufano (1998)).[4] This allows us to estimate distinct slope coefficients, b_k, for each of the five quintiles of past performance. Controls is a vector of variables used in earlier studies. It contains the fund's past return risk, its size and age, lagged flows and segment flows as well as load and management fees. We estimate (10) using time-fixed effects regressions. Results are presented in Table 2.

Please insert Table 2 here.

[4] The piecewise linear regression uses the following definitions: $\text{Quintile}\,1_{i,t-1} = \min(0, 2; \text{rank}_{i,t-1})$, $\text{Quintile}\,2_{i,t-1} = \min(0, 2; \text{rank}_{i,t-1} - \text{Quintile}\,1_{i,t-1})$, ..., $\text{Quintile}\,5_{i,t-1} = \text{rank}_{i,t-1} - [\text{Quintile}\,1_{i,t-1} + \text{Quintile}\,2_{i,t-1} + \text{Quintile}\,3_{i,t-1} + \text{Quintile}\,4_{i,t-1}]$, where $\text{rank}_{i,t-1}$ denotes the performance rank based on raw returns of a fund as compared to the other funds in the same segment.

Column (a) contains regression results with actual inflows as dependent variable, while Columns (b)-(e) contain the results for the various synthetic measures of fund flows as dependent variable. The positive and convex performance flow relationship documented in the numerous studies cited above is confirmed by our results for each specification. Investors chase good performance but do not punish bad performance to the same extent. Regarding the influence of our control variables, we find results that are broadly consistent with those reported for the U.S.

However, the focus of this note is on the appropriateness of different flow measures. Thus, in this context it is more interesting that results are very similar for all used measures of net-flows. Irrespective of which flow measure we use, we always find a pronounced convex performance flow relationship. Estimated coefficients, significance levels and R^2 are very similar in all cases. Furthermore, the influence of the control variables is also very consistent across all specifications. This indicates that studies on determinants of fund flows are not biased by the calculation of synthetic flow measures.

6 Conclusion

In this note we present different ways of constructing measures for calculating the flow of new money into mutual funds. These flow measures are based on actual flow data available to us as well as on synthetically calculated money flows. We concentrate on the measures most often used in studies conducted for the U.S. mutual fund market. We show that the synthetic measures of fund flows suggested in the literature are highly correlated with actual fund flow data. The correlation between synthetic measures based on monthly data and actual fund flows is higher than the correlation between synthetic measures based on yearly data and actual fund flows.

Furthermore, we conduct a basic performance flow study to determine the quality of synthetic measures of fund flows in this kind of analysis. The results of our study do not depend on the

particular flow measure used. This indicates that the inferences from studies based on synthetically calculated flow measures are not biased. Synthetic flow measures can be used whenever actual flow data is not available.

Table 1: Correlation Coefficients between Actual and Synthetic Flow Measures

	$synFlow(end)_{i,t}$	$synFlow(beg)_{i,t}$	$synFlow(mid)_{i,t}$	$synFlow(monthly)_{i,t}$
$ActualFlow_{i,t}$	0.9304	0.9008	0.9352	0.9688

Table 2: Convex Performance Flow Relationship for Different Synthetic Measures of Fund Flows and one Measure Based on Actual Flow Data

	$ActualFlow_{i,t}$ (a)	$synFlow(end)_{i,t}$ (b)	$synFlow(beg)_{i,t}$ (c)	$synFlow(mid)_{i,t}$ (d)	$synFlow(monthly)_{i,t}$ (e)
Quintile $1_{i,t-1}$	- 0.0804	0.0568	-0.1927	0.0592	-0.1268
Quintile $2_{i,t-1}$	0.0450	0.0804	0.1317	0.0172	0.1083
Quintile $3_{i,t-1}$	0.1703	0.0403	0.1611	0.1307	-0.1497
Quintile $4_{i,t-1}$	0.3226	0.3141	0.2636	0.3817	0.2068
Quintile $5_{i,t-1}$	0.6624**	0.6896**	0.8092***	0.6106**	0.6906**
$Risk_{i,t-1}$	-0.3504	-0.1140	-0.1603	-0.0982	-0.2611
ln age$_{i,t-1}$	-0.0034	-0.0080	-0.0116	-0.0124	-0.0066
ln $TNA_{i,t-1}$	-0.0146**	-0.0223***	-0.0143**	-0.0147**	-0.0135**
$Flow_{i,t-1}$	0.0381***	0.0229***	0.0108***	0.0176**	0.0363***
Flow industry$_{i,t}$	0.0921***	0.1102***	0.1014***	0.1328***	0.0980***
$load_{i,t-1}$	-11.0602**	-10.4638**	-10.1409**	-11.5993**	-9.6863**
Management fees$_{i,t-1}$	4.7047*	7.0503**	3.0500	5.3003*	4.5041*
R^2	9.93%	9.91%	8.11%	9.26%	8.99%
Number of observations	3199	3172	3194	3178	3142

***, **, * significant at the 1%-, 5%-, 10%-level. Performance ranks are based on raw returns.

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