Review of Income and Wealth
Series 51, Number 3, September 2005

WHY HAVE U.S. HOUSEHOLDS INCREASINGLY RELIED ON MUTUAL FUNDS TO OWN EQUITY?

by John V. Duca*

Federal Reserve Bank of Dallas

U.S. households have increasingly used mutual funds to own equity outside of retirement accounts owing to two developments. The first is a decline in equity mutual fund loads, which are negatively correlated with stock ownership rates, which have doubled owing to greater ownership through mutual funds. The second is improved confidence in future family finances. Both effects are consistent with recent models of equity participation, in which lower asset transfer costs and lower income risk induce equity investing by middle-income households, who—in practice and owing to diversification considerations—are more likely to indirectly hold stocks through mutual funds.

1. Introduction

How households invest their portfolios, especially in historically higher earning assets such as stocks, has become a more important topic in the wake of stock price swings, increased stock ownership rates in many OECD countries, and the challenge of funding the retirement of an aging population as pensions have come under pressure. This paper analyzes the long-run factors behind why U.S. households have increasingly relied on mutual funds to own equity.

Because pension and investment laws affecting portfolios differ across countries and over time, one particular nation (the U.S.) is examined to better isolate how economic factors that may be relevant across countries, such as mutual fund fees and financial confidence, affect portfolio behavior. Equity in U.S. pensions is held less and less in traditional plans promising defined benefits and increasingly in defined contribution accounts (e.g. 401(k) plans), into which employers and employees make known contributions and from which, employees later withdraw funds depending upon investment performance. U.S. households have also increasingly invested in stocks via mutual funds inside or outside of tax-favored individual retirement accounts (IRAs).

The overall stock exposure of U.S. households jumped from 13 percent of assets in 1990 to 21 percent in 2002, and excluding assets in defined contribution

Note: I would like to thank an anonymous referee, Bart van Ark, Edward Wolff, Jennifer Afflerbach, Nathan Balke, Ricardo Llaudes, Leonard Nakamura, David Simon, and Alan Viard for making helpful suggestions. The paper also benefited from what I have learned about mutual funds from Sean Collins, Sarah Holden, John Rea, and Brian Reid. I thank Jamie Lee, Ricardo Llaudes, and Dan Wolk for providing excellent research assistance. I especially thank the Investment Company Institute for providing some of the data used and numerous people at various mutual funds who provided historical data on the equity funds in my sample. The views expressed are those of the author and do not necessarily reflect those of the Federal Reserve Bank of Dallas or the Federal Reserve System. Any remaining errors are my own.

*Correspondence to: John V. Duca, Vice President and Senior Economist, Research Department, Federal Reserve Bank of Dallas, P.O. Box 655906, Dallas, TX 75265-5906, USA (john.v.duca@dal.frb.org).

TABLE 1

EQUITY HOLDINGS OF U.S. HOUSEHOLDS

	Billions Current Dollars		Percent all Equity			Other Ratios[1]		
	1990	2002	1990	2002	Change	1990	2002	Change
1. Total assets	23,958	48,415						
						Percent of all assets		
2. Total equity assets	3,124	10,051	100	100		13%	21%	+8
3. Directly held corporate stock	1,770	5,045	57	50	−7	Equity ex. IRA and defined contribution pensions as % assets[1]		
4. Indirectly held	1,354	5,006	43	50	+7	12%	17%	+5
5. Bank personal trusts and estates	214	385	7	4	−3			
6. Life insurance co.	58	692	2	7	+5			
7. Defined benefit pensions	344	535	11	5	−6			
8. Defined contribution pensions	278	1,076	9	11	+2			
9. State and local gov't. retirement	285	870	9	9	0			
10. Federal gov't. retirement	0.3	49	0	0.5	+1			
						% Direct + Mutual Fund Equity[1]		
11. Mutual funds (excludes #8)	175	1,399	6	14	+8	9%	22%	+13
12. IRA equity in mutual funds	58	621	2	6	+4	% Direct + nonIRA Mutual Fund Equity (MF)[1]		
13. Mutual funds ex. IRAs	117	778	4	8	+4	6%	13%	+7
14. Pension assets (6 + 7 + 8 + 9 + 10 + 12)	1,018	3,843	33	38	+6			

Notes: [1]Right-most columns of line 4 based on dollar entries in line 2 minus dollar entries in lines 8 and 12, then divided by line 1. Right-most columns of line 11 based on entries in line 11 divided by the sum of dollar entries in lines 3 and 11. Right-most columns of line 13 based on dollar entries in line 13 divided by the sum entries in lines 3 and 13. Equity in line 11 excludes defined contribution pension equity (e.g. 401(k) and 403(b) plans) in line 8.

Source: December 9, 2004 Flow of Funds Release and author's calculations.

(e.g. 401(k) plans) and IRAs, from 12 percent in 1990 to 17 percent in 2002 (Table 1).[1] These shifts not only stemmed from capital gains, but also coincided with a doubling of the stock ownership rate since the 1970s to 51 percent by 2001, owing to increased indirect ownership of stocks, mainly through mutual funds. Indeed, excluding IRA assets, equity in mutual funds rose as a share of directly held stocks plus equity in mutual funds, from 4 percent 1982 to 13 percent by 2002 (Figure 1). The importance of mutual funds extends beyond the U.S., as differences in mutual fund use help account for cross country patterns of overall stock ownership and for much of the rise in overall stock ownership rates in Western Europe (Guiso *et al.*, 2003). As Guiso *et al.* (2003) stress, stock ownership rates have increased to over 50 percent in the U.S. and Sweden and to roughly one third of the population in the U.K., and have more than doubled in other countries having less equity participation, such as the Netherlands, Italy, France, and Germany.

[1]The numerators omit equity in defined benefit pensions that do not expose households to risk.

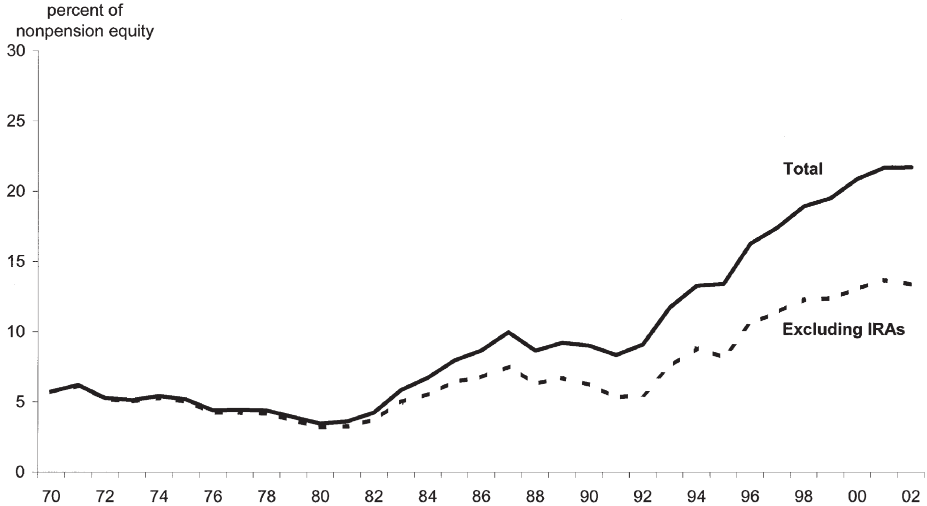

Figure 1. Equity Mutual Fund Assets Rise as a Percent of Directly and Mutual Fund Held, Household Equity Assets

Note that both series exclude equity in defined benefit pension plans and defined contribution plans (e.g. 401k/403b) in their numerators and denominators.

Source: Flow of Funds accounts, Investment Company Institute, and author's calculations.

This shift could have several important ramifications. It could imply that there have been increases in the stock market or stock wealth sensitivity of consumption (see Dynan and Maki, 2001; Duca, 2004), money demand (Duca and Anderson, 2004), and retirement decisions (see Cheng and French, 2000; Coronado and Perozek, 2003). Greater stock ownership rates may also influence voting (Duca and Saving, 2001) and attitudes toward inflation, capital gains taxes (Nadler, 1999), and Social Security reform. For these reasons, it is important to understand the factors inducing households to increasingly use mutual funds as a means of owning equity.

One plausible factor behind this rise is that lower equity fund costs raised the appeal of mutual funds to shareholders and induced more equity participation among the middle class, who, owing to limited wealth and diversification, preferred mutual funds to individual stocks. In fact, the rise of U.S. stock ownership rates since the early 1980s has reflected increased indirect ownership that accompanied lower fund costs (Figure 2).[2] Indeed, these costs are negatively and significantly correlated with total (–0.94) and indirect stock ownership rates (–0.98), consistent with the effect of lower transfer costs in portfolio calibration models (Saito, 1995;

[2]Ownership rates are not fully consistent. First, SCFs treat all mutual fund assets as stock before 1989, but only equity funds thereafter. Second, SCFs count stock in IRA or 401(k) plans since 1989. Third, some early SCFs treat non-traded equity as stock, but some do not. 1986 data are omitted because unlike other SCFs, that SCF did not ask about stock in employers or investment clubs. Also, the quality of this SCF is suspect because it was done by phone without edit checks and may be biased by selection effects from movers since it re-contacted 1983 respondents. Ownership data are from Aizcorbe *et al.* (2003), Kennickell *et al.* (2000), Katona *et al.* (1968, 1970, 1971), and Durkin and Elliehausen (1978). Mutual fund costs are from Duca (2004).

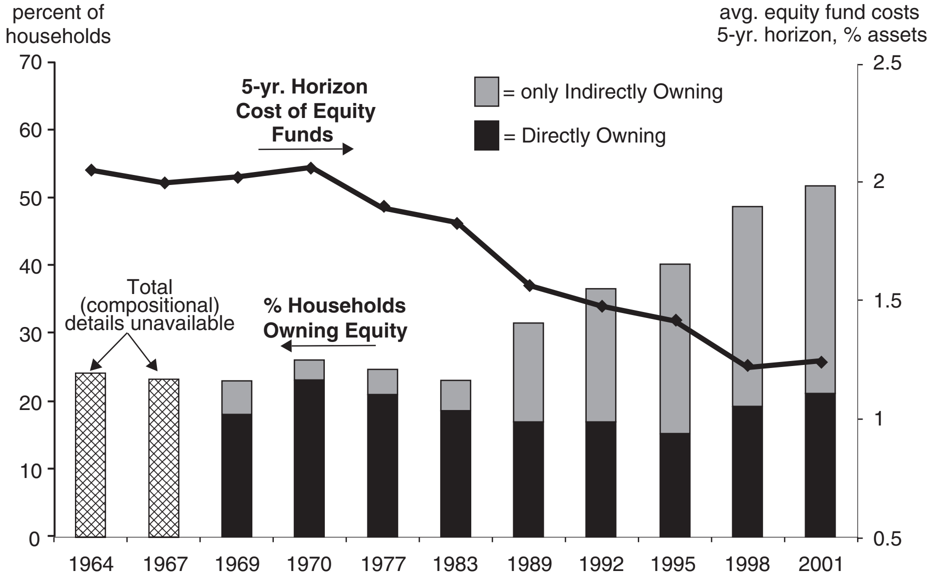

Figure 2. Equity Fund Costs Fall and Stock Ownership Rates Rise
Source: Various Surveys of Consumer Finances and Duca (2004).

Heaton and Lucas, 2000) and with Guiso *et al*. (2003), who provide some partial data suggesting that cross-country differences in the costs of mutual funds can help account for cross-country differences in household investment in mutual funds. Using time series data on mutual fund costs in the U.S., the current paper analyzes the long-run factors behind the rising use of mutual funds to own equity to better understand why households have invested more in stocks.

This paper finds that lower mutual fund costs and greater confidence have raised the use of mutual funds to own stock in the U.S. Section 2 provides theoretical background for the data described in Section 3. Section 4 presents results that are interpreted in the concluding section.

2. Explanations for the Increased Use of Mutual Funds

Several factors for the increased relative use of equity funds are suggested by studies of equity participation, behavioral finance, demographics, and changes in pension laws. These include effects from transactions costs, higher confidence, demographics, and IRA/401(k) plans.

2.1. *Transaction Costs*

Lower mutual fund fees can boost mutual fund use by inducing shareholders to shift into mutual funds, as reflected in household net purchases of equity funds and net sales of directly held stocks in the 1990s (Reid and Millar, 1999), and by bolstering equity participation. In theory, transfer fees can deter entry under uncertainty (Dixit, 1989). Loads may have been such a barrier to stock ownership for middle-class families who could only feasibly own a diversified portfolio via mutual funds. In the optimization models of Heaton and Lucas (2000), Saito (1995), and Vissing-Jorgensen (2002), transaction costs coupled with non-diversifiable labor market risk can deter middle-income families from owning stocks and lower transaction costs can induce stock ownership. Higher mutual fund fees in the 1970s and early 1980s may thus account for the lower stock ownership rates of that era. Indeed, three patterns in SCF data imply that mutual fund use boosted U.S. equity ownership rates in the 1990s (Kennickell *et al.*, 1997, tables 4 and 6). First, stocks rose from 32 to 41 percent of household financial assets from 1989 to 1995. Second, stock ownership rates rose from 26 to 40 percent, with the biggest rises among middle-class families and the smallest among those with incomes over $100,000. Third, the share of financial assets in bond and equity mutual funds rose, while that of directly held bonds and stocks dipped slightly.

2.2. *High Confidence or High Excess Returns*

By raising household tolerance of asset risk, lower non-diversifiable labor income risk can induce stock ownership, as in Heaton and Lucas (2000), Saito (1995), and Vissing-Jorgensen (2002), especially for the middle-class investors who favor mutual funds. Confidence indexes shifted to a higher range since the early 1980s, likely owing to lower business cycle risk reflected in less GDP volatility (McConnell and Quiros, 2000) and a lower frequency of recession. (Lower macroeconomic risk and stock-buying associated with greater recognition of the high historical equity premium (Mehra and Prescott, 1985; Siegel, 1994) may have lowered the equity premium (Blanchard, 1993).) High equity returns in the 1990s may have induced greater stock ownership out of myopia or fads, as implied by behavioral finance studies (Shiller, 1984; DeBondt and Thaler, 1985; Bernartzi and Thaler, 1995). In addition, confidence swings not tracked by returns may have also induced shifts into stocks by small investors who tend to own mutual funds.

2.3. *Possible Demographic Factors*

Two demographic factors may have boosted mutual fund use. One is the rising share of the population preparing for retirement (Morgan, 1994). Because new investors tend to be less wealthy than shareholders, diversification induces new investors to buy stocks via mutual funds. Thus, the aging of the baby boomers could have contributed to the rising mutual fund share of equity holdings, the drop in the equity premium, and the post-1980 rise in the equity share of household assets. A second factor is greater longevity, which has an unclear theoretical impact on saving because the need to fund a longer retirement may be offset by a longer work life. In practice, social security penalties on earnings of senior citizens reduce the latter, but greater longevity may boost the demand for equity by lengthening investor horizons. However, the fall in the personal saving rate in the 1990s seems at odds with these two demographic explanations.

Moreover, Laderman (1997) finds that the higher mutual fund share of household assets owed to greater mutual fund use within age groups (as in more recent data, Kennickell *et al.*, 2000) and not to demographic shifts, implying that the greater use of mutual funds stems from a common factor, such as lower mutual fund costs. In addition, the age 35 and over share of the labor force in the mid-1990s was near that of the early 1970s, when equity fund use was lower (see Figure A1 in the Appendix, which presents evidence against a role for demographic shifts).

2.4. *IRAs and Defined Contribution (401k/403b) Plans*

Mutual fund use for non-pension investments may have been affected by IRA laws and shifts from defined benefit to defined contribution pensions.[3] Laws favor the use of third parties to manage IRA assets, and fiduciary concerns induce firms to offer mutual funds in defined contribution plans. These factors likely induced many families to incur the costs of learning about mutual funds, which were arguably a barrier to equity participation.[4] Since many mutual funds count IRA assets toward the minimum balances for opening asset management accounts and avoiding maintenance fees, IRA assets can lower the costs of non-IRA mutual fund assets. It should be noted that these potential effects on stockholding through non-retirement mutual fund accounts are indirect, and thus may be limited in size. On the other hand, improvements in financial technology have lowered the costs of mutual funds as discussed in a later section, which may have induced an increased use of mutual funds not only outside of retirement accounts, but also in IRAs and defined contribution pension plans.

3. Data and Variables

Variables used to model the relative use of mutual funds to own equity include measures of mutual fund use, IRA regulations, equity mutual fund costs, and household expectations.

3.1. *The Mutual Fund Share of Household Equity Assets*

The use of mutual funds to own equity is based on Flow of Funds data on mutual fund equity and directly held corporate equity for the Household and Non-Profit Organization Sector. The latter includes individual stocks and equity in closed-end funds and the former, stock in IRAs but not in defined contribution pension plans (e.g. 401(k) plans). To limit complications from pension and IRA assets, ICI estimates of IRA assets in equity mutual funds are netted out to measure non-IRA equity in mutual funds (MFEXIRA). The relative use of mutual funds to own equity (MF) is the ratio of MFEXIRA to directly held stocks plus MFEXIRA (see line 13, Table 1). By its construction, MF focuses on equity that households control and equity not directly affected by shifts in pension and IRA regulations, which would greatly complicate the analysis.

The IRA equity netted out includes IRA and self-employed retirement stock fund assets before 1986, and afterward, stock fund assets in IRAs, self-employed retirement plans and simple IRAs. From 1996 to 2002, IRA adjustments equal

[3]Gustman and Steinmeier (1992) and Ippolito (1995) attribute half the shift toward defined contribution plans to job shifts away from unionized, larger firms having defined benefit plans. Ippolito (1995) attributes the other half to tax changes favoring defined contribution plans.

[4]Haliassos and Bertaut (1995) argue that learning costs can deter stock ownership while mutual fund investment minimums have not. Their findings do not preclude a role for mutual fund fees.

IRA assets in domestic equity plus international equity funds multiplied by the percent of fund assets not held in short-term liquid assets plus 60 percent of IRA assets in hybrid funds (usually 60 percent invested in equity). Mixing ICI and Flow of Funds data is not problematic since the latter are derived from ICI data.

IRA and Keogh (a form of self-employed IRA) data are available from ICI since 1970 and Flow of Funds data on direct stock holdings exclude equity in bank trusts and estates since 1969.

In calculating MF, equity in partnerships and sole proprietorships is omitted because their values are not based on market prices and owners derive labor income from that equity. Equity in trusts, estates, and through life insurance is excluded because legal and tax factors limit household's control over these assets and their life insurance assets are mainly pension annuities.

Equity in retirement accounts is excluded to avoid greatly complicating the analysis. In particular, household exposure to stocks through retirement assets has changed over time, with the shift from defined benefit to defined contribution pensions and IRAs raising several problems for including retirement assets. First, defined benefit plans expose firms but not households to stock prices. But if defined benefit assets are excluded, the shift from defined benefit to defined contribution pensions raises difficulties for including defined contribution assets in MF which would be distorted by regime shifts across pension types arising from changes in regulations.[5] Including IRA equity raises complications because IRAs were created in 1981 (Keoghs earlier) and IRA regulations changed, being liberalized in 1982, restricted in 1987, and liberalized when Roth IRAs were created in 1998. Also, defined contribution assets can affect IRAs because workers can rollover 401(k) balances into IRAs when changing employers. These time series concerns with including IRA assets appear in unit root tests, which provide stronger evidence of a unit root in the mutual fund use variable which excludes IRAs. Although qualitative results were similar when IRA assets were included (not shown), this paper focuses on analyzing mutual fund use excluding retirement assets because pension and IRA regime shifts likely affect broader measures of mutual fund use in ways that are harder to model and more difficult to interpret.

3.2. *Equity Mutual Fund Costs*

Two sources of equity fund costs are available. ICI estimates mutual fund costs as a share of assets based on expense ratios, loads, and other fees across all open-end equity funds (Rea *et al*., 1999). Using redemption data, this series annuitizes the front- and back-end loads over a fifteen-year holding period. The ICI data has the advantage of covering all fund costs at all equity funds. Its main disadvantage is that it starts in 1980, limiting the numbers of observations (23) and business cycles covered. Another source is Duca's (2004) equity fund cost data that cover 11 more years (1970–2002) and three more business cycles and bear markets. The longer sample helps identify long-run factors affecting mutual fund use, which differed greatly between the 1970s and the two most recent decades. Also, unlike

[5]Equity in defined contribution pensions includes equity in mutual funds and employer stock acquired under favorable terms, bonuses, or pensions.

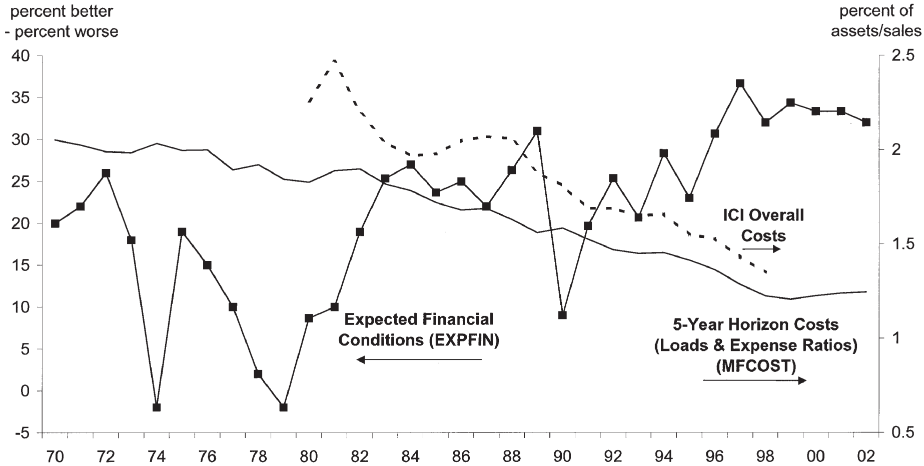

Figure 3. Equity Mutual Fund Costs Fall and Household Financial Expectations Improve Since the Early 1980s

Note that EXPFIN equals percent households expecting their financial situation to improve in twelve months minus the percent expecting it to worsen.

Source: University of Michigan Survey Research Center, Investment Company Institute, and Duca (2004).

ICI data, Duca's panel has the advantage of excluding institutional funds that have lower costs than household funds.

However, the panel series omits some costs and is from a subset of funds. The latter disadvantage is likely minor since the sampled funds account for over half of all equity fund assets in each year. The panel series differs in weighing individual fund costs using assets, while ICI uses sales. Nevertheless, the two series move together during since the 1980s (Figure 3),[6] explaining why tests (not shown) yield similar post-1980 results. This paper presents results using the panel data because they cover the 1970s, which differed greatly from the 1980s and 1990s, and because the degrees of freedom are severely restricted by the use of annual data.

Details on equity cost variables from Duca (2004) are as follows. LD1 measures load fees using the weighted average front-end and back-end load as a percent of assets transferred, where the back-end load is for withdrawals within a year of investment. An alternative, LD5, uses a five-year horizon (annualized) with front-end loads and back-end loads for withdrawals after five years from the initial investment, both divided by five. Correlations between the stock ownership rate and the load variables are similar, as are correlations between each equity fund load variable and the percent of families that only indirectly own stock (–0.93 to –0.98).

Because LD1 and LD5 may be distorted by mutual funds that raise expense ratios when cutting loads, the variables ELD1 and ELD5 add the expense ratio as a percent of assets to LD1 and LD5, respectively, on an asset-weighted basis.

[6]The ICI series exceeded ELD5 by a small 0.2 percentage points in 1997, reflecting that ICI covers other costs and smaller funds having higher costs than the funds in Duca's (2004) sample.

Using quarterly data over 1954–2002, all four variables have a unit root, but using annual data from the 1970–2002 sample, evidence of a unit root was significant for only the broadest measure of mutual fund costs ELD5. Accordingly, ELD5 is used in the cointegration analysis and is simply denoted MFCOST hereafter. (Results were similar using the other three mutual fund cost measures.) Overlapping data on MFCOST and the ICI series move similarly, consistent with Rea *et al.*'s (1999) finding that equity fund costs fell in the late 1990s as a large decline in loads offset a slight up-tick in expense ratios.[7]

Since pre-1984 data are incomplete, fund costs were from Duca's sample of 133 large equity funds using data from the funds, Morningstar, CDA/Wiesenberger, and IBC/Donoghue. A panel list is available from the author. Funds were included if yearend assets exceeded $1 billion in 1991 if the fund existed before 1983, $2 billion in 1994 if the fund began after 1983, $5 billion in 2003, or $250 million in 1975. The first cutoff reflects whether a fund was big before equity funds grew rapidly in the late 1990s and the second, whether a growing but new fund was big in the mid-1990s. Given stock gains in the 1990s, the hurdles for new funds were higher in 1994 and 2002 to keep data costs from exploding. The fourth criterion includes funds that were relatively large in 1975 when few funds existed. Funds are omitted if they were closed-end or only open to employees of a specific firm with a few reasonable exceptions (see Duca, 2004).

Possible economies of scale in mutual funds imply potential interaction between mutual fund use and costs. Because cointegration analysis tests for whether long-run relationships exist, it does not rule out or depend on costs being exogenous to mutual fund use. Nevertheless, granger causality results shown later imply that the relative use of mutual funds to own equity does not lead mutual fund costs, while financial technology in the form of bank productivity leads mutual fund costs, which in turn, lead the relative use of mutual funds to own equity.

3.3. *Confidence*

For several reasons, confidence is tracked with expectations of future finances (EXPFIN), equal to the percent of households in the Michigan survey expecting their financial situation to improve over the next twelve months minus the percent expecting it to worsen (Figure 3).[8] First, EXPFIN tracks expectations.[9] Second, it may also reflect risk attitudes affecting portfolio behavior.[10] (These two attributes may explain why EXPFIN outperformed excess stock returns in alternative empir-

[7]Rea *et al.* (1999) find that half of the fall in equity fund costs owed to individual mutual funds cutting loads and the other half to households shifting from higher to lower cost funds.

[8]To correspond with yearend mutual fund data, the fourth quarter average of monthly data is used to reduce noise since 1978. In other tests not shown, nominal and real I(1) excess stock returns (using S&P 500 returns and Treasury yields) were generally insignificant. EXPFIN's better performance may arise because it better tracks expectations of returns and risks.

[9]EXPFIN may reflect entry effects by tracking sentiment. While Warther (1995) found the average discount on closed-end equity funds insignificant in models of mutual fund inflows, this may not preclude a long-run role. Warther (1995, p. 233) doubts the relevance of the discount to open-end mutual funds because it reflects the sentiment of experienced investors (and not necessarily general sentiment) and may reflect aspects of sentiment irrelevant to open-end funds.

[10]The Conference Board survey is not used because it starts in 1975, limiting the small sample.

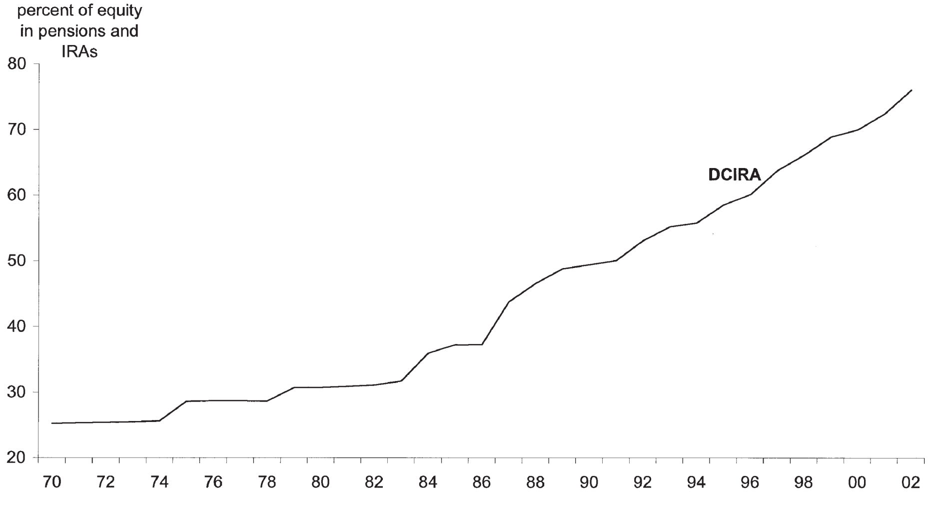

Figure 4. Rising Share of Equity Retirement Assets in IRAs and Defined Contribution Plans

Note that DCIRA equals the ratio of the sum of equity in defined contribution pensions and IRAs to the sum of those equity assets plus equity in defined benefit pension plans, expressed as a percent.

Source: Flow of Funds, Investment Company Institute, and author's calculations.

ical models of mutual fund use (not shown).) Third, unlike the Michigan index and many of its components, EXPFIN has a unit root according to standard tests. To see if uncertainty from oil shocks affected mutual fund use, some regressions include a dummy (OILDUM) equal to 1 for years (1973, 1979, 1981, and 1990) when real oil prices surged more than 10 percent and above the range of the prior five years.

3.4. *IRA Regulations and Defined Contribution Pension Plans*

To check for robustness, several of the regressions and empirical tests included the share of all equity in retirement accounts (IRAs plus defined benefit and defined contribution pensions) held in IRAs and defined contribution plans using Flow of Funds and ICI data (Figure 4). This pension-shift variable (DCIRA) was included to control for the possible impact of IRA and pension shifts on the use of mutual funds to own equity outside of IRAs and defined contribution pension plans. DCIRA has the advantage of consistently measuring the changing importance of IRAs and defined contribution pensions over the entire sample in a way that can be used to test for long-run and short-run effects on mutual fund use while avoiding the inclusion of unwieldy, arbitrary, and insignificant dummy variables.[11] In addition, DCIRA has the advantage of internalizing shifts between IRAs and defined contribution equity assets that can arise if workers roll-over defined contribution assets into IRAs when changing employers.

[11]In regressions not shown, dummies for liberal IRA regulations over 1982–86 and for other years (1987–2002) were insignificant in vector error-correction models (discussed below).

4. Empirical Findings

This section presents cointegration tests to assess the long run shifts in mutual fund use. Then, causality tests based on cointegration results, are presented. Finally, vector error-correction models are used to analyze short-run movements in mutual fund use.

4.1. *Cointegration Results*

As Engle and Granger (1987) stress, cointegration analysis should be used to detect long run relationships among nonstationary variables that have unit roots, and models of short-run movements should not omit information about any long-run relationships to avoid misspecification. Cointegration tests are used to find relationships among mutual fund use, expectations about future finances, and five-year horizon equity fund costs, and whether these relationships are robust to also including the pension shift variable (DCIRA). Each of these variables has a unit root, being nonstationary in levels and stationary in first differences, according to augmented Dickey–Fuller statistics that are insignificant for the levels and significant for the first differences of each variable (Table 2). Variables are in natural logs (denoted by a capital letter "L" in their names), except EXPFIN which has some negative values. For robustness, a version of EXPFIN that is scaled around 100 was created that can be used in logs (LEXPFIN). This was done by adding 100 to EXPFIN, adding 2 to post-1959 readings to handle changes in sampling after 1959, and basing the index to equal 100 in 1966. This conversion mirrors the University of Michigan's Survey Research Center's (2005) conversion of several diffusion indexes having some negative values into its better known overall indexes.

With or without the pension variable, tests found only one cointegrating vector among each set of variables used based on two standard cointegration test statistics (Table 2). One is the trace statistic, which rejected only the absence of one cointegrating vector in each case at the 5 percent level using Johansen–Juselius's (1990) rank significance criterion. The other statistic is the maximum eigenvalue statistic, which also only rejected the absence of one cointegrating vector in each case at the 5 percent level.[12] In each case, vectors minimizing the Akaike information statistic from vectors estimated using assumptions regarding whether variables had a deterministic trend (none, a linear trend, or a quadratic trend) and whether the vector should be estimated with or without a constant favored including a constant but not a time trend in the vector and allowing the individual variables to have time trends (this is consistent with the unit root tests which found significant time trends for each variable).[13] The significant trace and

[12]If more than one vector were found, the procedure used would not definitively yield a useful long-run relationship among the variables tested. If no significant vector were found, then one could not reject the absence of a long-run relationship. Neither problem was encountered here.

[13]Letting variables have their own trends is sensible, and omitting a trend in the cointegrating vectors avoids the non-intuitive inclusion of a trend, which may arise from omitted variable or specification bias. The Akaike information criterion (AIC) helps select among specifications based on fit and helps assess the proper number of lags to include by balancing improved fit against reduced degrees of freedom from longer lag lengths. The similar Schwartz information criterion (SIC) favored having a constant but not a time trend in the vector and disallowing time trends in the variables. But, restricting assumptions to allow for trends in each variable (in line with other evidence), the SIC favors including a constant but not a time trend in the vector.

TABLE 2

COINTEGRATION RESULTS

Unit Root Test Statistics Using 1970–2002 Data: Augmented Dickey-Fuller Statistics (constant with trend)

Variable	Level (modified SIC lag)	5% Critical Level for Lag	1% Critical Level for Lag	First Difference (modified SIC lags)	5% Critical Level for Lag	1% Critical Level for Lag	Degree of Integration
LMF	2.427 (0)	–3.563	–4.285	–4.494** (0)	–3.563	–4.285	1
LDCIRA	2.607 (0)	–3.563	–4.285	–5.775** (0)	–3.563	–4.285	1
LMFCOST	2.336 (0)	–3.563	–4.285	–4.932** (0)	–3.563	–4.285	1
EXPFIN	2.612 (2)	–3.563	–4.285	–7.238** (0)	–3.563	–4.285	1
LEXPFIN	2.669 (2)	–3.563	–4.285	–7.235** (0)	–3.563	–4.285	1

Vec. #	Cointegrating Vector (data: 1970–2002)	Trace Statistic (no vector)	MaxEigen (no vector)
1	$LMF_t + 0.933LMFCOST_t{}^{**} - 0.035EXPFIN_t{}^{**} - 1.576$	36.407**	26.823**
	(3.89) (–7.53)	(other statistics imply one significant vector)	
2	$LMF_t + 0.977LMFCOST_t{}^{**} - 0.033EXPFIN_t{}^{**} - 1.620$	*VECM Estimates with*	
	(3.95) (–7.16)	*Oil Shock Dummy Present*	
3	$LMF_t + 2.371LMFCOST_t{}^{*} - 0.032EXPFIN_t{}^{**} + 0.652LDCIRA_t - 4.768$	49.075*	29.032*
	(2.65) (–7.79) (1.53)	(other statistics imply one significant vector)	
4	$LMF_t + 2.449LMFCOST_t{}^{**} - 0.030EXPFIN_t{}^{**} + 0.673LDCIRA_t - 4.908$	*VECM Estimates with*	
	(2.76) (–7.44) (1.60)	*Oil Shock Dummy Present*	
5	$LMF_t + 0.992LMFCOST_t{}^{**} - 4.070LEXPFIN_t{}^{**} + 16.389$	36.458**	26.832**
	(4.11) (–7.37)	(other statistics imply one significant vector)	
6	$LMF_t + 1.032LMFCOST_t{}^{**} - 3.942LEXPFIN_t{}^{**} + 15.779$	*VECM Estimates with*	
	(4.16) (–7.03)	*Oil Shock Dummy Present*	
7	$LMF_t + 2.662LMFCOST_t{}^{**} - 3.688LEXPFIN_t{}^{**} + 0.763LDCIRA_t + 10.975$	49.387*	29.292*
	(2.97) (–7.74) (1.78)	(other statistics imply one significant vector)	

Notes: t-statistics in parentheses. *(**) significant at the 5 (1) percent level.

Vectors 1, 3, 5, and 7 based on the Johansen–Juselius criterion, for which E-Views lists eigenvalues and trace statistics. LMF omits equity in IRAs and pensions (defined benefit and contribution). The Akaike information criteria implied a lag length of 1 for estimating cointegrating vectors and estimating vectors with a constant, no time trend in the vector, and allowing variables to have time trends. Flipping the signs in the cointegrating vectors yields the estimated equilibrium; thus, vector 1 implies that equilibrium $LMF_t = -0.933*LMFCOST_t + 0.035*EXPFIN_t + 1.576$.

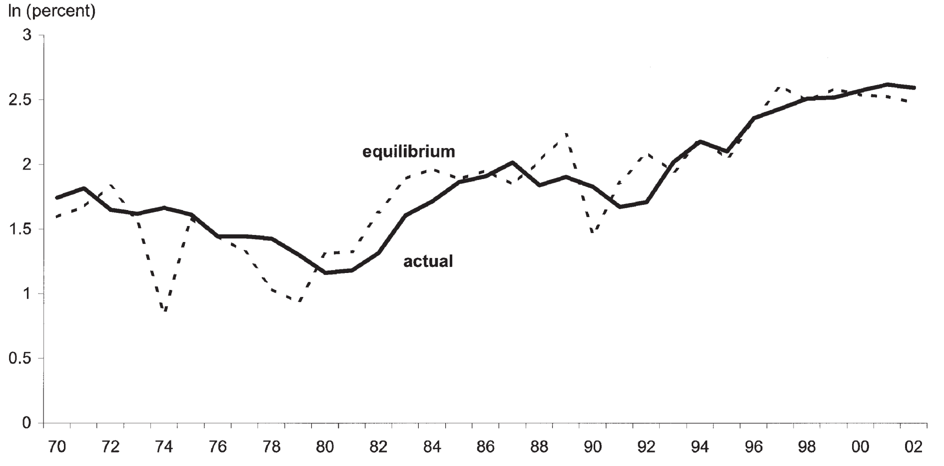

Figure 5. Equilibrium Estimates Track Actual Mutual Fund Use

Notes: Log of ratio (MF) of mutual fund equity to the sum of itself and directly held equity, where each component excludes stock in IRAs and defined contribution pensions. Equilibrium from vector 1 (Table 2), using 5-year horizon equity fund loads adjusted for expense ratios (MFCOST) and an index of household expectations of their year-ahead financial condition (EXPFIN).

Source: Flow of Funds accounts, Investment Company Institute, Duca (2004), and author's calculations.

maximum eigen statistics reject the hypothesis of that no cointegrating (long-run) relationship exists for each combination of variables. This result, coupled with the insignificant statistics for the existence of more than one cointegrating vector (not shown) support the hypothesis that one long-run (cointegrating) relationship exists in each case. Similar vector error-correction models (VECMs)—which jointly estimate long- and short-term (e.g. first difference) relationships—were also estimated but include the oil dummy as a short-term variable.

Several interesting patterns emerge from the results in Table 2. Note that the economic relationships from the implied equilibrium relationships can be obtained by flipping the signs in the cointegrating vectors (see the note in Table 2). First, equity fund costs are significantly and negatively related to equity fund use in the long run. Second, expectations of financial conditions have a statistically significant and positive relationship with relative equity fund use. Third, equilibrium equity fund use implied by the vector 1 tracks actual use well, as shown in Figure 5, which plots estimated equilibrium levels with actual levels. Fourth, although low financial expectations in the early 2000s reduced estimates of equilibrium mutual fund use, this effect was outweighed by slightly lower mutual fund costs (Figure 5). The smaller rises in the relative use of mutual funds since 1999 (Figure 1) accord with the smaller rise in stock ownership rates and the smaller decline in mutual fund costs between 1998 and 2001 than had occurred between 1995 and 1998 (Figure 2). The last important pattern is that mutual fund costs and financial confidence remain significant and have the same qualitative effects in the presence of the pension-shift variable DCIRA, which is insignificant at the 5 percent level, with a positive sign implying that non-pension mutual fund use is negatively related to these pension shifts. The last result might arise if equity in mutual fund retirement accounts substitutes for mutual fund holdings of stock outside of these accounts. Nevertheless, this last result should not be misinterpreted as implying that the rising use of 401(k) and IRAs has not boosted overall mutual fund use because the mutual fund use variable tested (MF) excludes equity in tax-favored retirement accounts from its numerator and denominator to limit the impact of pension behavior arising from changes in taxes, labor market behavior, and pension regulation.

4.2. *Causality Test Results*

Improvements in technology plausibly reduced mutual fund costs, thereby raising the relative use of mutual funds. But shifts in relative mutual fund use may have lowered fund costs via economies of scale in operating funds. Causality tests were run to address this issue.

Since equity fund use, mutual fund costs, and confidence are cointegrated, such tests need to include a lagged error-correction term and an additional condition for causality from variable X to Y is that lags of ΔX and the error-correction term are jointly significant (Enders, 1995, pp. 367, 371, 372). Table 3 shows results using an optimal lag length on first difference terms of one (implied by the Akaike and Schwartz lag-length criteria) and error-correction terms from the cointegrating vector 1. Lagged error-correction terms lead changes in MF, but do not changes in mutual fund costs, while lagged first difference terms were insignificant. Joint tests of the first difference and error-correction terms (upper-right part of Table 3) show one-way causality from mutual fund costs to mutual fund use (and from financial confidence to mutual fund use—not shown), implying that long-run swings in fund costs lead short-run changes in mutual fund use. This finding is also obtained when ΔEXPFIN was omitted and EXPFIN was not used in estimating the error-correction term, as shown in the upper-left portion of Table 3.

Other results indicate that mutual fund costs are linked to financial technology, as tracked by bank productivity (BPROD), which outpaced non-farm business productivity since the early 1980s. MFCOST is cointegrated with bank productivity (available 1967–2002)—meaning that mutual fund costs are related to financial sector productivity—and the equilibrium equity fund costs implied by the cointegrating vector closely track actual equity fund costs (Figure 6).[14]

Causality test results indicate that the lagged error-correction term leads changes in equity fund costs but does not lead changes in bank productivity (Table 3). In addition, lagged first differences of productivity were not significant in explaining short-run changes in loads and lagged first differences of loads were insignificant in accounting for growth in bank productivity. These findings indicate that long-run movements in financial sector productivity, as captured in the error-correction term, lead short-run movements in broadly defined equity mutual fund costs.

[14]Based on the Akaike criteria, the vector is estimated using a lag length of 2 and assuming a constant but not a time trend in the vector and allowing variables to have their own time trends.

TABLE 3

CAUSALITY TESTS

Basic Specification: $\Delta\log(Y)_t$ = constant + EC_{t-1} + $\log(X)_{t-1}$ + $\log(Y)_{t-1}$

	Lags of Δlog MFCOST & MF			Lags of Δlog MFCOST, Δlog MF, & ΔEXPFIN		
Direction of causality	F-Test $EC_{t-1} = 0$	F-Test $\Delta\log(X)_{t-1} = 0$	F-Test $EC_{t-1} = \Delta\log(X)_{t-1} = 0$	F-Test $EC_{t-1} = 0$	F-Test $\Delta\log(X)_{t-1} = 0$	F-Test $EC_{t-1} = \Delta\log(X)_{t-1} = 0$
LMFCOST $\Rightarrow$ LMF	7.718*	0.143	4.280*	15.738**	0.113	8.095**
LMF $\Rightarrow$ LMFCOST	1.355	0.054	0.682	0.025	0.155	0.086

EC from Cointegrating Vector for LMF & LMFCOST (4 lags optimal)
LMF + 2.523*LMFCOST** –3.067
(6.36)
Trace Statistic (no vector) MaxEigen (no vector)
15.795* 16.684*
(other statistics imply one significant vector)

EC term for tests directly above involving all 3 variables based on vector 1 in Table 2

LMFCOST and Banking Sector Productivity (LBPROD)

Direction of causality	F-Test $EC_{t-1} = 0$	F-Test $\Delta\log(X)_{t-1} = 0$	F-Test $EC_{t-1} = \Delta\log(X)_{t-1} = 0$	EC from Cointegrating Vector for MFCOST & BPROD: $LMFCOST_t + 0.819LBPROD_t$** – 4.019 (23.84)	
LBPROD $\Rightarrow$ LMFCOST	13.498**	0.674	7.580**	Trace Statistic (no vector) 16.540*	MaxEigen (no vector) 16.491*
LMFCOST $\Rightarrow$ LBPROD	0.452	0.129	0.285	(other statistics imply a unique vector)	

Unit Root Test Statistics Using 1967–2002 Data: Augmented Dickey-Fuller Statistics (constant with trend)

Variable	Level (modified SIC lag)	5% Critical Level for Lag	1% Critical Level for Lag	First Difference (modified SIC lag)	5% Critical Level for Lag	1% Critical Level for Lag	Degree of Integration
LMFCOST	–2.521 (0)	–3.544	–4.244	–5.075** (0)	–3.548	–4.253	1
LBROD	–2.063 (0)	–3.544	–4.244	–4.911** (0)	–3.548	–4.253	1

Notes: t-statistics in parentheses.

*(**) denotes significant at the 5 (1) percent level.

The one lag lengths on the $\Delta\log(X)$ and $\Delta\log(Y)$ terms are optimal according to the Akaike and Schwartz criteria. Tests involving LMF use data over 1970–2002 and tests involving LBROD use data from 1967–2002.

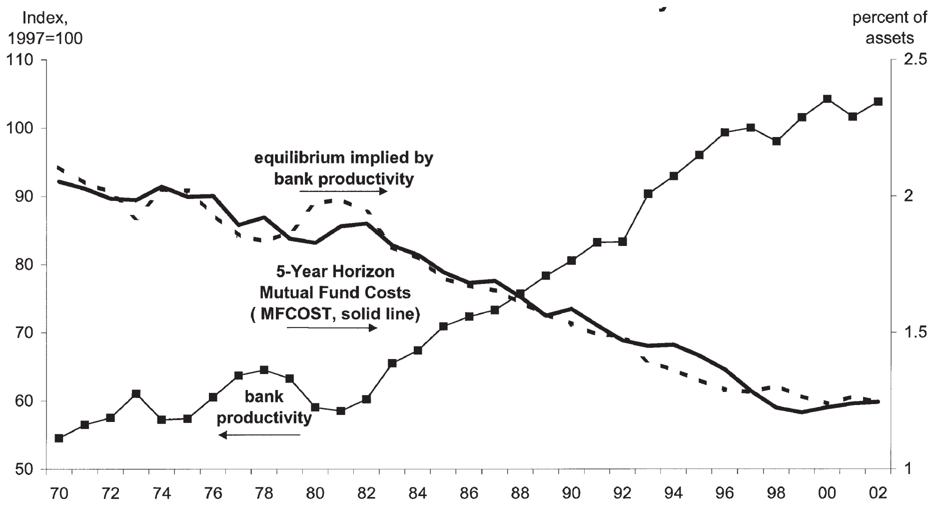

Figure 6. Declines in Equity Mutual Fund Costs Mirror Increases in Bank Productivity

Equilibrium from the cointegrating vector at the bottom of Table 3, using 5-year horizon equity fund loads adjusted for expense ratios (MFCOST) and bank productivity.

Source: Bureau of Labor Statistics, Investment Company Institute, Duca (2004), and author's calculations.

4.3. *Results for Explaining Short-Run Movements in the Relative Use of Equity Funds*

Short-run changes in mutual fund use are analyzed using vector error-correction models (VECMs, Table 4), which jointly estimate the impact of long-run and short-run factors, where the error-correction (EC) terms equal actual minus the estimated equilibrium logs of MF, with the latter based on the correspondingly numbered cointegrating vectors in Table 2. Each VECM contains short-run factors, such as the lagged dependent variable and lagged changes in mutual fund costs and confidence. Thus, models 1 and 2 include financial expectations and mutual fund costs as long-term determinants, but model 2 includes the oil variable which alters the estimated EC term and enters as a short-term variable. Models 3 and 4 correspond to models 1 and 2, but include the pension shift variable in the error correction term and its lagged first difference. Models 5–7 correspond to models 1–3, except they use the log version of financial expectations.

Several patterns arise in Table 4. First, error-correction terms are significant with the expected negative sign, implying that long-run factors help explain short-run changes. Since each error-correction term equals the actual log level minus its equilibrium, results imply that mutual funds use falls when actual use exceeds its equilibrium. With fund costs negatively related to mutual fund use in the long run, this implies that a persistent drop in fund costs boosts mutual fund use in the short run. For analogous reasons, financial confidence has oppositely signed short-run effects because it is positively related to mutual fund use in the long run. Second, the size of the error-correction coefficients indicates that the gap between actual and equilibrium use of mutual funds closes at reasonable speeds of 44–52 percent

TABLE 4

MODELS OF THE CHANGE IN THE EQUITY FUND SHARE OF DIRECTLY AND MUTUAL FUND HELD EQUITY ASSETS

	Models Without LDCIRA Shift Variable		Models With LDCIRA Shift Variable		Models Using Log of Scaled EFIN Index		
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.027	0.041	0.033	0.050⁺	0.027	0.040⁺	0.031
	(1.15)	(1.80)	(1.21)	(1.90)	(1.15)	(1.77)	(1.16)
EC_{t-1}	–0.451**	–0.487**	–0.492**	–0.524**	–0.441**	–0.475*	–0.493**
	(–3.97)	(–4.49)	(–4.03)	(–4.54)	(–4.04)	(–4.54)	(–4.14)
$\Delta MFCOST_{t-1}$	0.284	0.328	0.439	0.454	0.261	0.289	0.472
	(0.34)	(0.42)	(0.51)	(0.57)	(0.31)	(0.37)	(0.55)
$\Delta EFIN_{t-1}$	–0.006*	–0.007*	–0.006+	–0.007*	–0.759*	–0.819*	–0.761*
	(–2.02)	(–2.32)	(–1.97)	(–2.21)	(–2.07)	(–2.38)	(–2.05)
ΔLMF_{t-1}	0.188	0.141	0.206	0.163	0.180	0.134	0.198
	(1.27)	(1.01)	(1.40)	(1.19)	(1.23)	(0.96)	(1.36)
$LDCIRA_{t-1}$			–0.103	–0.198			–0.036
			(–0.20)	(–0.42)			(–0.07)
$OILDUM_t$		–0.124*		–0.130*		–0.121*	
		(–2.06)		(–2.18)		(–2.02)	
$\overline{R}^2$	0.352	0.435	0.367	0.459	0.360	0.439	0.380
D.W.	1.96	2.03	1.91	2.11	1.85	2.03	1.92
LM(1)	0.29	0.27	0.03	0.82	0.32	0.24	0.01
LM(2)	0.29	0.30	0.05	0.97	0.33	0.25	0.03
Q(16)	8.24	14.47	7.68	15.36	8.24	14.08	7.44

Notes: t-statistics in parentheses.
*(**) denotes significant at the 5 (1) percent level.
EC terms from same-numbered vectors in Table 2.
Sample period is 1972–2002, using lagged first differences of data available over 1970–2002.

a year. Third, the oil dummy has a negative and statistically significant coefficient. Fourth, the error-correction term was the most statistically significant variable and lagged changes of long-run factors were insignificant or less significant in every model, consistent with the view that portfolios are mainly driven by long-run factors. Fifth, these results were qualitatively unaffected by including the pension shift variable DCIRA or when using the log-index version of expected family financial conditions.

5. Conclusion

This paper finds that over the long run, the use of mutual funds (outside of pension accounts) to own equity relative to directly holding stock is negatively related to mutual fund costs and positively related to confidence in future family finances. These results for the U.S. are consistent with models which imply that lower transfer costs and lower income risk induce higher stock ownership rates (Heaton and Lucas, 2000; Vissing-Jorgensen, 2002) among middle-income families, for whom mutual funds are a more feasible way of owning a diversified stock portfolio than directly buying stocks. Furthermore, explainable short-run changes in mutual fund use mainly reflect these long-run factors. In particular, error-correction models indicate that short-run changes in mutual fund use are negatively correlated with the gap between actual and equilibrium mutual fund usage, where equilibrium levels reflect the long-run impact of mutual fund costs and financial confidence.

Other findings imply that lower mutual fund costs owe to greater financial productivity, whose long-run movements lead short-run changes in mutual fund costs, with no reverse causality. Furthermore, long-run trends in mutual fund costs lead short-run movements in the relative use of equity funds, with no reverse causality. Thus, while confidence may shift if the macroeconomic environment became persistently less optimistic, it is unlikely that the large increases in financial productivity levels will reverse. If anything, other innovations, such as exchange traded funds, will likely further reduce cost and other barriers to stock ownership.

Thus, much of the increases in stock ownership rates and exposure to stock wealth in the U.S. during the 1990s are likely to persist, along with their potential ramifications for economic and political behavior. Cross country evidence that stock ownership is highly linked to mutual fund use (Guiso *et al.*, 2003) suggests that these implications may be relevant for other developed nations, where attempts to deepen the use of equity markets by firms could, along with low or declining mutual fund costs, induce higher stock ownership rates.

Appendix: Why Demographic Shifts Do Not Alter the Qualitative Results

This appendix reviews why demographic shifts do not alter the qualitative results about the relative use of mutual funds to own nonpension equity. First, mutual fund use (MF) has nearly tripled since the early 1970s, whereas recent levels of AGE35+ are near those of the early 1970s (Figure A1). In contrast, the pattern of mutual fund costs lines up with the pattern of relative mutual fund use over 1970–2002, and as is the case in earlier years for MFA, another measure of mutual fund use. MFA extends MF by downwardly adjusting pre-1969 directly held equity (which includes stock in bank trusts and estates before 1969) by 13.83 percent, the 1969 ratio of equity in bank trusts and estates to directly held stock plus equity in bank trusts and estates.

There is more evidence against AGE35+. First, AGE35+ does not have a unit root (Table A1), reflecting that it is dominated by low frequency swings associated with the demographic passage of the baby-boom generation. Second, when AGE35+ is included with MF, MFCOST and EXPFIN, a statistically significant and unique cointegrating vector could not be found (vector 2). Third, when the log version of EXPFIN is used, AGE35+ is insignificant (vector 4), with a negative sign implying that equilibrium mutual fund use is positively related to AGE35+. Fourth, over 1958–2002, the sign of AGE35+ switches to positive (vector 6) implying that equilibrium mutual fund use is negatively related to AGE35+. This switch in sign likely reflects how the sample periods encompass different portions of the low frequency curvature in AGE35+. Finally, in both samples, the qualitative impacts of MFCOST and LEXPFIN are unaffected by including AGE35+, with only small quantitative differences (vectors 3 and 4; and vectors 5 and 6). Note that these results for MF and MFA regard the relative use of mutual funds

TABLE A1

DEMOGRAPHIC AND LONGER SAMPLE PERIOD FINDINGS

Unit Root Test Statistics for ln(AGE35+): Augmented Dickey-Fuller Statistics (constant with trend)

Sample Period	Level (SIC lag in parentheses)	First Difference (SIC lag in parentheses)	Second Difference (SIC lag in parentheses)	Third Difference (SIC lag in parentheses)	Integrated of Degree 1?
1970–02	–4.061*(1)	–1.279 (0)	–1.145 (8)	9.008** (0)	No
1958–02	–1.941 (1)	–2.022 (1)	–1.065 (8)	12.294** (0)	No

Vector # (lag length)	Cointegrating Vector	Trace Statistic (no vector)	MaxEigen (no vector)
	Data: 1970–2002		
1 (1)	LMF$_t$ + 0.933LMFCOST$_t$** – 0.035EXPFIN$_t$** – 1.576	36.407**	26.829**
	(3.89) (–7.53)	(other statistics imply one significant vector)	
2 (n.a.)	No unique cointegrating vector using LMF, LMFCOST, EXPFIN, and LAGE35+$_t$	(other statistics imply multiple vectors)	
3 (1)	LMF$_t$ + 0.992LMFCOST$_t$** – 4.070LEXPFIN$_t$** + 16.389	36.458**	26.832**
	(4.11) (–7.37)	(other statistics imply one significant vector)	
4 (2)	LMF$_t$ + 1.191LMFCOST$_t$** – 2.977 LEXPFIN$_t$** – 1.157LAGE35+$_t$ + 15.881	52.906**	27.492**
	(2.66) (–7.05) (–1.43)	(other statistics imply one significant vector)	
	Data: 1958–2002		
5 (1)	LMFA$_t$ + 1.315LMFCOST$_t$** – 3.534LEXPFIN$_t$** + 13.775	29.111$^+$	21.992*
	(5.46) (–6.21)	(other statistics imply one significant vector)	
6 (1)	LMFA$_t$ + 1.837LMFCOST$_t$** – 4.175LEXPFIN$_t$** + 0.784LAGE35+$_t$ + 13.284	64.794**	35.770
	(8.34) (–7.18) (1.82)	(other statistics imply one significant vector)	

Notes: *($^+$,**) denotes significant at the 95% (90%, 99%) level. t-statistics in parentheses.

Vectors chosen using the lag length which yields a one significant cointegrating vector, minimizes the AIC criterion, and allows for time trends within the variables (consistent with unit root tests), but not within the cointegrating relationship. LMFA is the log of the mutual fund share variable which adjusts direct stock holdings because pre-1969 data include stock held through bank and personal trusts. Post-1969 data were the same, but pre-1969 direct stock holdings were downwardly adjusted by a multiplicative factor based on the relative size of stock held through trusts relative to the sum of itself and direct stock holdings in 1969.

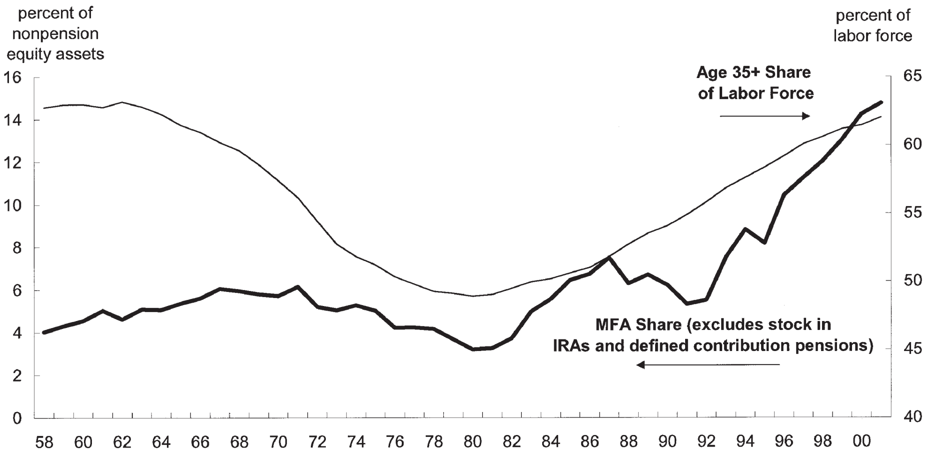

Figure A1. Age Composition Not Simply Related to Relative Mutual Fund Use

Pre-1969 data on MFA share is based on Flow of Funds data that were break-adjusted by the author.

Source: Flow of Funds, Investment Company Institute, Bureau of Labor Statistics, and author's calculations.

to own equity excluding pensions and IRAs, and for this reason do *not* imply that demographic trends are not linked to the form in which households own stocks in IRAs or pension accounts.

References

Aizcorbe, Ana M., Arthur B. Kennickell, and Kevin B. Moore, "Recent Changes in U.S. Family Finances: Evidence from the 1998 and 2001 Survey of Consumer Finances," *Federal Reserve Bulletin*, 89, 1–32, January 2003.

Bernartzi, Shlomo and Richard H. Thaler, "Myopic Loss Aversion and the Equity Premium Puzzle," *Quarterly Journal of Economics*, 110, 75–92, February 1995.

Blanchard, Olivier J., "Movements in the Equity Premium," *Brookings Papers on Economic Activity*, 75–138, 1993.

CDA/Wiesenberger, *Investment Companies*, CDA Investment Technologies, Rockville, Maryland, various annual issues.

Cheng, Ing-Haw and Eric French, "The Effect of the Run-up in the Stock Market on Labor Supply," *Economic Perspectives*, Federal Reserve Bank of Chicago, 48–65, Fourth Quarter 2000.

Coronado, Julia L. and Maria G. Perozek, "Wealth Effects and the Consumption of Leisure: Retirement Decisions During the Stock Market Boom of the 1990s," FEDS Working Paper No. 2003–20, Board of Governors of the Federal Reserve System, Washington, DC, May 2003.

DeBondt, Werner F. M. and Richard H. Thaler, "Does the Stock Market Overreact?" *Journal of Finance*, 42, 793–805, July 1985.

Dixit, Avinash K., "Entry and Exit Decisions Under Uncertainty," *Journal of Political Economy*, 97, 620–37, June 1989.

Duca, John V., "Financial Technology Shocks and the Case of the Missing M2," *Journal of Money, Credit, and Banking*, 32, 820–39, November 2000.

———, "Mutual Funds and the Stock-Wealth Channel in the U.S.," mimeo, Federal Reserve Bank of Dallas, November 2004.

Duca, John V. and Richard G. Anderson, "The Evolving Impact of Stock Market Shocks and Mortgage Activity on Broad Money Demand," mimeo, Federal Reserve Bank of Dallas, July 2004.

Duca, John V. and Jason Saving, "The Political Economy of the Mutual Fund Revolution: How Falling Mutual Fund Costs Have Affected Congressional Elections," mimeo, Federal Reserve Bank of Dallas, December 2001.
Durkin, Thomas A. and Gregory E. Elliehausen, *1977 Consumer Credit Survey*, Board of Governors of the Federal Reserve System, Washington, DC, 1978.
Dynan, Karen E. and Dean M. Maki, "Does Stock Market Wealth Matter for Consumption?" FEDS Working Paper 2001–23, Board of Governors of the Federal Reserve System, Washington, DC, May 2001.
Enders, Walter, *Applied Economic Time Series*, John Wiley & Sons, New York, 1995.
Engle, Robert F. and Clive W. J. Granger, "Co-integration and Error Correction: Representation, Estimation, and Testing," *Econometrica*, 55, 251–76, March 1987.
Guiso, Luigi, Haliassios, Michael, and Tulio Jappelli, "Household Stockholding in Europe: Where Do We Stand and Where Do We Go?" *Economic Policy*, 36, 123–70, April 2003.
Gustman, Alan L. and Thomas L. Steinmeier, "The Stampede Toward Defined Contribution Pension Plans: Fact or Fiction?" *Industrial Relations*, 31, 361–9, Spring 1992.
Haliassos, Michael and Carol C. Bertaut, "Why So Few Hold Stocks," *The Economic Journal*, 105, 1110–29, September 1995.
Heaton, John and Deborah Lucas, "Portfolio Choice in the Presence of Background Risk," *The Economic Journal*, 110, 1–26, January 2000.
IBC/Donoghue, *Mutual Funds Almanac*, IBC/Donoghue, Ashland, Massachusetts, various annual issues.
Investment Company Institute, *Mutual Fund Fact Book*, Investment Company Institute, Washington, DC, various annual issues.
Ippolito, Richard A., "Toward Explaining the Growth of Defined Contribution Plans," *Industrial Relations*, 34, 1–20, January 1995.
Johansen, Soren and Katarina Juselius, "Maximum Likelihood Estimation and Inference on Cointegration—with Applications to the Demand for Money," *Oxford Bulletin of Economics and Statistics*, 52, 169–20, May 1990.
Katona, George, Charles A. Lininger, and Eva Mueller, *1967 Survey of Consumer Finances*, University of Michigan, Ann Arbor, Michigan, 1968.
Katona, George, William Dunkleberg, Gary Hendricks, and Jay Schmiedeskamp, *1969 Survey of Consumer Finances*, University of Michigan, Ann Arbor, Michigan, 1970.
Katona, George, Lewis Mandell, and Jay Schmiedeskamp, *1970 Survey of Consumer Finances*, University of Michigan, Ann Arbor, Michigan, 1971.
Kennickell, Arthur B., Martha Starr-McCluer, and Annika E. Sunden, "Family Finances in the U.S.: Recent Evidence From the Survey of Consumer Finances," *Federal Reserve Bulletin*, 83, 1–24, January 1997.
Kennickell, Arthur B., Martha Starr-McCluer, and Brian J. Surette, "Recent Changes in U.S. Family Finances: Results from the 1998 Survey of Consumer Finances," *Federal Reserve Bulletin*, 86, 1–29, January 2000.
Laderman, Elizabeth, "Deposits and Demographics," *FRBSF Letter* 97–19, Federal Reserve Bank of San Francisco, June 27, 1997.
McConnell, Margaret M. and Quiros, Gabriel P., "Output Fluctuations in the United States: What has Changed Since the Early 1980s?" *American Economic Review*, 90, 1464–76, December 2000.
Mehra, Rajnish and Edward C. Prescott, "The Equity Premium: A Puzzle," *Journal of Monetary Economics*, 15, 145–61, March 1985.
Morgan, Donald P., "Will the Shift to Stocks and Bonds by Households be Destabilizing?" Federal Reserve Bank of Kansas City, *Economic Review*, 31–44, Second Quarter 1994.
Morningstar, *Morningstar Mutual Funds*, Morningstar, Chicago, various issues.
Nadler, Richard, "The Rise of Worker Capitalism," *Cato Policy Analysis*, 359, November 1999.
Rea, John D., Brian K. Reid, and Travis Lee, "Mutual Fund Costs, 1980–98," *Investment Company Institute Perspective*, 5(4), 1–12, September 1999.
Reid, Brian and Kimberlee Millar, "Mutual Fund Developments in 1998," *Investment Company Institute Perspective*, 5(2), 1–12, February 1999.
Saito, Makoto, "Limited Market Participation and Asset Pricing," manuscript, University of British Columbia, Department of Economics, 1995.
Shiller, Robert J., "Stock Prices and Social Dynamics," *Brookings Papers on Economic Activity*, 457–98, 1984.
Siegel, Jeremy J., *Stocks for the Long Run: A Guide to Selecting Markets for Long-Term Growth*, Irwin Professional Publishers, Burr Ridge, IL, 1994.
University of Michigan, Survey Research Center, "Index Calculations," http://www.sca.isr.umich.edu/documents.php?c=i, 2005.

Vissing-Jorgensen, A. "Towards an Explanation of Household Portfolio Choice Heterogeneity: Non-financial Income and Participation Cost Structures," http://www.kellogg.northwestern.edu/faculty/vissing/htm/vissing_nber2_update.pdf, 2002.
Warther, Vincent A., "Aggregate Mutual Fund Flows and Security Returns," *Journal of Financial Economics*, 39, 209–335, October/November 1995.