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ABSTRACT

Many middle-income workers save for retirement through 401(k) plans. This study addresses the concern that low account balances of older workers may indicate that these vehicles are not sufficient to insure adequate retirement savings. In particular, the study shows that workers are not persistent (continuing once a worker has started) in contributing, and a weak stock market exacerbates the problem.

The study suggests that the concept of inertia, which is in vogue in behavioral economics, does not seem to hold for 401(k) saving behavior. Furthermore, the investment strategy of dollar cost averaging does not seem to hold, either. Using panel data (Panel Study of Income Dynamics) covering a six-year time span from 1999 to 2005, the study presents descriptive and econometric evidence about the persistence behavior of individuals with 401(k) accounts. In particular, the PSID data that were analyzed come from four biannual waves in 1999, 2001, 2003, and 2005. Descriptive data show that of the sample of household heads aged 21-65 in 2005 who were employed in every time period, only about one-third (35 percent) contributed to their plan in all four waves. Job changing had an impact. However, even for individuals in the sample who did not change jobs, less than half (46 percent) contributed in all four years of the survey.

An equation modeling 401(k) contribution behavior was estimated using logit regression analysis. When this model was estimated with the sample of individuals who were employed in each panel and with the sample of individuals who were employed in each panel and never changed jobs, the coefficient on the Dow Jones Industrial Average was positive and significant. Workers contributed to their plans when the market was up. This investment error is called *herd investing*, where individuals get into the market when it is high and not when it is low.

The study concludes that the findings have important implications for the pension system and adequacy of retirement income. Projections of future retirement income readiness that assume that workers persistently contribute over their working lives greatly exaggerate the future levels of pension assets workers will have accumulated.

The Persistence of Employee 401(k) Contributions over a Major Stock Market Cycle:
Evidence on the Limited Power of Inertia on Savings Behavior

Leslie A. Muller and John A. Turner

Have workers accumulated sufficient retirement savings? Munnell, Webb, and Golub-

Sass (2009) find that half of U.S. workers have insufficient savings to be on track for having

adequate retirement income. Scholz and Seshadri (2008), however, using different assumptions,

find a smaller percentage, but a substantial minority, to have insufficient savings. Other than

Social Security, middle-income workers save for retirement largely through 401(k) plans. Thus,

these findings of insufficient saving lead to a question about the adequacy of worker savings

through 401(k) plans for at least some workers. The low account balances accumulated by many

older workers are a direct indication of the possible insufficiency of savings through these plans.

One aspect of this issue is the persistency of worker contributions. Persistency refers to

whether workers continue contributing, and for how long, once they have started. Whether

workers display persistency in contributing to their 401(k) plans is important from a policy

perspective. Projections of final retirement wealth, such as the two cited above, are often made

using micro simulation models, which have their own set of assumptions regarding contribution

persistence. If these models incorrectly assume that once a worker contributes he will contribute

for the remainder of his working life, these projections will be too high, falsely indicating that

workers will have adequate savings at retirement. In addition, workers who do not contribute

consistently do not benefit from dollar cost averaging, which is likely to decrease rates of return

on 401(k) balances, leading to even lower retirement wealth.[1] Dollar cost averaging occurs

when the 401(k) participant consistently contributes the same dollar amount, regardless of

whether the stock market is up or down. By doing so, the participant automatically purchases more shares when the stock market is down than when it is up.

Results from behavioral economics suggest that inertia would cause workers who began contributing to their 401(k) plans to continue doing so, as long as they remained with the same employer.[2] Inertia, sometimes called status quo bias, refers to a psychological propensity to not make changes but to continue doing what one is doing. Relating to pensions, inertia would cause contributors to continue contributing. That clearly would be the path of least resistance, since stopping contributions would require action on the individual's part. Inertia involves not making changes to a greater degree than would be predicted solely taking into account the transactions costs involved in making changes. However, it does not necessarily imply the complete absence of change. Presumably, if the incentives are sufficiently great, workers overcome inertia.

In this paper, we investigate the power of inertia on worker pension contributions over a period of a number of years. In particular, we investigate the hypothesis that inertia would cause workers who are contributing to a 401(k) plan to continue doing so.

This hypothesis thus relates to the limits of the traditional model of rational behavior. It has relevance for the policy idea that automatic enrollment in defined contribution plans is a way to encourage participation in those plans because, due to inertia, workers will continue contributing once they have been enrolled.

This paper uses the Panel Study of Income Dynamics (PSID) to investigate an aspect of the issue of persistency of contributions, which is: Do workers persistently contribute to 401(k) plans over stock market cycles?[3] Because workers may stop contributing during periods of stock market decline, examining contributions over a stock market cycle may provide insight into what may be a cause of inconsistent contributions over time. The dramatic rise in the stock market

over the late 1990s, followed by the dramatic decline, and then the subsequent rise to all time highs, provides a particularly volatile period to examine the persistency of 401(k) contributions.

Examining persistency of worker contributions over this period may also provide insight into the savings behavior of workers. Are workers target savers, offsetting the stock market decline by investing more? Or are workers "herd investors," putting money in the stock market when it is doing well, and becoming discouraged and not contributing when it is doing poorly? Or might workers be "inertia investors," contributing regardless of the state of the stock market? The relative prevalence of these three types of worker-investors may have important implications for the adequacy of worker preparedness for retirement.

RESEARCH GOALS

Our research has a number of goals:[4]

1) It documents the density and the persistency of workers' pension contributions. The density of contributions is the percentage of years in which the worker contributes. Persistency refers to whether workers continue contributing to their plan after they make their first contribution. It also describes how long they continue to contribute.

2) It describes how persistency varies across population groups.

3) It analyzes the variation in participation across workers using multivariate regression analysis. What factors explain why people who are covered by pensions stop contributing to them?

4) It investigates the effect of changes in the stock market over time on participation. Participation is measured by whether the worker is contributing.

5) It provides evidence on the prevalence of different types of investors among 401(k) participants.

6) It investigates the extent to which differences in pension participation across population groups are due to differences in persistence of contributions.

Based on the life cycle hypothesis, where workers reduce savings during downturns in their incomes, we hypothesize that contribution persistence, or "inertia" investing, is more likely when workers have stable earnings patterns and stable demographics—marital status, family size, and health. Smith, Johnson, and Muller (2004) find that result for some changes of circumstances. We hypothesize that "herd" investing, which is an investment error, is more likely to occur among lower-income people, who presumably have less financial sophistication. Previous research, reviewed in Turner (2003), found that lower-educated workers were more likely to make errors in investment decisions than more highly educated workers. We hypothesize that "target" investing is more likely to occur among lower- and middle-income workers than upper-income workers because lower- and middle-income workers are more likely to be weighing trade-offs of present versus future consumption than upper-income workers, for whom savings for bequests is more likely to be where trade-offs occur.

THEORETICAL CONSIDERATIONS

While simulations that project the future retirement income of workers often assume continuous years of contributions, workers may not persist in their contributions to their plans, but instead contribute intermittently. Because of family responsibilities or other reasons, workers may face times when they are either unemployed or out of the labor market. Even when workers are in the labor market, their pension contributions may vary over time due to changes in their needs, their earnings, whether their job provides a pension, the availability and generosity of employer matching contributions, or their perceptions as to the optimal timing of contributions over stock market cycles.

These effects on pension contributions may be correlated with the stock market price changes. When stock prices are low, which is a good time to buy, workers' pension contributions may also be low or cease. This could occur for several reasons. First, some workers get discouraged when the stock market is declining and stop contributing. For others, their incomes may fall, such as when work hours are reduced. Alternatively, however, if workers have a target account balance, they may vary their contributions to offset capital market changes.

These risks influence the worker's pension accumulations through their effect on the level, density, and timing of a worker's pension contributions and preretirement withdrawals. The density of contributions is the proportion of the working life that he or she contributes to a pension.

We investigate whether variability in earnings affects the time pattern of savings in 401(k) plans. When workers have uneven earnings profiles, they may reduce their savings during periods when their earnings are relatively low to maintain their consumption levels during those periods. This cyclical pattern of savings is at odds with the approach recommended for investing of dollar-cost averaging investments by investing the same amount each period, regardless of the state of financial markets (State Farm 2010).

Variability in pension contributions over time may be affected by the degree of risk aversion of the pension participant (Blake, Cairns, and Dowd 2007). If participants have a target level of pension assets and their level of assets declines, they may contribute more to offset the decline. If so, then participants with greater holdings in equity may have greater volatility in pension contributions. Thus, variability in pension contributions over time may be partly the result of human capital risk resulting in variability in earnings (Mitchell and Turner 2010) and partly the result of capital market risk.

LITERATURE ON 401(K) PERSISTENCY

When the stock market declines and the economy is doing poorly, the life cycle model predicts that some people with 401(k) accounts may reduce their pension contributions to smooth their consumption over time, attempting to maintain their level of consumption in a lagging economy. A study by Putnam investors finds that in 2008, 21 percent of 401(k) plan participants had reduced their contributions and 4 percent had stopped contributing due to the economic downturn (O'Connor-Grant 2008). An Irish study conducted in 2009 found that a third of defined contribution plan participants had reduced or eliminated their contributions (PricewaterhouseCoopers 2009).

On the other hand, surveys indicate that some older people nearing their target retirement dates increase their contributions to reach their target level of savings before retirement (Mincer 2008). Thus, the pattern may vary by the age and number of years from the expected date of retirement of the worker.

Seligman and Wenger (2005) suggest that investment market returns may rise during periods of unemployment to the extent that the stock market is a leading indicator, with stock prices rising before unemployment falls. If true, unemployed workers might systematically miss opportunities to invest when equity prices are low. Their results suggest that such unemployment-related losses are larger for low-wage workers because they are more prone to job loss.

While a number of cross-sectional studies have examined determinants of pension contributions in the United States and in the United Kingdom, only a couple of studies have examined the persistency of workers' contributions over time.[5] Smith, Johnson, and Muller (2004) use the Survey of Income and Program Participation (SIPP) to look at the persistency of

employee contributions to 401(k) plans for up to 12 years. They find that 19 percent of contributors displayed intermittent patterns (i.e., had breaks in their contributions) and contribution rates tended to vary over time.

While the empirical analysis focuses on 401(k) contribution plans, Individual Retirement Accounts also provide evidence as to the persistency of worker contributions. Smith (2001), using a sample of tax returns from 1987–1996, finds a high rate of initial drop off in pension contributions to Individual Retirement Accounts (IRAs). Thus, worker contributions to IRAs indicate a lack of persistence to those plans. While this evidence does not directly relate to worker behavior in 401(k) plans, it suggests a pattern of lack of persistence in contributions. Of those contributing in 1987, only 45 percent were still contributing in 1992, with 40 percent contributing through 1996. Smith (2006) uses the British Household Panel Survey to examine the issue of persistency of contributions to individual account defined contribution plans. Her results suggest a link between pension contributions and changes in an individual's income needs, measured by financial circumstances, health, having a baby, and moving to a new house.

Data from Canada indicate that between 1991 and 1993, about half of participants in Registered Retirement Savings Plans (RRSPs, similar in some respects to IRAs, contributed in only one or two of the three years (Maser 1995). A more recent study for Canada has found that contributions to RRSPs varied considerably from year to year as workers' earnings varied (LeBlanc 2002). The same study finds that people with significant earnings reductions during working years accounted for most of the withdrawals from RRSPs before retirement.

Sailer, Bryant, and Holden (2006) use panel data on individual income tax returns combined with W-2s and other informational documents to study the persistence of contributions to IRAs and 401(k) plans over the period 1999–2002. They find that in 2002, 35 percent of those

who had contributed in 1999 to an IRA also contributed in 2000, 2001, and 2002. By comparison, for persons who filed tax returns in all years, they find a persistency of over 60 percent for 401(k) contributions over the same period

Employer contributions also may vary. During the stock market decline of 2001–2002, some U.S. companies that were especially hard hit, such as Ford and Bethlehem Steel, suspended their employer contributions to save money (Marquez 2008). Further suspensions occurred during the stock market decline starting in late 2007, as indicated by a listing of more than 300 companies compiled by the Pension Rights Center (2010). Employers are permitted to suspend their contributions at any time, so long as they are not obligated by labor contracts to maintain them.

DATA

We use the PSID, a nationally representative longitudinal survey of over 9,000 families. The research design involves creating longitudinal records for the heads of household at four points: 1999, 2001, 2003, and 2005. Our sample consists of all current workers in each wave, ages 21–65 in 2005. Workers who provided contribution amounts in response to the survey are counted as contributing to a plan. This use of the PSID is unique to the analysis of 401(k) contribution behavior, as no previous study has a representative sample of individuals throughout a long period of time over a stock market cycle.

Table 1 presents information on the monthly average closing prices for the Dow Jones Industrial Average (DJIA) for the period over which the data were collected. The majority of interviews are conducted in the months March through June.[6] It indicates that the survey months in the years 1999, 2001, and 2005 were periods of relatively high closing prices, while 2003 was

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a period of relatively low closing prices. The data point for 1999 corresponds to a point near the peak of the stock market; for 2003, a point near the bottom; and for 2005, a point representing a substantial rebound. Since a majority of the surveys were done in May and June, and the differences in the DJIA between the two months in all waves is small, we use the May average of each year in our analysis.

Table 1 Dow Jones Industrial Average Closing Prices ($)

Year	DJIA		DJIA monthly March–June	
	May	June	High	Low
1999	10,522	10,971	10,971	9,786
2001	10,912	10,502	10,912	9,878
2003	8,859	8,985	8,985	7,992
2005	10,467	10,275	10,503	10,193

SOURCE: Yahoo Finance. http://finance.yahoo.com/q/hp?s=%5EDJI&a=02&b=1&c=1999&d=11&e=31&f=2005&g=m.

DESCRIPTIVE ANALYSIS

This section presents results examining the persistency of pension contributions over a stock market cycle. It examines responses to the question, "What amount or percent of pay do you voluntarily contribute currently?"

Percent Currently Contributing and the Stock Market

Table 2 presents basic descriptive statistics on the number of workers contributing in different years. The main point to be drawn from Table 2 is that the percentage of workers contributing to a 401(k) plan is positively correlated with the DJIA, with a drop in the percentage of workers contributing in 2003, when the DJIA was at a low. This is evidence of an error in the investment pattern of some workers—not contributing when the stock market is low and

contributing when the stock market is high. This pattern leads to lower accumulated assets than would be expected from a simulation that does not recognize the pattern.

A possible upward trend that is suggested by the increase in percentage contributing in 2005 may be due to two factors. First, the sample is getting successively older in each subsequent survey. Pension participation rates tend to increase with age. Second, the coverage rate of 401(k) plans has continued to grow over time.

Table 2 Percent of Workers Contributing to a 401(k) Plan During the Stock Market Cycle

Year	Number contributing	Percent of workers	DJIA— May
1999	1,043	36	10,522
2001	1,031	36	10,912
2003	936	32	8,859
2005	1,122	39	10,467

SOURCE: Authors' tabulations from PSID. Sample includes individuals who worked in all four panels. N=2,896. Sample is weighted.

In addition to investigating the relationship of contribution persistence to changes in the stock market, we also examine more broadly the patterns and determinants of the persistence of contributions. In the regression analysis, we return to the issue of the effect of the stock market on contribution persistence.

Density of Contributions

Table 3 provides descriptive statistics for the density of pension contributions over the years 1999, 2001, 2003, and 2005 for workers who worked in each of the four years. The density of pension contributions is defined here as the percentage of the four sample years in which the worker contributed. The largest group—36 percent—is people who contributed in none of the sample months for the four waves. Among workers who contributed, 31 percent contributed in only one year, while 20 percent contributed all four years. Thus, we find little evidence of

persistency in contributions. This finding suggests that inertia is hardly a factor, and that workers do not engage in dollar cost averaging. In the following tables, we explore this finding further.

Table 3 Density of Pension Contributions over Four Sample Years (1999, 2001, 2003, 2005) for People Who Worked all Four Years

Number of years in which pension contribution was made	Frequency	Percent	Percent of contributors	Percent of contributors contributing at least *x* years
0	1,043	36	n/a	n/a
1	570	20	31	100
2	496	17	27	69
3	412	14	22	42
4	375	13	20	20
TOTAL	2,896	100.0	100.0	—

SOURCE: Authors' calculations from PSID surveys. Total number of contributors = 1,852. Sample is weighted.

Table 4 repeats Table 3 but for the sample of people contributing in 1999. Even though the density of contributions is higher for this group, it still indicates a low density of contributions. For people starting out the period in 1999 as contributors, 85 percent contributed at least half of the years, but only 35 percent contributed all four years. Thus, this table presents strong evidence against inertia causing persistence in contributions, even among people who worked in all four sample periods and began the portion of the PSID studied as contributors.

Table 4 Density of Pension Contributions over Four Sample Years for Persons Contributing in 1999, for People Who Worked All Four Years

Number of years in which pension contribution was made	Frequency	Percent	Percent of contributors contributing at least *x* years
1	157	15	100
2	219	21	85
3	302	29	64
4	365	35	35
TOTAL	1,043	100.0	—

SOURCE: Authors' calculations from PSID surveys. Sample is weighted.

Changing jobs can result in a worker who initially was able to participate in a pension plan subsequently not being able to do so. Table 5 examines the density of contributions for people who contributed in 1999, worked all four sample years, and did not change jobs.[7] Even for this group, less than half (46 percent) contributed in all four years.

Table 5 Density of Pension Contributions over Four Sample Years for Persons Contributing in 1999, for People Who Worked All Four Years and Did Not Change Jobs during That Time Period

Number of years in which pension contribution was made	Frequency	Percent	Percent of contributors contributing at least x years
1	57	11	100
2	93	17	90
3	143	26	72
4	252	46	46
TOTAL	545	100.0	—

SOURCE: Authors' calculations from PSID surveys. Sample is weighted.

Table 6 drops the restriction that the respondent worked in all four years. Thus, in this table some workers may not persist in contributing to a pension because they have stopped working. In this larger group of workers, 20 percent who contributed in 1999 only contributed that year, with 29 percent contributing in all four years. Thus, these data show a very low density of pension contributions, due in part to lack of persistency of work.

Table 6 Density of Pension Contributions over Four Sample Years for Persons Contributing in 1999, Including People Who Did Not Work in All Four Years

Number of years in which pension contribution was made	Frequency	Percent	Percent of contributors contributing at least x years
1	243	20	100
2	275	23	80
3	335	28	57
4	357	29	29
TOTAL	1,212	100.0	—

SOURCE: Authors' calculations from PSID surveys. Sample is weighted.

Persistency of Contributions

In this section, we examine the persistency of contributions to 401(k)-type plans. We define persistency as the percentage of workers contributing in a base year who continue to contribute in consecutive subsequent years.

To persist in contributing, it is necessary to persist in working. Therefore, we first examine persistency in working. Table 7 indicates that of those working in 1999, 81 percent worked all four sample years.

Table 7 Persistency of Work

Year	Percent who worked in year *x* and in all subsequent sample periods up to:		
	2001	2003	2005
1999	92	86	81
2001	—	91	90
2003	—	—	92

SOURCE: Authors' calculations from PSID surveys. Sample is weighted.

Table 8 examines evidence on the persistency of contributions. It provides evidence as to a low persistency of contributions, but one that also varies over time.

Table 8 Persistency of Contributions, for People Who Worked All Four Years

Year in which contribution was made	Percent of workers in year *x* that contributed in year x and in all subsequent sample periods up to:		
	2001	2003	2005
1999	67	44	36
2001	—	59	46
2003	—	—	71

SOURCE: Authors' calculations from PSID surveys. Sample is weighted.

Table 9 examines a slightly different concept from density or persistency. It examines what percentage of workers who contributed in 1999 also contributed in a particular subsequent

year. We include this measure to provide an alternative measure of the extent that workers

contribute consistently. Sixty-three percent of workers who contributed in 1999 also contributed

in 2001.

Table 9 Percentage of Workers Who Contributed in 1999 Who Contributed in the Year Indicated, for People Who Worked All Four Years

Year in which contribution was made	Frequency	Percent
1999	1,072	100
2001	671	63
2003	584	54
2005	663	62

SOURCE: Authors' calculations from PSID surveys. Sample is weighted.

Persistency of Contributions for Workers in the Same Job, by Demographic and Economic Group

In this section, we examine persistency of contributions for workers in the same job for

all four panels generally, then broken down by demographic and economic group. Table 10

investigates persistency for workers in the same job. When comparing the sample of all workers

in Table 8 to this table, as would be expected we see a much higher persistency with workers in

the same job.

Table 10 Persistency of Contributions, for Workers in the Same Job over All Panel Years

| Year in which contribution was made | Percent of workers in year x that contributed in year x and in all subsequent sample periods up to: | | |
	2001	2003	2005
1999	71	53	46
2001	—	66	61
2003	—	—	81

SOURCE: Authors' calculations from PSID surveys. Sample is weighted.

Table 11 reports persistency by race. The persistency for whites over the period is

consistently considerably higher than for blacks. This finding would explain lower participation

rates for blacks than whites and lower accumulated account balances. The sample sizes for

Hispanics and "other" races are too small to provide separate estimates.

Table 11 Persistency of Contributions, by Race, for Workers in the Same Job over All Panel Years

Year in which contribution was made	Percent of workers in year *x* that contributed in year *x* and in all subsequent sample periods up to:					
	2001		2003		2005	
	White	Black	White	Black	White	Black
1999	76	56	56	36	52	32
2001	—	—	68	55	63	45
2003	—	—	—	—	82	76

NOTE: The sample for Hispanics is 19 and for "other" races is 17.

SOURCE: Authors' calculations from PSID surveys. Sample includes individuals who worked all four years. Sample is weighted. 1999 sample size for whites (382) and blacks (129).

Table 12 investigates persistency by gender. It finds little difference in persistency by

gender for workers not changing jobs.

Table 12 Persistency of Contributions, by Gender, for Workers in the Same Job over All Panel Years

Year in which contribution was made	Percent of workers in year x that contributed in year x and in all subsequent sample periods up to:					
	2001		2003		2005	
	Male	Female	Male	Female	Male	Female
1999	71	66	52	58	48	52
2001	—	—	66	66	62	56
2003	—	—	—	—	82	81

SOURCE: Authors' calculations from PSID surveys. Sample includes individuals who worked all four years. 1999 weighted sample sizes for males (469) and females (76). Sample is weighted.

Table 13 investigates persistency by education level, finding relatively little difference by

education level. Fifty-one percent of college graduates contribute over the four panels, while 48

percent of high school graduates do. Workers with lower levels of education may have lower

persistency because educated individuals may see a higher value in dollar cost averaging and

saving for the future. That effect may be offset to some extent if more educated individuals are

more adept at making changes in their pension status.

Table 13 Persistency of Contributions, by Education, for Workers in the Same Job over All Panel Years

Year in which contribution was made	Percent of workers in year x that contributed in year x and in all subsequent sample periods up to:					
	2001		2003		2005	
	hsdeg	colldeg	hsdeg	colldeg	hsdeg	colldeg
1999	74	71	53	55	48	51
2001	—	—	66	68	63	62
2003	—	—	—	—	74	85

SOURCE: Authors' calculations from PSID surveys. Sample includes individuals who worked all four years. Weighted 1999 sample size for those whose highest degree is high school (186) and college degree (317). Note that the sample size for workers without a high school degree is too small to be of statistical value. Sample is weighted.

Table 14 investigates persistency by quartile of family income. As theory would predict,

higher levels of family income are consistent with higher persistency. These effects are

considerably larger than the effects found for differences in education level.

Table 14 Persistency of Contributions, by Quartile of 1999 Family Income, for Workers in the Same Job over All Panel Years

Year in which contribution was made	Percent of workers in year x that contributed in year x and in all subsequent sample periods up to:											
	2001				2003				2005			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1999	55	68	69	78	48	51	54	56	42	48	53	49
2001	—	—	—	—	60	57	73	67	49	53	70	63
2003	—	—	—	—	—	—	—	—	73	78	83	85

SOURCE: Authors' calculations from PSID surveys. First quartile includes family income of $0–$40,000, second quartile $40,001–$60,000, third quartile $60,001–$90,000, fourth quartile $90,001 and over. Sample includes individuals who worked all four years. 1999 sample size for 1st quartile (75), 2nd quartile (120), 3rd quartile (147), and 4th quartile (212). Sample is weighted.

ECONOMETRIC ANALYSIS

From the analysis in Table 2, it appears that there is a positive relationship between 401(k) participation and prices in the stock market. The marked drop in participation in 2003 coincides with the low in the stock market in that year. In this section, we present a regression model that controls for other variables that may also affect participation.

There are two goals in this section: to estimate whether the DJIA is correlated with 401(k) participation, and to examine whether the usual demographic, financial, and job-related characteristics from previous cross-sectional research continue to play a role in participation over time. Previous models of 401(k) participation have not taken into consideration the potential bias in the OLS estimates when not controlling for unobserved tastes for saving.[8,9] We begin with specifying a general model for 401(k) participation, and then amend the model to include our variable of interest, the DJIA.

A General Model for 401(k) Participation

Over the years, economists have identified numerous motives for saving, including life cycle consumption smoothing, precautionary motives, and bequest intent. These theories identify personal characteristics that may affect the saving decision, including risk aversion, future discount rate, and liquidity constraints. More recent research adds to the list by identifying other effects on the saving choice, such as financial education and/or knowledge (Bernheim and Garrett 2003; Agnew, Utkus, and Young 2007), trust (Agnew, Utkus, and Young 2007), lack of self control (Laibson, Repetto, and Tobacman 2005), inertia and procrastination (Choi, Laibson, and Madrian2004), and childhood upbringing (Becker 1996).[10]

While some of these characteristics can be explicitly controlled for in an econometric model, many of them are unobservable or difficult to measure.[11] Hence, estimation using an unobservable effects model allows the individual unobservables to be controlled for, leading to consistent estimates. After careful consideration as to the most appropriate estimation technique, we are using fixed effects logit estimation.[12] Hence, following the notation in Wooldridge (2002), our model is

$$(1) \qquad y_{it} = x_{it}\beta + c_i + u_{it},$$

where i denotes each individual and t denotes the time period, where $t = 1999, 2001, 2003, 2005$. The dependent variable y_{it} is a binary choice variable modeling whether the worker participated in the 401(k) plan. The matrix x_{it} includes independent variables thought to affect the participation decision. The variable c_i is the time-invariant individual unobservable effect. The idiosyncratic error term is u_{it}.

In choosing the independent variables, we look to economic theory and previous empirical models of 401(k) participation. Englehardt and Kumar (2007) develop a theoretical model of 401(k) participation that includes such demographic variables as age, race, education, marital status, number of children, and gender. Age is a proxy for the stage in the life cycle, marital status for precautionary motives (e.g., more security in marriage), and number of children for bequest motives. Furthermore, Bernheim and Scholz (1993) find that college-educated individuals are more likely to engage in more sophisticated financial planning and save more adequately for retirement.

By construction, in order for fixed-effects to control for the unobservable effects, it also differences out the time-invariant variables. Hence, we are unable to include race, gender, and

education in the model. We will address the consequences of not including these variables when discussing the results.

We also control for financial variables such as family income, net wealth, and whether the person currently has another pension plan. Family income identifies the tax bracket for the family, and both family income and net wealth control for liquidity constraints. More family income may push the family into a higher tax bracket, hence providing more tax savings from participating in a 401(k) plan, increasing the probability of participating. Higher income and net wealth affords the family more liquidity to pay for current expenses; hence we expect a positive coefficient estimate on these two independent variables. Finally, economic theory suggests that having another pension plan could signal the individual as a saver, increasing the probability of participation. On the other hand, additional saving wealth could also diminish the chance of saving in another vehicle if the person is a target saver. Thus, the sign of the expected coefficient estimate is ambiguous.

Unfortunately, the PSID does not provide data on whether a nonparticipant is eligible for participation in a pension plan. Hence, we include part-time status as a control variable, since part-time employees are less likely to be eligible for a plan. Tenure acts much like age, as a proxy for stage in the life cycle, and may affect eligibility in the 401(k) plan. Starting in an individual's twenties until ages closer to retirement, we would expect a positive relationship between tenure and participation. To proxy for precautionary saving motives, we also include a binary variable describing whether the individual considers himself in good health.[13] Bad health could cause an individual to save less in a 401(k) plan because of the difficulty of withdrawing funds from the retirement plan if medical expenses arise. Finally, due to the strong housing market throughout the stock market cycle, we control for this alternative investment to the

401(k) plan with state housing price indices for all panel years. Anecdotal evidence throughout the survey period suggests that some individuals were investing in real estate instead of retirement plans during periods of high housing prices. Hence, we would expect individuals in states with higher price indexes to invest more in real estate than 401(k) plans, resulting in a negative coefficient estimate.[14]

The inclusion of the individual unobservable effect in this model is an important addition to the literature. The other longitudinal study on 401(k) behavior by Smith, Johnson, and Muller (2004) uses pooled ordinary least squares (POLS), which does not take advantage of the ability to control for the unobservable effects. Estimation by POLS results in the unobserved tastes for saving being put into the error term, and if one reasonably assumes correlation of c_i with the explanatory variables, it will provide biased estimates.

Adding in the stock market variable

To investigate the correlation between changes in the stock market and persistency in participation and contribution rates, we add to Equation (1) a continuous variable, z_t, that represents the natural log of the DJIA:

(2) $\quad y_{it} = x_{it}\beta + \delta z_t + c_i + u_{it}$,

where z_t varies across time, $t = 1999, 2001, 2003, 2005$.

Results

We report regression results for two samples in Table 15. In both samples, the relationship between the DJIA and the probability of participating in a 401(k) plan is positive and statistically significant at a 1 percent level. This is true whether a worker changes jobs or

remains in the same position throughout the panel. The higher the DJIA, the more likely the worker is to participate in the company 401(k) plan, even controlling for factors such as the fluctuations within the housing market.

If inertia is the driving force behind contribution decisions, the inclusion of the stock market variable should be statistically insignificant. This is not the case. Instead, workers are more likely to participate if the stock market is higher. This type of behavior can be described as "herd" investing, where individuals get into the market when it is high and get out when it is low. This is an investment error, as the worker is getting into the stock market when it is high and getting out when it is low.

As expected, the effect of family income on participation is positive and highly statistically significant. The estimate on whether the worker has another pension plan is also positive and significant at the 1 percent level. This result suggests that even after taking into account unobservable tastes for saving, workers who have one pension plan are likely to see value in participating in the 401(k) plan. This increased likelihood could be due to the experience of already having a plan and feeling confident in managing one's own assets. Since the PSID does not distinguish between offering a plan and worker eligibility, having another pension plan could also signal eligibility and hence a greater chance of participating.

We believe the consequences of omitting education, race, and gender from the regression are minor. Since income and education are known to be positively correlated, it is probable that simply controlling for family income is sufficient to capture educational effects. In addition, highly educated workers are more likely to have financially sophisticated time horizons for saving, as well as an appreciation for the value of saving and planning for retirement. These tastes for saving are captured in the unobservable effect, which is controlled for in our model.

Gender has consistently been found to be statistically insignificant in previous participation models.[15] Furthermore, although a few studies have found that race affects participation, these effects are due to a lower confidence in financial investing and distrust in financial institutions, which would be captured in the unobservable effect.[16]

Table 15 Fixed Effect Logit Estimates, Using Two Samples

Independent variable	Sample: Individual worked in all four panel years	Sample: Individual worked in the same job in all four panel years
age	−0.06	−0.80
	(0.11)	(0.14)
agesq	0.0008	0.0006
	(0.001)	(0.002)
married	0.32	0.19
	(0.29)	(0.39)
number of children	0.03	0.05
	(0.10)	(0.12)
family income	$2.5e^{-06}$ **	$1.3e^{-06}$
	$(9.3e^{-09})$	$(2.2e^{-06})$
net wealth	$-8.8 \ e^{-09}$	$-4.1 \ e^{-08}$
	$(5.8e^{-08})$	$(8.8e^{-08})$
has other pension plan	3.3**	2.8**
	(0.17)	(0.23)
tenure	-0.005	0.04
	(0.01)	(0.02)
part time status	−0.45	−0.45
	(0.42)	(0.62)
health good	0.10	0.008
	(0.01)	(0.38)
log of DJIA	4.09**	4.97**
	(0.61)	(0.80)
state housing index	0.002	0.001
	(0.002)	(0.003)
N	3,138	1,551
Log likelihood	−730.4	−425.7

NOTE: Dependent variable is whether the individual participated in a 401(k) plan in that year. ** statistically significant at the 1% level.

CONCLUSIONS

We reject the hypothesis that inertia in contributions is the main motivating force. Regression results show a positive, statistically significant effect of the level of the DJIA on 401(k) participation over time. We also find a low density and low persistence in contributions over a fairly short period of time. This result varies across demographic and economic groups in predictable ways, with workers in the same job over the period and with high education or high income having relatively high persistency, but other groups not having a high degree of persistency. Lack of persistency occurs when workers change jobs and when they don't. Generally, lack of persistency because of job changes accounts for less than half of the lack of persistency among workers initially contributing to a pension. The degree of persistence varies over time, depending in part on the state of the stock market. It also depends on the length of the time period considered. Our findings of relatively little persistency, compared to other studies, occur in part because of the relatively long time period we examine (six years) and because of the volatility in the stock market over this period.

These findings have important implications for the functioning of the pension system, with its reliance on 401(k) plans. Projections of future retirement income readiness that assume that workers persistently contribute over their working lives greatly overstate the future levels of pension assets that workers will have accumulated. Our work suggests that perhaps many people participating in 401(k) plans will not have accumulated adequate resources because they will not have contributed to their plans a sufficient percentage of their adult working lives.

APPENDIX

JUSTIFICATION FOR THE CHOICE OF FIXED EFFECTS ESTIMATION

Theory suggests that the individual unobservable effect c_i is likely correlated with at least one of the independent variables in Equation (2). For example, if c_i includes innate tastes for saving, a person's choice on whether to save and how much will affect the level of net worth and whether the person has another pension plan. If these unobserved effects are not controlled for (hence throwing them into the error term) estimating the model using pooled OLS will produce inconsistent estimates.

Using either fixed or random effects estimation will eliminate the unobserved effects and produce consistent estimates. However, while fixed effects estimates are consistent regardless of whether the independent variables are correlated with the unobserved effects, consistent estimates using random effects requires that the explanatory variables and the unobserved effects be uncorrelated. As detailed in the paragraph above, there are reasons to believe that c_i is correlated with at least one of the explanatory variables. If this is the case, using random effects will produce inconsistent estimates.

To confirm the decision to use fixed effects, we conduct a Hausman test. The null hypothesis is that fixed and random effects produce estimates that are statistically the same, or that $\rho=0$. If we reject the null hypothesis, then the strict exogeneity assumption is violated and we should use fixed effects.

We estimate Equation (2) below using both fixed and random effects:

(2) $y_{it} = x_{it}\beta + \delta z_t + c_i + u_{it}$

The results are reported in Table A.1.

Table A.1 Estimates Using Random and Fixed Effects

Independent variable	Random effects	Fixed effects
age	−0.12	−0.80
	(0.07)	(0.14)
agesq	0.001	0.0006
	(0.001)	(0.002)
married	0.27	0.19
	(0.18)	(0.39)
number of children	−0.04	0.05
	(0.07)	(0.12)
family income	$5.55e^{-06}$	$1.3e^{-06}$
	$(1.29e^{-06})$	$(2.2e^{-06})$
net wealth	$-5.4\ e^{-08}$	$-4.1\ e^{-08}$
	$(7.29e^{-08})$	$(8.8e^{-08})$
has other pension plan	3.1	2.8
	(0.17)	(0.23)
tenure	0.008	0.04
	(0.009)	(0.02)
part time status	−0.67	−0.45
	(0.51)	(0.62)
health good	0.50	0.008
	(0.28)	(0.38)
log of DJIA	4.52	4.97
	(0.73)	(0.80)
state housing index	0.16	0.001
	(0.26)	(0.003)
ρ	0.45	

NOTE: Dependent variable is whether the individual participated in a 401(k) plan in that year. $\chi^2 = 198$.

By looking at the estimates we can see a large difference between the random effects and fixed effects estimates. This observation is verified by computing the χ^2 statistic and comparing it to the critical value at two degrees of freedom. The null hypothesis is clearly rejected, at both a 1 and 5 percent level. We conclude that the estimates are statistically different, making random effects estimation inconsistent. Hence we choose to estimate the regression using fixed effects.

Notes

1. Dichev (2007) finds this result for investors generally.

2. See Choi et al. (2002) and Madrian and Shea (2001).

3. The relevant questions in the 2005 PSID to determine the type of pension begin at question P11 and P16 found on the questionnaire. Because the term "401(k)" is not used when the interviewer asks about plan type, we must determine which respondents have 401(k)-type plans. We define a 401(k) as a plan where money is accumulated in an account, contributions are made by the employee, and the contributions are not required.

4. The effect on participation of an employer match is an important issue. However, the data do not provide information on whether employers of workers who do not participate offer a match, so we are not able to examine this issue here.

5. e.g., see Clark and Schieber (1998) and Munnell, Sunden, and Taylor (2002).

6. The interviews in 2001 were conducted in March–June (81 percent), with only 4 percent of interviews conducted in September–November, when the market was very low.

7. The sample is restricted to workers who reported six or more years of tenure in 2005.

8. The obvious choices for controlling for unobserved effects in a cross-sectional model are to find suitable instruments and/or proxy variables for taste for saving. To our knowledge, no studies on participation have been done that employ either of these techniques.

9. Hurd, Lillard, and Panis (1998) develop a theoretical framework for choosing proxy variables for unobservable saving preferences such as planning horizon, risk aversion, and bequest intent. They use these variables in estimating who is likely to spend a lump sum distribution from a 401(k). Data were taken from the Health and Retirement Study (HRS), which includes questions that are not common in other large data sets. The HRS is longitudinal, but not a good choice for this analysis because it focuses on near-retirees and retirees.

10. Becker's (1996) conclusions are generalized to childhood experiences and upbringing affecting adult choices, of which saving is one.

11. Net wealth can proxy for liquidity constraints, and age and/or tenure for stage in the life cycle (discount rate). Whether the person has had financial education can be controlled for explicitly, however, a suitable proxy for financial knowledge has not been established.

12. See the appendix for explanations and test results leading to our choice of fixed effects estimation.

13. Smith, Johnson, and Muller (2004) use a measure of self-reported health in their model as well. They also find a statistically significant effect of having a child or purchasing a home in the current year on 401(k) participation. We eliminate these variables from the model due to statistical insignificance.

14. On the other hand, if individuals are adding to new saving when participating in a 401(k), high housing prices may make people feel as though they are richer (wealth effect), hence increasing 401(k) participation.

15. Englehardt and Kumar (2007) develop a theoretical model that does not include gender. Munnell, Sunden, and Taylor (2002) and Bassett et al. (1998) also do not include gender as an explanatory variable.

16. See Shanmuganathan et al. (2004) and Lach (1999).

REFERENCES

Agnew, Julie, Lisa Szykman, Stephen P. Utkus, and Jean A. Young. 2007. "Do Financial Literacy and Mistrust Affect 401(k) Participation?" Issue in Brief No. 7-17. Chestnut Hill, MA: Boston Center for Retirement Research. http://crr.bc.edu/images/stories/Briefs/ib_7-17.pdf (accessed April 14, 2011).

Bassett, William F., Michael J. Fleming, and Anthony P. Rodrigues. 1998. "How Workers Use 401(k) Plans: The Participation, Contribution, and Withdrawal Decisions." no. 38 (March).

Becker, Gary. 1996. *Accounting for Tastes*. Cambridge, MA, and London: Harvard University Press.

Bernheim, B. Douglas, and Daniel M. Garrett. 2003. "The Effects of Financial Education in the Workplace: Evidence from a Survey of Households." *Journal of Public Economics* 87(7–8): 1487–1519.

Bernheim, B. Douglas, and John Karl Scholz. 1993. "Private Saving and Public Policy." In *Tax Policy and the Economy*, Vol. 7, James Poterba, ed. Cambridge, MA: MIT Press, pp. 73–110.

Blake, David, Andrew Cairns, and Kevin Dowd. 2007. "The Impact of Occupation and Gender on Pensions from Defined Contribution Plans." *Geneva Papers on Risk & Insurance* 32: 458–482.

Choi, James J., David Laibson, and Brigitte Madrian. 2004. "Plan Design and 401(k) Savings Outcomes." *National Tax Journal* 52(2):275–298.

Choi, James J., David Laibson, Brigitte Madrian, and Andrew Metrick. 2002. "Defined Contribution Pensions: Plan Rules, Participant Choices, and the Path of Least Resistance." In *Tax Policy and the Economy*, Vol. 16, James Poterba, ed. Cambridge, MA: MIT Press, pp. 67–113.

Clark, Robert L., and Sylvester J. Schieber. 1998. "Factors Affecting Participation Rates in 401(k) Plans." In *Living with Defined Contribution Plans*, O. Mitchell and S. Schieber, eds. Philadelphia, PA: Pension Research Council and the University of Pennsylvania Press.

Dichev, Ilia. 2007. "What Are Stock Investors' Actual Historical Returns?" *American Economic Review* 97(1): 386–401.

Engelhardt, Gary V. and Anil Kumar. 2007. "Employer matching and 401(k) Saving: Evidence from the Health and Retirement Study." *Journal of Public Economics* 91(10): 1920-1943.

Hurd, Michael D., Lee Lillard, and Constantijn Panis. 1998. "An Analysis of the Choice to Cash Out Pension Rights at Job Change or Retirement." *RAND Working Paper 1979-DOL*. Santa Monica, California: RAND.

Lach, J. 1999. "The Color of Money." *American Demographics*. February: 59-60.

Laibson, David, Andrea Repetto, and Jeremy Tobacman. 2005. "Self Control and Saving for Retirement." In *Social Security Reform: Financial and Political Issues in International Perspective*, Robin Brooks and Assaf Razin, eds. Cambridge, MA, and New York: Cambridge University Press, pp. 73–143.

LeBlanc, Pierre. 2002. "RRSPs and Pre-Retirement Earnings Replacement." Chapter in PhD dissertation, "Essays on Tax-Deferred Savings in Canada." Harvard University, Cambridge, MA.

Madrian, Brigitte C., and Dennis Shea. 2001. "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior." *Quarterly Journal of Economics* 116 (4): 11491187.

Marquez, Jessica. 2008. "401(k) Matches May be Targeted in Market Downturn." *Workforce Week*, July 15. http://www.workforce.com:80/section/00/article/25/65/02.php (accessed April 14).

Maser, Karen. 1995. "Who's Saving for Retirement?" *Perspectives on Labour and Income* 7(4): 7–14.

Mincer, Jillian. 2008. "Unsteady Economy Prompts 401(k) Strategy Shifts." *Wall Street Journal*, June 28.http://online.wsj.com:80/article/SB121398711873992485.html (accessed April 14).

Mitchell, Olivia S., and John A. Turner, 2010. "Labor Market Uncertainty and Pension System Performance." In *Performance of Privately Managed Pension Funds,* Richard Hinz, ed. Washington, DC: World Bank.

Munnell, Alicia, Annika Sunden, and Catherine Taylor. "What Determines 401(k)Participation and Contributions?" 2002. *Social Security Bulletin* 64(3): 64–75.

Munnell, Alicia, Anthony Webb, and Francesca Golub-Sass. 2009. "The Retirement Risk Index after the Crash." Issue in Brief No. 9-22. Chestnut Hill, MA: Center for Retirement Research at Boston College.http://crr.bc.edu/images/stories/Briefs/ib_9-22.pdf (accessed April 14, 2011).

O'Connor-Grant, Coleen. 2008. "Putnam Finds Diminishing 401(k) Contributions." *OnWallStreet.com*, June 23. http://www.onwallstreet.com/asset/article/613601/news/putnam-finds-diminishing-401k-contributions.html?pg=&topicName=news (accessed April 14, 2011).

Pension Rights Center. 2010. "Companies that Have Changed or Temporarily Suspended their 401(k) Matching Contributions." Pension Rights Center, Washington, DC. http://www.pensionrights.org/publications/fact-sheet/companies-have-changed-or-temporarily-suspended-their-401k-matching-contribu (accessed April 14, 2011).

PricewaterhouseCoopers. 2009. *Pensions Survey 2009.* Dublin: PricewaterhouseCoopers Pensions Group.

Sailer, Peter, Victoria L. Bryant, and Sarah Holden. 2006. "Trends in 401(k) and IRA Contribution Activity, 1999–2002—Results from a Panel of Matched Tax Returns and Information Documents." *Special Studies in Federal Tax Statistics 2005: Selected Papers Given in 2005 at the Annual Meetings of the American Statistical Association and the National Tax Association.* Washington, DC: Internal Revenue Service, Statistics of Income Division. http://www.irs.gov/pub/irs-soi/05sailer.pdf (accessed April 14, 2011).

Scholz, John Karl, and Ananth Seshadri. 2008. "Are All Americans Saving 'Optimally' for Retirement?" Working Paper No. 2008-189. Ann Arbor, MI: University of Michigan Retirement Research Center. http://www.mrrc.isr.umich.edu/publications/papers/pdf/wp189.pdf (accessed April 14, 2011).

Seligman, Jason S., and Jeffrey B. Wenger. 2005. "Asynchronous Risk: Unemployment, Equity Markets, and Retirement Savings." Upjohn Institute Working Paper No. 05-114. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research. http://www.upjohninst.org/publications/wp/05-114.pdf (acccessed April 14, 2011).

Shanmuganathan, P., Merlin Stone, and B. Foss. 2004. "Ethnic Banking in the USA." *Journal of Financial Services Marketing* 8(4): 388-400.

Smith, K., R. Johnson, and L. Muller .2004. "Deferring Income in Employer-sponsored Retirement Plans—The Dynamics of Participant Contributions." *National Tax Journal* 57(3): 639–670.

Smith, P. 2001. *A Longer-Term Perspective on IRA Participation: Evidence from a Panel of Tax Returns.* Washington, DC: Office of Tax Analysis, U.S. Department of Treasury.

Smith, Sarah. 2006. "The Persistency of Pension Contributions in the U.K.: Evidence from Aggregate and Micro Data." Working Paper No. 06/139. Bristol, U.K.: Centre for Market and Public Organisation, University of Bristol. http://www.bris.ac.uk/Depts/CMPO/workingpapers/wp139.pdf (accessed March 14, 2011).

State Farm. 2010. "What is Dollar Cost Averaging?" http://www.statefarm.com/mutual/sc/invest_know/dollarcst.asp (accessed March 14, 2011).

Turner, John. 2003. "Errors Workers Make in Managing 401(k) Investments." *Benefits Quarterly* 19(4): 75–82.

Wooldridge, Jeffrey M. *Introductory Econometrics: A Modern Approach*. 2002. Boston: South Western College Publishing.