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The effects of fund commonality in mutual fund families on fund operating expenses and return correlations: Evidence from U.S. equity mutual funds

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Abstract

This article examines the effects of the commonality of mutual funds within a fund family, which is measured by common stock holdings and multi-fund management, on fund operating expenses and return correlations. For U.S. equity funds during the period of 2001–2006, we find that common stock holdings and multi-fund management are negatively related to fund operating expenses but positively related to the correlation of fund return residuals, which increases the correlation of fund returns. Additionally, we find that the fund commonalities can have negative net effects on risk-adjusted returns of a portfolio with equity funds that have different investment objectives.

JEL classification: G23; G11

Keywords: Mutual fund family; Fund commonality; Fund operating expense; Fund return correlation

1. Introduction

Many people in the United States use mutual funds as investment and retirement saving vehicles. Over 90 million individual investors owned mutual funds and held about 87% of the total mutual fund assets in 2014 (Investment Company Institute [ICI], 2015). Mutual fund investors often limit their transactions to one fund family to save search costs (Ciccotello, Miles, and Walsh, 2007; Sirri and Tufano, 1998), to simplify fund management (Elton,

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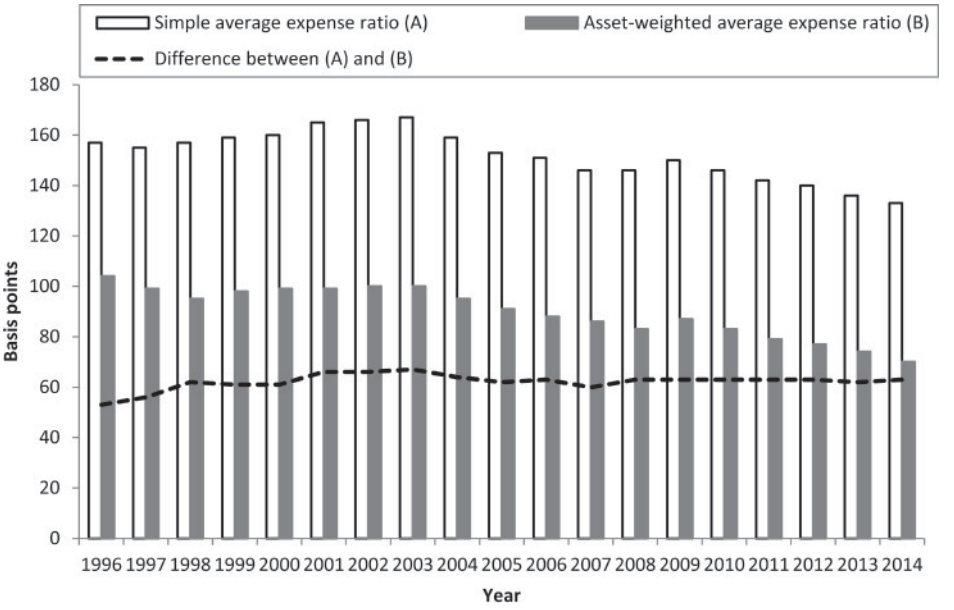

Fig. 1. Expense ratios in equity mutual funds. *Source*: Investment Company Institute Fact Book.

Gruber, and Green, 2007), or as a result of following a fund family's reputation (Ciccotello, Greene, and Walsh, 2007; Gerken, Starks, and Yates, 2014). In addition, mutual fund investors have become sensitive to a fund's expense ratio.[1] Fig. 1 shows the simple average expense ratios, the asset-weighted average expense ratios, and the difference between the two expense ratios of equity funds for the period of 1996 to 2014 (ICI, 2015). The figure indicates that even if the mutual fund industry has recently provided more low-cost equity funds, equity fund investors have kept their sensitivity to fund expense ratios. Because long-term returns are significantly affected by fund expenses (e.g., Carhart, 1997; Gil-Bazo and Ruiz-Verdu, 2009; Haslem, Baker, and Smith, 2008), it is natural that fund investors focus on a fund's expense ratio. However, if a lower expense ratio results from increased fund commonality within a family, seeking only low-cost funds from one family may result in increasing an investor's portfolio risk.

In this study, we measure the commonality of funds by how much a fund holds the same stocks for other funds in the same family and whether a fund is managed by multi-fund managers who simultaneously manage multiple funds in the family. Common stock holdings and multi-fund management have been recognized in the recent literature that emphasizes mutual funds as members of a fund family rather than as stand-alone entities (e.g., Agarwal, Ma, and Mullally, 2015; Choi, Kahraman, and Mukherjee, 2013; Elton et al., 2007; Yadav, 2010). Common stock holdings and multi-fund management may reduce fund operating expenses (excluding 12b-1 fee), which are associated with portfolio management and administrative services. The two fund commonalities, however, may also enhance return correlations between funds and thereby increase an investor's portfolio risk.

This study examines the effects of common stock holdings and multi-fund management of funds on fund operating expenses and return correlations. Common stock holdings and multi-fund management are assessed only for pairs of funds that have different investment objectives, by excluding pairs of funds that have the same investment objective. Because of

this exclusion, the fund commonalities are conservatively evaluated. We analyze 154 actively managed U.S. equity funds from 46 fund families for the period of 2001 to 2006, reconciling key data items (such as a fund's stock holdings and managers) in the Center for Research in Security Prices (CRSP), the Thomson Financial Mutual Fund Holdings, and the Morningstar databases. We find that common stock holdings and multi-fund management are negatively related to fund operating expenses but positively related to the correlation of fund return residuals, which increases the correlation of fund returns. For a portfolio that is constructed with funds in the same family, the findings indicate that an increase in a portfolio's risk-adjusted return net of expenses (such as a Sharpe ratio using expense-adjusted returns) because of decreased fund operating expenses can be wiped out by an increase in the portfolio risk because of increased return correlations. Because of the opposite effects on a portfolio's risk-adjusted return, we additionally investigate the effects of the fund commonalities on risk-adjusted returns of a portfolio that consists of equity funds with different investment objectives and find that the fund commonalities can have negative net effects on risk-adjusted returns of the portfolio.

Our findings contribute to the financial services literature in three ways. First, we expand previous research on mutual fund expenses by showing that a fund's operating expense can be reduced by its common stock holdings and managers who simultaneously manage other funds in the family. Second, we extend extant research on interfamily dynamics by showing that the fund commonalities within a family can deteriorate an investor's portfolio diversification by increasing the correlation of fund returns. Third, our findings provide practical implications to individual mutual fund investors. When individual investors construct a portfolio with low-cost equity funds within a family, they should be aware of an investment risk that fund commonalities that lower fund operating expenses can increase fund return correlations and thereby can reduce the portfolio's risk-adjusted return.

The remainder of the article is organized as follows. Section 2 addresses hypotheses on relations between fund commonalities and operating expense and between fund commonalities and return correlations. Section 3 describes the data and the sample. Section 4 presents the methodology. Section 5 presents empirical findings. Section 6 concludes with a summary of findings and implications for individual mutual fund investors.

2. Fund commonalities, operating expense, and return correlation

Funds in a family may have common features even if they have different investment objectives (Elton et al., 2007). For example, different funds may hold the same stocks as a result of fund managers' common view on individual companies from a common security selection process at a family level (Elton et al., 2007) or of fund managers' efforts to reduce the costs of monitoring the performance of the stocks held in their portfolios (Shawky and Smith, 2005). In addition, different funds may be managed simultaneously by a manager(s) in particular when the manager(s) exhibits superior past performance (Agarwal, Ma, and Mullally, 2015). These common features would increase the commonality of funds in the family. The increased fund commonality, in turn, may influence the characteristics of funds, such as fund operating expenses and the correlation of fund returns.

2.1. Fund commonalities and operating expense

Mutual funds incur ongoing charges for managing fund assets. Fund expenses paid out of fund assets consist of three broad components: management fees, other expenses including administrative fees, and 12b-1 fees (Collins, 2003; Khorana & Servaes, 2007; Latzko, 1999). The first and typically largest is the management fee paid to a fund manager, which compensates a fund manager for expenses incurred in providing services, including asset allocation and security selection. The second is other expenses including administrative fees, which mainly relate to recordkeeping and transactions services to shareholders.[2] The third is the 12b-1 fees spent on advertising, marketing, and distribution services or commissions to brokers. A fund's expense ratio may matter to fund families that want to increase assets under management because mutual fund investors increasingly purchase funds with low expenses (Khorana & Servaes, 2007). For example, Collins (2007) documents that 90% of net new cash flow to stock funds went to those funds whose expense ratios were below the average expense ratio of stock funds offered in the marketplace from 1997 to 2006. Thus, fund families or managers may increase their efforts to reduce a fund's expense ratio.

We focus on fund operating expenses, defined by fund expenses net of 12b-1 fees, because fund operating expenses account for the largest share of a fund's expense ratio (Collins, 2003) and because 12b-1 fees are mainly related to distribution fees for the services provided by brokers rather than the services by fund families (ICI, 2015). Fund operating expenses, consisting of management fees and other expenses including administrative fees (Collins, 2003), may be reduced by an increase in common stock holdings or multi-fund management. First, common stock holdings may be able to lower a fund's management fee. Fund managers in the same family are likely to use the same research analysis produced by either internal analysts or external research firms (Elton et al., 2007). The sharing of the research analysis within a family may increase common stock holdings across different funds, but it may also reduce the costs incurred in the security selection process, which are related to a fund's management fees. Thus, we expect that a fund's common stock holdings are negatively related to its management fee. Second, the management of multiple funds (i.e., the multi-fund management) may be able to lower a fund's other expenses including administrative fees. Fund families often assign multiple funds to the same portfolio manager. Agarwal et al. (2015) find that, for the period of 1980 to 2012, 48% of mutual fund managers managed multiple funds simultaneously. This multi-fund management may enable a fund manager to reduce administrative fees by efficiently allocating her resources among the funds she manages. In this respect, we expect that multi-fund management is negatively related to a fund's other expenses. Thus, for a fund's management fee and other expenses, we hypothesize the following:

Hypothesis 1-a: Common stock holdings are negatively related to a fund's management fee.

Hypothesis 1-b: Multi-fund management is negatively related to a fund's other expenses.

2.2. Fund commonalities and return correlation

Except for common exposure to market and systematic factors, return correlations of funds in a family may be increased by nonmarket or nonsystematic factors that are shared between funds, such as common stock holdings and the management of multiple funds. To measure the correlation of fund returns caused by nonmarket or nonsystematic factors, we use the correlation of return residuals. Following Elton et al. (2007), we decompose the correlation of fund returns into two parts: (1) the return correlation caused by market and systematic factors, such as size, book-to-market, and momentum factors, and (2) the correlation of return residuals, which are not captured by market and systematic factors. Then we focus on the correlation of return residuals and examine whether return residual correlations are related to common stock holdings and multi-fund management. First, common stock holdings of funds may enhance the commonality of funds in a family. Elton et al. (2007) find that return correlations of funds are higher within families than between families and that about 60% of the increased correlation is because of common stock holdings. Thus, we expect that common stock holdings are positively related to the correlation of return residuals, which increases the correlation of fund returns. Second, multi-fund management may also increase the commonality of funds. Funds within a family tend to pursue a similar investment strategy (e.g., low- or high-risk strategies) across different investment objectives (Elton et al., 2007). Similarly, funds managed by a multi-fund manager may adopt a similar investment strategy even if they have different investment objectives. A multi-fund manager may pursue her investment strategy for her different funds by selecting stocks with similar risk characteristics (but not necessarily the same stocks). Thus, funds managed by a multi-fund manager would be more likely to have similar risk characteristics and, as a result, to have a higher correlation of return residuals than those managed by different fund managers. In this respect, for the correlation of return residuals, we hypothesize the following:

Hypothesis 2-a: Common stock holdings are positively related to the correlation of return residuals.

Hypothesis 2-b: Multi-fund management is positively related to the correlation of return residuals.

3. Data and sample

The data come from the CRSP, the Thomson Financial Mutual Fund Holdings, and the Morningstar databases for the period of 2001 and 2006. First, we merge the CRSP and the Thomson Financial Mutual Fund Holdings and collect the information on funds' stock holdings.[3] To identify fund investment objectives, we use the Investment Company Data, Inc.'s (ICDI) classifications that are matched with the Strategic Insight (SI) classifications because the broad ICDI categories enable us to develop a parsimonious model (Table 1). Our sample includes only actively managed U.S. equity funds that are classified as Aggressive Growth (AG), Growth and Income (GI), and Long-Term Growth (LG). Second, we use the Morningstar to collect the information on fund managers and management fees, instead of

Table 1 Investment objective classifications for equity mutual funds

ICDI Classification	SI Classification
Aggressive Growth (AG)	Aggressive Growth (AGG) and Small Company Growth (SCG)
Growth and Income (GI)	Growth and Income (GRI) and Income and Growth (ING)
Long-Term Growth (LG)	Growth (GRO) and Growth Mid-Cap (GMC)

Notes: This article uses the Investment Company Data, Inc.'s (ICDI) classifications that are matched with the Strategic Insight (SI) classifications. The matching is conducted on the basis of a two-way table of ICDI and SI classifications for the period of January 2001 to June 2003. The ICDI classifications are not available from the CRSP database after July 2003.

the CRSP. The CRSP provides less reliable information on fund managers (Massa, Reuter, and Zitzewitz, 2010) and reports management fees that include waivers and reimbursements, which can lead to negative management fees. We merge the Morningstar and the merged dataset above, using funds' tickers, CUSIPs, net asset values, and returns that prior studies use to merge the Morningstar and the CRSP databases (e.g., Berk and van Binsbergen, 2015; Pástor, Stambaugh, and Taylor, 2015).[4] Third, we include only funds that have distinct portfolios. Mutual funds offer multiple shares, but they usually have the same portfolio managers, the same pool of securities, and the same returns before expenses and loads (Zhao, 2004). The Morningstar designates the oldest share class as a fund that has the distinct portfolio.[5] Relying on the information provided by the Morningstar, we include only funds that are identified as ones that have distinct portfolios. Fourth, we include only funds that existed for the period of 2001 to 2006. Last, we exclude 14 observations where a fund's expense ratio is less than its management fee.[6] After all of these data-cleaning steps, we have a sample of 154 U.S. equity funds from 46 fund families.

4. Methodology

4.1. Fund commonalities: Common stock holding and multi-fund management

As proxies to capture the commonality of funds within a family, we use common stock holdings and multi-fund management (or the management of multiple funds). First, we define common stock holdings of funds within a family as follows:

$$MatchH_{ijt} = \sum_{k} min(w_{kit}, w_{kjt}) \tag{1}$$

where w_{kit} and w_{kjt} are the weights of stock k held by funds i and j at year-end t, respectively, and the sum is taken over all the stocks in both funds. Funds i and j have different investment objectives. A fund's stock holding is determined by using the information reported on the date closest to the end of the year t. $MatchH_{ijt}$ ranges from 0 to 1. It is equal to 0 when the two funds do not have any common stock holdings in their portfolios at year-end t; it is equal to 1 when they hold exactly the same portfolios at year-end t. In addition, to indicate fund

i's common stock holdings for all other investment objective funds in the same family, we modify Eq. (1), which is defined for a pair of funds, as follows:

$$ComH_{it} = \frac{\sum_{j=1}^{L} MatchH_{ijt}}{L} \tag{2}$$

where $MatchH_{ijt}$ is the common stock holdings of funds i and j at year-end t and the sum is taken over L, which indicates the total number of funds in all other investment objectives that are different from fund i's investment objective. Thus, $ComH_{it}$ indicates the average weight of common stock holdings in a portfolio of fund i at year-end t.

Second, we define multi-fund management as follows:

$$MatchM_{ijt} = \begin{cases} 1, \text{ if there is at least one multi-fund manager between funds } i \text{ and } j \\ 0, \text{ otherwise} \end{cases} \tag{3}$$

where funds i and j have different investment objectives. To determine a fund's managers, we use a measure of whether or not they manage the fund at the end of the year. $MatchM_{ijt}$ takes a value of 1 if there is at least one multi-fund manager between funds i and j at year-end t and 0 if there is no multi-fund manager between the funds at year-end t. In addition, to indicate whether or not fund i is managed by fund managers who simultaneously manage funds in other investment objectives, we modify $MatchM_{ijt}$, which is defined for a pair of funds, as follows:

$$ComM_{it} = \begin{cases} 1, & if \sum_{j=1}^{L} MatchM_{ijt} > 0 \\ 0, & if \sum_{j=1}^{L} MatchM_{ijt} = 0 \end{cases} \tag{4}$$

where $MatchM_{ijt}$ indicates the multi-fund management that is defined for a pair of funds i and j at year-end t and the sum is taken over L, which indicates the total number of funds in all other investment objectives that are different from fund i's investment objective. $ComM_{it}$ takes a value of 1 if fund i is managed by at least one multi-fund manager at year-end t and 0 if fund i is managed by fund managers who do not manage other investment objective funds at year-end t.

4.2. Model specification

4.2.1. Fund commonalities and operating expenses

To test the hypotheses on relationships between fund commonalities and fund operating expenses (H1-a and H1-b), we estimate the following model:

$$Expense_{it} = \gamma_0 + \gamma_1 ComH_{it} + \gamma_2 ComM_{it} + \gamma_3 Z_t + v_{it} \tag{5}$$

where the dependent variable $Expense_{it}$ indicates fund i's operating expense, management fee, or other expenses in year t. First, we use as the dependent variable a fund's operating expense ratio that is computed by subtracting a 12b-1 fee from a fund's expense ratio

(Collins, 2003). To calculate a fund's operating expense ratio, we use fund expense ratios from the CRSP database and 12b-1 fees from the Morningstar database. This enables us to include more valid observations in the sample. For our sample, the CRSP provides fewer missing values for a fund's expense ratio than the Morningstar, while the Morningstar provides fewer missing values for a fund's 12b-1 fee than the CRSP. For example, if we use the data on 12b-1 fees from the CRSP, we would lose about 47% of the sample. Second, we use a fund's management fee as the dependent variable. For management fees, we use the Morningstar database because the management fee provided by the CRSP can be offset by fee waivers and reimbursements, which can lead to negative management fees. These negative management fees might distort a relationship between fund commonalties and management fees. Third, we use a fund's other expense ratio as the dependent variable. A fund's other expenses include fees for administrative and business services, such as legal, accounting, and administrative services (Collins, 2003; Mahoney, 2004). A fund's other expense ratio is computed by subtracting a management fee from a fund's operating expense ratio.

Eq. (5) also includes a set of control variables (Z) at fund and family levels. Following prior studies, we first include a fund's annual turnover ratio that represents trading activity. A fund with a higher turnover ratio is likely to have a higher expense ratio because of active trading (Malhotra and McLeod, 1997). The higher expense ratio caused by the active trading, however, may result from an increase in a fund's *other expenses* because they include registration fees on the fund shares sold each year and custodial fees that cover the costs of settling trades (Latzko, 2003). Second, we control for a fund's load, using a dummy variable, which indicates whether or not a fund has a sales load (either a front-end or back-end load). The variable takes a value of 1 if a fund has any sales loads and 0 otherwise. Third, we control for a fund's investment objective, using two dummy variables with a base category of AG. Fourth, we control for fund size and family size, using the natural logarithm of one plus a fund's year-end total net assets (in billions) and the natural logarithm of one plus the year-end total net assets (in billions) managed by a family, respectively. Last, we include family fixed effects, which control for unobserved time-invariant family characteristics such as different strategic behaviors at a family level (e.g., Clare, O'Sullivan, and Sherman, 2014; Gaspar, Massa, and Matos, 2006), and year fixed effects.

4.2.2. Fund commonalities and return residual correlation

To test the hypotheses on relationships between fund commonalities and the correlation of return residuals (H2-a and H2-b), we first decompose the correlation of returns into two parts, following Elton et al., (2007):

$$Corr(R_i, R_j) = Corr(F_i, F_j) + Corr(e_i, e_j) \tag{6}$$

where $Corr(R_i, R_j)$ is the correlation of returns of funds i and j; $Corr(F_i, F_j)$ is the correlation of fund returns caused by systematic movements; and $Corr(e_i, e_j)$ is the correlation of return residuals. We calculate $Corr(e_i, e_j)$ with residuals that are obtained from estimating the Carhart four-factor model (Carhart, 1997):

$$R_{it} - RF_t = \alpha_i + \beta_{iEM}(EM_t) + \beta_{iSMB}(SMB_t) + \beta_{iHML}(HML_t) + \beta_{iMOM}(MOM_t) + \varepsilon_{it} \quad (7)$$

where R_{it} is the return of fund i in month t; RF_t is the one-month Treasury-bill rate in month t; EM_t is the monthly excess return on the market, which is calculated by the monthly return of the CRSP value-weighted index less the one-month Treasury-bill rate in month t; SMB_t, HML_t, and MOM_t denote the size-factor, the book-to-market factor, and the momentum factor in month t, respectively; and ε_{it} is a random error.

Second, we regress return residual correlations ($Corr(e_i, e_j)$) on the average common stock holding and the multi-fund management between funds as follows:

$$Corr(e_i, e_j) = \phi_0 + \phi_1 AMatchH_{ij} + \phi_2 AMatchM_{ij} + \phi_3 W + u_{ij} \quad (8)$$

where $AMatchH_{ij}$ is the average common stock holding between funds i and j for the period of 2001 to 2006; $AMatchM_{ij}$ is a dummy variable to indicate whether there exists any multi-fund management between funds i and j for the period; and W indicates a set of control variables at fund and family levels.[7] We control for funds' investment objectives, using two dummy variables with a base category of a combination of GI and LG. In addition, at a family level, we include (1) the natural logarithm of the total number of funds having distinct portfolios that are offered in AG, GI, and LG investment objectives by a family over the period and (2) family size defined by the natural logarithm of one plus the average total net assets (in billions) managed by a family over the period. Last, we include family fixed effects, which control for unobserved time-invariant family characteristics.

5. Results

5.1. Summary statistics

Table 2 presents summary statistics of the sample for the period of 2001 to 2006. The average expense ratio is 1.17%; the average 12b-1 fee is 0.17%; and the average operating expense ratio is 1.00%. A fund's management fee and other expenses, on average, account for 71% and 29%, respectively, of a fund's operating expense ratio. Funds hold, on average, 17% of their portfolios with the same stocks across other funds in different investment objectives. About 39% of the funds in the sample are managed by multi-fund managers over the period. Most funds in the sample have sales loads. This is because we use funds that have distinct portfolios defined by the Morningstar and they are likely to be Class A shares that generally have a front-end load.

Table 2 also provides summary statistics by fund investment objectives: AG, GI, and LG. Funds seeking AG, on average, have a higher expense ratio, a higher operating expense ratio, and a higher management fee than those seeking GI or LG. However, 12b-1 fees and other expenses are similar across the fund investment objectives. In addition, funds seeking AG have significantly less common stock holding than those seeking GI or LG, but AG funds are more likely to be managed by multi-fund managers than are LG funds.[8] Last, the average total net asset of AG funds is less than that of GI or LG funds.

Table 2 Sample summary statistics

		Observation	Mean	Standard deviation	Min	Max
Full sample (154 funds)	Expense ratio (%)	903	1.17	0.34	0.40	2.31
	12b-1 fee (%)	913	0.17	0.22	0.00	1.00
	Operating expense (%)	901	1.00	0.29	0.15	1.90
	Management fee (%)	913	0.71	0.22	0.24	1.50
	Other expenses (%)	901	0.29	0.21	0.00	1.13
	Fraction of common stock holding in a fund portfolio	915	0.17	0.16	0.00	0.96
	Multi-fund management (yes = 1)	915	0.39	0.49	0.00	1.00
	Turnover ratio	897	0.77	0.73	0.03	7.76
	Load fund (yes = 1)	915	0.98	0.13	0.00	1.00
	Fund size ($ billion)	915	3.88	10.61	0.001	120.84
	Family size ($ billion)	276	52.11	158.43	0.17	1,149.30
Aggressive Growth (43 funds)	Monthly gross return (%)	3,096	0.88	5.50	−34.28	25.95
	Expense ratio (%)	254	1.33	0.31	0.79	2.31
	12b-1 fee (%)	255	0.19	0.27	0.00	1.00
	Operating expense (%)	253	1.13	0.22	0.36	1.80
	Management fee (%)	255	0.85	0.18	0.46	1.50
	Other expenses (%)	253	0.29	0.22	0.00	1.03
	Fraction of common stock holding in a fund portfolio	256	0.13	0.16	0.00	0.96
	Multi-fund management (yes = 1)	256	0.45	0.50	0.00	1.00
	Turnover ratio	253	0.76	0.63	0.04	3.58
	Load fund (yes = 1)	256	0.98	0.15	0.00	1.00
	Fund size ($ billion)	256	0.89	1.25	0.004	9.51
Growth and Income (43 funds)	Monthly gross return (%)	3,079	0.61	3.68	−14.39	18.46
	Expense ratio (%)	246	1.04	0.33	0.55	2.27
	12b-1 fee (%)	252	0.16	0.19	0.00	1.00
	Operating expense (%)	245	0.88	0.30	0.32	1.90
	Management fee (%)	252	0.61	0.21	0.24	1.00
	Other expenses (%)	245	0.28	0.19	0.00	1.13
	Fraction of common stock holding in a fund portfolio	253	0.17	0.15	0.00	0.81
	Multi-fund management (yes = 1)	253	0.38	0.49	0.00	1.00
	Turnover ratio	243	0.54	0.39	0.03	2.17
	Load fund (yes = 1)	253	1.00	0.06	0.00	1.00
	Fund size ($ billion)	253	5.84	12.71	0.014	79.33
Long-Term Growth (68 funds)	Monthly gross return (%)	4,877	0.46	4.99	−24.85	29.00
	Expense ratio (%)	403	1.15	0.33	0.40	2.09
	12b-1 fee (%)	406	0.16	0.20	0.00	1.00
	Operating expense (%)	403	0.99	0.28	0.15	1.79
	Management fee (%)	406	0.69	0.20	0.31	1.00
	Other expenses (%)	403	0.30	0.21	0.00	1.13
	Fraction of common stock holding in a fund portfolio	406	0.20	0.15	0.00	0.81
	Multi-fund management (yes = 1)	406	0.35	0.48	0.00	1.00
	Turnover ratio	401	0.92	0.89	0.03	7.76
	Load fund (yes = 1)	406	0.98	0.15	0.00	1.00
	Fund size ($ billion)	406	4.53	12.00	0.001	120.84

Notes: The sample consists of 154 actively managed U.S. equity funds from 46 fund families for the period of 2001 and 2006. Summary statistics are obtained from fund-year observations except for family size and monthly gross return. Summary statistics of family size are obtained from family-year observations and summary statistics of monthly gross return from fund-month observations.

Table 3 Effects of fund commonalities on fund expenses

	Operating expense		Management fee		Other expenses	
	(1)	(2)	(3)	(4)	(5)	(6)
Common stock holding (*ComH*)	−0.138**	−0.134*	−0.158**	−0.076*	0.020	−0.047
	(0.047)	(0.063)	(0.032)	(0.035)	(0.042)	(0.060)
Multi-fund management (*ComM*, yes = 1)	−0.042**	−0.051*	0.014	0.018	−0.056**	−0.069**
	(0.014)	(0.025)	(0.012)	(0.016)	(0.013)	(0.024)
Turnover ratio	0.022	0.019	−0.018**	−0.012	0.041**	0.033*
	(0.014)	(0.015)	(0.007)	(0.007)	(0.012)	(0.015)
Load fund (yes = 1)	0.035	−0.070	0.032	−0.014	0.001	−0.058
	(0.087)	(0.049)	(0.033)	(0.014)	(0.065)	(0.042)
Growth and Income (GI)	−0.157**	−0.204**	−0.180**	−0.165**	0.023	−0.042*
	(0.019)	(0.018)	(0.015)	(0.010)	(0.018)	(0.016)
Long-Term Growth (LG)	−0.060**	−0.068**	−0.087**	−0.079**	0.025	0.007
	(0.018)	(0.014)	(0.013)	(0.008)	(0.016)	(0.014)
Fund size	−0.119**	−0.105**	−0.043**	−0.028**	−0.076**	−0.076**
	(0.010)	(0.012)	(0.006)	(0.006)	(0.009)	(0.011)
Family size	−0.026**	−0.083**	−0.038**	0.011	0.012*	−0.091**
	(0.005)	(0.017)	(0.004)	(0.016)	(0.005)	(0.021)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Family fixed effects	No	Yes	No	Yes	No	Yes
Observations	895	895	895	895	895	895
Adjusted R^2	0.426	0.641	0.468	0.807	0.148	0.392

Notes: The table reports the results of the regressions of fund expenses on fund commonalities. The dependent variables are operating expense (Columns 1 and 2), management fee (Columns 3 and 4), and other expense (Columns 5 and 6) of mutual funds. A fund's operating expense is divided into a fund's management fee and other expenses. Fund size and family size indicate the natural logarithm of one plus a fund's year-end total net assets (in billions) and the natural logarithm of one plus the year-end total net assets (in billions) managed by a family, respectively. Robust standard errors are in parentheses.

*$p < 0.05$, **$p < 0.01$.

5.2. Regression results

5.2.1. Effects of fund commonalities on fund operating expenses

Regression results in Table 3 present that fund operating expenses are significantly negatively related to two fund commonalities: common stock holdings and multi-fund management.[9] First, common stock holdings are significantly negatively related to a fund's operating expense ratio. A 10% increase in common stock holding, for example, reduces a fund's operating expense ratio by 1.3–1.4%. To further examine how common stock holdings are related to the components of fund operating expenses, we estimate Eq. (5) for funds' management fees (Columns 3 and 4) and other expenses (Columns 5 and 6). Regression results show that common stock holdings are significantly negatively related to a fund's management fee, supporting hypothesis H1-a. However, common stock holdings are not significantly related to a fund's other expenses. Thus, the results indicate that a decrease in a fund's operating expense ratio caused by an increase in common stock holdings occurs through a decrease in its management fee, not through its other expenses. Second, multi-fund management is significantly negatively related to a fund's operating expense ratio (Columns 1 and 2). For example, a fund's operating expense ratio is reduced by 4.2–5.1% when a fund

is managed by multi-fund managers who simultaneously manage other funds that have different investment objectives. In addition, regression results on management fees (Columns 3 and 4) and other expenses (Columns 5 and 6) show that multi-fund management is not significantly related to a fund's management fee but significantly negatively related to a fund's other expenses, supporting hypothesis H1-b. Thus, the results indicate that a decrease in a fund's operating expense ratio caused by multi-fund management occurs through a decrease in its other expenses, not through its management fee.

For the effects of the control variables on fund operating expenses, Table 3 shows similar results reported in prior studies. First, a fund's turnover ratio, indicating trading activity, is positively related to a fund's other expenses (Columns 5 and 6), which include administrative fees such as registration fees on the fund shares sold and the costs of settling trades (Latzko, 2003). Second, a fund's load is not significantly related to a fund's operating expenses. This result is consistent with Khorana and Servaes (2007) claiming that a positive relationship between loads and fund expenses is driven by 12b-1 fees rather than by fund operating expenses. Third, funds seeking GI or LG are likely to have a lower operating expense ratio than those seeking AG. The lower operating expense ratios of GI and LG funds result mainly from their lower management fees. Last, fund size and family size are significantly negatively related to fund operating expenses, the negative relation that indicate economies of scale at fund and family levels, respectively (e.g., Dowen and Mann, 2004; Latzko, 1999). In particular, consistent with Elton, Gruber, and Blake (2012), we find that a negative relationship of other expenses and fund size is stronger than a negative relationship of management fee and fund size.

In summary, the regression results in Table 3 indicate that a fund's operating expense ratio can be reduced by an increase in common stock holdings or by multi-fund management.[10] The influences of the two commonalities on a fund's operating expense ratio, however, occur through different channels: common stock holdings reduce a fund's management fee while multi-fund management lowers a fund's other expenses.

5.2.2. Effects of fund commonalities on return residual correlations

Next, we examine whether common stock holdings and multi-fund management affect the correlation of fund returns within families. For doing this, we focus on the correlation of return residuals, which is a component of the correlation of fund returns (Eq. 6).

Panel A of Table 4 presents summary statistics for pairs of funds that have different investment objectives, such as AG-GI, AG-LG, and GI-LG. In particular, GI-LG funds have, on average, a higher return correlation but a lower return residual correlation than the other pairs of funds. The higher return correlations between GI and LG funds may result from their similar investment objectives (GI vs. LG), while the lower return residual correlations may be caused by a lower level of nonsystematic commonality between the funds.

Panel B of Table 4 presents regression results of return residual correlations, which are obtained after estimating the Carhart four-factor model (Eq. 7). First, results in Columns (1) and (2) show that average common stock holding (*AMatchH*) and multi-fund management (*AMatchM*) are significantly positively related to the correlation of return residuals, supporting hypotheses H2-a and H2-b, respectively. For example, a 10% increase in common stock

Table 4 Effects of fund commonalities on return residual correlation
Panel A: Summary statistics of pairs of funds within families

	Observation	Mean	Standard deviation	Min	Max
Return correlation:	256	0.82	0.18	−0.15	0.98
between AG and GI funds (AG-GI)	38	0.76	0.23	−0.15	0.91
between AG and LG funds (AG-LG)	100	0.80	0.16	−0.03	0.98
between GI and LG funds (GI-LG)	118	0.84	0.17	−0.07	0.98
Return residual correlation:	256	0.16	0.25	−0.66	0.87
between AG and GI funds (AG-GI)	38	0.17	0.25	−0.31	0.69
between AG and LG funds (AG-LG)	100	0.21	0.24	−0.39	0.87
between GI and LG funds (GI-LG)	118	0.11	0.24	−0.66	0.58
Average common stock holding	256	0.18	0.16	0.00	0.79
Multi-fund management for the period (yes = 1)	256	0.17	0.37	0.00	1.00
Family size ($ billion)	46	52.11	153.54	0.33	872.43
Total number of funds offered by a family (*TNFO*)	46	3.83	3.95	2.00	27.00

Notes: AG, GI, and LG indicate fund investment objectives of Aggressive Growth, Growth and Income, and Long-Term Growth, respectively. Average common stock holding indicates the average of the common stock holdings between funds for the period of 2001 to 2006. *TNFO* indicates the total number of funds having distinct portfolios that are offered in AG, GI, and LG investment objectives by a family over the period.

Panel B: Regression results of return residual correlation

	(1)	(2)	(3)	(4)	(5)	(6)
Average common stock holding (*AMatchH*)	0.695** (0.090)	0.767** (0.118)	0.778** (0.114)	0.789** (0.141)	0.706** (0.091)	0.775** (0.117)
Multi-fund management for the period (*AMatchM*, yes = 1)	0.191** (0.038)	0.195** (0.057)	0.249** (0.054)	0.223** (0.086)		
AMatchH × A*MatchM*			−0.278 (0.163)	−0.100 (0.222)		
AMatchM1 [A]					0.164** (0.044)	0.133* (0.060)
AMatchM2 [B]					0.281** (0.042)	0.395** (0.089)
Fund objectives: AG-GI	0.153** (0.044)	0.136** (0.052)	0.159** (0.045)	0.138** (0.053)	0.154** (0.044)	0.130* (0.051)
Fund objectives: AG-LG	0.145** (0.028)	0.111** (0.034)	0.157** (0.030)	0.114** (0.036)	0.149** (0.028)	0.121** (0.035)
log(*TNFO*)	0.078* (0.032)		0.077* (0.033)		0.065* (0.033)	
Family size	−0.050** (0.014)		−0.050** (0.014)		−0.044** (0.014)	
Family fixed effects	No	Yes	No	Yes	No	Yes
Observations	256	256	256	256	256	256
Adjusted R^2	0.387	0.451	0.390	0.449	0.391	0.466
p-value for *F*-test: [A] = [B]					0.025*	0.007**

Notes: AG, GI, and LG indicate fund investment objectives of Aggressive Growth, Growth and Income, and Long-Term Growth, respectively. *TNFO* indicates the total number of funds having distinct portfolios that are offered in AG, GI, and LG investment objectives by a family over the period of 2001 to 2006. Family size indicates the natural logarithm of one plus the average total net assets (in billions) managed by a family for the period. Observations indicate the number of different pairs of funds. Robust standard errors are in parentheses.
*$p < 0.05$, **$p < 0.01$.

holdings increases the correlation of return residuals by 7%, while the multi-fund management between funds increases the correlation of return residuals by 19%.

Second, we include an interaction term of average common stock holdings (*AMatchH*) and multi-fund management (*AMatchM*) in a model to see if they interact with each other on return residual correlations (Columns 3 and 4). The coefficient of the interaction term (*MatchH* × *MatchM*), however, is not statistically significant while the main effects of the two commonalities remain significant. The results, thus, indicate that common stock holdings and multi-fund management independently influence the correlation of return residuals.

Third, we further examine whether or not different multi-fund management structures are related to return residual correlations. We divide multi-fund management into two categories (Columns 5 and 6). One is that a pair of funds is managed by at least one multi-fund manager, but not managed by exactly the same managers (*MatchM1*). The other is that a pair of funds is managed by exactly the same fund manager(s) (*MatchM2*). Because the management by exactly the same managers is more likely to increase similarity between funds, we expect that the coefficient of *MatchM2* is higher than that of *MatchM1*. *MatchM1* and *MatchM2* are dummy variables that have the same base category, which is that a pair of funds is managed by two completely different groups of fund managers. Results in Columns (5) and (6) show that both variables, *MatchM1* and *MatchM2*, are significantly positively related to return residual correlations and that the coefficient of *MatchM2* is significantly greater than that of *MatchM1* (p-values for F-tests < 0.05), as expected.

In summary, the regression results in Table 4 show that common stock holdings and multi-fund management are positively related to the correlation of return residuals. The results indicate that, when an investor constructs a portfolio with equity funds that have different investment objectives within a family, the fund commonalities can deteriorate the investor's portfolio diversification by increasing the correlation of return residuals, which is a component of the correlation of fund returns.

5.3. Fund commonalities and risk-adjusted returns

Regression results presented in Tables 3 and 4, taken together, indicate that common stock holdings and multi-fund management *decrease* funds' operating expense ratios, but *increase* their return correlations. These results imply that an increase in a portfolio's risk-adjusted return net of expenses caused by a decrease in fund operating expenses can be wiped out by an increase in the portfolio risk resulting from increased return correlations. In this section, we examine *net* effects of the fund commonalities on a portfolio's Sharpe ratio net of expenses.

For the examination, we employ a hypothetical investor who constructs a diversified portfolio with equity funds that have AG, GI, and LG investment objectives, as suggested by Moreno and Rodriguez (2013). Suppose that a portfolio consists of two different investment objective funds with equal weights and that the two funds are not managed by multi-fund managers. For each portfolio, we use a set of assumptions presented in Panel A of Table 5. First, we compute a portfolio's annual gross return (before expenses) and expense ratio, using the average monthly gross returns and the average expense ratios presented by fund investment objectives in Table 2. Second, we calculate a portfolio's risk, using annualized

Table 5 Increased fund commonalities and risk-adjusted returns

Panel A: Annual gross returns, expense ratios, risks, and Sharpe ratios of portfolios constructed with different investment objective funds

Portfolio	Annual gross return (R_p)	Portfolio expense ratio (ER_p)	Portfolio risk (σ_p)	Portfolio Sharpe ratio ($S_{p)}$
AG-GI	9.33%	1.19%	14.96%	0.372
AG-LG	8.38%	1.24%	17.25%	0.265
GI-LG	6.65%	1.10%	14.44%	0.207

Notes: The panel presents a set of assumptions on three different portfolios of AG-GI, AG-LG, and GI-LG funds. AG, GI, and LG indicate fund investment objectives of Aggressive Growth, Growth and Income, and Long-Term Growth, respectively. Each portfolio consists of two different investment objective funds with equal weights.

Panel B: Common stock holding increased by 10%

Portfolio:	AG-GI		AG-LG		GI-LG	
	(1)	(2)	(1)	(2)	(1)	(2)
ΔPortfolio expense ratio	−1.14%	−1.14%	−1.15%	−1.15%	−1.14%	−1.14%
ΔPortfolio risk		0.36%		0.45%		0.22%
ΔSharpe ratio	0.24%	−0.12%	0.31%	−0.14%	0.42%	0.20%
Additional gross return (basis points)	2.0		2.1		0.7	

Notes: The panel reports changes in a portfolio's expense ratio, risk, and Sharpe ratio due to a 10% increase in common stock holding between funds in a portfolio. Additional gross return indicates how much additional gross return is needed to have the same increase in a Sharpe ratio (reported in Column 1 for each portfolio) caused by a decrease in a portfolio's expense ratio.

Panel C: Multi-fund management by exactly the same fund managers

Portfolio:	AG-GI		AG-LG		GI-LG	
	(1)	(2)	(1)	(2)	(1)	(2)
ΔPortfolio expense ratio	−4.33%	−4.33%	−4.36%	−4.36%	−4.35%	−4.35%
ΔPortfolio risk		1.73%		2.30%		1.27%
ΔSharpe ratio	0.92%	−0.80%	1.18%	−1.09%	1.60%	0.32%
Additional gross return (basis points)	9.7		10.6		3.9	

Notes: The panel reports changes in a portfolio's expense ratio, risk, and Sharpe ratio when funds in a portfolio are managed by exactly the same fund managers. Additional gross return indicates how much additional gross return is needed to have the same increase in a Sharpe ratio (reported in Column 1 for each portfolio) caused by a decrease in a portfolio's expense ratio.

standard deviations of monthly gross returns in Table 2 and the average return correlations in Panel A of Table 4. Third, we use a risk-free rate. Last, we calculate a portfolio's Sharpe ratio net of expenses, which is defined by $S_p = (R_p - ER_p - RF)/\sigma_p$ where R_p is a portfolio's annual gross return; ER_p is a portfolio's weighted expense ratio with equal weights; RF is a risk-free rate of 2.57%, which is the average rate of one month Treasury bills for 2001–2006; and σ_p is a portfolio's risk.

Panels B and C present changes in a portfolio's expense ratio, risk, and Sharpe ratio because of an increase in fund commonality such as a 10% increase in common stock

holdings (Panel B) or multi-fund management by exactly the same fund managers (Panel C). The results of portfolios of AG-GI, AG-LG, and GI-LG funds are obtained by combining the assumptions in Panel A and the regression results in Tables 3 and 4. We compute a change in a portfolio's expense ratio, using the results on fund operating expenses (reported with year and family fixed effects) in Column (2) of Table 3 and assuming that a 12b-1 fee is not affected by a change in fund commonality.[11] Next, we calculate a change in a portfolio's risk, using the results on return residual correlations (reported with family fixed effects) in Column (6) of Panel B, Table 4. To investigate a change in a Sharpe ratio net of expenses (Panels B and C, Table 5), we examine two cases: one considers only a decrease in a portfolio's expense ratio (Column 1), and the other considers both a decrease in a portfolio's expense ratio and an increase in a portfolio's risk (Column 2). The first case is to reflect that an investor disregards an enhanced portfolio risk resulting from an increase in the fund commonalities, while the second case is to reflect that an investor incorporates the enhanced risk into her portfolio return.

Panel B of Table 5 presents changes in a portfolio's expense ratio, risk, and Sharpe ratio when common stock holdings between two funds in a portfolio are increased by 10%. First, for a portfolio of AG-GI funds, a 10% increase in common stock holdings has a negative net effect on the portfolio's risk-adjusted return. The increased fund commonality decreases the portfolio's expense ratio by 1.14%, a decrease which raises the portfolio's Sharpe ratio by 0.24% (Column 1). However, the increased common stock holding also increases the portfolio risk by 0.36%; as a result, the portfolio's Sharpe ratio is eventually decreased by 0.12% (Column 2). Thus, the increased common stock holding results in a negative net effect on the portfolio's risk-adjusted return. For an increase in the Sharpe ratio caused by the decreased portfolio expense ratio, we further investigate how much additional gross return is needed to have the same increase in the risk-adjusted return. We find that the portfolio should additionally earn a 2.0 basis point return to have the same increase of 0.24% in the Sharpe ratio (reported in Column 1). Second, for a portfolio of AG-LG funds, a 10% increase in common stock holdings results in a negative net effect on the portfolio's risk-adjusted return, a result which is similar to that of AG-GI funds. The increased fund commonality reduces the portfolio's expense ratio by 1.15%. The lower portfolio expense ratio increases the portfolio's Sharpe ratio by 0.31% (Column 1). However, the increased fund commonality increases the portfolio risk by 0.45% (Column 2). As a result, the portfolio's Sharpe ratio is decreased by 0.14% (Column 2), indicating a negative net effect on the portfolio's risk-adjusted return. For an increase of 0.31% in the Sharpe ratio because of the decreased portfolio expense ratio, the portfolio needs an additional gross return of 2.1 basis points. Third, in contrast to portfolios of AG-GI and AG-LG funds, a 10% increase in common stock holding results in a positive net effect on the risk-adjusted return of a portfolio of GI-LG funds. The increased fund commonality reduces the portfolio's expense ratio by 1.14%, which increases the Sharpe ratio by 0.42% (Column 1). However, the increased fund commonality raises the portfolio risk by 0.22% (Column 2). As a result, the Sharpe ratio is increased only by 0.20% (Column 2). For an increase of 0.42% in the Sharpe ratio because of the decreased portfolio expense ratio, the portfolio needs an additional gross return of 0.7 basis points. In summary, an increase in common stock holdings of a portfolio decreases the portfolio's expense ratio, but increases its risk. The increased portfolio risk can cause a

negative net effect on the portfolio's risk-adjusted return, as shown in the portfolios of AG-GI and AG-LG. In addition, because of the increased portfolio risk, the portfolio needs an additional return to have the same Sharpe ratio that an investor would have from the decreased portfolio expense ratio.

Panel C of Table 5 presents changes in a portfolio's expense ratio, risk, and Sharpe ratio when funds in a portfolio are managed by exactly the same fund managers. Results in Panel C are similar to those reported in Panel B, though the magnitudes of the changes are greater in Panel C than in Panel B. The multi-fund management reduces a portfolio's expense ratio by 4.43% for AG-GI, 4.36% for AG-LG, and 4.35% for GI-LG funds, and the decreased expense ratios raise the portfolios' Sharpe ratios by 0.92%, 1.18%, and 1.60%, respectively (Column 1). However, the multi-fund management also increases the portfolio risk by 1.73% for AG-GI, 2.30% for AG-LG funds, and 1.27% for GI-LG funds. As a result, the Sharpe ratios are decreased by 0.80% for AG-GI funds and 1.09% for AG-LG funds, while the Sharpe ratio of GI-LG funds is increased by 0.32%. The results indicate that the multi-fund management has negative net effects on risk-adjusted returns for portfolios of AG-GI and AG-LG funds, while it has a positive net effect on risk-adjusted returns for a portfolio of GI-LG funds. Finally, each portfolio needs an additional return to have the same Sharpe ratio that the portfolio would have from the decreased portfolio expense ratio. The AG-GI portfolio needs an additional gross return of 9.7 basis points; the AG-LG portfolio needs an additional gross return of 10.6 basis points; and the GI-LG portfolio needs an additional gross return of 3.9 basis points. In summary, similar to an increase in common stock holdings, the multi-fund management by exactly the same managers decreases a portfolio's expense ratio, but increases its risk. The increased risk can bring a negative net effect on the portfolio's risk-adjusted return, as shown in the portfolios of AG-GI and AG-LG.

6. Conclusion

In this study, we provide extensive evidence that the commonality of funds within a family can influence funds' operating expenses and return correlations. Using common stock holdings and multi-fund management as proxies for the fund commonality in a family, we have analyzed a sample of 154 actively managed U.S. equity funds from 46 fund families for the period of 2001 to 2006. We first find that common stock holdings and multi-fund management can decrease funds' operating expenses and that the influences on fund operating expenses occur through different channels: common stock holdings reduce a fund's management fee while multi-fund management lowers a fund's other expenses that include administrative fees. Second, we find that common stock holdings and multi-fund management can increase the correlation of return residuals, which raises the correlation of fund returns. Third, because the results indicate opposite effects of the fund commonalities on risk-adjusted returns, we have investigated net effects on risk-adjusted returns of portfolios with equity funds that have different investment objectives and found that the fund commonalities can have negative net effects on the portfolios' risk-adjusted returns.

This study enhances an understanding of the commonality of funds within a family. We expand previous research by showing that fund commonalities within a family can influence

fund operating expenses and return correlations. This study also provides practical implications to individual mutual fund investors. When investors construct a portfolio with different low-cost equity funds from a single family, they should be aware of an investment risk that fund commonalities that lower fund operating expenses can increase the correlation of fund returns and, as a result, can reduce the portfolio's risk-adjusted return. In other words, when expense-conscious investors invest in equity funds in the same family, they need to pay additional attention to fund commonalities such as funds' common stock holdings and management structure.

Notes

1 Mutual fund investors have also invested largely in low-cost funds. For example, at year-end 2014, equity funds with expense ratios in the lowest quartile held 74% of the funds' total net assets, whereas those with expense ratios in the upper three quartiles held only 26% (ICI, 2015).
2 The transaction services include providing statements and reports, disbursing dividends, and paying state and local taxes and custodial, legal, audit, registration, and directors' fees (Collins, 2003; Latzko, 1999).
3 To merge the CRSP and the Thomson Financial Mutual Fund Holdings, we use the MFLINKS files from the Wharton Research Data Services (WRDS).
4 When using fund returns to merge the two databases, we focus on monthly returns in December and compare fund returns reported from the two databases. When the difference in returns is less than or equal to 10 basis points in any year, we include the funds in the sample. However, when the return difference is greater than 10 basis points, we drop the funds from the merging process.
5 The Morningstar adds a note that funds having distinct portfolios are likely to have the A share class.
6 An inclusion of the 14 dropped observations does not make regression results significantly different from the results reported in this article.
7 Year-end stock holdings that are used to calculate the average common stock holding between funds are not matched with monthly fund returns that are used to compute the correlations of return residuals. However, using the annual holdings data would not significantly affect results reported in this study because it focuses on common stock holdings of funds in the same family rather than funds' trading behavior in which a more precise measurement of the timing of trades, such as monthly holdings data, is needed (Elton et al., 2010).
8 For common stock holdings by fund investment objectives, pairwise *t*-test results show that common stock holdings are significantly different among the three investment objectives: the difference between AG and LG funds is significant at 1% level (*t*-statistics=5.03) and the differences between AG and GI and between GI and LG funds are significant at 5% level (*t*-statistics = 2.41 for AG-GI and *t*-statistics = 2.45 for GI-LG). For the multi-fund management, pairwise *t*-test results show that the difference between AG and LG funds are significant at 5% level (*t*-statistics = 2.31)

but the differences between AG and GI funds and between GI and LG funds are not statistically significant.

9 Common stock holding and multi-fund management are weakly positively correlated with a correlation coefficient of 0.137 ($p < 0.001$). The positive correlation, however, does not cause a serious multi-collinearity in estimating the regression models of Eqs. (5) and (8). For example, the values of the variance inflation factor (VIF) for both variables are lower than 10, which is usually used to indicate whether a serious multi-collinearity problem exists or not (e.g., Hair et al., 1995; Kennedy, 1992; Neter, Wasserman, and Kutner, 1989).

10 We check the robustness of the results presented in Table 3, using the data on fund expense ratios from the Morningstar, instead of the CRSP. Appendix A reports regression results. The results are not significantly different from those reported in Table 3. Thus, our results are robust to the use of different data sources for fund expense ratios.

11 The assumption of no change in 12b-1 fees would be valid because a 12b-1 fee that relates to distribution services is less likely to be affected by a change in fund holdings or fund management structure.

Appendix A Robustness check for the effects of fund commonalities on fund expenses

	Operating expense		Management fee		Other expenses	
	(1)	(2)	(3)	(4)	(5)	(6)
Common stock holding	−0.248**	−0.275**	−0.158**	−0.076*	−0.037	−0.128**
	(0.047)	(0.064)	(0.032)	(0.035)	(0.036)	(0.043)
Multi-fund management (yes = 1)	−0.067**	−0.054*	0.014	0.018	−0.074**	−0.054**
	(0.016)	(0.025)	(0.012)	(0.016)	(0.012)	(0.020)
Turnover ratio	−0.018	−0.001	−0.018**	−0.012	−0.002	0.016*
	(0.012)	(0.010)	(0.007)	(0.007)	(0.009)	(0.008)
Load fund (yes = 1)	0.044	−0.093	0.032	−0.014	0.012	−0.065
	(0.103)	(0.066)	(0.033)	(0.014)	(0.081)	(0.059)
Growth and Income (GI)	−0.200**	−0.186**	−0.180**	−0.165**	−0.020	−0.038**
	(0.019)	(0.017)	(0.015)	(0.010)	(0.016)	(0.013)
Long-Term Growth (LG)	−0.087**	−0.092**	−0.087**	−0.079**	−0.001	−0.030**
	(0.019)	(0.013)	(0.013)	(0.008)	(0.016)	(0.011)
Fund size	−0.088**	−0.068**	−0.043**	−0.028**	−0.044**	−0.042**
	(0.010)	(0.012)	(0.006)	(0.006)	(0.007)	(0.008)
Family size	−0.033**	0.004	−0.038**	0.011	0.004	0.008
	(0.005)	(0.015)	(0.004)	(0.016)	(0.004)	(0.012)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Family fixed effects	No	Yes	No	Yes	No	Yes
Observations	817	817	895	895	817	817
Adjusted R^2	0.432	0.701	0.468	0.807	0.103	0.546

Notes: This table is to check the robustness of the results presented in Table 3, using the data on fund expense ratios from the Morningstar, instead of the CRSP. The dependent variables are operating expense (Columns 1 and 2), management fee (Columns 3 and 4), and other expense (Columns 5 and 6) of mutual funds. Fund size and family size indicate the natural logarithm of one plus a fund's year-end total net assets (in billions) and the natural logarithm of one plus the year-end total net assets (in billions) managed by a family, respectively. Robust standard errors are in parentheses.

*$p < 0.05$, **$p < 0.01$.

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