

The Sources of Scale Economies Within Large Mutual Fund Families

by

David A. Latzko
Business and Economics Division
Pennsylvania State University, York Campus

1031 Edgecomb Avenue
York, PA 17403 USA

phone: 717-771-4115
fax: 717-771-4062
e-mail: DXL31@psu.edu

Abstract

Since some mutual fund expenses are fixed costs, asset growth may reduce the ratio of fund expenses to average net assets. Utilizing a sample of eight large mutual fund families, I estimate a translog cost function to evaluate the existence and sources of economies of scale in mutual fund complex administration. Just two families, American and Fidelity, exhibits scale economies on average. Investment management and distribution expenses both tend to be subject to diseconomies of scale. The reliable sources of scale economies are some of the “other” administrative expenses, but these make up a small portion of total costs.

The Sources of Scale Economies Within Large Mutual Fund Families

Understanding mutual funds as an industry requires an understanding of the costs of operating a fund. All mutual funds have expenses. Since some of these expenses are fixed costs, there are potentially enormous economies of scale in managing money. Several researchers have, in fact, found that there are scale economies in the administration of open-end mutual funds (Ferris and Chance, 1987; McLeod and Malhotra, 1994; Malhotra and McLeod, 1997; Latzko, 1999; Rea, Reid, and Millar, 1999; Securities and Exchange Commission, 2000). While these studies speculate upon the possible causes of mutual fund scale economies, they do not investigate the sources of these cost economies. In this paper I attempt to discover the sources of mutual fund economies of scale by examining the relationship between fund assets and the various categories of fund expenses.

Malhotra and McLeod (1997) note that funds in the same family tend to share expenses such as computer, telephone, and shareholder accounting systems. Therefore, funds that are part of a mutual fund family ought to obtain greater economies of scale than can be explained solely by fund size. The greater the amount of assets managed by a fund complex, the greater the possible scale economies and consequent reduction in the average costs of family members. Indeed, Baumol, Goldfeld, Gordon, and Koehn (1990) and Collins and Mack (1997) find that mutual fund complexes exhibit scale economies.

This suggests an advantage in utilizing mutual fund families to investigate the sources of economies of scale in mutual fund administration: any family complex effects are held constant. A second advantage is the consistency of expense accounting within a fund family. This consistency allows for a finer degree of cost disaggregation making it possible to more accurately pinpoint which costs are subject to scale economies. I utilize a sample of eight large mutual fund families (AIM, American, Fidelity, Janus, MFS, T. Rowe Price, Putnam, and Vanguard) in order to evaluate the existence and sources of economies of scale in mutual fund complex administration. The single family approach risks

unrepresentativeness, though several commonalities across the major expense categories among the eight families are uncovered in the results below.

I find little evidence of widespread economies of scale in mutual fund administration. Of the eight large mutual fund families examined, only Fidelity and American exhibit scale economies on the average dollar invested and only Fidelity has a downward sloping average cost curve over the entire range of fund assets. This suggests that investors have perhaps failed to benefit cost-wise from the rapid growth in net assets experienced by the mutual fund industry in recent years and that the very largest funds have surpassed the minimum efficient scale.

Investment management fees, typically the largest single cost category, are subject to strong diseconomies of scale. This is surprising since the management fee is either a fixed percentage of fund assets, a declining percentage of fund net assets, or contains a group fee based on total family assets which, according to the prospectus for the Fidelity Aggressive Growth Fund (2000, p. 22) for example, “drops as total assets under management increase.” Only the Vanguard Group realizes significant scale economies on this expense.

While intended to attract assets into funds thereby making economies of scale possible, marketing and distribution fees uniformly exhibit diseconomies of scale among the five fund families reporting these expenses. The reliable sources of scale economies are the “other” administrative expenses, especially auditing fees, custodian fees, and legal expenses. Auditing fees are the greatest source of potential economies of scale for those families reporting this expense.

The remainder of the paper is organized as follows. Section I discusses the various categories of mutual fund expenses. Section II describes the empirical model used to examine the existence of economies of scale. Section III discusses the data sources. The results are presented in Section IV. Section V concludes.

I. Mutual Fund Expenses

Three major categories of mutual fund expenses are paid out of fund assets. The first and generally largest is the management fee paid to the fund's investment advisor. Second is the 12b-1 distribution fee spent on advertising, marketing, and distribution services or on commissions to sales representatives. Third are the "other" administrative expenses resulting from the provision of record keeping and transaction services to shareholders. These services include providing statements and reports, disbursing dividends, providing custodial services, and paying state and local taxes, auditing, legal, and directors' fees.

The investment advisory fee compensates the fund's manager for the expenses it incurs for providing its services, including security research and analysis. The advisor's profit also comes out of the management fee. The investment advisory fee is a fixed percentage amount deducted from fund assets over the year, although some funds have performance-related management fees. Even though Herman (1963) found that management fees were not significantly responsive to variations in asset size, it seems improbable these costs could grow at the same rate as fund assets. It might be more difficult and costly to manage a large portfolio than a small one, but it does not seem likely that it would cost ten times more to manage a \$500 million fund than a \$50 million portfolio.¹

The 12b-1 fee is named after the SEC rule allowing mutual funds to pay marketing and advertising costs directly out of fund assets. The fee can range from 0.25 percent to 1.25 percent of net assets. The purpose of 12b-1 fees is to increase fund assets. By attracting investors into the fund, 12b-1 fees make scale economies possible, but the fees themselves only add to a fund's expenses. Ferris and Chance (1987), Chance and Ferris (1991), McLeod and Malhotra (1994), and Malhotra and McLeod (1997) all find that 12b-1 plans raise expense ratios.

¹Apropos to the difficulty of managing a large fund, Carhart (1997) finds that a fund's performance is unrelated to its size.

The remainder of fund expenses is for operating costs and shareholder services. The major operating expenses are the fees associated with registering the fund shares sold each year with the SEC, the custodial fees which cover the costs of settling trades and holding fund assets, and the accounting, auditing, and legal costs of running the fund. Shareholder servicing costs are the expenses related to shareholder communications such as responding to shareholder inquiries and printing and distributing fund prospectuses and reports. Other shareholder servicing costs include transfer agent fees which cover the cost of maintaining accounts, processing transactions, and generating shareholder statements. The transfer agent is usually paid for its services on a per-account basis.

It is some of these other administrative expenses that are potentially subject to large economies of scale. For example, since the transfer agent is paid per-account the cost of maintaining shareholder accounts is the same for all shareholders, regardless of the size of their account. Suppose the annual cost of maintaining an account is \$10 and that the mutual fund has 100,000 shareholders. If the fund has \$100 million in assets (an average of \$1,000 per account), then the transfer agent fees are 1.0 percent of fund assets. But, if total assets are \$250 million (an average account of \$2,500), then transfer agent expenses are 0.4 percent of fund assets. This expense ratio, the average cost of maintaining shareholder accounts, falls as fund assets rise.

II. Model Specification

The cost function of a mutual fund is modeled as a translog function. The advantage of the translog cost function is that it allows scale economies to vary with the level of fund assets.² The translog cost function takes the form

$$(1) \quad \ln \text{COST} = \alpha_0 \ln \text{ASSETS} + 1/2 \alpha_1 (\ln \text{ASSETS})^2 + \sum_j \alpha_j X_j + e,$$

² It is for this reason that the translog function is often used in economies of scale research: banks (Noulas, Ray, and Miller, 1990), real estate investment trusts (Bers and Springer, 1998), electrical power generation (Christensen and Greene, 1976), and police departments (Gyimah-Brempong, 1987).

where COST is the fund's operating expenses, ASSETS equals total fund net assets, X_j is a vector of fund characteristics that may affect costs, and e is a random error term. The vector X_j is included to control for factors that affect the costs of managing and administering a mutual fund. Just one control variable is used in what follows: the average expense ratio for funds with the same investment objective as the fund in question.

If there are economies of scale in mutual fund administration, there should be a negative relation between the fund's expense ratio and its net assets. Ferris and Chance (1987), McLeod and Malhotra (1994), and Malhotra and McLeod (1997) all find a negative relationship between fund size and the expense ratio. However, they each consider only two categories of funds, utilizing dummy variables for growth and income funds or for equity and bond funds. Yet within these broad classifications persistent patterns of differences appear in expense ratios. Some types of funds are just more costly to manage. Global and international funds, for example, often have higher custodial, management, and transactions costs and, therefore, tend to have higher expense ratios than domestic growth and equity income funds with the same amount of assets under management. I add the fund objective average expense ratio to the right-hand side regressors to control for the inherent variations in fund expenses due to differing investment objectives.

III. Data and Sources

I obtained data on funds in the eight largest mutual fund families (Fidelity, Vanguard, American, Putnam, Janus, AIM, T. Rowe Price, and MFS). Information on mutual fund expenses was located in the statement of operations in each fund's periodic financial report. These reports have various 1999 and 2000 dates. Fund net assets are from the report's statement of changes in net assets and are averaged over the period. Investment objective information is from the October 9, 2000 *Barron's Lipper Mutual Funds Quarterly*. A number of funds have issued several classes of shares. These funds' statements of operations do not attribute most expenses to particular classes of shares. Instead, typically all but the

distribution expenses are treated as joint costs. So, I aggregate distribution expenses across share classes and merge all of a fund's classes of shares into a single observation. Table I summarizes the data set.

Using the fund investment objective provided in *Barron's*, I place each fund into one of 14 categories. I place all municipal bond funds in a single category. Since several of the debt and equity investment objective categories contain very few funds, I collapse several categories into groups containing funds with similar investment objectives: "balanced" consists of balanced, balanced target, and flexible funds, "fixed income" contains all the various corporate and U.S. Treasury bond funds, "global" consists of global, global flexible, and global small-cap funds, "income" contains income, convertible securities, and utility funds, "international" consists of international, international small-cap, Canadian, emerging markets, European, and Latin American, Pacific region, Pacific Ex-Japan, Japanese, and China region funds, and "specialty" consists of specialty, telecommunications, environmental, financial services, gold, health/biotech, natural resources, real estate, sector, and science and technology funds. Table II lists the number of funds in each investment objective category along with the arithmetic average expense ratio utilized as the control variable in the translog function.

Cost information for several funds is incomplete so these funds are dropped from the sample. When the empirical model is estimated for each cost category, any observations equal to zero for the specific cost category are deleted.

IV. Results

For each fund family, equation (1) is estimated for total fund expenses as well as separately for the various cost variables. The estimated coefficients of the translog function for total fund expenses are reported in Table III. All coefficients are statistically significant, and the adjusted R-square's are quite high. The fund asset coefficients are positive, implying that total fund expenses rise with assets. The elasticity of cost with respect to assets, the percentage change in cost associated with a percentage change in fund assets, is used to evaluate the existence and extent of scale economies in mutual fund

administration. This elasticity is calculated by taking the first derivative of the translog cost function in equation (1):

$$(2) \quad \partial (\ln \text{COST}) / \partial (\ln \text{ASSETS}) = \alpha_0 + \alpha_1 (\ln \text{ASSETS}).$$

If the cost elasticity is less than one, mutual fund expenses increase less than proportionately with fund assets, implying economies of scale. If the elasticity is greater than one, diseconomies of scale exist, and if the cost elasticity equals one, there are constant returns to scale as fund costs increase proportionately with assets.

One approach to evaluating the existence of scale economies using the cost elasticity is the “average” method (Noulas, Ray, and Miller, 1990). The average method estimates the cost elasticity for each observation and averages across observations to obtain the group average elasticity. Table IV presents the asset-weighted total expenses cost elasticity for each fund family. The asset-weighted average cost elasticity describes the cost economies resulting from the average dollar invested with the mutual fund family. The average dollar invested with a Fidelity or an American fund generates cost scale economies. The T. Rowe Price and MFS families exhibit constant returns to scale on average while the AIM, Janus, Putnam, and Vanguard fund families exhibit diseconomies of scale on the average dollar invested. The economies of scale obtained by these mutual fund families can be summarized by computing the average cost curve facing the typical fund in the family. This is derived by calculating the predicted average costs from the predicted total costs of equation (1) for various fund asset sizes, holding the control variable constant at its mean value. Figure 1 plots the average cost curve for a typical mutual fund in each family complex. Scale economies are available in all families at some fund asset size. Only for the average Fidelity fund do average costs diminish over the full range of fund assets. The other seven fund families have U-shaped average costs curves for the typical fund. The most striking feature in Figure 1 is the near flatness of the average cost curves over a wide range of fund assets. Average costs vary by less than 0.1 cents over a range of assets from \$1,000 million to at least \$10,000 million. The range is much wider for some families.

Examination of the individual cost categories provides insight regarding the sources of overall economies and diseconomies of scale. Table V summarizes the cost economies using an asset-weighted “average” method for various expense categories within each fund family. Recall that economies of scale are observed when the cost elasticity is less than one. Also, the smaller the elasticity, the greater the possible scale economies attainable on that expense.

The overall scale economies actually realized by a fund complex not only depend on the economies of scale obtained on the individual expense categories but also on the importance of these costs in the family’s total cost structure. It is of little import if the greatest potential scale economies are available on a cost that accounts for less than 0.1 percent of total expenses. So, define a cost category’s contribution to scale economies as

$$(3) \quad (1 - \text{cost elasticity}) \times \text{percent of total cost.}$$

Expenses that yield economies of scale will have a positive contribution to scale economies, and the greater this contribution the more that cost category accounts for the fund family’s overall cost economies. Expenses that generate diseconomies of scale will have a negative contribution to scale economies.

A. Fidelity Investments

Fidelity, the largest mutual fund family, is one of just two fund complexes in the sample to obtain cost economies on the average dollar invested. The weighted-average cost elasticity for Fidelity is 0.95 which means that a 10 percent increase in fund assets results in a 9.5 percent increase in the expenses of the average fund. The Fidelity Magellan fund accounts for 18 percent of sampled family total assets. An additional \$100 million dollars, an increase of 0.1 percent, invested into this fund results in an additional \$726,000 in expenses. This lowers the fund’s expense ratio by 0.000009. The Fidelity fund family ought to be able to achieve further scale economies. The median Fidelity fund has less than \$700 million in

assets and Figure 1 indicates that the really rapid decrease in average costs is exhausted at \$3500 million in fund assets. However, 81 percent of family assets are in funds with more than \$3500 million in assets.

Fidelity's largest cost is the management fee, accounting for nearly 70 percent of total expenses. Fidelity shows modest diseconomies of scale on this expense. The greatest potential scale economies are the audit expenses but these amount to just 0.2 percent of family expenses. The calculations in the contribution to scale economies column of Table V indicate that the source of Fidelity's overall economies of scale lies in its major "other" expenses, especially the transfer agent fees, which, while having a cost elasticity of just 0.92, are over a quarter of total expenses. Other cost categories making a large contribution to scale economies are accounting fees and registration fees.

B. Vanguard Group

Vanguard, the second largest fund family, has the lowest expense ratio among the sampled families. But, Vanguard shows the strongest diseconomies of scale, with a cost elasticity of 1.04. An additional \$100 million (a 0.1 percent increase) invested into the largest Vanguard fund results in \$194,000 in additional expenses. This raises the fund's expense ratio by 0.00002, which would not even be reflected in the published ratio. While the average dollar invested with a Vanguard fund results in diseconomies of scale, there are scale economies available to the smaller Vanguard funds. Average costs begin to rise for funds with over \$1500 million in assets; the median fund has a little less than \$1800 million in assets. However, 94 percent of sampled family assets are in funds with more than \$1500 million in assets. So, further growth in family assets is most likely to result in further diseconomies of scale.

Vanguard gets its largest contribution to scale economies, 3.1, from its investment advisory fee. Custodian fees make a small contribution to scale economies. Management and administrative expenses are both Vanguard's largest cost item and its largest source of diseconomies of scale, having a cost elasticity of 1.11 and a contribution to scale economies of -6.9. Vanguard also fails to achieve scale

economies on its other large expenses, shareholder account maintenance and marketing and distribution. Auditing fees represent its greatest potential source of cost economies but these fees account for just 0.1 percent of expenses, so their contribution to scale economies is nearly zero.

C. American Funds

The American Funds family, with a weighted-average cost elasticity equal to 0.99, achieves small economies of scale on the average dollar invested. A 10 percent increase in fund assets leads to a 9.9 percent increase in the expenses of the average fund. An additional \$100 million in the assets of the largest family fund, Investment Company of America, increases its expenses by \$553,000. This increases its expense ratio by 0.000005. Further scale economies are possible for funds in this family. The average cost curve of the average fund does not exhibit diseconomies of scale until \$65,000 million in assets.

The greatest potential source of scale economies for American Funds is auditing and legal fees. These have a cost elasticity of 0.09. However, since they are but 0.1 percent of expenses auditing and legal fees contribute just 0.1 to actual scale economies. The management services fee is the source of American's modest overall cost economies. Distribution and transfer agent fees are large sources of diseconomies of scale.

D. Putnam Investments

The Putnam family realizes a cost elasticity of 1.03, meaning that the expenses resulting from the average dollar invested increase more than proportionately with assets. Average costs increase for funds with more than \$10,000 million in assets. Just four of the 75 funds have more than \$10,000 million in assets, but they contain 51 percent of the Putnam family assets. The largest Putnam fund has \$37,000 million in assets. An additional \$100 million in assets raises its expense ratio by 0.0002, not enough to change the published ratio.

Putnam realizes diseconomies of scale on its five largest expenses: management, distribution, investor servicing, other, and postage. These account for more than 99 percent of total expenses. Only auditing fees make a positive contribution to scale economies.

E. Janus

The Janus family of funds has experienced extremely rapid asset growth over the past several years. So, perhaps it is not surprising that its cost structure has not caught up with its asset base. The average dollar invested with a Janus fund results in slight diseconomies of scale. The total cost elasticity is 1.02. An additional \$100 million invested into the median sized Janus fund, a 2.8 percent increase, results in an extra \$926,000 in expenses. This reduces its expense ratio by 0.0003. Again, this is not enough to affect the published expense ratio. Scale economies are still available to the handful of smaller Janus funds. The average cost curve for the average Janus fund begins to show diseconomies of scale at \$10,000 million in assets. Just four funds have more than \$10,000 million in assets, although they contain 77 percent of family assets.

Janus funds show diseconomies of scale for its two largest expenses, the advisory fees and the transfer agent fees and expenses. Modest scale economies are available on the remaining costs, but these total less than 6 percent of family expenses. Registration fees and custodian fees contribute the most to scale economies, 0.9 and 0.3. The largest source of potential scale economies is the audit fees.

F. T. Rowe Price

T. Rowe Price shows constant returns to scale on the average dollar invested. The total cost elasticity is 1.0. An additional \$100 million in assets results in an extra \$676,000 in operating expenses for the median Price fund. This is a 20.6 percent increase in assets, and the fund's expense ratio would fall by 0.005. Average costs per dollar of fund assets vary by less than 0.005 cents for funds with assets between \$1,000 million and \$10,000 million, a range containing the median sized Price fund. Two funds

have more than \$10,000 million in assets. These two funds account for nearly one quarter of sampled family assets.

T. Rowe Price realizes constant returns to scale on the average dollar invested even though it experiences diseconomies of scale on its two largest expenses, investment management (which has a contribution to scale economies equal to -11.0) and shareholder servicing. All of the remaining administrative expenses provide Price with significant cost economies. Custody and accounting expenses have the largest contribution to scale economies, 1.5 . Legal and audit fees, with a cost elasticity of 0.04 , are the largest potential source of these economies but have an actual contribution of 0.2 .

G. AIM Funds

The AIM family of funds, with a weighted-average cost elasticity equal to 1.01 , experiences very modest cost diseconomies of scale on the average dollar invested. The average cost curve of the typical fund has a positive slope by \$4,000 million in assets. The median AIM fund has around \$400 million in net assets so further scale economies are possible in smaller funds. A \$100 million increase in the assets of the median AIM fund results in an additional \$1.81 million in operating costs. The fund's expense ratio falls by 0.02 .

The AIM family of funds realizes diseconomies of scale on the average dollar invested for its three largest expenses: advisory fees, distribution fees, and transfer agent fees. These have a contribution to scale economies of -2.9 , -0.4 , and -2.1 , respectively. Administrative services fees constitute the largest source of potential scale economies but make up less than one-half percent of total expenses. AIM realizes its largest scale economies on its "other" expenses. These mainly consist of the advisory and administrative fees for the handful of funds that did not expense these fees separately. They have a contribution to scale economies of 4.5 .

H. MFS Investment Management

MFS, the smallest family in the sample, shows constant returns to scale on the average dollar invested. The average cost curve of the typical fund is flat by \$5,000 million in assets. Total expenses rise by \$1.74 million when the median fund's net assets increase by \$100 million (a 37.2 percent increase in assets). This lowers the expense ratio by 0.03. The average cost curve has a positive slope by \$7500 million in fund assets. Three funds have assets in excess of that amount. These account for just 18 percent of sampled family assets.

The management fee, the second largest cost category, shows very slight economies of scale with a contribution to scale economies of 0.4. But, this is dwarfed by the contribution of the distribution and service fees, which are the family's largest expense and show large diseconomies of scale. These have a contribution to scale economies of -7.9 . Auditing fees are the greatest potential source of scale economies. The negative cost elasticity implies that, on average, auditing costs drop as the size of the fund increases.

V. Conclusions

Contrary to previous research (Ferris and Chance, 1987; McLeod and Malhotra, 1994; Malhotra and McLeod, 1997; Latzko, 1999), I find little evidence of widespread economies of scale in mutual fund administration.³ Of eight large mutual fund families, just American and Fidelity exhibit scale economies on the average dollar invested. Two others obtain constant returns to scale. Average costs decline very rapidly for funds in all eight families for asset levels below \$10 billion. So, smaller funds in all families have further scale economies available. However, since the larger funds tend to experience rising average

³ This finding can be reconciled with previous research detecting scale economies because while I calculate an asset-weighted cost elasticity, Latzko (1999) uses an unweighted average. On an unweighted basis, the average fund in all eight families exhibits economies of scale. Unweighted average cost elasticities are 0.89 for Fidelity, 0.94 for MFS, 0.95 for AIM and American, 0.96 for T. Rowe Price, 0.97 for Putnam, and 0.98 for Janus and Vanguard.

costs, the average dollar invested in all but the American and Fidelity families does not result in lower average costs.

The results in Table V show modest scale economies across most cost categories, an unsurprising result given that most fund expenses are variable costs. Each fund family in the sample realizes diseconomies of scale on its largest expense. For Fidelity, Janus, T. Rowe Price, and AIM this is the investment advisory fee. Only Vanguard obtains significant scale economies on investment advisory fees. The American and MFS fund families achieve very slight scale economies on the management fee. Marketing and distribution expenses are a large source of scale economies for the five families reporting this cost category, rising more than proportionately with fund assets. This confirms previous findings that 12b-1 fees raise fund expense ratios.

The largest potential and realized sources of scale economies are within “other” administrative expenses category: accounting, audit, and legal fees, with auditing fees being the greatest potential source of cost economies for those families reporting this expense. Again, this is an unsurprising result since some of these expenses are fixed costs. A surprising result is the diseconomies of scale experienced on transfer agent and shareholder servicing expenses by all fund families except Fidelity. Transfer agent fees are the primary reason the Fidelity fund family obtains total expense scale economies.

Table I. Data Summary

<u>Fund Family</u>	<u>Number of Funds</u>	<u>Total Net Assets</u>	<u>Median Fund Assets</u>	<u>Family Expense Ratio</u>
Fidelity	155	\$546,967,157,338	\$673,396,000	0.67
Vanguard	81	444,087,883,000	1,779,580,000	0.28
American	28	297,029,016,500	6,267,845,000	0.72
Putnam	75	223,018,819,778	823,582,051	1.18
Janus	19	166,253,553,000	3,563,147,000	0.96
T. Rowe Price	65	97,904,970,000	484,396,000	0.79
AIM	55	84,559,419,172	349,645,449	1.42
MFS	56	74,979,945,500	268,652,754	1.32

Notes: Information on mutual fund expenses was located in the statement of operations in each fund's periodic financial report. These reports have various 1999 and 2000 dates. Fund net assets are from the report's statement of changes in net assets and are averaged over the period. The family expense ratio is calculated by dividing total expenses among all the family funds in the sample by family net assets and multiplying by 100.

Table II. Investment Objectives

<u>Investment objective</u>	<u>Number of funds</u>	<u>Average expense ratio</u>
balanced	22	0.88
equity income	9	0.72
fixed income	72	0.90
global	27	1.52
income	9	0.81
international	55	1.67
large cap	35	1.02
midcap	77	0.93
money market	49	0.52
municipal bonds	86	0.75
S&P index	3	0.33
small cap	14	1.03
specialty	64	1.50
world income	12	1.45
full sample	534	1.04

Notes: Table II lists the number of funds in each investment objective category along with the arithmetic average expense ratio. The expense ratio for a fund is calculated by dividing total expenses by net assets and multiplying by 100. Investment objective information is from the October 9, 2000 *Barron's Lipper Mutual Funds Quarterly*. *Barron's* has more than 34 different investment objectives for stock and taxable funds and seven types of municipal bond funds. I place all municipal bond funds in a single category. Since several of the debt and equity investment objective categories contain very few funds, I collapse several categories into groups containing funds with similar investment objectives: "balanced" consists of balanced, balanced target, and flexible funds, "fixed income" contains all the corporate and Treasury bond funds, "global" consists of global, global flexible, and global small-cap funds, "income" contains income, convertible securities, and utility funds, "international" consists of international, international small-cap, Canadian, emerging markets, European, and Latin American, Pacific region, Pacific Ex-Japan, Japanese, and China region funds, and "specialty" consists of specialty, telecommunications, environmental, financial services, gold, health/biotech, natural resources, real estate, sector, and science and technology funds. See page F32 of the October 9, 2000 *Barron's Lipper Mutual Funds Quarterly* for a description of the various investment objectives.

Table III. OLS Estimates of the Translog Total Cost Function by Fund Family

<u>Variable</u>	<u>Fidelity</u>	<u>Vanguard</u>	<u>American</u>	<u>Putnam</u>	<u>Janus</u>	<u>T. Rowe Price</u>	<u>AIM</u>	<u>MFS</u>
Log of fund assets	0.516 (13.47)	0.392 (11.33)	0.541 (26.63)	0.535 (32.82)	0.561 (24.70)	0.488 (26.02)	0.551 (19.28)	0.547 (25.01)
Log of fund assets squared	0.009 (5.74)	0.014 (9.32)	0.009 (10.11)	0.011 (15.40)	0.010 (9.81)	0.012 (13.61)	0.010 (8.05)	0.010 (10.14)
Fund objective average expense ratio	0.998 (7.05)	0.867 (5.99)	0.631 (4.90)	0.571 (7.54)	0.296 (1.94)	0.716 (9.81)	0.629 (6.15)	0.747 (7.35)
Adjusted R ²	0.86	0.91	0.95	0.97	0.93	0.97	0.95	0.96
Standard error	0.66	0.39	0.19	0.23	0.15	0.21	0.28	0.23
number of observations	155	81	28	75	19	65	55	56

Notes: OLS regressions of total fund expenses on three variables: $\ln \text{COST} = \alpha_0 \ln \text{ASSETS} + 1/2 \alpha_1 (\ln \text{ASSETS})^2 + \alpha_2 \text{OBJECTIVE} + e$, where COST denotes total fund operating expenses, ASSETS is total fund net assets, and OBJECTIVE is the average expense ratio for funds with the same investment objective as the fund in question. Data were collected from the statements of operations and changes in net assets in the fund annual reports. t-statistics are in parentheses.

Table IV. Average Elasticities for Total Expenses by Fund Family

<u>Fund Family</u>	<u>Cost elasticity</u>	<u>Standard deviation of elasticity</u>
Fidelity	0.95	.03
Vanguard	1.04	.04
American	0.99	.02
Putnam	1.03	.03
Janus	1.02	.02
T. Rowe Price	1.00	.03
AIM	1.01	.03
MFS	1.00	.03

Notes: Cost elasticities, $\partial (\ln \text{Cost}) / \partial (\ln \text{Assets})$, are calculated using $\alpha_0 + \alpha_1 (\ln \text{Fund Assets})$, where α_0 is the coefficient on the log of fund assets and α_1 is the coefficient on the log of fund assets squared from the regressions of the translog cost functions reported in Table 3. The reported elasticities are the determined using the “average” method (Noulas, Ray, and Miller, 1990). The average method estimates the cost elasticity for each observation and averages across observations to obtain the group average elasticity. Table IV presents the asset-weighted total expenses cost elasticity for each fund family. If the cost elasticity is less than one, mutual fund expenses increase less than proportionately with fund assets, implying economies of scale. If the elasticity is greater than one, diseconomies of scale exist, and if the cost elasticity equals one, there are constant returns to scale as fund costs increase proportionately with assets.

Table V. Cost Elasticities for Cost Categories by Fund Family

Fidelity					
<u>Cost Category</u>	<u>Percent of Total Cost</u>	<u>Cost Elasticity</u>	<u>Standard Deviation</u>	<u>Contribution to Scale Economies</u>	<u>Sample Size</u>
management fee	69.4	1.04	.04	-2.8	155
transfer agent fees	26.8	0.92	.03	2.1	131
accounting fees	1.5	0.51*	.01	0.7	131
registration fees	1.0	0.55*	.00	0.4	130
custodian expenses	0.6	0.66	.02	0.2	127
audit	0.2	0.23	.03	0.2	131
reports to shareholders	0.2	1.02*	.05	-0.0	29
interest	0.1	0.05*	.03	0.1	38
legal	0.1	0.91	.05	0.0	132
miscellaneous	0.1	0.96*	.05	0.0	112
trustees compensation	0.1	1.22	.10	-0.0	150
Vanguard					
<u>Cost Category</u>	<u>Percent of Total Cost</u>	<u>Cost Elasticity</u>	<u>Standard Deviation</u>	<u>Contribution to Scale Economies</u>	<u>Sample Size</u>
management and administrative	62.8	1.11	.05	-6.9	81
account maintenance	14.9	1.01	.02	-0.1	26
investment advisory	13.6	0.77	.02	3.1	81
marketing and distribution	6.2	1.06	.05	-0.4	81
custodian fees	1.4	0.73*	.04	0.4	81
shareholders' reports	1.0	1.02*	.06	-0.0	81
auditing	0.1	0.16	.03	0.1	81
trustees' fees	0.0	1.01	.07	-0.0	72

American

<u>Cost Category</u>	<u>Percent of Total Cost</u>	<u>Cost Elasticity</u>	<u>Standard Deviation</u>	<u>Contribution to Scale Economies</u>	<u>Sample Size</u>
management services	49.1	0.96	.02	2.0	28
distribution expenses	34.5	1.08	.03	-2.8	28
transfer agent fee	11.1	1.15	.03	-1.7	28
postage	2.0	1.13	.04	-0.3	28
custodian fee	1.4	0.94*	.03	0.1	28
registration statement	0.9	0.82	.02	0.2	28
reports to shareholders	0.4	0.64	.01	0.1	28
directors' fees	0.2	0.70	.02	0.1	28
other expenses	0.2	0.84	.02	0.0	23
taxes	0.1	0.15	.01	0.1	25
auditing and legal	0.1	0.09	.03	0.1	28

Putnam

<u>Cost Category</u>	<u>Percent of Total Cost</u>	<u>Cost Elasticity</u>	<u>Standard Deviation</u>	<u>Contribution to Scale Economies</u>	<u>Sample Size</u>
compensation of manager	43.4	1.03	.03	-1.3	75
distribution fees	42.0	1.10	.04	-4.2	60
investor servicing/custodian	11.7	1.06	.04	-0.7	75
other	2.3	1.26*	.07	-0.6	60
postage	0.3	1.38	.11	-0.1	37
compensation of trustees	0.1	0.51*	.00	0.0	75
registration fees	0.1	0.71*	.03	0.0	29
reports to shareholders	0.1	0.54*	.01	0.0	40
auditing	0.1	-0.14	.08	0.1	44
administrative services	0.0	0.81	.03	0.0	75
legal	0.0	0.30	.02	0.0	41

Janus

<u>Cost Category</u>	<u>Percent of Total Cost</u>	<u>Cost Elasticity</u>	<u>Standard Deviation</u>	<u>Contribution to Scale Economies</u>	<u>Sample Size</u>
advisory fees	73.3	1.06	.02	-4.4	19
transfer agent fees	20.9	1.02	.02	-0.4	19
registration fees	2.1	0.57*	.00	0.9	19
custodian fees	1.8	0.85	.03	0.3	19
printing expenses	1.2	0.97	.03	0.0	19
postage and mailing expenses	0.7	0.97	.03	0.0	19
other expenses	0.1	0.48*	.00	0.1	19
audit fees	0.0	0.17	.02	0.0	19
trustees fees and expenses	0.0	0.91*	.04	0.0	18

T. Rowe Price

<u>Cost Category</u>	<u>Percent of Total Cost</u>	<u>Cost Elasticity</u>	<u>Standard Deviation</u>	<u>Contribution to Scale Economies</u>	<u>Sample Size</u>
investment management	73.0	1.15	.04	-11.0	64
shareholder servicing	22.9	1.05	.04	-1.1	65
custody and accounting	2.0	0.23	.03	1.5	65
shareholder literature	1.2	0.73	.02	0.3	65
registration	0.5	0.63	.02	0.2	63
legal and audit	0.2	0.04	.04	0.2	65
directors and trustees	0.1	0.18	.03	0.1	65
miscellaneous	0.1	0.53*	.01	0.0	65

AIM

<u>Cost Category</u>	<u>Percent of Total Cost</u>	<u>Cost Elasticity</u>	<u>Standard Deviation</u>	<u>Contribution to Scale Economies</u>	<u>Sample Size</u>
advisory fees	41.7	1.07	.04	-2.9	35
distribution fees	37.7	1.01	.03	-0.4	53
transfer agent fees	11.5	1.18	.06	-2.1	55
other	7.8	0.39*	.02	4.8	55
custodian fees	0.9	0.77	.06	0.2	49
administrative services	0.4	0.30	.03	0.3	35
directors' fees	0.1	0.47*	.00	0.1	51

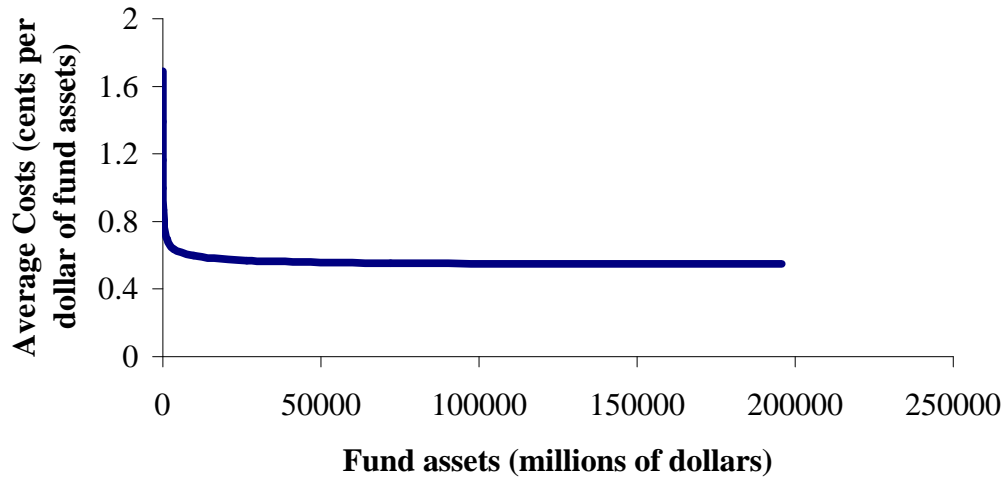
MFS

<u>Cost Category</u>	<u>Percent of Total Cost</u>	<u>Cost Elasticity</u>	<u>Standard Deviation</u>	<u>Contribution to Scale Economies</u>	<u>Sample Size</u>
distribution and service fees	46.2	1.17	.05	-7.9	54
management fee	37.2	0.99	.03	0.4	56
shareholder servicing agent	8.1	1.10	.05	-0.8	56
miscellaneous	4.7	0.94	.04	0.3	56
custodian fee	1.8	0.83	.03	0.3	56
postage	0.8	1.20	.08	-0.2	56
administrative fee	0.4	0.88	.04	0.0	56
printing	0.4	0.65	.02	0.1	56
auditing fees	0.2	-0.06	.06	0.2	56
trustees compensation	0.2	0.44*	.01	0.1	53
legal fees	0.1	0.39*	.00	0.1	56

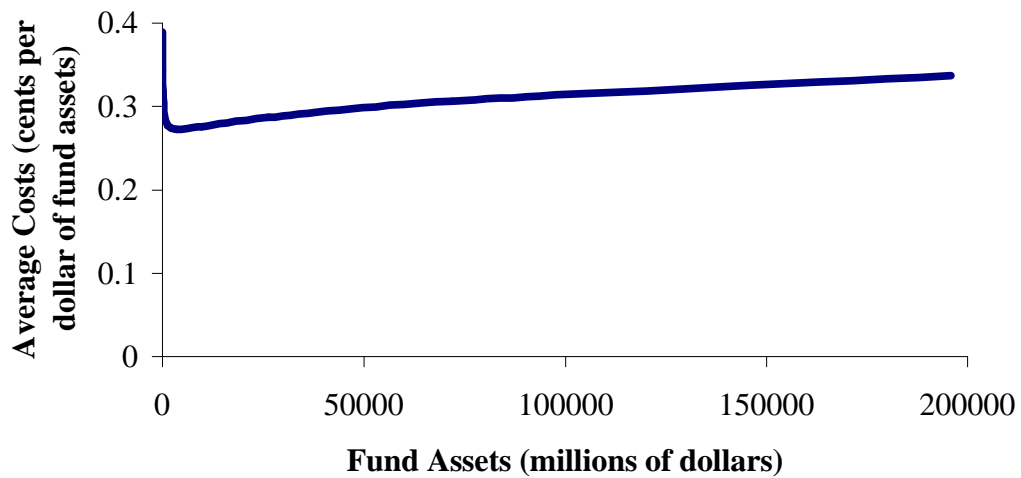
Notes: A translog function is estimated separately for the various cost variables for each fund family. The table summarizes the cost economies using an asset-weighted “average” method for the various expense categories within each fund family. Cost elasticities, $\partial (\ln \text{Cost}) / \partial (\ln \text{Assets})$, are calculated using $\alpha_0 + \alpha_1 (\ln \text{Fund Assets})$, where α_0 is the coefficient on the log of fund assets and α_1 is the coefficient on the log of fund assets squared from the unreported regressions of the translog cost functions. The reported elasticities are the determined using the “average” method (Noulas, Ray, and Miller, 1990). The average method estimates the cost elasticity for each observation and averages across observations to obtain the group average elasticity. If the cost elasticity is less than one, mutual fund expenses increase less than proportionately with fund assets, implying economies of scale. If the elasticity is greater than one, diseconomies of scale exist, and if the cost elasticity equals one, there are constant returns to scale as fund costs increase proportionately with assets. The contribution to scale economies is equal to $(1 - \text{cost elasticity}) \times \text{percent of total cost}$. * denotes that an underlying coefficient is not significantly different from zero at the .05 level.

Figure 1. Average Cost Curves by Fund Family

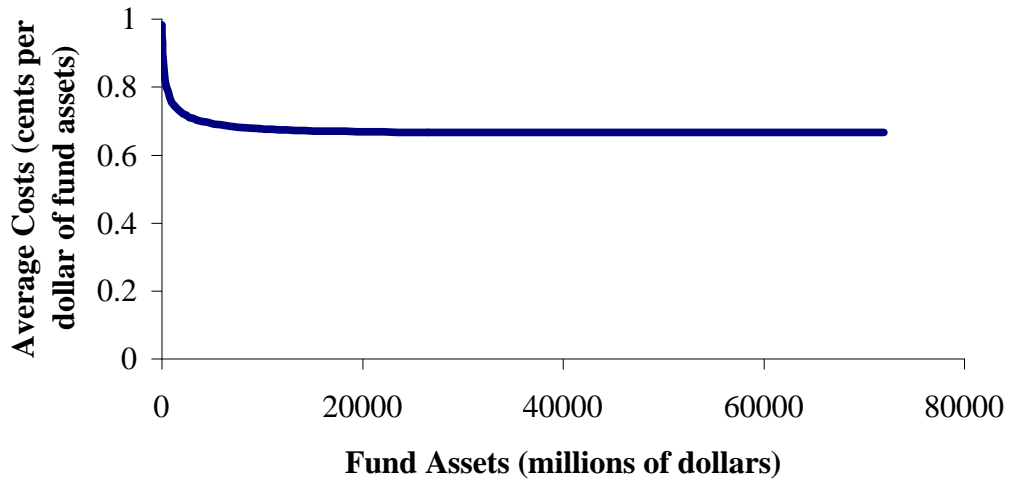
Panel A. Fidelity Investments Average Cost Curve



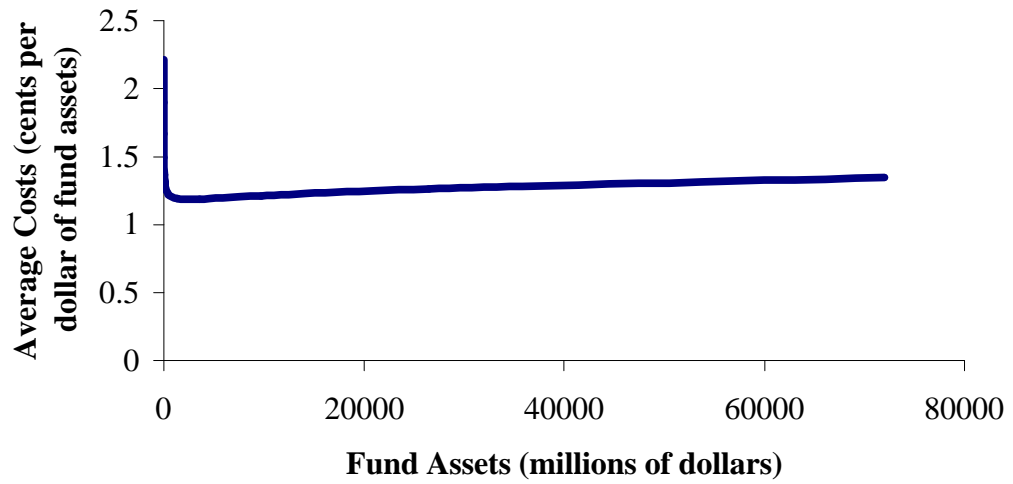
Panel B. Vanguard Group Average Cost Curve



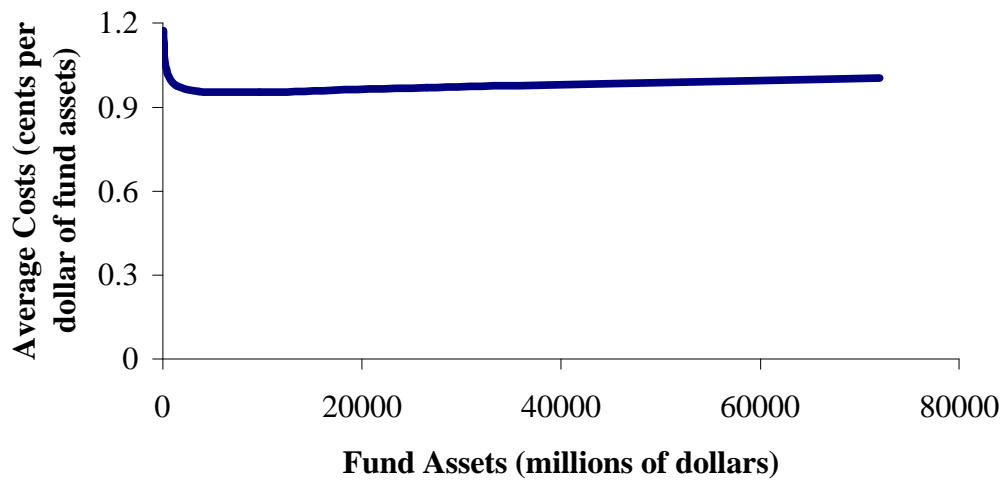
Panel C. American Funds Average Cost Curve



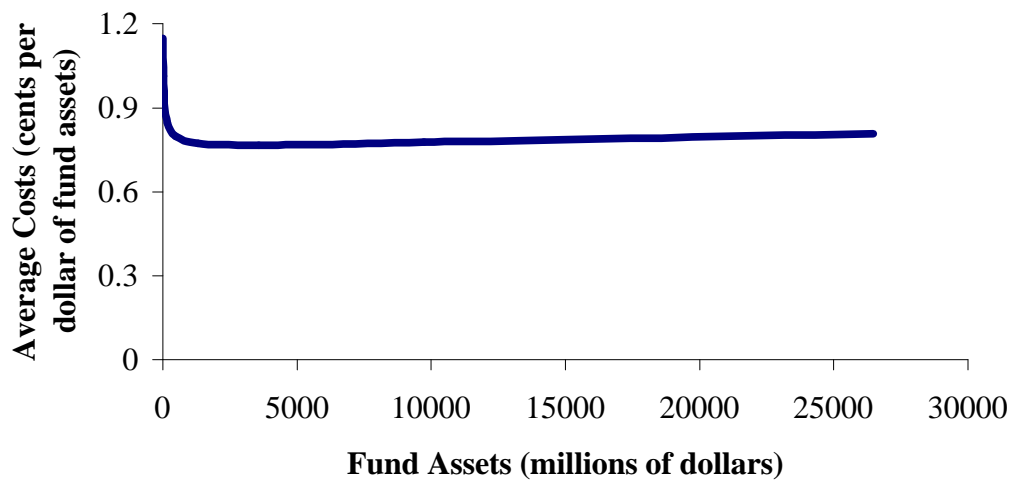
Panel D. Putnam Investments Average Cost Curve



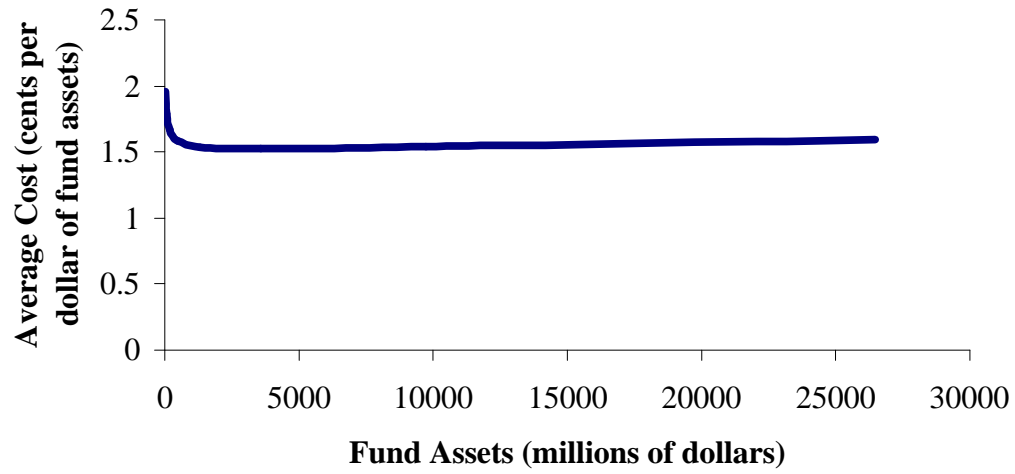
Panel E. Janus Average Cost Curve



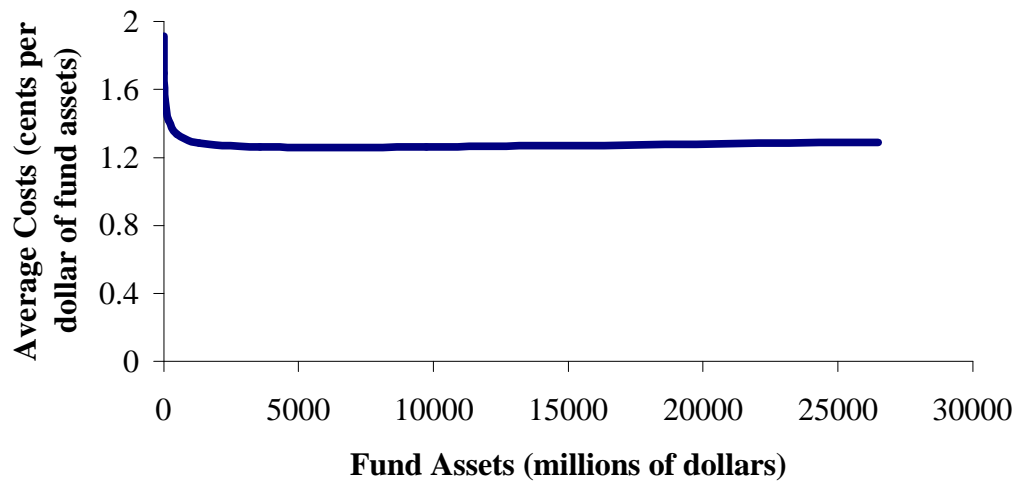
Panel F. T. Rowe Price Average Cost Curve



Panel G. AIM Funds Average Cost Curve



Panel H. MFS Investment Management Average Cost Curve



Notes: This figure displays the average cost curve facing the typical fund in each family. This is derived by calculating the predicted average costs from the predicted total costs from the OLS regression of a translog cost function for various fund asset sizes, holding the control variable constant at its mean value.

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