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Performance and Employer Stock in 401(k) Plans ⋆

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Abstract. Participants in 401(k) retirement plans violate the basic principle of diversification by investing significant fractions of their savings in their employers' equity. This paper characterizes investors' active changes to their company stock investment over time by analyzing new inflows and transfers. The average investor seems to base active changes on salient information, paying attention to past returns, volatility, and business performance. Past returns, over a three-year horizon, predict higher inflow allocations and transfers, whereas volatility and business performance only have a weak effect. The sensitivity to past returns is asymmetric, with investors reacting more strongly to positive and above-S&P500 returns.

1. Introduction

Over the last three decades, there has been a fundamental shift in the way private pensions are funded in the United States. Many employers have switched from defined benefit (DB) plans, which guarantee employees a fixed retirement income, to defined contribution (DC) plans, most of which are of the 401(k) type. Most of the savings flowing into DC plans are taken out of the employees' salaries, and the employees themselves decide how these savings are invested. As their portfolios accumulate, they have full discretion over the part of their portfolio they contribute themselves. [1]

It is important to understand the behavior of this emerging class of investors, because their savings and investment decisions will determine the adequacy of retirement funds for the next generation of retirees. Given the magnitude of assets under their control – at the end of 2000, DC plans had 2.5 trillion dollars, equivalent to about 20% of the total market capitalization of the NYSE [2] – their investment

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[1] In 1997, about 70% of new contributions came from employees' deferred compensation. The plan sponsor selects the investment vehicles they can choose from, but there has to be at least a diversified equity fund, a bond fund and another option.

[2] Source: Flow of Funds, Federal Reserve Board; NYSE. The 2.5 trillion includes all DC plans, public and private.

decisions also have the potential to influence returns. Furthermore, studying their behavior can tell us how individuals choose their portfolio weights in general.

In 401(k) plans sponsored by large companies, the second most popular investment category is company stock, the equity of the employer who sponsors the plan. In 1999, 401(k) investors participating in plans that offered company stock as an investable fund had more than a quarter of their account balances invested this way. [3] Finance theory has strong implications for investing in company stock: don't do it. In general it is a bad idea to invest a high proportion of one's wealth in a single firm. It is even worse when that single firm is one's employer, because its fortunes and its employees' earnings are likely to be positively correlated. But individuals do it, and they like to do it. For instance, Nelson (2000) reports that responding to employees' complaints, Motorola eliminated its policy of limiting employees' investment in its stock to 25% of their contributions. Furthermore, it seems that individuals see investing in company stock just like investing in equity *funds*, which are well diversified. Holden and VanDerhei (2001) report that individuals invest 71.1% of their balances in equity funds if their 401(k) plan does not offer company stock as an investment choice. In plans that do offer company stock, they invest only 44.5% in equity funds but 36.3% in company stock. [4]

Non-diversification is very costly: Meulbroek (2002) calculates that employees in firms within the highest quintile of company stock ownership sacrifice 42% of their wealth compared to investing in a well-diversified portfolio. She also finds that companies seem to be aware of this problem, at least to some degree: there is a negative correlation between company stock ownership and the cost of company stock ownership.

A host of theories and stories attempt to explain this puzzling behavior. Huberman (2001) points out that it is consistent with a more general tendency to invest in the familiar. Benartzi (2001) reports that past long-run returns are correlated with the weight of company stock in employees' portfolios and suggests that employees excessively extrapolate from past returns. Consultants stress the importance of company culture in explaining employees' desire to own company stock, which suggests the presence of unobserved firm-specific factors. Or participants may simply invest in company stock because they like it. Huberman et al. (2003) report that controlling for various individual and plan-level attributes, the participation probability is about 2% higher when company stock is an investable fund. One interpretation could be that the desirability of company stock stimulates participation.

[3] Holden and VanDerhei (2001), for plans with more than 5000 participants: Equity funds: 49.6%, Company stock: 25.4%, Guaranteed investment contracts: 11.6%, Balanced funds: 5.2%, Bond funds: 3.9%, Money funds: 3.1%.

[4] If the plans also offer Guaranteed Investment Contracts (an investment that is similar to buying an annuity), the corresponding figures are 62.3% in equity funds vs. 47.9% in equity funds and 23.9% in company stock.

This paper does not attempt to explain the levels. Its main contribution is to characterize the active changes 401(k) investors make to their company stock investment. It describes the *dynamics* of the investment process, holding constant factors that determine the levels.

Having observed that investment in company stock is irrational and big, the dynamics of investment in company stock are interesting because understanding them will help understand how investors actually select their portfolio weights in other contexts, and how they change them as time and circumstances change.

We focus on four categories of explanatory variables: past stock market performance of the firm, past business performance of the firm, risk characteristics of the returns (i.e., their second moments), and current weight of employer stock in the overall 401(k) holdings. Past returns are the most precisely measured, and are probably very salient to the investors. Much of financial economics is devoted to studying how well past returns predicts future returns, with the almost uniform answer: very poorly, if at all. Awareness of this finding should steer investors away from return chasing. Past business performance measures such as sales growth and return on equity may correlate with employees' observations on how well their firms do, but the correlation need not be tight. Business performance may well be serially correlated, and stock returns may be correlated with business performance. But since stock prices reflect expectations of future business performance, it is unlikely that fluctuations in business performance can provide useful guidance to portfolio rebalancing. Return variance and covariance with the market's return (beta) should steer investors away from investing in employer stock. Finally, the more employees already invest in the company stock, the more they should diversify away from it.

Using new plan-level data hand-collected from SEC filings, this study focuses on two measures of active change to company stock investment, transfers in and out of the company stock fund as a fraction of all assets (*transfers*) and the fraction of new savings invested in company stock (*inflow allocations*), and attempts to explain their determinants. The data consist of a panel of 153 401(k) plans over at most eight years. The data set contains no information about individual participants and therefore this paper does not study how variation in individual attributes influences the tendency to invest in company stock.

Individual attributes and plan design may affect investment in company stock, and may also be correlated with the identities of the plans. Assuming that these correlations are stable over time, we exploit the panel structure of the data to control for them. We also consider transfers and inflow allocation separately to allow at least for some underlying individual heterogeneity across those two decisions.

When analyzing decisions related to security prices, economists use returns over fixed periods as primitive constructs. At least to a first approximation such returns appear to be i.i.d. random variables and therefore lend themselves naturally to statistical analysis. Lay people who make decisions – and most participants in 401(k) plans fall into this category – probably do not use fixed-interval returns as decision inputs. Rather, they probably compare the current price with some past benchmark price. How far in the past that benchmark price is, varies across individuals. Moreover, their sensitivity to the difference between (or the ratio of) the current and past prices may depend on the difference being positive or negative (or the ratio being greater or smaller than one).

This study finds that prices as far as three years prior to the actual decision can serve as benchmarks. The further in the past these prices are, the weaker their benchmark role. Presumably, the further in the past these prices are, fewer participants use them as benchmarks. Still, it is surprising that investors look back as far as three years to select their portfolio allocation. Enough investors go back three years, or else the effect would not show up with the magnitude and statistical significance it does.

The details of the sensitivity to past returns are just as interesting: the reaction to past performance is asymmetrical. Good past performance – current high company stock price relative to the benchmark price – is associated with increased flows and with transfers of 401(k) investments into company stock. The reverse does not hold for bad past performance. Empirically, this is in line with Sirri and Tufano (1998), who find a similar asymmetry for mutual fund flows. Thus, it seems that good past returns attract more investments, but bad past returns do not cause participants to reduce their exposure to company stock. Recalling the tendency of most participants to be passive and do nothing – the status quo bias – it seems that good past returns generate positive impressions that lead investors to move away from the status quo, whereas bad past returns fail to inspire action.

Changes in portfolio weights that follow changes in stock prices may be important building blocks in models of return predictability. In general, it is difficult to observe a relation between stock prices (or changes in them) and portfolio weights, because security trading must net to zero. The task is even harder when the price changes are over horizons longer than a few months. The 401(k) environment is different because company stock has a special status in the eyes of employees.

The next main finding is that investors show some tendency to rebalance: lagged levels of company stock investment are negatively related to transfers and, to a lesser extent, to inflow allocations as well. This sensible tendency to rebalance contrasts with another empirical regularity: employees' voluntary allocation to company stock is higher in companies that match employee contributions with their own stocks. (See for instance Holden and VanDerhei (2001).)

The estimators of the sensitivity of investment in company stock to business performance, proxied here by sales growth and return on equity, are positive, and marginally statistically significant. Whether the weakness of the effect is due to weak measurement or the actual weakness of the effect is an exploration that we leave to a future study.

Finally, measures of riskiness such as market beta and return volatility seem to be unrelated to investment in company stock.

Participants in defined contributions plans, unlike customers of discount brokerages, actually make very few active changes to their portfolios. They hardly ever change their inflow allocations and the turnover they generate is minimal compared to other non-professional investors. [5] If they do make changes, past and current prices of company stock – salient and readily available – may offer them guidance. Thus, the effects we find are due to the action of the minority of alert participants.

A reasonable conjecture is that the alert participants – those who are less affected by the status quo bias – will diversify their portfolio risk. To some extent they do: the larger the weight of company stock in their plans' holdings, the bigger the fraction they transfer away from company stock. On the other hand, some plan participants – perhaps even the same individuals – seem to be unduly impressed by the stock's past performance.

The aggregate (plan-level) nature of our data poses a natural limit to the interpretation of the results. It is noteworthy, however, that the estimates are lower bounds to the underlying individual responsiveness to past performance since only very few plan participants make active changes to either their inflow allocations or their accumulated portfolio. Also, non-discrimination regulations and caps on pre-tax contributions (at $10,000 during the sample) limit the influence of wealthy plan participants.

This paper also revisits Benartzi's (2001) hypothesis that long-run returns explain the high allocation to company stock. That paper uses a cross-section of company stock inflow allocations to argue that plan participants excessively extrapolate from past returns when they form their 401(k) portfolios. Re-estimation of his specification with new and extended data points towards a significantly weaker relationship after 1993. Furthermore, during the extended sample period transfers significantly reduce total flows (inflow allocations plus transfers) into company stock.

The results from the specification presented in this paper can be interpreted as time series evidence for excessive extrapolation (as opposed to Benartzi's evidence for the cross-section). But they show that the effect of past returns does not extend ten years into the past. In fact, it seems improbable that individuals consider such a long track record when they make their portfolio decisions. A combination of inertia – the tendency to leave inflow allocations unchanged – and return sensitivity over shorter horizons may account for Benartzi's findings. (See Section 5.)

The effect of past returns on future prices has received a considerable amount of attention in the finance literature, but we do not yet understand through which channel this effect operates. The contribution of the paper in this area is mainly suggestive. Even though it is unlikely that plan participants who invest in company stock influence returns, the results of this study imply that they exhibit a form

[5] Ameriks and Zeldes (2001) report that more than half of the individuals in their sample of TIAA-CREF participants made no change to their inflow allocation over a nine year period. More than two thirds made zero or one change to the way their new savings were invested. Agnew et al. (2000) report an annual portfolio turnover of only 2% in a sample of 401(k) investors.

of herd behavior with respect to past performance. If changes in allocations are part of an explanation for return predictability, being able to estimate the return sensitivities of portfolio quantities is crucial. We can identify this behavior because of the unique nature of company stock. Unlike other asset classes, the return to company stock varies across firms, but the investors in each firm seem to treat their company's stock as an asset class in itself. Estimating the return sensitivity of exposure to equity is harder since there is hardly any cross-sectional variation and because the returns of most equity indices are highly correlated.

The paper proceeds as follows: the next section describes the new panel of 401(k) investment choices we constructed and use. In Section 3 we analyze inflow allocations, including a discussion of the relevant literature, estimation, and the empirical results. Section 4 extends the results to transfers. Section 5 compares the results to Benartzi's findings and discusses some implications for return predictability. Section 6 concludes. Appendix D shows that allocation to company stock does not predict returns, addressing the concern that insider knowledge may be behind the participants' behavior. Appendices A–C discuss the institutional background of DC plans, security regulation issues, and possible incentives to buy company stock.

2. Data

We collected a new dataset from information contained in Form 11-K, an annual disclosure form that some companies have to file with the Securities and Exchange Commission. The data are on the plan-level, and the unit of analysis is the average participant in a plan. (For more information on Form 11-K see Appendix B).

2.1. CONSTRUCTION

Our sample consists of all companies that were part of the Standard and Poor's 500 Index at any time between 1994 and 1998. For 239 of these 635 firms we collected data on a total of 335 plans. Aside from the firms that simply did not have 11-K filings, we also excluded plans with unusable 11-Ks (either because they did not include detailed enough information or because the fiscal year of the plan did not end in December), plans for employees in Puerto Rico, and plans that had total assets of less than \$1 million. Quite a few companies filed for more than one plan; on average there are 1.3 plans per company.

For plans that had both Form 11-K available and met the other selection criteria, we collected the following data for each year: Total assets available for participants at the end of the plan year (A_{it}), total assets invested in employer stock at the end of the plan year (AS_{it}), total employee (participant) contributions (P_{it}), employee contributions that are allocated to the company stock account (PS_{it}), and transfers in and out of the company stock account (TS_{it}). For plans that include an ESOP (Employee Stock Ownership Plan, see p. 34), we only counted employer stock as

Table I. Balance sheet for 401(k) plan

The structure of pension plan balance sheets from which the data were constructed. Items actually collected are in **bold**.

	Company stock fund	Total plan
Value of investments, beginning of period	AS_{it}	A_{it}
+ Net appreciation of investments	NetAppr.	Net.Appr.
+ Plan participants contribution	**+PS**$_{it+1}$	**+P**$_{it+1}$
+ Employer contribution	$+ES_{it+1}$	$+E_{it+1}$
+ Benefits paid out to (retired) plan participants	$-BS_{it+1}$	$-B_{it+1}$
Net transfers between funds	**+/–TS**$_{it+1}$	0
Value of investments, end of period	**AS**$_{it+1}$	**A**$_{it+1}$

"assets in employer stock" if it was actually allocated to the employees. [6] We also constructed a dummy for plans where the employers matching or profit sharing contribution was exclusively in company stock.

Table I shows the collected variables in a financial statement format. The changes in the net asset position from $t - 1$ to t involves more than the discretionary inflows by participants (P_{it} and PS_{it}) and transfers (TS_{it}). The other changes include appreciation, employer contributions, rollovers, forfeitures, and benefit payments. The collected balance sheet items cover all *discretionary* changes to the portfolio, however.

2.2. SUMMARY STATISTICS

Panel A of Table II shows the extent and the dollar value of the plans covered by the full sample for each year from 1991–1998.

The sample thins out slightly going back in time (see Column 6). [7] The average plan stays in the sample for 3.76 years, with eight years as the maximum and one year as the minimum. The total assets in Column 1 include both assets contributed by the employer and by the employees participating in the plan. They are useful to gauge the coverage of our sample. VanDerhei and Holden (2000) report that in 1998 the 30,102 plans in the EBRI database represented a total asset value of \$371 billion, which implies that the 176 plans that are in our sample for the year 1998 cover more than 60% in value of the extensive VanDerhei sample. On the other hand, the Department of Labor (U.S. Department of Labor (2000)) reports that in

[6] Most ESOPs in large publicly traded companies are set up as leveraged ESOPs. In these so-called LESOPs the company guarantees for a loan that purchases a large amount of common stock and releases part of it each year to participating employees.

[7] The Securities and exchange commission did not require electronic filing before 1994. The data for the first few years are from companies that reported earlier data in their 1994 filing.

Table II. Aggregate annual summary statistics, $ billion

Panel A reports the statistics for the entire sample, and Panel B for the subsample of plans that could be matched to the independent variables used in the analysis. Panel B has no 1991 observations because one of the independent variables is fraction of assets in company stock at the beginning of the year. The variables are defined in Table 1. All figures are in $ billion, unadjusted for inflation, except those in column 6.

Year	(1) $\sum_i A$	(2) $\sum_i AS$	(3) $\sum_i P$	(4) $\sum_i PS$	(5) $\sum_i TS$	(6) Plans	(7) Average	(8) Median
Panel A: Full sample								
1991	8.35	3.84	0.37	0.14	0.09	27	0.309	0.155
1992	49.98	20.79	3.34	1.10	−0.49	101	0.495	0.151
1993	98.33	39.99	5.79	1.71	−1.75	171	0.575	0.157
1994	97.95	37.25	6.10	1.75	1.21	149	0.657	0.225
1995	131.64	49.96	7.07	1.98	−1.93	160	0.823	0.284
1996	170.92	62.85	8.43	2.26	−2.16	184	0.929	0.314
1997	217.96	77.45	9.51	2.39	−1.07	203	1.074	0.400
1998	258.59	91.40	10.43	2.56	−2.69	196	1.319	0.437
Panel B: Plans with at least three consecutive observations								
1992	8.71	4.15	0.36	0.15	−0.15	25	0.348	0.169
1993	48.01	19.57	2.62	0.85	−1.23	67	0.717	0.210
1994	76.38	29.47	4.61	1.44	1.14	100	0.763	0.250
1995	105.31	40.23	5.40	1.66	−1.86	106	0.994	0.333
1996	130.95	48.52	6.31	1.71	−1.95	114	1.149	0.380
1997	177.49	67.84	7.56	2.05	−0.92	127	1.398	0.448
1998	194.24	75.10	7.88	2.08	−2.55	113	1.719	0.502

1996 the net assets of all 401(k) plans with more than 100 participants were valued at $931 billion.

However, the appropriate universe to consider is all large 401(k) plans that include publicly traded company stock. In 1992 this universe consisted of 823 plans with $166.9 billion in assets and $68.6 billion in company stock (see Prolman and Kruse (1996)). Compared to this, our sample covered more than 25% in value, even though in 1992 our sample is much smaller compared to the subsequent years and we only include plans from S&P500 companies that also make company stock a *choice*. The figure from Prolman and Kruse (1996) includes plans sponsored by *all* publicly traded firms and plans that have company stock only in their portfolio because the company contributes it as a benefit.

The amount of total assets per plan increases steadily from $309 million in 1991 to $1,319 million in 1998. The distribution of assets per plan is skewed: the median plan is only half the size of the average plan (Columns 7–8, all figures in current dollars).

The percentage invested in company stock shows a downward trend. The percentage of total assets (across all plans) decreases from over 40% in 1993 to 35% in 1998. In part this is due to the higher number of larger plans early in the sample because smaller plans tend to have less in company stock, but the downward trend also holds true for the average and median percentage invested in company stock per plan (not reported). The same downward trend also applies for new investment in company stock. 30% out of a total of new discretionary savings of $5.79 billion flowing into the 401(k) plans in 1993 were invested in company stock. In 1998 that figure had declined to 25% out of $10.43 billion. (See Columns 3 and 4).

Even on the aggregate level, the volatility of transfers in and out of the company stock fund is an order of magnitude larger than for new inflows and a general trend is less visible (Column 5). While generally negative (i.e. outflows), 1994 saw aggregate net inflows via transfers of $1.14 billion. Except for that year, transfers almost cancel out the new inflows invested in company stock, which somewhat diminishes the need to explain the high levels of company stock investment for new inflows.

Panel B of Table II reports the same statistics for the sample of plans that will be used in the empirical analysis. These plans have at least three consecutive annual observations and could be matched to the full set of independent variables discussed below. They tend to be larger, both in the median and the average.

Since we are interested in *active* investment decisions by plan participants, the fraction of total assets invested (asset allocation) in company stock is not the correct measure. The year-end assets intermingle employer and participant contributions and it is not possible to find out which part of the company stock held by the plan came from voluntary participant contributions and what came from matching and profit sharing. As mentioned above, many companies invest their matching contribution automatically in company stock and employees have to keep the matching funds in company stock until they retire. This leads to an overestimation of company stock held voluntarily by plan participants. [8] More importantly, to a large extent, the changes in the weight of company stock in the overall portfolio is driven by the returns of company stock relative to the performance the other investments of the plan.

The allocation of new inflows (PS) and transfers (TS) reflect plan participants' decisions. Ideally we would like to normalize the number of participants to get the average company stock investment per plan participant. Since this information is seldom provided, we normalize new inflows into company stock (PS) by total new inflows (P) and transfers (TS) by the total assets in the plan at the end of

[8] One could however argue that the fact that plan participants invest their own money in company stock implies – by revealed preferences – that they would invest the matching contribution in company stock even if they did not have to.

the year (A). We define two measures of active changes to the portfolio, the inflow allocation

$$INALLC_{it} = \frac{PS_{it}}{P_{it}} \tag{1}$$

and transfer flows

$$TRANS_{it} = \frac{TS_{it}}{A_{it}}. \tag{2}$$

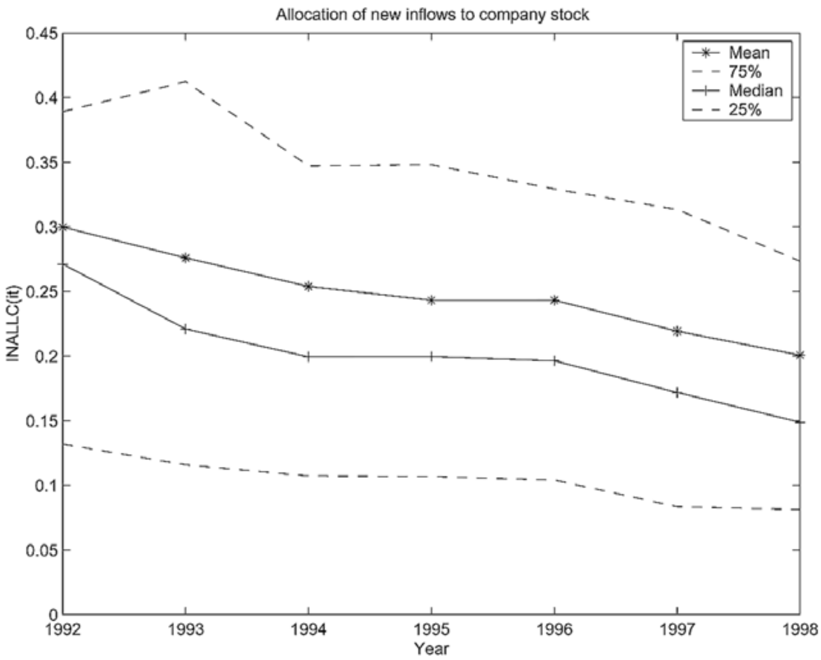
Total new inflows (P) are a good proxy for the number of plan participants. Non-discrimination regulations and caps on pre-tax contributions limit the variation in the contribution by each plan participant across plans. Also, at the individual level, the variable PS/P is one of the actual decision variables. The same is not true for the transfers, and we choose to normalize them by total end of year assets (A) which is the more natural normalization. Presumably, just as participants focus on which percentage of new savings to invest in company stock, they focus on which percentage of their *existing* savings to transfer in or out of the company stock fund.

Rows 1 and 3 of Table III summarize $INALLC_{it}$ and $TRANS_{it}$ for the sample with at least three adjacent observations that could be matched to the independent variables. The table also gives summary statistics of new inflows into company stock normalized by assets instead of new inflows ($\frac{PS}{A}$), of transfers normalized by all assets invested in company stock ($\frac{TS}{AS}$), of the fraction of beginning of year assets invested in company stock ($\frac{AS}{A}$), and of company stock fractions of the companies' total market capitalization ($\frac{AS}{MCap}$). On average, individuals have 35% of plan assets invested in company stock and invest an additional 25% of their new savings this way. The average plan holds 2.6% of the outstanding stock of the sponsoring company.

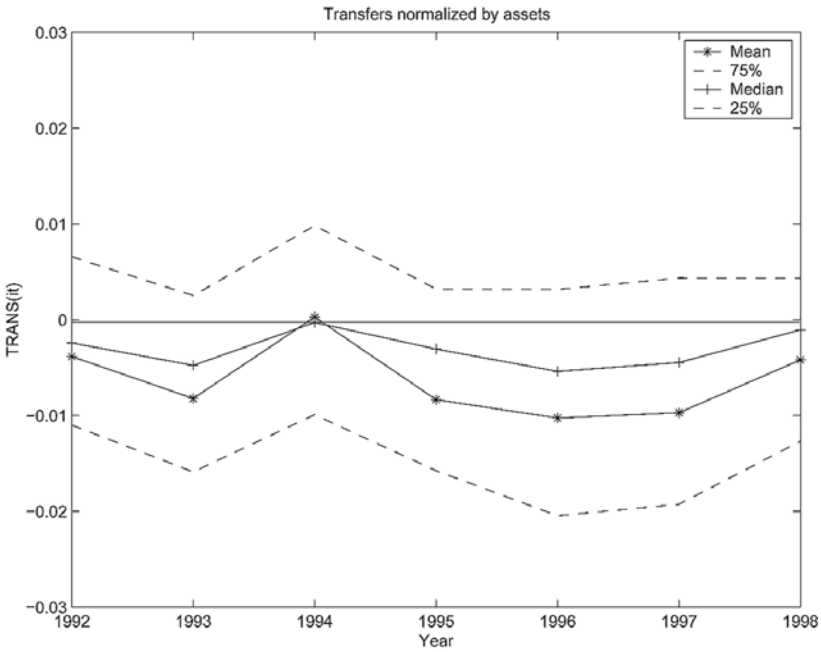
Larger plans on average have higher inflow allocations and there seems to be an overall downward trend. Panel (a) of Figure 1 shows the mean (equally weighted), median, and quartiles of *INALLC* for each year separately. There is no apparent trend in transfers (Figure 1, panel (b)). While larger plans have higher inflow allocations, they also have larger outflows compared to the assets available for plans participants. This may be caused by the higher average age of participants in larger plans who transfer out company stock received as a matching contribution earlier in their careers.

3. Performance and Inflow Allocations

Participants in 401(k) plans have two ways to actively change their portfolio: they may change the way their new savings are allocated to the investment alternatives



a. New Inflows



b. Transfers

Figure 1. Allocation of new inflows to company stock and Transfers in and out of company stock.

Table III. Summary statistics

The first four lines summarize the distribution of the dependent variables, *INALLC* and *TRANS*, and alternative different normalizations (by end of year total assets, end of year assets in company stock.). RET_{it-1} is the return on company stock in plan i lagged by one period, $STDC$ and $BETA$ the company stock standard deviation and market beta, both lagged by one period. ROE is the return on equity, $SALGR$ the sales growth, also both lagged by one year. Variable definitions are in Table I. Mean and standard deviations are pooled across all years and plans. The within plan standard deviation is an average of the standard deviation per plan over time. AR(1) is the coefficient of a pooled regression of the relevant variable on its lagged value, i.e. it is an unweighed average of autocorrelations. The total number of observations is 652, and the number of plans is 153.

Variable	Mean	Stdv.	Stdv within	25%	Median	75%	AR(1)
$INALLC_{it}$	0.263	0.183	0.051	0.116	0.213	0.362	0.894
$\frac{PS}{A}$	0.017	0.018	0.007	0.006	0.012	0.020	0.642
$TRANS_{it}$	−0.008	0.026	0.021	−0.017	−0.004	0.004	0.220
$\frac{TS}{AS}$	−0.017	0.114	0.092	−0.055	−0.013	0.014	0.200
RET_{it-1}	0.170	0.221	0.196	0.038	0.166	0.319	0.019
$STDC$	0.016	0.005	0.003	0.015	0.015	0.018	0.769
$BETA$	0.865	0.373	0.221	0.654	0.826	1.047	0.587
ROE	0.177	0.177	0.098	0.106	0.158	0.226	0.266
$SALGR$	0.096	0.176	0.132	0.016	0.065	0.135	0.216
$\frac{AS}{A}_{it-1}$	0.361	0.235	0.046	0.156	0.348	0.526	0.946
$\frac{AS}{MCap}$	0.026	0.029	0.006	0.006	0.016	0.036	0.906

in the plan and they may transfer existing assets between choices. In this section we consider the first: we characterize the determinants of the inflow allocation dedicated to company stock. We construct the variable $INALLC_{it}$ as the fraction of new savings by the average participant of plan i invested in company stock during year t. (See Equation (1).)

3.1. INERTIA

Given that changes to the allocation of inflows and transfers are free, *INALLC* should never differ from the desired share of company stock in the portfolio. Evidence from individual-level data on investment decisions in defined contribution plans suggests otherwise: Once the initial decisions are made, they are perceived as the status quo and change may come only very slowly. Indecision is also a decision, one that simply prolongs the choice in the previous period. Samuelson and Zeckhauser (1988) report that in any given year only about 2.5% of participants in the TIAA-CREF retirement fund change their inflow allocation. Ameriks and

Zeldes (2001) confirm that this kind of behavior seems to be the rule rather than the exception. Again using TIAA-CREF data, they find that more than half of the individuals they track over a nine year period made no change to their inflow allocation. More than two thirds made none or one change to the way their new savings were invested. They conclude that “these striking results imply that much of the observed variation in portfolio shares is driven by initial choices and subsequent asset returns”. Samuelson and Zeckhauser (1988) cite this behavior as one instance of a *status quo* bias: individuals tend to stick to status quo choices more frequently than rational behavior would predict. This is particularly true for sequential decisions where the status quo is one alternative among many choices.

Most of the variation in *INALLC* is cross sectional: the within (plan) standard deviation is 0.051, compared to an overall standard deviation of 0.183 (See Table III). If, to a first approximation, the desired portfolio share of company stock is constant but positive and investors use the inflow allocation to control this portfolio share, we should see a lot of variation in *INALLC*. But the company stock inflow allocation is highly persistent, with an unconditional serial correlation of about 0.9. (See also Figure 1)

We do not offer a straightforward explanation of these high levels of company stock investments in the inflows. Just as for the portfolio itself, there may be a host of factors, such as familiarity (Huberman (2001)), subsidies or implicit incentive contracts that make plan participants buy company stock. The mere inclusion of company stock in the set of investable funds may induce some participants to invest in it (See Benartzi and Thaler (2001)). The comprehensive figures by Holden and VanDerhei (2001) suggest something along these lines. Participants invest 71.1% of their balances in equity funds, if their 401(k) plan does not offer company stock as an investment choice. In plans that do offer company stock, they invest only 44.5% in equity funds but 36.3% in company stock.

There is, however, one explanation of non-diversification that we can rule out: *insider knowledge* by plan participants. Appendix D shows that allocation to company stock does not predict returns, dispelling concerns that plan participants trade successfully on private information.

Being interested in the *dynamics* of company stock investment, we control for cross-firm heterogeneity and general time trends by including plan- and time-fixed effects.

3.2. PAST RETURNS

Despite the inertia in *INALLC*, investors make changes. Those infrequent choices have a profound impact on the way their savings are invested. But there is no clear guidance from finance theory for the choice, other than reducing the inflow allocation to zero, an advice investors obviously ignore. It is, however, likely that investors compare current prices with past benchmarks, the most obvious being past prices.

Such likely comparisons suggest that recent returns affect current asset allocation of those who actively make asset allocation choices. When having a third of their savings invested this way, following returns closely seems natural. Otherwise they will observe returns indirectly through the appreciation of the investment. The performance of mutual funds in general is measured by past performance, and Barber et al. (2002) report that investors tend to buy funds with a strong performance record. Bergstresser and Poterba (2002) study the after-tax returns of equity mutual funds and show them to be good predictors of subsequent cash inflows. In the language of experimental psychology, returns reflect the salient feature of investment and are therefore considered first when making an investment decision. (See, for instance, Kahneman and Tverski (1972)). Dorn and Huberman (2002) find a direct empirical link between past performance and diversification: for discount brokerage customers, past high *portfolio* returns seem to be related to diversification in the current period, over a horizon of about three months.

Various authors have interpreted patterns observed in asset prices as being generated by trend chasing, i.e., buying if returns have been high. Returns in general and stock returns in particular exhibit positive serial correlation over short (6 month to 1 year) horizons and mean reversion thereafter. This stylized fact seems to hold for both individual stocks (see e.g., Jagadeesh and Titman (2001)) and wider asset classes (see Cutler et al. (1991)). A series of authors (Barberis et al. (1998); Daniel et al. (1998); Hong and Stein (1999)) construct models with boundedly rational agents to mimic the observed behavior of returns. In all of these models at least one group of investors underestimates returns in the short run and overestimates them over longer time horizons. In De Long et al. (1990), a group of "positive feedback" investors buys on past returns. In this case, as in Barber et al. (2002), this behavior is motivated by excessive extrapolation, past returns creating high expectations for future returns.

There may also be a more indirect role for returns: Periods of good overall company performance foster a general atmosphere of optimism within the company, making the employees over-optimistic about the company's future prospects. Employees may be unaware that these good prospects are already discounted in the stock price and that they are the *cause* of good past returns. In this case, as in the case of excessive extrapolation, we would expect to see positive changes to the inflow allocation as a result of high past returns.

3.3. THE EMPIRICAL MODEL

We expect returns to have a positive effect on inflow allocation, since returns are the most salient feature of investing. Therefore we estimate the effects on *INALLC* several years into the past. Other measures of performance can also lead changes in inflow allocation. We use sales growth and returns on equity (ROE) to proxy for information individuals have about the performance of their company's business. Presumably, participants are more likely to buy more company stock when impressed with their company's performance.

Other factors play a role in the dynamics of the inflow allocation. In the model we also include the *market beta* and the *standard deviation* of the company's returns. The latter should proxy for the idiosyncratic risk, which is relevant given the high levels of non-diversification. If investors dislike volatility and the standard deviation of their largest investment increases, they should decrease their company stock inflow allocation. [9] On the other hand, increases in the volatility may indicate a more intensive arrival of information which could induce individuals to prefer higher exposure to company stock. The market beta of the company's returns should influence the portfolio decision of investors who are only interested in expected returns, ignoring volatility and the fact that they do not hold a well-diversified portfolio. Finally, we allow for the possibility that participants react to changes in the level of *non-diversification*. We include the fraction of all assets invested in company stock at the beginning of the year ($CSSH_{it-1}$) as an additional independent variable. This is the *actual* share of assets individuals have invested in company stock as opposed to the inflow allocations and includes shares individuals have received as a matching contribution from their employer. The portfolio weight of company stock may be higher than usual because of high returns but also because of company stock matches and additional contributions in the form of company stock by the employer.

We specify the model in a linear fashion:

$$INALLC_{it} = \rho\, INALLC_{it-1} + \delta' X_{it} + \alpha_i + \lambda_t + u_{it}. \tag{3}$$

$INALLC_{it}$, as defined in (1), measures new inflows into the company stock fund as a fraction of overall investor directed savings. The lag of *INALLC* controls for the general inertia in changes to the inflow allocation. The other right hand side variable, X_{it}, is a vector that contains four lags of the continuously compounded raw returns of company i's stock (RET_{it-1}, ..., RET_{it-4}). [10] While inflow allocations are measured at the end of each year, they are an average over that year. To avoid the inclusion of information that was not available to investors at the time they made changes to *INALLC*, we do not include the current period's return since – depending on the plan's policy – participants may change their inflow allocations at different points in time during the year. Also, high returns on company stock after *INALLC* has been set may lead to a spurious correlation between returns and inflow allocations. Other than lags of returns, X_{it} includes the return on equity (ROE_{it-1}), sales growth ($SALGR$), the standard deviation of company i's return ($STDC_{it-1}$), and the market beta ($BETA_{it-1}$). All of these variables are lagged by one year as well. Finally, X_{it} contains the 'non-diversification' measure, which

[9] Meulbroek (2002) finds a negative correlation between the fraction invested in company stock and the cost of non-diversification related to the firms idiosyncratic risk.

[10] To be more exact, it is the common stock return of the company who sponsors plan i.

is the fraction of all assets invested in company stock at the beginning of the year ($CSSH_{it-1}$).

The variables α_i and λ_t capture other omitted plan- or time-specific factors and control for all other reasons for plan participants to buy company stock, factors that do not change over time, such as a tendency to invest in the familiar or company culture. The time effects control for a general downward trend in company stock inflow allocations. They also net out the effect of the 1990s bull market, which coincided with our sample period. Unfortunately, the short time dimension of the data set makes it impossible to investigate the effect of the market return on the allocation decision. There are a maximum of seven degrees of freedom to estimate coefficients on variables with no cross-sectional variation, such as the market return. [11]

3.4. ESTIMATION

The model specified in (3) includes plan specific effects and a lagged dependent variable. The plan specific levels are driven by institutional factors and the sample includes almost all of the plans of S&P500 companies. Furthermore, we suspect that the plan specific effects are correlated with returns. These observations imply the need to control for fixed effects in the estimation. Relatively straightforward procedures exist to correct for the presence of a lagged dependent variable bias in a fixed effects framework.

Consider the model after removing the fixed effects by taking differences: [12]

$$\Delta INALLC_{it} = \rho\, \Delta INALLC_{it-1} + \delta' \Delta X_{it} + \Delta u_{it}. \tag{4}$$

In the absence of the lagged dependent variable, estimation with OLS would be appropriate. Using the same procedure for the model in (4) yields biased and inconsistent estimates of both parameters ρ and δ because

$$\mathrm{Cov}_t\,(INALLC_{it-1} - INALLC_{it-2}, u_{it} - u_{it-1}) \neq 0. \tag{5}$$

Furthermore, the inconsistency does not disappear for $N \to \infty$ and fixed T. The least-squares dummy variables estimator suffers from the same problem, see Hsiao (1986).

Anderson and Hsiao (1981) propose an instrumental variables estimator that uses $INALLC_{it-2}$ as an instrument for $\Delta INALLC_{it-1}$. Arellano and Bond (1991) extend this idea to a linear GMM framework. If in Equation (3) the u_{it}'s are serially

[11] Including year dummies also has the effect that the coefficients on the returns can be interpreted as effects of excess returns.

[12] For this part of the analysis the year fixed effects are treated as part of the X vector.

uncorrelated, the optimal matrix of instruments should use the all $INALLC_{it-s}$, $s \geqq 2$. If the X's are strictly exogenous, i.e., $E(X_i u_{it}) = 0$, then all its components are valid instruments as well. Theoretically, even in an unbalanced panel, as in the present case, *all* the lags of the predetermined variable and the exogenous variables could be used as instruments. Arellano and Bond report Monte Carlo evidence suggesting that the inclusion of too many lags results in overfitting in samples with small T. Therefore we only exploit the moment conditions implied by the lags of the dependent variable.

The $(T_i - 2)$ equations for plan i can be written as

$$y_i = W_i \delta + \iota_i \alpha_i + \nu_i$$

where δ is a parameter vector of coefficients, including the coefficient on the lagged dependent variable, and W_i is the data matrix. ι_i is a $(T_i - p) \times 1$ vector of ones, and α_i is the fixed effect.

The Arellano-Bond GMM estimator is given by

$$\widehat{\delta} = \left[\left(\sum_i W_i^{*\prime} Z_i \right) A_N \left(\sum_i Z_i' W_i^* \right) \right]^{-1} \left(\sum_i W_i^{*\prime} Z_i \right) A_N \left(\sum_i Z_i' y_i^* \right)$$

where

$$A_N = \left(\frac{1}{N} \sum_i Z_i' H_i Z_i \right)$$

and W_i^* and y_i^* are first-differenced versions of W_i and y_i. The matrix Z_i contains the instruments. If we use all plans with at least three observations, Z_i has six rows (one for each observation in the time dimension) and 35 columns, 21 for the lagged levels of the dependent variable at least two years into the past and 14 for the exogenous covariates, including year effects.[13] H_i is a weighting matrix. The one-step estimator under differencing uses

$$H_i = \begin{pmatrix} 2 & -1 & \ldots & & 0 \\ -1 & 2 & \ldots & & 0 \\ . & . & & & . \\ . & . & & & . \\ . & . & & & -1 \\ 0 & 0 & \ldots & -1 & 2 \end{pmatrix}$$

[13] The plans in the panel with the longest time dimension have 8 adjacent observations. We lose the first two due to the inclusion of the lagged levels. This leaves a total of $(6 \cdot 7)/2 = 21$ instruments from the lagged inflow allocations.

as weights, whereas the two-step estimator uses

$$H_i = \widehat{\nu}_i^* \widehat{\nu}_i^{*\prime}$$

where $\widehat{\nu}_i^*$ are the one-step residuals.

The consistency of the GMM estimator depends crucially on the assumption of no serial correlation in the error terms. Arellano and Bond suggest a test for the absence of serial correlation: if the disturbances $\hat{\nu}_{it}$ are not serially correlated, there should be evidence of significant negative first order serial correlation in the first-differenced residuals and no evidence of second order serial correlation. The test statistics m_1 (first order) and m_2 (second order) are based on standardized residual autocovariances and should be distributed $N(0, 1)$ under the null of no serial correlation.

We will also report the Sargan test of overidentifying restrictions, which is asymptotically distributed as chi-square with as many degrees of freedom as overidentifying restrictions, under the null hypothesis of the validity of the instruments. For more details see Arellano and Bond (1998, 1991).

3.5. RESULTS

Column 1 in Table IV reports the results of estimating (3) using the Arellano-Bond GMM estimator with the full set of lags of *INALLC* as instruments for the lagged dependent variable. We present only the results of the two-step procedure estimated from differences, together with the heterogeneity-robust standard errors obtained from the step-one residuals.

Three lags of returns on company stock turn out to be significant at the 1% level. For the one-year return, we estimate a coefficient of 0.082. If the company experiences returns that are one standard deviation (≈ 0.22) above the mean, on average plan participants increase the inflow allocation to company stock by about 1.8 percentage points in the subsequent year. While this may not seem large, it is still surprising given that the return contains no relevant information. The sensitivity of *INALLC* to returns declines backwards with time. The coefficients on returns two and three years into the past are 0.065 and 0.013 respectively, both statistically significant. The effect of returns lagged four years is small and insignificant.

Individual-level Return Sensitivities

Choices observed on the plan-level obscure the individual heterogeneity that may be present in return sensitivities. Given the high degree of persistency, only a few individuals change their inflow allocation in response to returns and the estimated coefficient underestimates the true parameter. Consider a 401(k) plan with no participant turnover and the simple case where each period a random fraction ρ of participants makes no changes to the fraction of new savings invested in company stock. The average inflow allocation of a member of this group will be

Table IV. Determinants of inflow allocations

The sensitivities of $INALLC_{it}$ (fraction of new inflows to the plan invested in company stock) to various variables are estimated using regression equation (3). The lagged returns (RET_{it-1} ... RET_{it-4}) were constructed using data from the monthly CRSP file matched to the firms in our sample. The market beta ($BETA_{it-1}$) and the standard deviation ($STDC_{it-1}$) were constructed from daily data and estimated over a 1-year window using the return on the S&P 500 index as market portfolio. Returns are continuously compounded cumulative one-year returns. $SALGR_{it-1}$ and ROE_{it-1} are the sales growth and the return on equity of the company that sponsors plan i, both constructed from Compustat. $CSSH_{it-1}$ is the fraction of all assets invested in company stock at the beginning of the year. All regressions include year dummies and a constant where appropriate (not reported). All results were estimated using the linear two-step GMM estimator proposed by Arellano and Bond (1991) described in the text. The fixed effects were removed using first differences. The standard errors (reported in parenthesis) are heteroskedasticity-robust. Also reported are tests for first and second order serial correlation (m_1 and m_2) and Sargan's test of the overidentifying restrictions. Column 2 reports the result of interacting the return in any given year with a dummy variable that is one if the return in the same year was above the return of the S&P500 index in the same year and zero otherwise. Column 3 interacts the return with an indicator for positive/negative returns. The symbols **, * and + indicate statistical significance on the 1%, 5% and 10% level, respectively. Heteroscedasticity-robust standard errors in parenthesis.

Dep. var.	(1)	(2)		(3)	
	INALLC				
		Returns interacted			
		Below S&P500	Above S&P500	Negative	Positive
Lagged	0.641**	0.679**		0.696**	
	(0.078)	(0.075)		(0.077)	
RET_{it-1}	0.082**	0.034	0.096**	−0.023	0.125**
	(0.013)	(0.022)	(0.013)	(0.044)	(0.019)
RET_{it-2}	0.065**	0.049*	0.068**	0.010	0.082**
	(0.011)	(0.019)	(0.013)	(0.030)	(0.017)
RET_{it-3}	0.013+	−0.012	0.023*	−0.022	0.029*
	(0.007)	(0.020)	(0.010)	(0.026)	(0.012)
RET_{it-4}	0.006	−0.018	0.012	−0.025	0.018
	(0.009)	(0.020)	(0.012)	(0.026)	(0.015)
$STDC_{it-1}$	0.908	0.741		0.482	
	(0.675)	(0.724)		(0.748)	
$BETA_{it-1}$	0.000	−0.006		−0.010	
	(0.009)	(0.009)		(0.008)	
ROE_{it-1}	−0.023	−0.021		−0.017	
	(0.038)	(0.034)		(0.030)	
$SALGR_{it-1}$	0.016	0.014		0.007	
	(0.019)	(0.020)		(0.019)	
$CSSH_{it-1}$	−0.128*	−0.141*		−0.140*	
	(0.062)	(0.063)		(0.063)	
Observ.	499	499		499	
Year FE	yes	yes		yes	
Plan FE	yes	yes		yes	
# of plans	153	153		153	
Sargan	21.43	23.34		23.79	
(p.val.,df)	0.372, 20	0.272, 20		0.252, 20	
m_1	−2.77	−2.87		−2.88	
(p.val.)	0.0056	0.0041		0.004	
m_2	1.76	1.81		1.57	
(p.val.)	0.0786	0.0705		0.1161	

$$INALLC^{A}_{it} = INALLC_{it-1}. \qquad (6)$$

In the same period, the remaining fraction $(1-\rho)$ of participants resets *INALLC* in reaction to the return in the previous period: [14]

$$INALLC^{B}_{it} = \alpha^{0}_{i} + \alpha^{1} RET_{i(t-1)}. \qquad (7)$$

Under the additional assumption that the investors in each group make the same overall contribution to the plan, the observed aggregate for plan i would be:

$$INALLC_{it} = (1-\rho)\alpha^{0}_{i} + \rho INALLC_{it-1} + (1-\rho)\alpha^{1} RET_{i(t-1)}. \qquad (8)$$

If this interpretation of heterogeneity is valid, the coefficient on the lagged inflow allocation $INALLC_{i(t-1)}$ would be a consistent estimate of the fraction of individuals who make no changes. The estimate on RET_{it-1} would have to be divided by $(1-\rho)$ to obtain an estimate of the underlying return sensitivity α^1. Note however that the assumption that the 'readjusting group' is selected randomly is crucial for this interpretation. This rules out a correlation between the propensity to readjust and past returns, for instance.

Given this assumption together with our estimate for ρ of about 0.641, the implied sensitivity of the active changers to the return one year into the past is $0.082/(1-0.641) = 0.228$. Assuming the same standard deviation of returns as above, this implies that a positive one-standard deviation increase in returns results in an upward revision of *INALLC* by 5 percentage points.

This back-of-the-envelope calculation makes a more general point. The underlying individual-level effect must always be larger if only a small fraction of participants modify their allocations, disregarding the causes of this inertia. The estimate serves as a lower bound of the true sensitivities of those who choose to change the allocation of their contributions.

The other measures of performance, return on equity and sales growth, are not statistically significant. Neither is the market beta and the volatility. The fraction of plan assets invested in company stock at the beginning of the year is significant at the 10% level, indicating that a 10 percentage point increase in the company stock portfolio weight induces investors to reduce *INALLC* by 1.2 points. One may argue that $CSSH_{it-1}$ is endogenous: high allocations to company stock during the previous year might drive up the weight of company stock. It turns out that this concern is not justified. Leaving out this variable or instrumenting with past transfers does not change the results in a significant way. [15] All estimates are net of year fixed effects (not reported).

[14] For simplicity, we assume that only one lag of returns is involved. This can easily be generalized.
[15] We investigate this problem in the context of transfers in Section 4.

The estimates are basically unchanged for the one-step estimator and for smaller sets of instruments. Even the less efficient Anderson-Hsiao instrumental variables (IV) method gives very similar results, both for the size of the coefficients and the statistical significance of the estimates (not reported). Also, the specification tests confirm the validity of the specification: We cannot reject the overidentifying restrictions and the estimated residuals seem to be serially uncorrelated according to the m_1 and m_2 test statistics. For a smaller sample we included two lags of *INALLC*. The second lag is small and not significant, whereas the coefficients on the first two lags of returns are actually larger (not reported).

3.6. ASYMMETRY IN RETURN SENSITIVITIES AND ROBUSTNESS

Sirri and Tufano (1998) report that mutual fund inflows respond positively to high returns but they are insensitive to low returns. Performing a similar exercise, we investigate if return sensitivities for below-average returns differ from those for above-average returns, where average returns are taken to be those of the S&P500. We construct an indicator variable for returns that are above the S&P500 return – a familiar return for investors since all plans offer either an S&P500 index fund or a similar diversified equity choice – and interact this indicator with the returns for all four lags, thereby creating two returns for each company/year/lag: Below-market returns if the return of the company was below that on the S&P500 and zero otherwise, and above-market returns if the return of the company was above-S&P500 and zero otherwise. Column 2 of Table IV reports the results that are obtained if the four lags of returns are replaced with these interacted returns, otherwise leaving the specification as in Column 1. The second experiment is similar. In Column 3 returns are interacted with dummies for positive/negative returns.

We find that a large part of the change in the inflow allocations is a reaction to above-S&P500 returns. For all lags the sensitivity to the high return is larger, except for returns lagged by two years, where the coefficient on the above-S&P500 return is still larger than the one on the below-S&P500 return, but the difference is not statistically significant. Conditional on the lagged inflow allocation, plan specific factors, a set of other variables, and last year's return being above the market return, the average plan participant increases the fraction of new inflows into the 401(k) account by 2.1 percentage points in reaction to a one-standard deviation increase in returns to company stock. For below-S&P500 returns this figure is only 0.8 percentage points, given the return standard deviation of 0.22. Ideally we would also interact the full set of S&P500 dummies with lags of *INALLC*, but the small time dimension of our sample prevents us from doing so. Additional results (not reported) show that interacting one lag of *INALLC* with the S&P500 indicator has no effect.

Distinguishing between positive and negative returns leads to an even stronger case for the presence of an asymmetry in return sensitivities. The coefficient on positive one-year return is more than five times as large as the coefficient on negative return. These results are generally in line with Sirri and Tufano (1998).

Table V demonstrates the robustness of the results for slightly different specifications. Column 1 uses inflows into company stock normalized by total assets instead of total inflows. Again, we find a dependence of inflows to two years of returns and a negative response to last year's weight of company stock in the portfolio. Sales growth is marginally significant. Qualitatively, the results also remain unchanged if the first differences of *INALLC* are regressed on the full set of variables (Column 2). An increase in last year's returns by one standard deviation increases the *change* in *INALLC* by 2.1 percentage points, not surprising given the average change in inflow allocations net of year effects being close to zero.

3.7. RISK, BUSINESS PERFORMANCE, AND PAST HOLDINGS OF COMPANY STOCK

Having reviewed the slope coefficients which turns out to be statistically significant in Tables IV and V, we turn attention to those that do not seem significantly different from zero. The sensitivities of inflows to the risk parameters – the standard deviation of the company stock's return as well as its market beta – are both close to zero, suggesting that risk, as captured by these two parameters, does not guide investors' choice of portfolio weights. This apparent disregard for risk is quite surprising, considering that employees invest a substantial portion of their 401(k) savings in employer stock. Or maybe such ignorance of risk is to be expected from investors who pour so much of their savings into their employer's stock.

The statistically significant negative coefficient on the fraction of all assets invested in company stock at the beginning of the year indicates investors' tendency to rebalance their holdings: the bigger their relative holdings of company stock, the more they reduce their flows into that asset. Thereby the investors show a glimmer of sensibility.

The firm's business performance as measured by return on equity and sales growth seems to have no effect on inflow allocation. Possibly, the noise in the data may obscure any relation. Not knowing when the inflow allocation is made creates some of that noise. Transfers, to which we turn next, do not pose this problem, since the choice of transfer is made in the year in which it is recorded.

4. Transfers

Plan participants may transfer money which has built up in one set of the investable funds into another set. In particular, they may transfer funds into, and out of company stock. Here we consider the net transfers into company stock during a year, normalized by the total assets invested in the plan at the end of the year. In principle one may add up transfers and inflows and investigate the total change to the 401(k) portfolio. But individuals may see transfers as distinct from changes in

Table V. Determinants of inflow allocations: additional specifications

Column (1): GMM estimation, as in the previous table; the dependent variable is the inflows normalized by total assets instead of total inflows. Column (2): OLS regression of *changes* in *INALLC* on the independent variables. This is an estimate of the model in (3) restricting $\rho = 1$. Variable definitions: see Table IV. The symbols **, * and + indicate statistical significance on the 1%, 5% and 10% level, respectively. Heteroscedasticity-robust standard errors are reported in parenthesis.

Dep. var.:	(1) $\frac{PS}{A}$	(2) $\Delta(INALLC)$
Lagged	0.555**	
	(0.036)	
RET_{it-1}	0.010**	0.097**
	(0.001)	(0.015)
RET_{it-2}	0.005**	0.057**
	(0.001)	(0.012)
RET_{it-3}	0.001	0.004
	(0.001)	(0.010)
RET_{it-4}	0.003	0.015
	(0.003)	(0.010)
$STDC_{it-1}$	0.074	−0.436
	(0.100)	(0.496)
$BETA_{it-1}$	0.000	0.004
	(0.001)	(0.006)
ROE_{it-1}	0.002	−0.008
	(0.007)	(0.005)
$SALGR_{it-1}$	0.004+	0.011
	(0.002)	(0.020)
$CSSH_{it-1}$	−0.016**	−0.060**
	(0.005)	(0.013)
Observations	499	721
R-squared		0.17
Year FE	yes	yes
Plan FE	yes	no
# of plans	153	
Sargan	23.23	
(p.val., df)	0.278, 20	
m_1	−1.75	
(p.val.)	0.0801	
m_2	0.34	
(p.val.)	0.7317	

their inflow allocations. Also, when analyzing plan-level data, different individuals may be behind these decisions.

Some employers place restrictions on transfers out of the company stock fund, especially if some of the company stock was contributed by the company in the form of a matching or profit sharing contribution. But assuming these restrictions and the assets not under the control of the investor do not vary over time within plans, *TRANS* is proportional to the transfers per participant. As alternatives, we considered normalizing by assets invested in company stock or total new inflows, but the results are not sensitive to this choice.

The status quo choice for transfers is to make no transfers, and this is what Ameriks and Zeldes (2001) observe in their panel of individual TIAA-CREF investors. It is surprising how few changes those individuals make to their portfolio, both by means of changes in the inflow allocation and transfers. Over a period of nine years, 82% of the individuals they tracked made no active net change to their equity allocations using transfers. The change in exposure to equity is driven almost exclusively by returns. In our data, transfers are far less persistent and more variable than inflow allocations (see Table III). The within-standard deviation of transfers normalized by total assets is three times as large as inflow allocations going into company stock.

To transfer funds, a participant must make an active decision. Unlike inflow allocation, there is no default transfer. Thus, inertia in participants' decisions does not apply to transfers. The empirical model for *TRANS* is specified without the lagged transfers, but is otherwise identical to (3):

$$TRANS_{it} = \delta' X_{it} + \alpha_i + \lambda_t + u_{it}. \tag{9}$$

According to Table III, transfers are slightly positively autocorrelated, which is sensible if in consecutive years they are guided by the same signals. For instance, if returns in year t lead transfers in year $t + 1$ and in year $t + 2$, then transfers will be autocorrelated, but the autocorrelation will vanish once we control for lagged returns. This indeed is the case. Estimation (not reported) including the lagged transfers yields a small ($<$0.10) and insignificant coefficient. The other results are unchanged.

Some employers make matching or profit sharing contributions to the company stock fund and in many cases don't allow participants to transfer those balances into other funds until employees reach age $59\frac{1}{2}$. Therefore some of the transfers we observe may be related to the average age of the company's workforce. In general, plan policies and plan participants' attributes may vary over time and across plans, but it is reasonable to assume the time variation to be limited considering the relatively short sample. Plan specific effects are meant to control for unobserved differences across plans. The empirical model includes the same independent variables as in Section 3: four lags of returns on company stock (RET_{it-1}, ..., RET_{it-4}), return on equity (ROE), sales growth ($SALGR$), the standard deviation of company i's return ($STDC$), the market beta ($BETA$) and the 'non-diversification' measure, which is the fraction of all assets invested in company stock at the beginning of the year ($CSSH_{it-1}$).

For returns, we find similar results as for the inflow allocations. Three lags of returns significantly predict positive transfers into the company stock fund conditional on the plan specific factors and other exogenous variables. A one standard-deviation increase in returns one year in the past triggers a $1 transfer into company stock for every $100 in plan assets at the end of the year (See Column 1 in Table IV, $0.052 * 0.22 = 0.012$). This result is robust to normalizing transfers by all new inflows instead of total assets (Column 2, Table VII). As for *INALLC*, the pattern of return sensitivities is declining, falling from 0.052 for the previous year's return to a (not significant) 0.005 for returns four years into the past.

Judging from studies using individual-level data (e.g., Ameriks and Zeldes (2001)), it is only a small fraction of individuals who makes transfers at all. We therefore expect this effect to be larger for individuals who actually decide to make transfers, but we are unable to observe these active changers. In contrast to inflow allocations, there is a discernable positive effect of one of the measures of business performance, sales growth, on the transfers. Good business performance predicts a higher allocation to company stock, controlling for the recent stock market performance of the company. This suggests that general optimism in the company induces plan participants overinvest in company stock even more, on top the large amounts they already invest this way.

While the effects of $BETA$ and $STDC$ are negligible, just like for *INALLC*, we find a very strong negative effect of $CSSH_{it-1}$ (fraction of total plan assets invested in company stock) on the transfer variable. That implies that individuals transfer $2.6 out of company stock for every $100 in plan assets after a ten-percentage point increase to $CSSH_{it-1}$. This observation is consistent with a tendency to rebalance the company stock investment, but is in contradiction with the effect of high company stock inflows in the context of company stock matching. Benartzi (2001) and VanDerhei et al. (1999) report that inflow allocations into company stock tend to be higher if the company matches employees' contributions with company stock instead of cash. Here we observe that high levels of company stock in the portfolio actually decrease company stock investment.

Estimating the parameter on lagged company stock investment poses an endogeneity problem similar to the one described in Section 3.4. Including the lagged fraction of company stock in overall assets is in part like including the lag of *TRANS* since this fraction reflects last year's transfer choices. Removing plan fixed effects by differencing creates an error term that is correlated with the difference in $CSSH_{it-1}$. In Table VII (third column) we present the results of instrumenting for this endogeneity using two-stage least squares. Akin to the Anderson-Hsiao procedure, we use the *levels* of *TRANS* and *INALLC* lagged by two years as instruments. This does not significantly alter our estimates. Even the coefficient

Table VI. Determinants of transfers

The sensitivities of $TRANS_{it}$ (Transfers in and out of company stock fund normalized by total plan assets) to various variables are estimated using regression equation (9). The lagged returns ($RET_{it-1} \ldots RET_{it-4}$) were constructed using data from the monthly CRSP file matched to the firms in our sample. The market beta ($BETA_{it-1}$) and the standard deviation ($STDC_{it-1}$) were constructed from daily data and estimated over a 1-year window using excess returns where the CRSP value weighted index proxied for the market portfolio. Returns are continuously compounded cumulative one-year returns. $SALGR_{it-1}$ and ROE_{it-1} are the sales growth and the return on equity of the company that sponsors plan i, both constructed from Compustat. $CSSH_{it-1}$ is the fraction of all assets invested in company stock at the beginning of the year. All regressions include year dummies and a constant where appropriate (not reported). All regressions were estimated using OLS after removing plan fixed effects by taking differences. The reported standard errors are heteroscedasticity-robust and allow for free correlation of the within-plan residuals. Column 2 reports the result of interacting the return in any given year with a dummy variable that is one if the return in the same year was above the return of the S&P500 index in the same year and zero otherwise. Column 3 interacts the return with an indicator for positive/negative returns. The symbols **, * and + indicate statistical significance on the 1%, 5% and 10% level, respectively.

	(1)	(2)		(3)	
Dep. var.	*TRANS*				
		Returns interacted			
		Below S&P500	Above S&P500	Negative	Positive
RET_{it-1}	0.052**	0.041**	0.054**	0.013	0.065**
	(0.011)	(0.015)	(0.010)	(0.021)	(0.012)
RET_{it-2}	0.033**	0.037*	0.025**	0.007	0.034**
	(0.010)	(0.018)	(0.009)	(0.025)	(0.010)
RET_{it-3}	0.020**	−0.007	0.026**	−0.021	0.033**
	(0.007)	(0.017)	(0.007)	(0.022)	(0.007)
RET_{it-4}	0.005	−0.034*	0.017**	−0.045*	0.024**
	(0.007)	(0.016)	(0.006)	(0.022)	(0.007)
$STDC_{it-1}$	0.554	0.897		0.607	
	(0.541)	(0.545)		(0.565)	
$BETA_{it-1}$	−0.001	−0.003		−0.004	
	(0.005)	(0.005)		(0.005)	
ROE_{it-1}	0.010	0.012		0.013	
	(0.014)	(0.012)		(0.011)	
$SALGR_{it-1}$	0.026**	0.029**		0.028**	
	(0.010)	(0.009)		(0.010)	
$CSSH_{it-1}$	−0.258**	−0.251**		−0.249**	
	(0.042)	(0.042)		(0.042)	
Observ.	496	496		496	
R-squared	0.26	0.3		0.29	
Year FE	yes	yes		yes	
Plan FE	yes	yes		yes	
# of plans	153	153		153	

Table VII. Determinants of transfers: additional specifications

In column 1, the dependent variable is transfers normalized by assets invested in company stock. In column 2, the dependent variable is transfers normalized by inflows. In column 3, it is *TRANS* as defined in Table VI, and the estimation is performed with instrumental variables: the variable $CSSH_{it-1}$ is instrumented with $INALLC_{it-2}$ and $TRANS_{it-2}$. All the independent variables are as defined in Table IV. The reported standard errors are heteroskedasticity-robust and allow for free correlation of the within-plan residuals. The symbols **, * and + indicate statistical significance at the 1%, 5% and 10% level, respectively.

Dep. var.	(1) $\frac{TS}{AS}$	(2) $\frac{TS}{P}$	(3) *TRANS*
RET_{it-1}	0.208**	1.195**	0.053**
	(0.046)	(0.321)	(0.016)
RET_{it-2}	0.135**	0.752**	0.034*
	(0.043)	(0.283)	(0.014)
RET_{it-3}	0.088**	0.639**	0.020+
	(0.026)	(0.224)	(0.011)
RET_{it-4}	0.024	0.209	0.005
	(0.029)	(0.157)	(0.008)
$STDC_{it-1}$	1.441	14.277	0.562
	(2.110)	(15.153)	(0.546)
$BETA_{it-1}$	−0.013	−0.027	−0.001
	(0.022)	(0.159)	(0.005)
ROE_{it-1}	−0.030	0.374	0.011
	(0.066)	(0.369)	(0.016)
$SALGR_{it-1}$	0.104**	0.601**	0.026**
	(0.038)	(0.208)	(0.009)
$CSSH_{it-1}$	−0.842**	−5.692**	−0.270+
	(0.162)	(1.281)	(0.148)
Observations	496	496	496
R-squared	0.19	0.17	0.26
Year FE	yes	yes	yes
Plan FE	yes	yes	yes
# of plans	153	153	153
Method	OLS	OLS	IV

on $CSSH_{it-1}$ hardly changes (from -0.26 to -0.27), but it is now only marginally significant, perhaps due to the low efficiency of the procedure.

We observe that, on average, 401(k) plan investors transfer funds into the company stock fund if returns have been high over the previous three years. Is this return sensitivity different for above- and below-market returns? Like in Section 3.6, we construct two sets of indicators for above/below-S&P500 returns and positive/negative returns, and interact them with the lagged returns. The result, in Columns 2 and 3 of Table IV, are consistent with the findings from inflow allocations. Transfers are more responsive to above-S&P500 returns for the first lag of returns, but the difference is not significant on conventional levels in a formal F-test. The declining pattern of coefficients is maintained, with the third lag being more precisely estimated than the second for the above-S&P500 returns. The results for the positive/negative return interaction are much clearer. None of the sensitivities to periods where returns were negative is significant at the 1% level. All of the coefficients of the positive returns are large and statistically significant.

Offering additional robustness tests, Table VII lends further confidence in the results. Column 1 contains the results of estimating the specification with transfers normalized by all assets in the company stock fund instead of all assets available to plan participants. Qualitatively, the results are the same. The coefficient on the first lag of returns implies a $4.5 transfer into the company stock fund for every $100 already invested that way, given a one-standard deviation increase in returns. The specification with transfers normalized by new inflows (Column 2) confirms the same.

In summary, the results on transfers are remarkably similar to those on inflows. The transfer and flow allocations require separate decisions and the forms that the employees fill for them are separate. Nonetheless, at least at the plan level they show positive sensitivities to between two and three years of past returns.

5. Extrapolation and Feedback Trading

Benartzi (2001) reports that the inflow allocations of a cross section of firms in 1993 is positively correlated with past returns, increasingly so over longer time horizons. He interprets this as evidence of excessive extrapolation:

> I find that allocations to company stock are correlated with past returns but not with future returns. This is consistent with employees excessively extrapolating past returns without sufficient regard to the low predictability of returns. [...] These results indicate that employees look for a long track record before they invest in company stock, which is consistent with the excessive extrapolation hypothesis.

Column 1 in Table VIII replicates this result using our sample and the set of independent variables used by Benartzi. [16] Regressing the cross section of *INALLC* for 1993 on the ten-year cumulative return, log market capitalization, market beta, volatility, a dummy for plans that pay matching contributions in the form of company stock (CS Match), and the log book to market ratio, we find a coefficient of 0.122 on the ten year return, compared to Benartzi's 0.126. For the full sample, the coefficient is considerably smaller, only 0.075 (Column 3).

[16] We could not exactly replicate the result because there are fewer observations in our sample for 1993.

Table VIII. Unconditional regressions

Replication and extensions of the results in Benartzi (2001). In all regressions the dependent variable is *INALLC*, and the estimation method is OLS. The independent variables are the ten-year cumulative return, log market capitalization (CRSP), market beta, volatility, a dummy for plans that pay matching contributions in the form of company stock (CS Match), and the log book to market ratio (book value of equity constructed from Compustat, market value from CRSP). In the specification involving the full sample (Columns 3–5), year dummies were included. The standard errors reported allow for free correlation of the within-plan residuals. The symbols **, * and + indicate statistical significance on the 1%, 5% and 10% level, respectively. Heteroscedasticity-robust standard errors are reported in parenthesis.

	(1)	(2)	(3)	(4)	(5)
	INALLC				
Sample:	1993	1993	Full	Full	Full
Lagged					0.876**
					(0.021)
Ten yr. Return	0.122**		0.075**		
	(0.022)		(0.015)		
RET_{it-1}		0.185*		0.023	0.072**
		(0.080)		(0.028)	(0.016)
RET_{it-2}		−0.012		0.084**	0.053**
		(0.061)		(0.025)	(0.011)
RET_{it-3}		0.263**		0.085**	0.018*
		(0.080)		(0.024)	(0.008)
RET_{it-4}		0.092		0.073**	0.014
		(0.089)		(0.024)	(0.010)
RET_{it-5}		0.168+		0.064**	0.002
		(0.088)		(0.025)	(0.009)
RET_{it-6}		0.145*		0.083**	0.012
		(0.070)		(0.020)	(0.009)
RET_{it-7}		0.217**		0.076**	−0.006
		(0.078)		(0.023)	(0.011)
RET_{it-8}		0.068		0.084**	0.019
		(0.100)		(0.021)	(0.011)
RET_{it-9}		0.227**		0.067**	0.002
		(0.072)		(0.022)	(0.010)
RET_{it-10}		0.147*		0.087**	0.013
		(0.061)		(0.022)	(0.010)
ln(MV)	0.069**	0.064**	0.035**	0.036**	0.003
	(0.018)	(0.019)	(0.009)	(0.009)	(0.002)
$BETA$	−0.184**	−0.130+	−0.040+	−0.039	0.003
	(0.053)	(0.072)	(0.023)	(0.024)	(0.006)
$STDC$	2.836**	3.004**	0.196	0.238	0.044
	(4.397)	(5.284)	(1.712)	(1.719)	(0.428)
CS Match	0.069*	0.056	0.098**	0.098**	−0.004
	(0.032)	(0.036)	(0.022)	(0.022)	(0.005)
ln(BV/MV)	0.076	0.124+	0.004	0.002	−0.002
	(0.055)	(0.069)	(0.026)	(0.026)	(0.010)
Observations	96	96	924	924	703
R-squared	0.38	0.45	0.24	0.25	0.9

Benartzi infers from his analysis that investors use very long histories of returns to make portfolio choices. However, his results, based on a single cross section of asset allocations, lend themselves to alternative interpretations. It is possible that investors rarely change their asset allocations, and when they change them, they use only recent returns for guidance. Thus, the allocation of those investors who last modified their allocation, say, nine years ago will be sensitive to the returns that were recent nine years ago. Therefore, in an analysis that is based on a single cross section, this combination of the status quo bias and investors using only recent returns will show up as if very distant past returns lead current asset allocation. Table VIII illustrates this observation.

Repeating the regression with each of the previous ten year returns entering separately (Column 2) shows that almost all lags starting two years into the past are large, statistically significant, and of similar size. Measuring these effects more precisely in the larger sample (Column 4) confirms that the apparent influence of long-run returns is an artifact of leaving out the lagged dependent variable. In our specification, two to three lags of returns have a strong and highly significant effect. The inclusion of more than four lags does not yield any significant estimates. This actually does not depend on the inclusion of fixed effects in the specification. Column 5 of Table VIII shows that re-estimating the specification with Benartzi's set of variables, ignoring the fixed effects but including the lagged levels of *INALLC* cuts the number of significant lags to three. The sensitivity of transfers discussed in Section 4 provides even stronger evidence that only returns over the previous two-to-three years matter. Still, even three years is a remarkably long time horizon for employees to recall.

A long list of authors tried to explain the evidence for return predictability and under/overreaction by building behavioral models that include investors who chase prices when making asset allocation decisions. [17] Usually such arguments are not constructed to derive implications for trading or periodic portfolio changes, but they all appeal indirectly to the notion that behavior is connected to past prices. Shiller (2001) writes about a similar mechanism:

> The essence of a speculative bubble is a sort of feedback, from price increases, to increased investor enthusiasm, to increased demand and hence further price increases. The high demand for the asset is generated by the public memory of high past returns and the optimism those high returns generate for the future.

There are always two sides to each trade, and therefore there are groups that identify a "buy" and those who identify a "sell" signal in the very same environment. (Moreover, each group discounts the motives of the other group!) This paper identifies 401(k) participants as groups that tend to buy more after run-ups in the company stock prices. Probably the employment relation inspires such behavior. Econometrically, using company stock returns has a major advantage to study trend

[17] See for instance Barberis et al. (1998), Daniel et al. (1998), or Hong and Stein (1999).

chasing behavior: it allows for precise identification with a relatively short time series.

Could the observed behavior influence returns? Probably not. Plan participants hold only a tiny fraction of their respective companies. Nevertheless, this paper presents one of the few instances where we actually observe the impact of past prices on allocation, over horizons longer than a few months. This may be crucial for understanding return predictability.

6. Conclusion

Focusing on company stock as an important investable fund, this paper studies primarily the changes in the allocation of funds and transfers to or from company stock.

Past returns are a strong predictor of both measures of change, inflows and transfers. Furthermore, there is an asymmetry in the reaction to past returns: both transfers and inflows react more strongly to above-S&P and positive returns. Contrary to previous results, the sensitivity to past returns extends only two to three years into the past. This is longer than a few months, documented for instance for foreign investors on the Finnish stock market (see Grinblatt and Keloharju (2000)), but considerably shorter than the ten-plus years reported by Benartzi (2001). This seemingly irrational behavior notwithstanding, investors also display a tendency to rebalance, primarily through transfers. This implies an interesting contradiction. Plan participants tend to amplify matching contributions made in the form of company stock with higher voluntary company stock contributions. But they also react to high levels of company stock in their portfolios in exactly the opposite way when it comes to transfers.

Employees who can participate in 401(k) plans make several choices. First, they choose whether to participate. Second, those who choose to participate also choose how to allocate the money they contribute. The first choice applies to all employees. The second applies to all participants. Two additional choices are available only to participants, but are not mandatory: the choice to modify the allocation of the contributions (which was selected in the past) and the choice to take money from a subset of funds in which it has accumulated and put it in another subset of funds – the choice to transfer funds. These latter two choices are seldom made. (Samuelson and Zeckhauser (1988); Ameriks and Zeldes (2001); Agnew et al. (2000)) The frequency of such choices cannot be estimated from the plan-level data underlying this study. It is noteworthy, however, that the smaller the fraction of participants who modify their allocations or transfer money across funds, the stronger is the estimated effect for those who do make these choices.

The results reported here bear a superficial to prospect theory (Kahneman and Tversky (1973)) which extends standard von-Neumann Morgenstern expected utility theory of evaluation of risky prospects. Two important features of prospect theory are (i) the relevance of past outcomes because they determine the current reference point relative to which gains and losses are measured, and (ii) future gains and losses are asymmetrically evaluated (loss aversion). But prospect theory describes how forward-looking individuals make decisions, whereas the findings here are about the influence of past outcomes on subsequent choices. These choices should be forward looking, and past performance should be relevant only if it helps predict future performance or if it affects current attitudes toward future returns. The evidence suggests that participants infer that positive past returns are likely to continue in the future, or that they are more willing to tolerate the risk associated with holding company stock after the stock has had an unusually good run.

The asymmetry is in line with Sirri and Tufano (1998) however, who find that mutual fund inflows react positively to *good* past performance and show no reaction to low returns. For mutual funds, this may even make sense. Mutual funds are managed portfolios and one can argue that a manager's past performance is predictive of his future performance. Baks et al. (2001) conjecture that a Bayesian investor may rationally use past performance to evaluate mutual fund managers whose heterogeneity in performance may be stable over time. With individual stocks a similar argument is weaker, unless one resorts to a serious market inefficiency which prevents prices from adjusting to very public and very salient information. Perhaps plan participants apply an otherwise useful heuristic under the wrong circumstances.

The Enron scandal has brought the dangers of non-diversification in 401(k) plans to the public's attention. The behavior documented in this paper may be one explanation for how plan participants build up such large holdings of company stock: they continually increase their holdings of company stock if the company has been doing well.

Appendix A. The Institutional Background

Compared to most western countries, the United States rely less on their Social Security system to provide for retirement income. Private individual savings play an important role, but company-sponsored retirement plans are the most common tool to maintain living standards during retirement for most Americans.

Until recently, company-sponsored retirement plans mimicked to some extent state-sponsored social security benefits: these *defined benefit plans (DB-plans)* promised workers a fixed retirement income calculated from income and tenure. Most large US companies still sponsor DB plans, but recent years have seen a tremendous growth of another type of company-sponsored program, *defined contribution (DC) plans*. While during the 1970s there were twice as many participants in DB than in DC plans, the opposite is true now.

In broad terms, defined contribution plans are a tax-advantaged form of deferred compensation, with employers usually committing to make regular additional contributions on top of what is saved by the employee. Since the tax advantages are the main incentive for employers to maintain such programs, the actual plans mostly reflect rules laid out in the Employee Income Retirement Security Act of 1974 (ERISA) and the Internal Revenue Code (IRC). The tax benefits that are available apply only to so-called "qualified plans", that is plans that comply with the rules established under IRC §401(a). [18] The income tax advantages comprise: (a) the deductibility of plan contributions for the employer, (b) the deferral of taxable income until the benefits are distributed, (c) tax exemption of the fund income, and (d) favorable tax treatment of distributions (plan benefits may be rolled over into an Individual Retirement Account).

The most commonly used defined contribution plans are 401(k) plans (which are also referred to as "Cash or Deferred Arrangement" or "CODA"), profit-sharing plans, employee stock ownership plans, money purchase pension plans, and stock bonus plans.

In a *profit sharing plan*, the employer makes regular contributions to a trust set up for this purpose. Depending on the plan, there need not be a definite rule according to which the contributions are made. The amount of contribution may be based upon the firm's profit for the year, and may be changed from year to year to reflect changing circumstances. The contributions are only required to be "recurrent and substantial" for the plan to remain in good standing with the IRS.

The voting rights of company stock held by a profit sharing plan need not be passed through to the participants and are exercised by the trustee who is appointed by the sponsor.

A *stock bonus plan* is "a plan established and maintained by an employer to provide benefits similar to those of a profit sharing plan, except that the benefits are distributed in stock of the employer company". [19]

In recent years, *401(k) plans* have become not only the most common form of defined contribution plans, but also the most popular vehicle for employees to hold shares of their own company.

A qualified *cash or deferred arrangement* (CODA, or 401(k)) is a type of profit sharing or stock bonus plan which allows employees to receive employer payments either in cash or as contributions to the plan. The main difference is that employees can arrange with their employer to reduce their regular compensation and to make an employee contribution to the profit sharing plan in the amount of the reduction, known as *elective contribution*. Usually those contributions are matched by the

[18] Aside from being established for the "exclusive benefit of employees and their beneficiaries", qualified plans have to meet the qualification requirements in §401(a) IRC: (1) the plan has to be established with the intent of being a permanent and continuing arrangement (2) the assets have to be legally separated from those of the employer (3) the plan must cover a "nondiscriminatory" group of employees (4) contributions and benefits must not discriminate in favor of "highly compensated employees" (5) benefits must be "definitely determinable", i.e. there have to be rules according to which the employer makes contributions.

[19] Treasury Regulation 1.401-1 (b)(1)(iii)

employer.[20] Because this possibility to defer current income tends to favor high-income employees, 401(k) plans have to satisfy additional requirements to qualify in the sense of ERISA and IRC.[21] Most 401(k) plans are legally set up as profit sharing and thrift-savings plans (see below); for 1995 the Department of Labor reported that more than 98% out of a total of 200,000 registered plans were of this type.

Historically, 401(k) plans grew out of the profit sharing movement. Already in the late 19th century some companies instituted plans that paid cash benefits based on profits. The high tax rates during World War II created the idea that deferred compensation should be treated differently. For a long time, CODAs stood on shaky legal ground because the ability by employees to choose cash makes the deferred amount "constructively received" and therefore taxable. The IRS made CODAs possible starting in the 1950s, but the paragraph 401(k) was not passed until 1978.

Employee Stock Ownership Plans (ESOPs) figure as the most prominent form of employee stock ownership. The idea that later grew into the ESOP legislation was born by Luis Kelso in the 1950s. He hoped that widespread employee ownership would create a more stable and equitable base for capitalism. ERISA established, among other things, ESOPs as a special form of defined contribution pension plan, usually a stock bonus plan.[22] Out of 9,232 ESOPs in 1995, 4,413 were stock bonus plans, the rest mostly profit sharing and thrift-savings plans. An ESOP may be a designated portion of another plan, such as a 401(k). In an ESOP, the company contributes firm stock to individual workers accounts. These contributions may either come directly from the company or, as in most cases, from a loan that the company takes on behalf of the ESOP trust, a "leveraged ESOP" or LESOP.

An individual who works for a company that has an ESOP must be fully vested not later than after the seventh year of service. This however does not imply that employees have the right to sell those shares after they are vested. They may do this only upon distribution of their account, which must begin within one year following the year of retirement at normal retirement age or later, disability, or death or within six years of any other separation of service.[23] Additional age rules apply.[24]

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[20] For example, the plan may allow employees to make elective contributions not exceeding 10% of compensation and may provide for employer contributions equal to half of all elective contributions that do not exceed 6% of compensation.

[21] One test is known as the "actual deferral percentage test", which sets limits on the deferral percentage of highly compensated employees relative to non-highly compensated ones. This encourages plan sponsors to subsidize contributions by non-highly compensated employees.

[22] Some more technical detail: An ESOP is a stock bonus plan qualified to borrow money and stipulated to invest primarily in the employers stock. Stock bonus plans usually do not invest in own firm stock.

[23] IRC §409(o)(1)

[24] Employees over 55 years must get the option to diversify 25% of their holdings, and this increases to 50% at age 60.

ESOPs are set up as trusts and run by a trustee appointed by the board of directors. This trustee is subject to the direction of the appointing group.[25] Publicly traded firms must pass through voting rights on distributed and vested employee-owned stock.

Diversification and Prudence. ESOPs are one exception to the rule that ERISA plans must be invested in a diversified portfolio, and no more than 10% of its assets must be invested in stock of the employer.[26] The trustees of profit sharing and other plans are bound by the ERISA requirement of prudent asset management,[27] and diversification of assets is considered to be part of prudence. Section 404(c) of the IRC code contains the other major exception: if participants can direct their investments themselves, plan fiduciaries are not responsible for losses that result from the participants actions as long as there are at least three investment alternatives, each of which is diversified and "has materially different risk and return characteristics".

Other Employer-sponsored Plans that May Hold Company Stock. Section 423 employee *stock purchase plans*, named after the corresponding IRC section, are another way to encourage broad-based stock ownership by employees. This type of plan, also known as stock discount plan, differs from defined contribution plans. They are not subject to the coverage, vesting, nondiscrimination, distribution, and other requirements of plans covered so far and are usually not considered pension plans under ERISA.[28] Typically the plans are designed such that employees elect to make deductions from their compensation and this deferral is then credited to an individual account where it is used to purchase stock options.

What seems to be the attraction of stock purchase plans is the possibility granting cheap in-the-money options, at a price as low as at 85% of the market value of the stock at the time of the grant. This discount does not count as taxable income if employees do not sell the stock before the end of the statutory holding period of two years.

Plans not mentioned so far include money purchase pension plans and thrift plans. Both may hold employer stock, much in the way as profit sharing plans. The former are very similar to profit sharing plans, except that employer contributions

[25] The trustee is subject to the general fiduciary rules of ERISA requiring him or her to act with prudence exclusively for the purpose of providing benefits to the participants. However, ESOPs are exempt from the diversification requirements normally imposed on pension plan trustees. (See Doernberg and Macey (1986))

[26] ERISA §407(a)(2)

[27] ERISA §404(a)(1)(B) states that the fiduciary of a pension plan must act "with the care, skill, prudence, and diligence under the circumstances then prevailing that a prudent man acting in a like capacity and familiar with such matters would use in the conduct of an enterprise of a like character and with like aims".

[28] There are some restrictions to make this plan qualified under Section 423 IRC: with some exceptions, the options must be granted to all employees, all grantees have to have "equal rights and privileges".

must be based on a fixed formula specified in the plan. They are common among small employers and therefore not particularly relevant for our analysis. Thrift plans (or “savings plans”) are a more generic form of defined contribution plans that also include 401(k) plans. Almost all thrift-savings plans are of the 401(k) variety.

Appendix B. Securities Regulation and Form 11-K

Some defined contribution plans have to register with the Securities and Exchange Commission (SEC) according to the Securities Act of 1933 because they are technically a security sold by a company. Generally this applies for plans that have pooled assets and in which employee money is invested in employer stock. Employer stock as an investment choice is interpreted as an “offer to sell securities”, but only if the decision to invest lies in the discretion of the individual employee: elective contributions to a 401(k) plan count as employee contributions, as do after-tax contributions. Employer matching contributions in company stock on the other hand are *not* seen as separate “offer to sell securities”. Also, year-end profit sharing contributions are treated as employer contributions and do not trigger a need to register (See Towers Perrin (1992)).

But securities regulations do not stop at one time registration. The Securities Exchange Act of 1934 requires that plans offering employer securities as an investment choice have to file annual reports, using Form 11-K. This corresponds to the dual filing requirement that affects companies with registered securities in general. After the initial registration commanded by the Securities Act of 1933 most large companies have to file annual reports (Form 10-k), to be in compliance with the Securities Exchange Act of 1934. Companies that file Form 10-k can simultaneously file form 11-K as an attachment.

Since 1994 the SEC has required public companies to make their filings available in electronic format in the free online database “EDGAR”. [29] The information from Form 11-K has not been used previously and is not part of the Compustat database that provides data from the annual report (Form 10-k) in electronic format.

Who Files Form 11-K? Two conditions determine whether a publicly traded company has to file: (i) company stock has to be offered as an investment choice and (ii) not all of the stock bought by employees is repurchased on the market. This excludes pension plans that give employer stock as a matching contribution or via a profit sharing arrangement while at the same time not offering employees to buy stock from their own contribution. Generally the requirements of registration preclude privately held businesses from offering company stock as an investment choice, but they may still be offered as an investment for company matching or supplemental contributions.

[29] www.sec.gov

Appendix C. Incentives to Buy Company Stock

The natural reaction of a trained economist when he or she observes "irrational" behavior is to look for a rational explanation. Overinvestment in a single security implies throwing away the free benefits of diversification and taking on substantial extra and unnecessary risk. One rational justification for this might be that employees receive company stock at a discount or that the company makes its matching contribution conditional on their employees investment decision ("conditional matching").

While it is hard to completely rule out this possibility, there is strong evidence that suggests otherwise.

Some companies encourage investment in company stock, while others seem to be aware of the potential hazard. The IBM corporation may be counted to the second group of firms. Quite unlike other firms, IBM admonishes its employees that "an investment in a single stock is generally more risky than investing in a broadly diversified group of stocks". [30]

While IBM may or may not have an interest in employees owning company stock, its plan description nowhere mentions any financial incentives to buy IBM stock through the company's 401(k) plan, neither does IBM's plan description that is included in Form 11-K. Among the approximately 2000 SEC forms we examined, there was none that mentioned discounts or conditional matching, even though the plan descriptions included in Form 11-K are usually fairly detailed, including matching provisions and descriptions of investment options. What comes closest is a practice that we call "nudging" whereby the company requires part of the employees contribution to be put into company stock, but without any requirement to keep it there. "Nudging" only occurred once in our sample: Form 11-K of "Carolina Power" specifies: "Employee contributions to the Plan can be allocated to one or more of the investment options in increments of 5%; however, a minimum of 25% of the first 6% of Deferred Contributions must be invested in Company common stock. This election is made at the time the employee begins to participate in the Plan. The election may be changed upon written request and is generally effective by the following pay period. A participant may transfer current fund balances among the Plan options." Furthermore we conducted telephone interviews with representatives of a not scientifically designed subsample of firms selected for their extraordinary high level of company stock investments. Among those, none had discounts or conditional matching.

We also interviewed several defined contribution consultants at Mercer Inc., a major human resource consulting firm which helps set up and manage 401(k) plans. None of them could recall any instance of incentives.

Even though there are no legal precedences, plan sponsors which influence the investment behavior of their employees may well be at risk for breaching fiduciary principles. ERISA generally requires the fiduciary of a qualified plan to act

[30] IBM's SEC Form 11-k for the fiscal year 1997.

prudently, which includes diversification and avoiding large losses. The sponsor may become liable for the losses if he does not otherwise. To our knowledge, the exemption from liability resulting from investor discretion mentioned above (p. 35) applies to all plans in our sample. Giving financial incentives may mean that plan participants do not really direct their investments themselves and employers become responsible for imprudent exposure to one security. (See: Goodfellow and Schieber (1997), Ortelere (1998))

Finally, if an employer wants to encourage widespread stock ownership by its employees, there are plenty of proven and legal ways to do so. Stock Purchase Plans (also known as Section 423 plans) allow employees to buy stock at a discount and in a tax-advantaged way. For obvious reasons, fiduciary requirements do not include diversification for this type of plan. Stock options have also become more popular even for low rank employees, not to mention ESOPs, which are another common means of giving stocks to employees

Doubts remain, however, whether all of the observed investment in company stock is truly voluntary. Dougherty (2000) mention that Kroger, a grocery store operator, makes matching conditional on company stock investment. (Kroger is not in our sample).

Appendix D. Does Company Stock Investment Predict Returns?

Insider knowledge may be an additional source of variation in *INALLC* and *TRANS*. Employees participating in the pension plan may increase their allocation to the company stock fund if they believe that the companies stock performance will be abnormal in the following year.

Using both levels and first differences of *INALLC* and *TRANS* to predict returns one and two years into the future does not confirm the existence of insider knowledge (see Table IX). None of the two variables, individually or jointly, predict future returns. This should not come as a surprise given the fact that there is mean reversion in stock returns (we find significant negative predictive power of returns lagged by two years) and the tendency to increase investment in company stock following positive returns.

Table IX. Investment in company stock and subsequent company returns

Changes in *INALLC* and in *TRANS* and their levels are used to predict subsequent returns of company stock. The dependent variables are one- and two-year returns of company stock (RET_{it+1} and RET_{it+1+2}, respectively). The symbols **, * and + indicate statistical significance on the 1%, 5% and 10% level, respectively. Heteroscedasticity-robust standard errors are reported in parenthesis.

Dependent Var.	(1) RET_{it+1}	(2) RET_{it+1+2}	(3) RET_{it+1}	(4) RET_{it+1}
$\Delta INALLC_{it}$	0.051	−0.044		
	(0.177)	(0.272)		
$\Delta TRANS_{it}$	0.380	−0.234		
	0.346)	(0.551)		
$INALLC_{it}$			−0.001	0.036
			(0.047)	(0.046)
$TRANS_{it}$			−0.153	0.263
			(0.417)	(0.434)
$STDC_{it-1}$	−0.698	−3.208**	−0.196	−0.447
	(0.467)	(0.864)	(0.409)	(0.431)
$BETA_{it-1}$	0.050**	0.100**	0.043**	0.046**
	(0.012)	(0.023)	(0.011)	(0.012)
ROE_{it-1}	−0.052	−0.101	−0.037	−0.045
	(0.069)	(0.109)	(0.068)	(0.073)
$SALGR_{it-1}$	−0.090	−0.032	−0.035	−0.053
	(0.061)	(0.093)	(0.051)	(0.056)
RET_{it}				0.098+
				(0.050)
RET_{it-1}				−0.049
				(0.050)
RET_{it-2}				−0.140**
				(0.046)
RET_{it-3}				0.073
				(0.046)
RET_{it-4}				−0.097*
				(0.044)
RET_{it-5}				0.101*
				(0.041)
RET_{it-6}				0.009
				(0.041)
Constant	0.143**	0.369**	0.097**	0.110**
	(0.032)	(0.054)	(0.032)	(0.035)
Obs.	737	714	1006	956
R-squared	0.03	0.05	0.02	0.06

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