Caught Between Two Principals

Nicolaj Siggelkow

Wharton School
2211 Steinberg Hall – Dietrich Hall
University of Pennsylvania
Philadelphia, PA 19104

siggelkow@wharton.upenn.edu
tel: (215) 573-7137
fax: (215) 898-0401

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Abstract
Mutual fund providers serve two principals with opposing interests: their owners, who want them to maximize profits, and their fund shareholders, who want them to maximize fund returns. I investigate what role is played by customer power and information, as well as by competition among fund providers in influencing the balance of power between these two opposing principals. Using a data set of essentially all U.S. mutual funds between 1992–2002, I find that customer power and information play a more important role than competition among fund providers to alleviate the agency problem between fund shareholders and fund providers. In particular, I find that fund providers shift advertising expenses via 12b-1 fees and research expenses via soft dollars (excess commissions paid by fund providers) onto fund shareholders. Expense shifting is much more pronounced for retail funds than for institutional funds, while it is much less affected by competition among fund providers.

1. Introduction

The principal-agent problem has found considerable attention in both the empirical and theoretical literature on the economics of organizations (Levinthal [1988]). Agency issues have been studied for various relationships. For instance, a large body of work considers the choice of employment mode—direct employee vs. independent contractor; or firm-owned establishments vs. franchisees—in light of agency problems (e.g., Krueger [1991]; Lafontaine [1992]; Shepard [1993]; Lafontaine and Slade [1997]; Nickerson and Silverman [2003]). In these cases, firms are treated as principals who hire agents. Other work has focused on agency issues between the managers of firms and the firms' shareholders. For instance, the incentives of managers rather than the benefits to shareholders have been found to drive the decisions with respect to firm acquisitions, asset sales, and takeover resistance (Walking and Long [1984]; Morck, Shleifer and Vishny [1990]; Slusky and Caves [1991]; Lang, Poulsen and Stulz [1995]). In this case, it is the shareholders who are the principals and the firm managers who are the agents.

Common to these various set-ups is a dyadic relationship between a single principal (or many principals with common interests, such as shareholders) and agents. A class of situations exists, however, in which agents are beholden to two principals who have opposing interests. The mutual fund industry is a good example of this situation. As currently stressed in the investigations by the Securities and Exchange Commission (SEC) and the New York State Attorney General, fund shareholders and fund providers, such as Janus Capital Group or Merrill Lynch, are engaged in a principal-agent relationship. Formally, Jensen and Meckling [1976] define an agency relationship "as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent" (p. 308). In the mutual fund industry, individual investors engage fund providers to perform financial services on their behalf. By buying an appropriate fund, fund shareholders "instruct" fund providers to invest their money, for instance, in large-cap stocks. The details of the implementation of this financial service, e.g., what securities to hold and what brokers to use, are left, however, to the fund providers. In this sense, each fund provider takes on the role of an agent vis-à-vis individual fund shareholders. This role of agent is

further pronounced by the fact that money managers have a legal "fiduciary duty" with respect to the assets that were entrusted to them, which is defined by the SEC as requiring a money manager to "execute securities transactions for clients in such a manner that the client's total cost or proceeds in each transaction is the most favorable under the circumstances" (in: Fraser [1992]).

The current reports in the popular press (*Wall Street Journal*, *Business Week*, etc.) on various trading and sales practices and the fee structures employed by mutual fund providers highlight the agency relationship between fund providers and their fund shareholders and lament the extent to which "investment-industry professionals [are] willing to sacrifice investors' best interests for the sake of profits" (Henry [2003]). However, in the same issue of most of these publications, one is also likely to find reports on other firms, say Vivendi, in which managers are accused of *not* maximizing profits for their owners. In the context of the mutual fund industry, if asset managers at mutual fund providers would not be maximizing profits—a practice of which the previous quote accuses them—the owners of the fund providers, i.e., the shareholders who have invested in the fund providers (e.g., Merrill Lynch's shareholders), would also have reason to complain of an agency problem. The owners of the fund providers can reasonably demand that the fund providers' managers maximize profits for them, as long as the providers do not engage in illegal activities. In short, asset managers are caught between two principals: fund shareholders, who want fund providers to maximize returns, and the owners of the fund providers, who want fund providers to maximize profits. Yet any dollar given to one principal comes directly out of the pocket of the other principal, and pleasing one principal might be seen as an agency problem by the other principal.[1]

In this paper, I study the degree to which two factors, competition among fund providers and customer power and information, shift the balance between the two opposing forces that act upon fund providers. The context of the analysis is given by two pieces of securities regulation that provide fund

[1] Only at Vanguard such two-sided agency problem does not arise, since Vanguard has adopted a "mutual" structure, in which fund shareholders are also the owners of the mutual fund providers. As a result, in this case, there exists only one agency relationship. It is interesting to note that Vanguard does not have any 12b-1 fees and does not employ soft dollar arrangements with brokers.

providers with subtle, yet legal opportunities to shift expenses onto fund shareholders. As described in more detail below, Section 28(e) of the Security Act Amendments creates the opportunity for fund providers to shift research expenses, which they would normally pay themselves, onto fund shareholders, while Rule 12b-1 (formally §270.12b-1 of Chapter II of Title 17 of the Code of Federal Regulations) creates the opportunity to shift advertising expenses. I test whether fund providers take advantage of these opportunities, i.e., choose to maximize profits for their owners, rather than maximize the returns for their fund shareholders.[2] Moreover, I test whether better informed fund shareholders and fund shareholders with more buyer power, such as institutional investors, are able to reduce the ability for fund providers to shift expenses. Likewise, I test whether greater competition among fund providers reduces the ability for fund providers to shift expenses.

The remainder of this paper is organized as follows. Section 2 provides background information on the organization of mutual funds and on the history of 12b-1 fees and soft dollars. Section 3 describes the data. Section 4 tests under which circumstances 12b-1 fees are used to shift marketing expenses. Section 5 tests under which circumstances soft dollars are used to shift research expenses. Section 6 concludes.

2. Background information

2.1. The mutual fund industry and organization of mutual funds and mutual fund providers

With its rapid growth over the past decade, the mutual fund industry has become the largest financial intermediary in the U.S. By the end of 2002, more than half of all U.S. households were owners of a mutual fund, entrusting the industry with $5.3 trillion in assets. Mutual funds, which allow individual investors to pool their assets and pursue common investment goals, can be considered investment services offered by investment management companies. Common with industry practice, an investment management company which offers one or more funds will be called a "fund provider" in the rest of this paper.

[2] Carhart [1997] finds that "expenses have at least a one-for-one negative impact on fund performance" (p. 58). Thus, from the fund shareholder's perspective, expenses play a critical role with respect to expected returns.

Each mutual fund is a legal entity consisting of the capital paid in by mutual fund shareholders and a board of directors who represent the individual shareholders' interests. Each board of directors consists of members of the fund provider and of at least 40% independent directors. Formally, the board of directors hires the fund provider to perform investment activities on behalf of the fund. In practice, however, the fund provider creates a fund, assigns a fund manager, and appoints a board of directors to monitor the handling of the fund's assets. For its services, the fund provider charges the fund a fee which is expressed as a percentage of assets under management, called the *expense ratio*. These fees are negotiated between each fund board and the management of the fund provider and have to be approved by the independent members of each fund board. Whereas the securities held by the mutual funds are owned by the fund shareholders, the fund provider is generally owned by a separate group of public or private owners. Thus, a shift of expenses from the fund provider onto the fund shareholders benefits the owners of the fund provider.

Over the last years, the issue of mutual fund fees has been one of the most prominent topics for this industry in the both the policy realm and in the business press. For instance, both the SEC [2000] and the United States General Accounting Office [2000] conducted in-depth studies of mutual fund fees, while headlines about fund fees can be frequently found in the *Wall Street Journal* (e.g., Solomon [2003]) or *Business Week* (e.g., Smith [1998]). Paralleling, and in part pre-dating this public interest, a small research literature studying various aspects of mutual fund fees has developed. For instance, Chordia [1996] analyzes formally the role that front- and back-end sales fees (loads) play in lowering the probability of redemption, while Christoffersen [2001] studies fee waivers in the money market mutual fund sector. Related to the current study, Ferris and Chance [1987] and McLeod and Malhotra [1994] study the effect of 12b-1 fees on small samples for earlier time-periods. While they find a general positive effect of 12b-1 fees on expenses, they do not investigate which factors moderate the relationship between 12b-1 fees and the overall fees charged, the main emphasis of this study.

Most previous work on mutual funds has centered around the questions whether fund managers add value (e.g., Jensen [1968]; Ippolito [1989]; Blake, Elton and Gruber [1993]; Malkiel [1995]) and whether

fund returns are persistent (e.g., Grinblatt and Titman [1992]; Brown and Goetzman [1995]). In contrast, agency issues have found only little attention in the literature. Exceptions include Tufano and Sevick [1997], Chevalier and Ellison [1997], and Zitzewitz [2003]. Tufano and Sevick [1997] study the relationship between the composition of fund boards and the fees that are charged by funds. They find that fees are lower when fund boards are smaller and have a greater fraction of independent directors, thus indicating agency problems at the level of the fund board. Focusing on the investment strategy of fund managers, Chevalier and Ellison [1997] find that fund managers increase the riskiness of their fund portfolios in the later months of the year after they have experienced low performance early in the year. They further show that the relationship between past performance and cash inflows is positive and convex. Since cash inflows are tied to compensation, fund managers face in essence an option. By increasing the variance of returns, fund managers increase the value of this option while imposing a higher risk on fund shareholders. Lastly, Zitzewitz [2003] investigates which funds and fund providers put in place countermeasures for arbitrage opportunities that can arise due to stale fund prices. In general, he concludes that "given the magnitude of dilution of long-term shareholders, the industry's slow response to the arbitrage issue is suggestive of a conflict between the interests of shareholders and those of either the management company or its employees" (p. 247).

In this paper, I explore whether fund providers take advantage of two particular opportunities to shift expenses onto fund shareholders. Thus, while Tufano and Sevick [1997] explore agency issues at the level of the fund board and Chevalier and Ellison [1997] analyze agency issues at the level of the fund manager, this paper, similar to Zitzewitz [2003], studies agency issues at the level of the fund provider.

2.2. The history of 12b-1 fees

The purpose and the origin of 12b-1 fees can be best understood in the context of changes in the commission fee structure. Until 1975, the New York Stock Exchange maintained minimum commission rates which were set at relatively high levels. For instance, from the early 1960s to the early 1970s, the mandated commission charge was 39¢ a share (Jarrell [1984]). As a point of comparison, charges in 1996

were around 3-5¢ a share. Prior to deregulation of commissions, brokers used the high commission fees to provide clients with research support. In addition, reciprocal arrangements between fund providers and brokers existed. For instance, a fund provider could direct its broker to "give up" to another party a portion of the commissions it had paid. This other party was usually another broker who had sold shares of mutual funds offered by the fund provider (Burgunder and Hartmann [1986]). Since fees of fund providers were linked to assets under management, sales efforts of brokers were of direct benefit to fund providers. Thus, give-ups allowed fund providers to reward brokers for sales efforts using the fund shareholders' assets, since fund shareholders footed the commission bill.

With the deregulation of commissions and the subsequent decline in commission rates this traditional source of rewarding brokers for hawking mutual funds dried up, however. As a result, fund providers were searching for new ways to re-instate bonus payments to brokers. This search was fueled by a general steep recession in the mutual fund industry. In seven of the eight years between 1972–1979, mutual funds experienced net outflows. Fund providers argued before the SEC that advertising and increased incentives for distributors could stop the net outflows. Moreover, it was argued, since increased inflows caused by marketing would yield scale economies and lead subsequently to lower expenses, *existing* shareholders would not be hurt if they had to pay for marketing expenses. Historically, the SEC had opposed the use of fund assets for payment of marketing and distribution expenses because of the potential conflicts of interest inherent in such practice. For instance, in 1972, the SEC stated that mutual fund selling expenses should "not, even in part, [be borne] by the existing shareholders of the fund who often receive little or no benefit from the sale of new shares" (Securities and Exchange Commission [1972]). Yet in October 1980, the SEC enacted Rule 12b-1 which permitted fund providers to deduct an annual fee from fund assets for marketing and distribution. At the same time, however, the SEC announced that it remained strongly concerned about the serious potential for fiduciary breaches when advisers use fund assets to sell shares, and thus it would stand prepared to adjust the rule if it were employed other than to rectify appropriate problems in a responsible fashion (in: Burgunder and Hartmann [1988]). 12b-1 fees were rapidly adopted by mutual funds of all sizes and continued to be

adopted as the industry climate changed for the better. While in 1983 24% of all funds levied 12b-1 fees, in 1986, 48%, in 1996, 59%, and by the end of 2002, 61% of all funds carried this fee.

2.3. The history of soft dollars

In short, soft dollars are rebates in form of research services given to customers of brokerage houses. For instance, a mutual fund provider might receive research services worth $1 for every $2 of brokerage commissions paid to the broker. In some cases, the research, or other services, are provided directly by the broker; in other cases, they are purchased by the broker from a third-party provider.

The soft dollar business has a long tradition on Wall Street. Prior to commission deregulation in 1975, one way for brokerage houses to differentiate themselves was to provide research and other services to clients in exchange for trading business. However, after deregulation in 1975, brokerage houses started to compete on price. With different brokerage commission fees available, money managers faced a new challenge with respect to fulfilling their fiduciary duty. Before deregulation, to fulfill their fiduciary duty, money managers had to consider mainly brokers' trade execution. After deregulation, money managers were apprehensive that in order to fulfill their fiduciary duty they had to always seek out the lowest commissions available, regardless of what services a brokerage house—in return for higher commissions—would offer. In response to these concerns (and after lobbying by the financial community) the Security Act Amendments of 1975, which deregulated commissions, included Section 28(e) which provided money managers with leeway ("a safe harbor") to make a trade-off between commission charges and services. This section states that a money manager "shall not be deemed to have acted unlawfully or to have breached fiduciary duty . . . solely by reason of his having caused an account to pay more than the lowest available commission if that person determines in good faith that the amount of the commission is reasonable in relation to the value of the brokerage and research services provided" (in: Fraser [1992]). "Research services" which can be compensated for by soft dollars include economic information, quotation equipment, financial databases, training seminars, journal subscriptions,

and computer hardware which is dedicated exclusively to research used for the benefit of the client who paid for the equipment.

Soft-dollars can lead to agency problems at the level of fund managers and at the level of fund providers. Fund managers may (illegally) use soft dollars for private gain. For instance, the *Wall Street Journal* reported on research seminars held in Paris, Madrid, and in Sarajevo during the Winter Olympics in 1984, all paid for with soft dollars (Smith [1984]). While a more recent probe by the SEC unearthed several similar abuses of soft-dollars,[3] it did not find widespread misuse (Securities and Exchange Commission [1998]).

This paper is concerned with a potential agency problem caused by soft dollars at the level of fund providers. It is tested whether soft dollars constitute hidden management charges. Fund providers are explicitly compensated for their services through the expense fee they charge fund shareholders. When fund providers use inflated brokerage charges to pay indirectly for research, fund providers may shift part of their expenses onto fund shareholders, since brokerage costs are not included in the expense fee but are paid by fund shareholders on top of the expense fee. If fund providers reduce their explicit expense fees when they obtain research services with soft dollars, fund shareholders would be indifferent to paying for research through the explicit fees or indirectly through higher brokerage commissions. However, if fund providers do not reduce their explicit fees, there would be evidence that fund providers shift part of their research expenses onto fund shareholders.

Before delving into the empirical tests, it may be useful to briefly recap the fees and expenses: Fund shareholders pay fund providers an annual fee, called the *expense ratio*. For funds that levy *12b-1 fees*, the 12b-1 fees are included in the expense ratio. Many funds charge also *front-* and *back-loads* (sales charges) which are paid separately by fund shareholders. In addition to the expense ratio, fund shareholders pay for *brokerage commissions.* The brokerage commission may include *soft dollars* which are rebated by brokers to fund providers in form of research or other services.

[3] For instance, Oakwood Counselors was charged with not disclosing a soft dollar arrangement with Merrill Lynch, which was paying for rent, salaries, legal-, and accounting fees (Pickard [1997]).

3. Data

The data used in this study have been obtained from two sources, the Center for Research in Security Prices (CRSP) *Survivor Bias Free U.S. Mutual Fund Data Base 2002* and the Morningstar *Principia Plus 1996* database. The CRSP data contain virtually all equity, bond, and money market funds that were available in a particular year, irrespective of whether the fund continued to exist in later periods. Since data on 12b-1 fees are first reported in the database in 1992, I use the data for the period 1992–2002 for the analysis of the relationship between 12b-1 fees and the expense ratio. In contrast to CRSP, Morningstar reports brokerage commission costs for equity funds. Unfortunately, the brokerage commission costs were not directly electronically available; hence this data item had to be collected by hand. To keep the data gathering feasible, I focused on one year of data (1996). The Morningstar data, which include essentially all equity funds commercially available, is used for the analysis of soft dollars.

A summary of the data for a selected number of years can be found in Table 1. In 1993, the sample contains 3,730 funds, which increases to 13,652 funds in 2002. The three variables of main concern in this paper are the expense ratio, the 12b-1 ratio, and the brokerage commissions. The expense ratio includes management fees, shareholder servicing and reporting costs, custodial fees, transfer agent fees, auditing and legal fees, director fees, interest expense, and 12b-1 fees. It does not include brokerage costs or sales charges (loads). Over the years, the mean expense ratio has ranged from 1.05% of assets in 1993 to 1.36% in 2002. It is instructive to look at expense fees not only as a percentage of assets, but also in absolute terms. In 1993, total fees of $14.1 billion were charged, while in 2002 fees of $39.6 billion were collected by fund providers. With respect to 12b-1 fees, in 1993, funds that charged 12b-1 fees, charged on average 0.35%, while in 2002 the average 12b-1 ratio was 0.60%. In total, 12b-1 fees of $2.3 billion were charged in 1993 and $7.6 billion in 2002. Explicit brokerage commissions are paid only for equity securities. For fixed-income securities, brokerage charges are included in the bid-ask spread. As a result, brokerage commissions are reported only for equity funds. On average, in 1996, equity funds spent $1.06 million (0.30% of assets) for brokerage commissions. The Morningstar sample as a whole covers total brokerage commissions of $2.4 billion.

Both datasets also classify funds as belonging to different categories. The CRSP dataset contains the fund classification by Strategic Insight, a mutual fund research and consulting firm. Each fund is assigned to one of 195 categories (e.g., Aggressive Growth Funds, Corporate Intermediate Maturity Bond Funds, etc.; the full list is available from the author). Morningstar uses its own classification. In total, 25 different categories are used for the equity funds that are included in the data for 1996 (list available).

< INSERT TABLE 1 ABOUT HERE >

4. The shifting of advertising expenses

4.1. Regression model

Fund providers claimed that current shareholders would not be hurt financially by 12b-1 fees, since scale economies, made possible through the increased inflows caused by marketing, would decrease the non-marketing fees they would charge fund shareholders. It is useful to think of the fees charged by fund providers in the following manner: Let F be the fee charged by funds that do not charge 12b-1 fees. Let N be the (non-marketing) fees and M the explicit marketing fees (12b-1 fees) charged by funds which levy a 12b-1 fee. Fund providers with no 12b-1 fee have to pay for marketing expenses themselves, out of the fees F they collect. For fund providers with 12b-1 fees, fund shareholders pay at least for part of the marketing with the fees M. If total fees charged were the same whether or not 12b-1 fees were levied, fund shareholders would be indifferent to paying explicitly for marketing or paying the fee F. Yet if fund providers who charge 12b-1 fees do not reduce their non-marketing fees by the amount of the 12b-1 fee, fund shareholders would be made worse off. In this case, fund providers would have been able to shift expenses onto fund shareholders.

I test the impact of 12b-1 fees on the expense ratio by regressing the *expense ratio* on the *12b-1 ratio* (the 12b-1 fee as a percentage of assets) and on other variables that may affect the expense ratio. A zero coefficient on the *12b-1 ratio* would indicate that the 12b-1 fees are accompanied by an equal reduction in non-marketing fees, i.e., that the presence of 12b-1 fees has a neutral effect on total fees charged. In contrast, a positive coefficient would indicate that 12b-1 fees increase the costs borne by existing

shareholders. In the following, I will call the coefficient on the *12b-1 ratio* the "pass-through rate," as it captures that fraction of the 12b-1 fees that is passed through to fund shareholders without reducing the non-marketing expenses.

The main goal of the analysis is to assess which factors affect the pass-through rate. To gauge whether customers with better information or more power have a lower pass-through rate, I conduct the analysis for two sub-samples: institutional funds and retail funds. Arguably, institutional investors are better informed and have more power than private fund shareholders.

To assess whether competition among fund providers affects the pass-through rate, I construct a number of competition measures at the level of fund categories and conduct separate analyses for each quartile of the data. For categories with high competition, one might expect a lower pass-through rate than for categories with low competition. One of the most common competition measures is the Herfindahl index. For each category *i* and year *t*, the Herfindahl index (*concentration*$_{it}$) is defined as $C_{it} = \sum_{k} \alpha_{kit}^2$, where α_{kit} is the market share of fund provider *k* in category *i* in year *t*. (Summary statistics of variables can be found in Table 1.) Two other competition measures are *fund providers*$_{it}$, the number of fund providers in category *i* in year *t*, and *density*$_{it}$, the number of fund providers that offer funds in category *i* in year *t* divided by the total assets in category *i* in year *t*.

A number of control variables are included in the model. Funds that do not charge a front- or back-end load may have higher expenses, since distribution charges are included in the expense ratio. As a result, variables *front load* and *back-end load*, both expressed in percent, are included. The age of the fund (in logarithmic form) is included, because fund providers may subsidize younger funds (Christoffersen [2001]); conversely, older funds may realize time-specific economies allowing them to lower expenses.

It is important to keep in mind that the expense ratio is essentially a price: it is the fee that is charged by the fund provider to the fund shareholders. By including the (relative) past performance of the fund (measured by the difference between the fund's return and the average return of its category in the

previous year), it is possible to assess whether funds that had high past performance increase their "price" to fund shareholders or not.

If funds that invest in volatile securities require a large amount of research, a positive coefficient on *volatility*, the standard deviation of the fund's monthly returns over the year, would be expected. Similarly, funds that have a high *turnover*, i.e., change their portfolio greatly, might incur larger research expenses. Funds that experience high redemption rates tend to hold a larger percentage of their assets in cash or cash equivalents (variable *cash ratio*). Since higher redemption rates lead to larger account service costs, the cash ratio is expected to have a positive coefficient. Lastly, to control for differences at the level of fund providers, *provider size*, expressed as the logarithm of total assets, and the *provider category size*, expressed as the logarithm of all assets that a fund provider has in a given category, are included in the regression.

I explicitly do not include a measure of fund size. If 12b-1 charges lead to larger funds which in turn are able to reduce their expense ratios, then the coefficient on fund size would pick up this beneficial effect of 12b-1 fees on the expense ratio and bias the coefficient on the 12b-1 ratio upward, towards finding an agency effect. In contrast, by excluding size, the regression attributes to the 12b-1 ratio any (decreasing) effect of size on expenses that is correlated with the 12b-1 ratio, thereby potentially biasing away from finding agency effects and making the test more stringent. (As reported below, the results do not change qualitatively if also the *provider category size* is dropped or if a measure of fund size is included.)

To take differences across categories and time into account, variables are centered around their yearly category mean. For instance, the dependent variable is the difference between a fund's expense ratio in year *t* and the mean expense ratio of all funds in that fund's category in year *t*. Similar differencing is performed for all variables.

4.2. Estimation method

Since the data is in the form of a panel, an econometric procedure that utilizes this structure is warranted. Panel estimation-techniques require more or less restrictive assumptions on the within-group correlation structure. (In the present case all observations for each fund correspond to a group.) Let **R** be the correlation matrix for modeling the within-group correlation. Let $R_{t, s}$ denote the t, s element of **R**. Ordinary least squares, for instance, would correspond to letting $R_{t, s} = 1$ if t = s, and 0 otherwise. A random-effects model would correspond to letting $R_{t, s} = 1$ if t = s, and ρ otherwise; and an AR(1) model would correspond to letting $R_{t, s} = 1$ if t = s, and $\rho^{|t - s|}$ otherwise. To obtain more flexibility with respect to the correlation structure, the model is estimated using the technique of generalized estimation equations (GEE) as developed by Liang and Zeger Liang and Zeger [1986]. GEE is attractive in this case, since due to the large number of panels in the data, the estimation can exploit GEE's option to impose as only constraint on the correlation matrix that the diagonal elements be equal to 1 and the matrix be symmetric, i.e., $R_{t, s} = 1$ if t = s, and ρ_{ts} otherwise, with $\rho_{ts} = \rho_{st}$. Hence, the procedure is able to take into account possible autocorrelation between observations over time without requiring a pre-specified, restrictive autocorrelation structure.

GEE is a synthesis of the generalized linear model (McCullagh and Nelder [1989]), which assumes independence, and the linear model with estimated covariance matrix (FGLS), which requires functional independence of the mean and the variance (Ziegler, Kastner and Blettner [1998]). The estimation technique iterates between a Fisher scoring algorithm for the estimates of the coefficients and a method of moment estimation for the working correlation matrix **R**. The variance of the coefficients is estimated consistently with a robust variance matrix estimator, tracing back to Huber [1967] and adapted by Liang and Zeger [1986]. For a review of GEE, see Ziegler, Kastner and Blettner [1998].

4.3. Results

Column (1) in Table 2 contains the regression results for retail funds, i.e., funds sold to individual investors. Of main concern is the coefficient on the *12b-1 ratio*, the pass-through rate. For retail funds,

the pass-through rate is 0.839 and highly significant ($p < 0.001$), implying that a 12b-1 fee of 1% increases the expense ratio of a fund by 0.839%. The control variables indicate that funds with front- and back-end loads have overall higher expense ratios. The effects are statistically significant, yet not very large. (A 1% load would increase the expense ratio by 0.01% and 0.04%, respectively.) Older and better performing funds tend to have lower expense ratios, while funds with more volatile returns have higher expense ratios. The amount of cash held in the fund seems to have no systematic effect on the expense ratio. Lastly, funds belonging to larger fund providers and to large categories within providers tend to have lower expense ratios. Again, while statistically significant, the effects are not very large. For instance, if the median fund provider of $20 billion doubled its size, the expense ratio would decline by 0.02%.

Column (2) reports the results for institutional funds. For these funds, the pass-through rate is 0.601, by itself statistically significantly different from zero ($p < 0.001$), but also statistically significantly lower than the pass-through rate for retail funds ($p < 0.001$). Overall, these results indicate that 12b-1 fees are used to shift marketing and distribution expenses onto current fund shareholders, yet the degree to which this effect occurs is larger for retail funds than for institutional funds. In particular, the pass-through rate for institutional funds is about 72% that of retail funds (0.601/0.839). Thus, customer power appears to have an alleviating effect on the agency relationship between fund shareholders and fund providers.

< INSERT TABLE 2 ABOUT HERE >

One should note that the above result does not state that expense ratios of institutional funds are lower than the expense ratios of retail funds—which could be true for a number of reasons, such as the larger average account size of institutional funds. The result is concerned with the degree to which 12b-1 fees increase the overall expenses charged. A look at the raw data makes this difference clear. Across all years, the average expense ratio charged by retail funds that also charge 12b-1 fees is 1.53%, while retail funds that do not charge 12b-1 fees have an average expense ratio of 0.90%, a difference of 0.63%. Retail funds that charged a 12b-1 fee, charged on average a 12b-1 fee of 0.56%. The raw data, thus,

would imply a pass-through rate of 0.63/0.56 = 1.13 for retail funds. For institutional funds, the average expense ratio of funds charging a 12b-1 fee was 0.90%, while for funds that did not charge a 12b-1 fee it was 0.79%, a 0.11% difference. Institutional funds that charged a 12b-1 fee, charged an average 12b-1 fee of 0.20%, implying a pass-through rate of 0.11/0.20 = 0.55. Thus, the raw data, without controlling for any other factors such as differences across categories and time, show the significant difference in pass-through rates between retail and institutional funds as well.

If a measure for fund size is included in the regression (the logarithm of fund assets), the coefficient on this measure is, as expected, negative and highly significant, yet the estimates for the pass-through parameter change only slightly to 0.813 and 0.590, respectively. These estimates would imply that the pass-through rate for institutional funds is 71% that of retail funds. Conversely, if neither *provider category size* nor *fund size* is included in the regression, the coefficient estimates change to 0.832 and 0.599.

One potential concern with the above results is that for some funds, especially those with multiple share classes, 12b-1 fees are a substitute for front- or back-end loads. Thus, for some funds full distribution expenses are included in the expense ratio, while for others they are not. Even though the front- and the back-end load are included as control variables, one may be concerned that the effect is not fully controlled for. To test the robustness of the results, I restrict the sample to funds that have neither front- nor back-end loads. Thus, only funds for which the expense ratio contains all expenses borne by the investor are included in the regression. With this sample restriction, pass-through parameters are estimated to be 0.789 for retail funds and 0.447 for institutional funds (both significant with $p < 0.001$). While the absolute effects are somewhat smaller, the relative difference between the pass-through rates is larger. In this subsample, the pass-through rate for institutional funds is only 57% (rather than 72%) that of retail funds.

One alternative explanation to expense shifting of the high pass-through rate for retail funds could be that funds that levy 12b-1 fees have higher service levels, which would justify their higher expenses. Systematic data on service levels for fund providers that charge and do not charge 12b-1 fees is difficult

to obtain. Surveys that do include both types of fund providers suggest, however, that 12b-1 fees are unlikely to be positively related to service levels. To our knowledge, the most comprehensive survey of fund provider service levels was conducted by the *Financial World Magazine* in 1993 (Wehle [1993]). Over 1,160 Magazine subscribers supplied service rankings for fund providers. Among the seven fund providers with the highest service score were five that did not charge any 12b-1 fee (or other loads), one that charged 25 basis points, and one that charged up to the maximum of 100 basis points. At the same time, all three fund providers with the poorest rating charged 12b-1 fees up to 100 basis points. Thus, at least given this survey data, there does not appear to exist a strong positive correlation between 12b-1 fees and service level.

We now turn our attention to the effect of competition between fund providers. Columns (3a) - (3d) contain the results when the full data is split by quartiles on the *concentration* measure. The columns are arranged such that competition is increasing from (a) to (d). For each quartile of the data, the pass-through parameter is slightly above 0.90 and highly significant. Yet, the parameters are not significantly different from each other. Thus, there is no evidence that different degrees of competition within the categories lead to a lower pass-through rate. Columns (4a) - (4d) split the data by quartiles on the density measure. No clear pattern is discernable in the results. In this case, the pass-through rate significantly increases, rather than decreases, by 0.075 from the lowest density quartile to the next quartile ($p < 0.01$), while the pass-through rate significantly decreases by 0.053 from the third to the fourth quartile ($p < 0.05$), providing some evidence of a competition effect at very high levels of density. (As reference for the magnitude of these effects, recall that the difference in the pass-through rate between retail and institutional funds was 0.238). In columns (5a) - (5d), results are reported when the data is split on quartiles based on the number of fund providers offering funds within a category. Again a significant increase, rather than decrease, in the pass-through rate can be detected between the quartile with the fewest providers to the next quartile (increase of 0.085, $p < 0.01$). No significant differences in the pass-through rate between the other quartiles can be detected. In sum, for the sample as a whole, competition

among fund providers does not appear to alleviate the agency relationship between fund providers and their clients.

I further investigate whether competition plays a different role for retail funds than for institutional funds. Table 3 reports the pass-through rates when the data is split by both retail and institutional funds and by competition quartile.[4] The results for the retail funds resemble those for the sample as a whole. Regardless of competition measure, the pass-through rate across the competition quartiles are generally not statistically significant from each other. For institutional funds, no clear pattern emerges. For instance, the pass-through rate for funds in the third quartile of *concentration* is significantly higher than for funds in the second and fourth quartile. In contrast, funds in the third *density* quartile have a significantly lower pass-through rate than funds in the second quartile. No significant differences across *fund provider* quartiles can be detected.

< INSERT TABLE 3 ABOUT HERE >

As a robustness check of these results, I further examine equity, bond, and money-market funds separately. Table 4 reports the pass-through parameters of each subsample. For equity and bond funds, retail funds exhibit significantly higher pass-through rates than institutional funds. For money-market funds, both retail and institutional funds have similar pass-through rates. Each sub-sample (e.g., retail equity funds, or institutional bond funds) is then further sub-divided into four groups using the quartile measures of *concentration* as cut-off points. For retail funds, in each sub-sample, a significant pass-through rate is present. Moreover, similar to the results of the full sample, for equity and bond funds, the degree of competition among fund providers appears to have no effect on the pass-through rate. Only for money-market funds does larger competition reduce the pass-through rate significantly. For institutional funds, no clear relationship between the concentration of the categories and the pass-through rate exists

[4] To estimate an unstructured correlation matrix, many long panels are necessary. Once the data is split into quartiles, the data become too sparse for institutional funds to allow for a completely unstructured correlation matrix. Inspection of the estimated correlation matrix for all institutional funds indicated that an AR(1) structure was reasonable. To be consistent, all results reported in Table 3 use an AR(1) correlation structure.

for equity and money market funds. For bond funds, the pass-through rate actually appears to be higher in less concentrated than in more concentrated categories (see Table 4).

< INSERT TABLE 4 ABOUT HERE >

4.4. Funds that switch

For one subset of funds the effect of charging a 12b-1 fee can be directly observed: funds that did not charge a 12b-1 fee and then switch to charging a fee. The raw data paint the following picture: The average expense ratio of all *retail* funds in the year before they started to charge a 12b-1 fee was 0.97%. In the year they first charged a 12b-1 fee, their expense ratio was 1.05%, significantly higher ($p < 0.001$). These funds charged an average 12b-1 fee of 0.24%, implying a pass-through rate of 0.333 (0.08/0.24). In subsequent years, these funds did not lower their expense ratios, either. The average expense ratio in the years subsequent to adding a 12b-1 fees stayed relatively constant (1.07% two years after, 1.08% three years and four years after, and 1.07% five years after adopting a 12b-1 fee).

For *institutional* funds, the average expense ratio was 0.80% before and 0.81% after charging on average a 0.28% 12b-1 fee, implying a pass-through rate of practically zero (0.04). Thus, for institutional funds, fund providers that charged 12b-1 fees did indeed fully reduce the non-marketing expenses so that overall expenses were not affected. For both retail and institutional funds, the higher saliency of imposing a fee that had previously not been imposed appears to reduce the amount that fund providers are able to pass through to their clients. Yet, as before, institutional funds have a lower pass-through rate.

The analysis using the raw data does not take a possible selection bias into account. Funds that switch may not be a random sample. To account for this possible selection bias, I employ matching techniques based on propensity scores as described by Dehejia and Wahba [1999] and [2002]. In short, funds that adopt a 12b-1 fee in year *t* are matched with funds that look very similar in year *t–1* but that do not adopt a 12b-1 fee in year *t*. As described in detail in Appendix 1, funds are grouped into strata containing funds of both types (future adopters and non-adopters) that are similar in their *t–1* propensity to adopt a 12b-1 fee in year *t* and that have similar expense ratios. The expense ratios of both types of funds are then compared in

year *t* using two approaches. In the first approach, the difference between the expense ratios of both types of funds within each stratum is computed for year *t* and the differences are weighted by the number of treated funds within each stratum. In the second approach, each future adopter is matched with the non-adopter that has the closest propensity score to the adopter. Differences in the expense ratios are then computed for all matched pairs in year *t*.

Using the differences within each stratum, I find that retail funds that start charging 12b-1 fees have expense ratios that are 0.091% higher than comparable funds that do not adopt 12b-1 fees. Using the second approach, I find an expense ratio difference of 0.087%. Both differences are statistically significant with $p < 0.001$ and imply pass-through rates of 0.363 and 0.350 respectively (see Table 5). In contrast, for institutional funds, the differences computed with either approach (0.061% and -0.001%) are not statistically significant. Overall, these results point to the same finding that we have seen before: 12b-1 fees are passed through more for retail funds than for institutional funds.

To assess the effect of competition, I divide the switching funds by the median value of *concentration* and conduct the propensity score matching algorithm for both sub-sets. For retail funds, I find similar increases in the expense ratio for funds that start charging 12b-1 fees in both competition sub-sets (i.e., for both low and high concentration categories). For institutional funds, I do not find any significant increases in the expense ratio for either competition sub-sample (see Table 5). In sum, competition again plays no role in alleviating expense shifting via 12b-1 fees.

<INSERT TABLE 5 ABOUT HERE >

While the results indicate that 12b-1 fees increase expenses for *existing* shareholders of retail funds, *new* shareholders could still be better off if the explicit sales fees (front or back-loads) are sufficiently decreased. This is not the case, however. Neither front-, nor back-loads change on average for funds that adopt 12b-1 fees. For retail funds that start charging 12b-1 fees, front-loads change on average from 2.50% to 2.49%, while back-loads increase from 0.15% to 0.20%. For institutional funds that start charging 12b-1 fees, front-loads decrease from 1.09% to 0.91% (not statistically significant), while none

of these funds charges a back-load. Thus, funds that start charging a 12b-1 fee are not simply changing to a different share class in which the structure of front-loads, back-loads and 12b-1 charges are restructured. Similarly, given that front- and back-loads do not change, total expenses over any holding period (which would spread the one-time load costs) is higher once 12b-1 fees are imposed.

5. Shifting of research expenses

This section analyzes the second opportunity that fund providers have to shift expenses onto fund shareholders. Fund providers usually pay their research expenses out of the fees they explicitly charge fund shareholders. However, by paying inflated commission charges, which are not included in the explicit fees but which are also paid by fund shareholders, fund providers obtain rebates (soft dollars) from brokers in the form of research services. In other words, fund providers are able to use commissions to pay for research services.

Two main consequences arise from this practice. First, fees are shifted from an explicit measure to a much more opaque area: Unlike the expenses charged, the brokerage commissions are not widely publicized. Until 1996, information about brokerage commissions was not included in the fund prospectus. Fund shareholders had to request from the fund provider a "Statement of Additional Information" in which brokerage expenses are listed. As a result, when soft dollars are used, individual investors face a more difficult task in assessing total expenses charged by fund providers.[5]

Second, the question arises whether fund managers reduce their explicit fees when they obtain services via soft dollars. If fund providers who use soft dollars reduce their explicit fees, fund shareholders would be indifferent to paying for research through the explicit fees or indirectly through higher brokerage commissions. If, however, explicit fees are not reduced, fund shareholders would be charged for research services twice.

[5] Soft dollars increase the difficulty of the fund board of director's monitoring task as well, increasing the possibility of abuse. The 1998 SEC probe into the soft dollar practices revealed that fund boards frequently receive only very sketchy information on the kind of services that advisers obtain with soft dollars.

Since direct brokerage commissions are paid only for equity securities, the following analysis contains only equity funds. Brokerage charges were available for 2,315 equity funds. Brokerage costs and the amount of soft dollars generated are non-trivial: On average, brokerage costs add 32 basis points to the expense ratio. To assess the magnitude of soft dollars, the median brokerage costs of funds were compared to the brokerage costs of funds that do not use soft dollars. Another comparison was made to the brokerage costs an individual investor would incur who traded the same volume of securities as fund managers using on-line brokers. I estimate that fund managers pay $1.63 in commissions to receive $1 worth of research services, a 61% rebate. This estimate is in line with rates reported in the business press of $1.60 for each dollar of research services (Schroeder [1994]). Interestingly, Jarrell [1984] reports that already in the late 1960s, brokers provided rebates in the form of research and "give-ups" of 60% for institutional-sized orders. In total, fund managers generated soft dollars of $1.47 billion in 1996. (For more detail on the estimate of the magnitude of soft dollars, see Appendix 2).

Due to the presence of soft dollars, brokerage commissions are implicitly consisting of two components: charges for trading costs and soft dollars. To assess whether fund providers reduce their explicit fees when using soft dollars, I regress the *brokerage ratio* (the ratio of commissions to trade dollars) on fund characteristics that influence trading costs and add the expense ratio to the regression. In other words, after controlling for attributes of the fund that influence the trading costs of the fund, it is tested whether the residual brokerage costs (i.e., the soft dollars) and the expense ratio are negatively correlated. A negative coefficient for the expense ratio would indicate that a substitution between soft dollars and explicitly charged fees is taking place—an insignificant coefficient would indicate that no substitution is taking place (Livingston and O'Neal [1996]). As in the previous analysis of the effect of 12b-1 fees, the data is split into different sub-samples and it is tested whether customer power or competition among fund providers affects the degree to which fee substitution takes place.

To compute the *brokerage ratio*, one needs to calculate the dollar amount of trades that each fund was engaged in. As described in Appendix 3, using the reported turnover of each fund and the fact whether the fund had net inflows or outflows, the dollar amount of trades can be inferred. Dividing the total

amount of brokerage commission fees paid by each fund by the dollar amount of trading, yields the *brokerage ratio.* The median fund had a brokerage ratio of 12.9¢ for any $100 worth of securities traded.

As control variables the regression model includes the fund's size (the logarithm of its assets), the market share and the fund's age, because managers of large funds, of funds with high market share and of funds that have existed for a long time might be able to obtain lower brokerage commissions. To control for trading intensity given fund size, the fund's turnover (in percent) is included. A further control variable is the cash ratio of the fund. To differentiate between the effects of various load structures, the front-load, the back-load, and the 12b-1 fee ratio are included. Lastly, category dummy variables and fund provider dummy variables are included. A classification scheme of 25 equity categories, as provided by Morningstar, is used. Unfortunately, it is impossible to control directly for the average size of the trades that individual fund managers place, which could have an impact on brokerage commission rates. However, as long as trading size is correlated with overall trading volume of the fund and/or with the category of the fund, the variables included will partially control for trading size.

Since the data comprise only one year, no panel-techniques are necessary and OLS is used. For statistical testing, I employ the Huber-White sandwich estimator of standard errors, robust to clustering, allowing for non-independence of observations within each fund provider, and heteroskedasticity (Huber [1967]; Rogers [1993]; White [1980]).

Results for all retail funds can be found in column (1) of Table 6. Rather than being negative, the coefficient on the expense ratio, the fee-substitution parameter, is positive and significant ($p < 0.025$). Thus, for retail funds, no evidence for fee-substitution can be found, but rather the converse. For retail funds, soft dollars (and thereby inflated brokerage costs) seem to be positively related to high explicit fees rather than to lower explicit fees. In contrast, as the results in column (2) show, for institutional funds the coefficient on the expense ratio is statistically insignificant. While there is no direct evidence for fee-substitution, at least no *positive* relationship between explicit fees and brokerage costs can be detected.

Dividing the data by degrees of competition has a less pronounced effect. Given the smaller data set, the data is split on the median level (rather than into quartiles). For sake of space, results are only

reported for the most common competition measure, the *concentration* measure. As the results in columns (3a) and (3b) for the entire sample show, at either degree of competition, a positive effect between the expense ratio and the brokerage ratio can be found. Similar results are obtained when the sample is restricted to retail funds (columns (4a) and (4b)). For institutional funds, no significant relationship between the expense ratio and the brokerage ratio can be found at any level of competition (columns (5a) and (5b)). In sum, similar to the results concerning 12b-1 fees, the degree of the agency problem between fund providers and clients appears to be moderated more by customer power than by competition among fund providers.

<INSERT TABLE 6 ABOUT HERE >

6. Conclusions

The mutual fund industry has experienced tremendous growth over the last 15 years. This growth was in part possible because individual investors trusted the participants in this industry. As the publisher of *Morningstar Mutual Funds*, a keen industry observer, noted: "The fund industry has stolen market share from its competitors by building a reputation as the one segment of the financial-services business in which honesty is the customary policy" (Phillips [1994]). To achieve such level of trust was a tremendous feat, given the dual agency role that most fund providers play. On one hand, fund shareholders engage fund providers as their agents to provide them with high fund returns. On the other hand, fund providers are financially accountable to their owners—fund providers are supposed to maximize profits from fees that are charged to the fund shareholders.

Four findings of the analysis stand out. First, 12b-1 fees appear to be used to shift advertising expenses from fund providers onto fund shareholders. Consequently, investors in funds that propose to adopt 12b-1 fees should seriously consider whether such fees will really benefit them. Similarly, independent fund directors, the guardians of fund shareholders' interests, should raise the question with the fund provider of the rationale and benefit, especially for existing shareholders, of starting a 12b-1 plan. More generally, the results indicate that the original justification of 12b-1 plans—allowing fund

providers to finance advertising so that they can overcome temporary weak demand, which in the end would create benefits for existing shareholders—is not borne out in the data.

Second, no evidence can be found that excess payments of brokerage commissions (soft dollars) are used to lower the explicit research fees that fund providers charge. These results suggest that, at a minimum, soft dollar arrangements should be made more transparent. The SEC's requirement to include per share brokerage commission costs in fund prospectuses (beginning in 1996) was a laudable first step. However, a better measure would be brokerage commissions as a percentage of assets. With this information, fund shareholders would be able to compare total expenses across funds. Currently, fund shareholders are not only generally unaware that brokerage commissions are a separate charge, levied on top of the expense ratio, but they are also unable to get helpful information on these hidden expenses.

More radically, converting soft dollars into hard dollars, i.e., requiring fund managers to pay true trading costs and to pay explicitly for research could increase accountability. (For instance, in 1995, the Teachers Insurance and Annuity Association-College Retirement Equities Fund (TIAA-CREF) discontinued its soft dollar arrangements with brokers and decided to pay directly for services.) By unbundling the research services from the trading services, mutual fund managers could again be held directly accountable for using only those brokers who offer best execution. Managers would not have to make the tricky tradeoff between execution and reimbursed services. Moreover, once fund providers have to pay for research out of their own budgets, efficiency might increase as well. With the current indirect system, a temptation can exist to "use up" soft dollars on potentially only marginally valuable services. Since many brokers are already using third-party service providers, it appears to make little difference whether brokers pay for these services, using soft dollars, or fund providers pay for these services directly.

The third key finding is that the amount of expense shifting appears to be larger for retail funds than for institutional funds. Two non-exclusive explanations for this result can be given. First, institutional investors may have more bargaining power and higher monitoring incentives than individual investors. As Grossman and Hart [1980] and Shleifer and Vishny [1986] have pointed out, a dispersed ownership

structure can lead to low monitoring levels, since individual investors bear the full monitoring costs, yet reap only a small fraction of the benefits. This argument would apply more directly to retail funds, which are owned by large numbers of small individual investors, than to institutional funds with fewer and larger investors. Second, and related to the first explanation, institutional investors might be better informed. Studies on retail investors have shown that many investors have no clear picture of the expenses charged by funds. For instance, Capon, Fitzsimons, and Prince [1996] found that 39% of all investors did not know whether their investments were in load funds or in no-load funds. A similar concern about the small knowledge that investors appear to have with respect to the fees they are paying has prompted the United States General Accounting Office to suggest that mutual funds be required to add further expense disclosures on semi-annual mutual fund statements (United States General Accounting Office [2000]).

The fourth key finding is that, in contrast to customer buyer and information, competition among fund providers appears to play no role in moderating the relative balance between the two agency relationships that fund providers find themselves in. No ameliorating effect of competition can be found with respect to expense shifting. This result suggest that competition alone may not solve the agency problem for clients.

The question arises in how far the results of this study are transferable to other service sectors, such as law and consulting, in which firms find themselves in similar two-sided agency relationships, being caught between two sets of principals, the clients and the owners.[6] At least with respect to the (missing) role played by competition, I would hypothesize that similar results might be found in other settings. Within each mutual fund category, mutual funds are fairly homogenous products. If in this setting

[6] Young consultants and law associates often face the question of whether to charge clients yet another hour—a profit maximizing strategy that might please the owners of their firms, yet may not be in best interest of their clients. The medical profession has a long history of combating this problem by instilling its practitioners with a deeply-respected ethos. Part of the Hippocratic oath reads: "I will apply, for the benefit of the sick, all measures which are required, avoiding those twin traps of overtreatment and therapeutic nihilism." In other professions, the practice of profit-enhancing "overtreatment" of clients may have been seen as good business practice.

competition does not play a role, it would appear unlikely that in other settings, in which services are more differentiated, competition would have a more powerful effect.

In the context of the mutual fund industry, the results indicate that fund providers are maximizing short-term profits. Higher fees not only raise the revenues on the existing assets under managements, but also, as Barber, Odean, and Zheng [2002] show, higher fees do not have a negative effect on future fund inflows. Rather, as they show, 12b-1 fees and cash inflows might even be positively correlated. Thus, charging 12b-1 fees appears, at least in the short-run, to be profit-enhancing for the owners of fund providers.

Whether the practice of expense shifting is profit-maximizing in the long-run, however, is an open question. Given the current increased sensitivity of investors with respect to governance, accountability, and disclosure, the practice of shifting expenses either via soft dollars or 12b-1 fees, especially if it raises expenses to investors without their knowledge, could develop into a serious problem for mutual fund providers. Both the SEC and the General Accounting Office are currently focusing their attention on fund sales practices and fee disclosures (Lucchetti [2003]). While expense shifting practices may be profit enhancing in the short run, the potential long-run consequences of these practices in an industry that has been build on a trust relationship between investors and fund providers should give fund providers reason to pause.

Table 1: Summary Statistics

The table below shows summary statistics for selected years of the mutual funds that were included in the analysis. For the analysis of 12b-1 fees, the CRSP data set was used. For the analysis of soft dollars, the Morningstar sample was used.

	1993 CRSP Sample		**1996 CRSP Sample**		**1999 CRSP Sample**		**2002 CRSP Sample**		**1996 Morningstar Sample (equity funds only)**	
	mean	stdv	mean	stdv	mean	stdv	mean	stdv	mean	stdv
fund size ($ millions)	464.6	1265.3	399.1	1590.9	536.0	2701.6	389.9	1884.9	581.0	2219.6
expense ratio (%)	1.047	0.630	1.209	0.655	1.300	0.772	1.363	0.745	1.503	0.603
12b-1 ratio* (%)	0.353	0.289	0.525	0.349	0.580	0.349	0.598	0.344	0.619	0.348
front loads (%)	1.708	2.280	1.257	2.047	1.149	2.055	1.098	2.041	1.534	2.291
back-end loads (%)	0.483	1.209	0.780	1.607	0.904	1.710	1.004	1.756	0.914	1.767
age (years)	9.092	9.808	7.260	7.891	7.925	7.340	8.762	7.270	7.987	10.625
volatility	0.016	0.016	0.019	0.017	0.031	0.028	0.035	0.025	-	-
provider size ($ millions)	30810.8	52627.4	46247.1	80017.7	80136.4	146876.8	69603.0	123688.8	27259.4	56543.6
provider categ. size ($ millions)	1277.0	4473.6	1823.4	8440.2	4202.7	21559.2	3280.8	12881.7	2537.7	8255.4
concentration	0.134	0.124	0.139	0.120	0.130	0.112	0.120	0.108	0.105	0.050
density	0.003	0.006	0.003	0.008	0.002	0.005	0.002	0.004	0.002	0.001
fund providers	78.445	73.821	82.935	76.331	107.844	96.895	123.582	102.146	117.661	65.586
observations	3730		7745		10872		13652		2315	

*only for funds that charge a 12b-1 fee

volatility is measured by the standard deviation of monthly returns of the respective fund; *concentration* is measured by the sum of the squared market shares of all fund providers who offer funds within a particular category in a particular year; *density* is measured by the number of fund providers within a particular category divided by the total assets within that category in the particular year; *fund providers* is the number of fund providers who offer funds in a particular category in the particular year.

Table 2: Regression results

The expense ratio of each fund is regressed on the 12b-1 ratio (the 12b-1 fee expressed as a percentage of assets). As control variables are included: the front- and the back-load expressed as a percentage of assets, the logarithm of fund age, the past performance of the fund measured by the difference between the fund's prior year's return and the average return of its category in the prior year, the volatility of the fund's portfolio measured by the standard deviation of the fund's monthly returns in the respective year, the amount of cash held by the fund expressed as a percentage of total assets, the size of the fund provider measured by the logarithm of total provider assets, and the logarithm of the assets held by the fund provider in all funds in the same category as the focal fund. To take differences across categories and time into account, variables are centered around their yearly category mean. For instance, the dependent variable is the difference between a fund's expense ratio in year *t* and the mean expense ratio of all funds in that fund's category in year *t*. Similar differencing is performed for all variables. Regression (1) includes only retail funds. Regression (2) includes only funds sold to institutional investors. Regressions (3a)-(3d) split the entire sample into quartiles based on the *concentration* of each category (see Table 1 for variable definitions). For instance, (3a) contains those funds that belong to the most concentrated categories. Regressions (4a)-(4d) split the entire sample into quartiles based on the *density* of each category. Regressions (5a)-(5d) split the entire sample into quartiles based on the number of *fund providers* in each category. Below the coefficients, robust standard errors are reported.

			concentration				**density**				**fund providers**			
dependent variable:	**retail**	**institutional**	**high**			**low**	**low**			**high**	**few**			**many**
expense ratio	**(1)**	**(2)**	**(3a)**	**(3b)**	**(3c)**	**(3d)**	**(4a)**	**(4b)**	**(4c)**	**(4d)**	**(5a)**	**(5b)**	**(5c)**	**(5d)**
12b-1 ratio	0.839*	0.601*	0.903*	0.905*	0.918*	0.928*	0.896*	0.971*	0.957*	0.904*	0.808*	0.893*	0.905*	0.933*
	0.011	0.061	0.018	0.021	0.019	0.019	0.020	0.016	0.018	0.018	0.020	0.023	0.018	0.019
front-load	0.011*	0.039*	0.012*	0.012*	0.017*	0.020*	0.015*	0.013*	0.018*	0.016*	0.008†	0.015*	0.014*	0.019*
	0.001	0.011	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002
back-load	0.041*	0.095*	0.036*	0.034*	0.038*	0.039*	0.037*	0.025*	0.033*	0.039*	0.044*	0.043*	0.036*	0.035*
	0.002	0.016	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.004	0.004	0.003	0.004
ln(age)	-0.019*	-0.007	0.009	-0.017†	-0.016†	-0.025*	-0.037*	-0.010‡	-0.002	0.000	0.003	0.006	-0.022*	-0.041†
	0.003	0.008	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.006	0.008	0.006	0.006	0.014
past performance	-0.023*	0.010	-0.079*	-0.008	-0.003	-0.005	-0.028	-0.015	-0.060†	-0.050†	-0.097*	-0.037	-0.010	-0.001
	0.006	0.015	0.016	0.019	0.012	0.010	0.015	0.008	0.019	0.018	0.020	0.023	0.009	0.027
volatility	0.246*	0.474‡	0.500†	0.748*	0.417†	-0.039	0.324‡	0.995*	0.817*	-0.116	0.094	0.741†	0.103	0.404†
	0.075	0.186	0.152	0.196	0.161	0.144	0.132	0.174	0.204	0.222	0.234	0.271	0.152	0.123
cash ratio	0.002	0.047‡	-0.019	0.080†	0.033†	-0.030	0.090†	0.099*	0.005	-0.021	-0.081‡	-0.006	0.010	0.077
	0.012	0.021	0.023	0.023	0.011	0.023	0.032	0.022	0.038	0.020	0.033	0.023	0.022	0.045
ln(provider size)	-0.024*	-0.014*	-0.017*	-0.031*	-0.035*	-0.020*	-0.033*	-0.030*	-0.023*	-0.019*	-0.019*	-0.024*	-0.028*	-0.027*

	0.001	0.004	0.002	0.002	0.003	0.003	0.003	0.003	0.002	0.002	0.003	0.003	0.002	0.005
ln(prov. cat size)	-0.021*	-0.019*	-0.041*	-0.025*	-0.013*	-0.023*	-0.014*	-0.030*	-0.028*	-0.033*	-0.027*	-0.023*	-0.021*	-0.020†
	0.001	0.003	0.003	0.002	0.003	0.002	0.003	0.003	0.002	0.003	0.003	0.002	0.002	0.006
intercept	0.024*	-0.106*	0.004	0.004	0.011†	0.005	0.016*	0.005	0.002	0.003	0.004	0.005	0.006	0.016†
	0.003	0.010	0.004	0.003	0.004	0.003	0.004	0.003	0.003	0.004	0.004	0.004	0.004	0.005
N	79273	10613	22390	22690	22287	22519	22653	22337	22413	22482	21831	22977	22234	22844
Wald χ^2	21779*	1132*	8644*	9630*	9075*	11150*	8548*	12585*	12127*	7825*	5425*	7604*	9860*	8028*

significance levels: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$

Table 3: Pass-through parameters at different levels of competition for retail and institutional funds

This table contains the regression estimates of the coefficient on the 12b-1 ratio from regressions similar to those described in Table 2. (The coefficients of the other variables are suppressed for sake of space.) The top panel contains the results of regressions akin to (3a)-(3d) of Table 2. In this table, however, the sample is first split by retail and institutional funds, and then within each sub-sample into quartiles based on *concentration*. The middle panel is akin to (4a)-(4d) of Table 2, while the bottom panel is akin to (5a)-(5d). In each case, the data is first split by retail and institutional funds before splitting it further into four sub-samples each. Below the coefficients, robust standard errors are reported.

concentration

	high			**low**
retail	0.841*	0.815*	0.839*	0.853*
	0.021	0.027	0.030	0.019
institutional	0.410*	0.461*	0.933*	0.536†
	0.114	0.142	0.109	0.173

density

	low			**high**
retail	0.769*	0.853*	0.816*	0.866*
	0.027	0.026	0.029	0.021
institutional	0.807*	0.710*	0.284†	0.431*
	0.118	0.109	0.107	0.130

fund providers

	few			**many**
retail	0.812*	0.845*	0.759*	0.783*
	0.020	0.033	0.025	0.026
institutional	0.683*	0.312†	0.498*	0.437‡
	0.092	0.109	0.153	0.194

significance levels: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$

Table 4: Pass-through parameters for retail and institutional funds split by fund type

This table contains the regression estimates of the coefficient on the 12b-1 ratio from regressions similar to those described in Table 2. (The coefficients of the other variables are suppressed for sake of space.) For this robustness analysis, equity, bond, and money-market funds are analyzed separately. For each group, five regressions are estimated. The first regression contains all funds of the respective sub-sample (e.g., all retail equity funds). These estimates can be found in columns (1a) and (1b). Each sub-sample is then further divided into four groups by the quartile values of variable *concentration*. These estimates can be found in columns (2a)-(5a) and (2b)-(5b). For instance, the first entry in column (2a) contains retail equity funds that belong to the most concentrated categories. Below the coefficients, robust standard errors are reported.

retail funds					**institutional funds**				
(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
	concentration					**concentration**			
equity funds	**high**			**low**	**equity funds**	**high**			**low**
0.800*	0.870*	0.851*	0.892*	0.811*	0.357*	0.248‡	0.248	0.507‡	0.248
0.019	0.032	0.055	0.032	0.034	0.100	0.120	0.206	0.220	0.133
bond funds	**high**			**low**	**bond funds**	**high**			**low**
0.772*	0.811*	0.843*	0.841*	0.829*	0.412*	0.305‡	0.171	1.240*	0.998*
0.018	0.031	0.036	0.042	0.034	0.115	0.127	0.100	0.142	0.182
money market funds	**high**			**low**	**money market funds**	**high**			**low**
0.635*	0.760*	0.736*	0.523*	0.535*	0.636*	0.342‡	0.686‡	0.836†	0.575†
0.034	0.060	0.091	0.109	0.068	0.088	0.133	0.288	0.294	0.190

significance levels: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$

Table 5: Pass-through parameters for funds that switch to charging 12b-1 fees

The analysis reported in this table involves funds that switch from having no 12b-1 fee in year *t-1* to having a 12b-1 fee in year *t*. Denote with exp_t the expense ratio of a fund in year *t*, exp_{t-1} the expense ratio of a fund in year *t-1*, and tw_t the 12b-1 fee in year *t*. The row labeled "raw data" contains the percentage of the 12b-1 fee that is reflected in an increase in the expense ratio, i.e., $(exp_t - exp_{t-1})/ tw_t$. The rows labeled "strat-diff" and "matched" take into account that funds that switch may not be a random sample. Using matching techniques based on propensity scores as described by Dehejia and Wahba [1999] and [2002], I match funds that switched to charging a 12b-1 fee in year *t* with funds that looked very similar in year *t-1* but that did not adopt a 12b-1 fee in year *t*. As described in detail in Appendix 1, funds are grouped into strata containing funds of both types (switchers and non-switchers) that are similar in their *t–1* propensity to adopt a 12b-1 fee in year *t*. Moreover, within each stratum, the expense ratio of both types of funds is not significantly different in year *t–1*. Using two approaches, I compare the expense ratios of both types of funds in year *t*. First, I compute the average difference between the expense ratios of both types of funds within each stratum for year *t* and weight the differences by the number of switchers within each stratum. This difference is then divided by the average 12b-1 fee in year *t* of those funds that switched (results reported in columns titled "strat-diff"). Second, I match each fund that switched with that fund that had the closest propensity score but did not switch, and compute the average differences between the expense ratios for all pairs in the respective year. This difference is then again divided by the average 12b-1 fee in year *t* of those funds that switched (results reported in columns titled "matched"). For the bottom panel, before conducting the matching procedure, funds are divided into two sub-samples; funds belonging to categories with below-median and above-median value of *concentration*.

	retail funds that switch		**institutional funds that switch**	
	full sample (N = 1036)		**full sample (N = 61)**	
raw data	0.333*		0.036	
strat-diff	0.363*		0.186	
matched	0.350*		-0.003	
	low concentration	**high concentration**	**low concentration**	**high concentration**
strat-diff	0.427*	0.248†	0.093	0.119
matched	0.314*	0.395*	0.072	0.104

significance levels: * $p < 0.001$, † $p < 0.01$

Table 6: Test of substitution between explicit expenses and brokerage costs

For all equity funds with brokerage commission data in 1996, the brokerage ratio is regressed on the expense ratio and other control variables. The brokerage ratio is defined as the brokerage commissions paid by the fund divided by the dollar amount traded. Control variables include the 12b-1 ratio, the front and the back-load, the fund's portfolio turnover, the logarithm of the fund's total assets, the cash ratio, the market share of the fund within its Morningstar category, the logarithm of the fund's age, and dummies for Morningstar categories and for each fund provider. Regression (1) includes only retail funds. Regression (2) includes funds only sold to institutional investors. Regressions (3a) and (3b) split the entire sample by the median value of *concentration*. For instance, (3a) contains those funds that belong to categories with above-median *concentration*. Regressions (4a) and (4b) contain only retail funds and split this sub-sample by the median value of *concentration*. Regressions (5a) and (5b) contain only institutional funds and split this sub-sample by the median value of *concentration*. Below the coefficients, robust standard errors are reported.

			all funds **concentration**		*retail funds* **concentration**		*institutional funds* **concentration**	
dependent variable: brokerage ratio	**retail (1)**	**institutional (2)**	**high (3a)**	**low (3b)**	**high (4a)**	**low (4b)**	**high (5a)**	**low (5b)**
expense ratio	0.047‡	0.001	0.052º	0.079†	0.051º	0.076‡	0.062	0.094
	0.021	0.074	0.030	0.030	0.031	0.033	0.154	0.104
12b-1 ratio	-0.098*	-0.019	-0.110†	-0.102‡	-0.109†	-0.126†	-0.087	-0.101
	0.027	0.116	0.037	0.043	0.041	0.048	0.204	0.163
front-load	0.003	-0.011	0.005†	0.003	0.006‡	-0.001	-	0.006
	0.002	0.007	0.002	0.003	0.003	0.003	-	0.008
back-load	0.005‡	-	0.008†	0.002	0.009†	0.002	-	-
	0.002	-	0.003	0.004	0.003	0.004	-	-
turnover	-0.027*	0.005	-0.023	-0.034*	-0.023	-0.037*	-0.021	0.015
	0.006	0.024	0.015	0.010	0.015	0.010	0.077	0.040
ln(assets)	0.002	0.004	0.000	0.003	-0.001	0.002	0.014	0.009
	0.003	0.006	0.004	0.006	0.004	0.007	0.011	0.022
cash ratio	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001	-0.004º
	0.002	0.002	0.002	0.002	0.002	0.002	0.006	0.002
market share	-0.072	-0.329	0.015	0.612	0.039	0.684	-2.980	3.528
	0.193	2.111	0.128	0.642	0.128	0.675	2.384	10.511
ln(age)	-0.002	0.028	-0.004	0.005	-0.005	0.001	0.009	0.019

	0.006	0.023	0.008	0.009	0.009	0.009	0.035	0.065
constant	0.036	0.244^{o}	0.567	-0.017	0.580	0.058	0.037	-0.103
	0.051	0.130	0.394	0.070	0.404	0.069	0.374	0.139
category dummies	included	included	included	included	included	included	included	included
provider dummies	included	included	included	included	included	included	included	included
N	2126	189	1154	1161	1079	1047	75	114
R^2	0.478	0.697	0.596	0.489	0.591	0.491	0.921	0.743

significance levels: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$, ^{o} $p < 0.1$

Appendix 1: Propensity score matching

The aim is to estimate the effect on the expense ratio of adopting a 12b-1 fee. This is akin to estimating a general "treatment" effect. The following draws on the expositions by Dehejia and Wahba [1999] and [2002]. Let R_{i1} be the expense ratio of a fund that has adopted a 12b-1 fee, and R_{i0} be the expense ratio of the same fund had it not adopted the 12b-1 fee. Let $T_i = 1$ if fund *i* adopts a 12b-1 fee, zero otherwise. For the treated population, we want to estimate

$$\tau_{|T=1} = E(R_{i1}|T_i = 1) - E(R_{i0}|T_i = 1)$$

While we can estimate $E(R_{i1}|T_i = 1)$, we cannot estimate $E(R_{i0}|T_i = 1)$. However, Rubin [1977] observed that if treatment is solely determined by observable variables X_i, i.e., $\{(R_{i1}, R_{i0}) \perp T_i\}|X_i$ (where $\perp$ stands for independence), then

$$\tau_{|T=1} = E_X[E(R_{i1}| X_i, T_i = 1) - E(R_{i0}| X_i, T_i = 0)| T_i = 1] \quad \text{(A1)}$$

Thus, the population treatment effect for the treated is equal to the treatment effect conditional on covariates X and assignment to treatment, averaged over the distribution of the covariates given treatment. With high-dimensional covariates, estimating (A1) directly becomes difficult. However, as Rosenbaum and Rubin [1983] show, conditioning on a one-dimensional propensity score is sufficient, since

$$\{(R_{i1}, R_{i0}) \perp T_i\}|X_i \Rightarrow \{(R_{i1}, R_{i0}) \perp T_i\}|p(X_i)$$

where $p(X_i)$ is the propensity score, or the probability of a unit i having been assigned treatment, i.e., $p(X_i) = Pr(T_i = 1|X_i) = E(T_i|X_i)$. Hence,

$$\tau_{|T=1} = E_{p(Xi)|Ti=1}[E(R_{i1}| p(X_i), T_i = 1) - E(R_{i0}| p(X_i), T_i = 0)| T_i = 1] \quad \text{(A2)}$$

To use (A2), a propensity score has to be estimated. The estimation strategy proposed by Dehejia and Wahba [2002] rests on Rosenbaum and Rubin's [1983] finding that $X_i \perp T_i|p(X_i)$, i.e., conditional on the propensity score, the covariates are independent of assignment to treatment. I start with a parsimonious logistic function with linear covariates to estimate the score. Observations are then ranked by their propensity score and split into strata such that within each stratum the difference in score between treated and non-treated is insignificant. Then, within each stratum it is tested whether all covariates are insignificantly different between treated and non-treated. If this is not

the case, the stratum is too coarsely defined and split. This process is repeated until all strata have balanced covariates.

In the current application, "treatment" corresponds to whether or not a firm adopts a 12b-1 fee in year *t* (after not charging a 12b-1 fee in year *t-1*). Call a fund that adopted a 12b-1 fee in year *t* "treated," and a fund that did not adopt a 12b-1 fee "non-treated." I estimate propensity scores in year *t–1* for all funds that are not charging a 12b-1 fee. The eventual logistic regression includes fund size, past fund performance, the cash ratio, and the category-adjusted expense ratio. Including the category-adjusted expense ratio as a covariate guarantees that conditional on the propensity score, the category-adjusted expense ratios of treated and non-treated funds are not significantly different in year *t–1*. I then estimate (A2) using two approaches suggested by Dehejia and Wahba [1999]. First, I compute the difference between the category-adjusted expense ratio of treated and non-treated funds within each stratum for year *t* and weight the differences by the number of treated funds within each stratum. Second, I match each treated fund with the untreated fund that has the closest propensity score to the treated fund. (The matching procedure is with replacement, i.e., the same non-treated fund may be matched to different treated funds.) I then take the differences between all pairs and conduct a paired t-test on the differences.

Appendix 2: The magnitude of soft-dollars

One should note that the magnitude of soft dollars, which were assessed as described in this Appendix, do not play any direct role in the regression estimation of whether soft dollars are used to shift expenses. The purpose of this Appendix is merely to provide further background on the incidental calculation of the magnitude of soft dollars.

In the sample, the average equity fund engaged in $803 million of trades and paid $961,000 in brokerage commissions. To get an estimate of the commission rate paid per share, one needs to know the average share price that was paid. The market-value weighted average stock price of the 2,793 securities listed on the NYSE was $40.32 for January 1996 and $45.10 for December 1996.[7] Assuming an average of $43, this implies a 5.1¢ commission per share. This estimate is in line with the 5.0¢ per share that are reported for institutional clients by Abel/Noser Corp., a brokerage firm in New York (Blume [1994]), the results of Livingston and O'Neil [1996], who estimate 6.2¢ for a $45 share, and Greenwich Associates who report an average commission of 6.0¢ a share for 1995 (Scotti [1996]).

To obtain an estimate of the amount of soft dollars paid, I compared the actual brokerage commissions paid by fund managers, which include soft dollars, to the brokerage commissions that investors pay for pure trades. To assess brokerage commissions for pure trades, I collected the brokerage commission schedules (as of January 1998) of 38 on-line brokerage houses (list available from the author). Commission schedules fall roughly into two classes: a) a flat fee regardless of trade size (15 brokerage houses) and b) a flat fee plus a per share fee, e.g., $14.95 for the first 1,000 shares plus 3¢ per share for any shares beyond 1,000. With these schedules, the commissions are dependent on both trade size and average share price. In a study on institutional trades involving 37 large money management firms, Chan and Lakonishok [1993] report median trade sizes of $79,000 for buys and $94,000 for sells. In their data the average share price is $36.50. Thus, adjusting for the rise in stock prices and assuming that the lot sizes are about the same, a rough estimate for the value of the median trade is $100,000.

With a share price of $43 and a trade size of $100,000 an individual investor would have paid on average 1.41¢ per share. (Median commissions are lower than average commissions and would have produced even lower

[7] This weighted average excludes Berkshire Hathaway, which had a share price of over $33,000. Including Berkshire yields a market-value-weighted average share price of $213 for 1996. The average share price for November 1997, again excluding Berkshire, was $56.46.

estimates.) Using the average commission rates only for the 23 brokers that do not offer a flat rate would imply 1.98¢ per share.

These estimates are in line with other studies. Bergsman [1996] notes that "most studies report that if one did pure trades, the actual cost is somewhere between 1 and 3 cents a share." Another verification of the estimates can be obtained by looking at the per-share brokerage commission fees of funds that do not deal with soft dollar brokerage houses, such as the Vanguard index funds. For instance, in 1996, Vanguard's Index 500 fund paid on average 1.66¢ per share, the Growth Portfolio Index fund 1.83¢, the Value Portfolio 1.88¢ and the Total Stock Market Index fund 2.16¢ (*Vanguard Index Trust Annual Report*, December 1997). The previous calculations implied that the average fund manager paid 5.1¢ per share. Thus, if one assumed that fund managers were able to obtain similar commission rates as individual investors, one would estimate that fund managers receive back about 3¢ per share in form of soft dollars, or a 60% rebate.

A different way to express these results is to compute how many dollars of brokerage commission "buy" one soft dollar. For the average equity fund in the sample, the calculations imply that a fund manager paid $1.38 in commissions for every $1 of services. More conservatively, using only the commission fees of brokers that do not offer a flat fee, the conversion rate would be estimated to be 1.63.

In these estimates, it is assumed that a fund manager pays the same commission as an individual investor. If fund managers were to get, however, better trade execution than individual investors, then they could (legitimately) pay a premium. Unfortunately, the available data do not allow us to gauge trade execution. However, Chan and Lakonishok [1993], studying the impact of institutional trading on stock market pricing, report that there appears to be no substitution between better commission prices and price impact. Moreover, some industry observers have claimed that the soft dollar practice can actually lead to inferior trade execution. Since fund managers have to direct some of their trades to brokers with whom they have soft dollar agreements, fund managers are actually not always able to direct trades to those brokers they might believe to offer best execution for a particular trade (Schroeder [1994]; Davis [1995]).

Appendix 3: Computation of trade dollars

The turnover reported by funds is formally defined as the lesser of purchases or sales divided by the fund's average assets. For a fund with a positive net inflow, the value of securities bought exceeds the value of securities sold. Thus, in this case, the fund's turnover represents the percentage of assets sold. For this fund, multiplying the turnover by average assets yields the dollar amount of securities that the fund sold. For the same fund, the dollar amount of securities bought can be computed as the amount sold plus the net inflows. Conversely, for a fund with net outflows, the dollar amount bought equals the turnover times average assets; and the dollar amount sold equals the amount bought minus the net flows (which are negative).

What remains to be computed are the net cash flows, which can be obtained by adjusting the change in asset size of the funds for appreciation (or depreciation) of existing assets. In computing net flows, I take into account that flows are neither occurring completely at the end nor at the beginning of the year. As a compromise, it is assumed that flows occur at a constant rate over the year. Moreover, it is also assumed that the returns of the fund are constant over the year. Let *r* be the annual return, and ρ the corresponding continuously compounded return, i.e., $e^{\rho} = 1 + r$. One dollar that flows into a fund at a constant rate and is compounded instantaneously at the rate ρ grows to: $\int_0^1 e^{\rho(1-t)} dt = \frac{e^{\rho} - 1}{\rho} = \frac{r}{\ln(1+r)}$

Let $\delta = \frac{r}{\ln(1+r)}$ and let *fund size*$_t$ stand for the size of the fund at the end of year *t*, then

$$\text{net flow}_t = \frac{\text{fund size}_t - (1 + r_t)\text{fund size}_{(t-1)}}{\delta}$$

$$\text{sell}_t = \begin{cases} \text{if net flow}_t > 0 : (\text{turnover}_t)(\text{average fund size}_t) \\ \text{if net flow}_t < 0 : (\text{turnover}_t)(\text{average fund size}_t - \text{net flow}_t) \end{cases}$$

$$\text{buy}_t = \begin{cases} \text{if net flow}_t > 0 : (\text{turnover}_t)(\text{average fund size}_t) + \text{net flow}_t \\ \text{if net flow}_t < 0 : (\text{turnover}_t)(\text{average fund size}_t) \end{cases}$$

and *trade dollars*$_t$ = *buy*$_t$ + *sell*$_t$

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