

Individual Account Investment Options and Portfolio Choice: Behavioral Lessons from 401(k) Plans

Jeffrey R. Brown
University of Illinois at Urbana-Champaign and NBER

Nellie Liang
Federal Reserve Board of Governors

Scott Weisbenner
University of Illinois at Urbana-Champaign and NBER

Prepared for the June 2006 Trans-Atlantic Public Economics Seminar

This Version: May 2006

Abstract: This paper examines how the menu of investment options made available to workers in defined contribution plans influences portfolio choice. Using unique panel data of 401(k) plans in the U.S., we present three principle findings. First, we show that the share of investment options in a particular asset class (i.e., company stock, equities, fixed income, and balanced funds) has a significant effect on aggregate participant portfolio allocations across these asset classes. Second, we document that the vast majority of the new funds added to 401(k) plans are high-cost actively managed equity funds, as opposed to lower-cost equity index funds. Because the average share of assets invested in low-cost equity index funds declines with an increase in the number of options, average portfolio expenses increase and average portfolio performance is thus depressed. Third, we show that investment restrictions – such as requiring a match in company stock or placing a ceiling on the fraction of assets that can be held in a particular asset – can change the overall risk/return profile of the portfolio much more than would be expected in a standard portfolio model. For example, restricting investment in company stock is associated with an overall reduction in all equities, not just company stock, perhaps suggesting that participants view such restrictions as a form of implicit investment advice.

Acknowledgements: This research was supported by the U.S. Social Security Administration through grant #10-P-98363-1 to the National Bureau of Economic Research as part of the SSA Retirement Research Consortium. The opinions and conclusions expressed are solely those of the author(s) and do not represent the opinions or policy of SSA, any agency of the Federal Government, or the NBER. We are grateful to the Social Security Administration for this financial support. We thank Julie Agnew, Clemens Sialm, and conference participants at the 2005 Retirement Research Consortium and the 2006 American Economic Association meetings. Vivek Choudhary, Soonho Lee, and Yoon Sok Lee provided excellent research assistance.

1. Introduction

Over two dozen countries around the world now include individual investment accounts as part of their public pension systems. Other countries, notably including the U.S., are also considering reforms that would allow individuals to directly invest part of their Social Security contributions in individual accounts. A key issue in designing such a program is determining what investment choices to offer individual participants. The simplest portfolio theory suggests that it is sufficient to provide a choice consisting of one portfolio of risky assets – the market portfolio – and one risk-free asset, and then to allow individuals to mix these two portfolios in accordance with their individual risk preferences. Most public and private plans in the U.S. and abroad, however, provide a large number and broad range of choices. For example, in the U.S., the vast majority of private sector defined contribution pension plans offer multiple investment options, often allowing individuals to choose from among several equity, bond, market and balanced fund options. Individuals also have thousands of mutual funds to choose from when allocating their non-pension portfolios. In Sweden, the Social Security system provides participants a menu of investment options that includes over 650 funds from which to choose.

The central question of this paper is whether the mix of investment options available to participants in an individual accounts program matters for portfolio allocation. In particular, we are interested in the “behavioral” response to the selection of fund options, over and above any “mechanical” link by which we mean changes that flow directly from adding or relaxing a binding constraint. For example, it is obviously the case that, if an individual is prohibited from owning a particular asset class, this will alter their portfolio choice if the absence of this the constraint the individual would have invested in this asset class. Instead, our focus is on the “behavioral” response, which might occur when a change in the menu of investment options leads to a large change in asset allocation, even though the investment opportunity set has not significantly changed. For example, imagine that an investor, faced with a choice between a diversified stock fund and a diversified bond

fund, chose to allocate 50 percent of her portfolio to each fund. If this individual were provided a second diversified stock fund as a third investment alternative, then the overall investment opportunity set of this individual has not substantially changed because the additional stock fund is largely redundant of the first. In this case, standard portfolio theory suggests that this individual's optimal allocation would still be close to 50 percent bonds and 50 percent stocks.

A growing body of evidence suggests, however, that many individual portfolio decisions may be influenced by plan design. For example, Bernartzi and Thaler (2001) suggest that many people follow a "naïve" diversification strategy, such as evenly dividing contributions across all available assets (e.g., a "1/n" strategy). If this is the case, then simply changing the relative number of stock and bond funds may alter the allocation of an investor's portfolio between stocks and bonds. If people behave in this way, then firm managers or policymakers who are charged with determining the set of investment options to make available to participants in a corporate or government individual accounts program should consider how the choice of fund options will influence individual portfolio allocations.

The private pension system in the U.S. – in particular, 401(k) plans, which are now the single most common private pension in the U.S. – provides a useful research laboratory with which to learn about these issues. Because plan sponsors have significant leeway in choosing which investment options to make available, there is considerable time series and cross sectional variation in the set of investment opportunities facing 401(k) participants. Using a rich panel data set on fund options and fund contributions to 401(k) plans during the 1990s, we examine several issues in this paper related to how the structure of investment options within a plan affects participant diversification.

We first focus on how the set of investment alternatives affects portfolio diversification. While some prior research has suggested that overall portfolio diversification is affected by the menu of options (Bernartzi and Thaler 2001), Huberman and Jiang (2004) highlight some of the difficulties in making inferences about individual behavior based on plan level data. For example, even if there

is evidence at the plan level that contributions are divided roughly evenly across plan options, this could be because individuals are each following a $1/n$ strategy because $1/n$ of the individuals are each concentrating their portfolio in one option, or other intermediate combinations. Nonetheless, in considering the set of investment options to make available to individuals through a large national pension system, the effect if the plan choice set on aggregate portfolio allocations is of substantial interest.

Our data allows us to do a more comprehensive examination of plan level portfolio responses both within and across multiple asset classes over many years. We find evidence that the allocation of contributions is significantly affected by the number and mix of investment options available. For example, our estimates suggest that by increasing the share of equity funds from $1/3$ to $1/2$ (such as by adding an additional equity fund option to a plan that already offers company stock, one equity fund, and one fixed income fund), overall participant allocations to equity funds increase by nearly 6 percentage points. We find similar strong effects for allocations to company stock, fixed income funds, and balanced funds.

A second issue that we address is the composition of actively vs. passively managed fund options. From 1990 to 2003, the number of mutual funds available to investors in the U.S. rose from 3,100 to 8,100, with the dramatic growth in actively managed equity funds (which quadrupled over the period) accounting for nearly 70% of the total increase. Consistent with this, we find the vast majority of the new funds added to 401(k) plans are also high-cost actively managed equity funds as opposed to lower-cost equity index funds. This result has strong implications for the relation between the investment performance of these retirement plans and the number of fund options provided. We find that the average share of assets invested in low-cost equity index funds declines and thus the average expenses paid increases with the number of equity options offered in the plan (thus depressing overall portfolio performance). For example, we estimate that a move from one equity fund in a plan to five equity funds is associated with a 22 basis point increase in the annual

plan-wide expense ratio paid by participants (as participants are investing more in higher-cost funds).¹ Given historically that actively-managed funds do not outperform index funds (even before expenses), these investment patterns (coupled with the composition of the new funds offered) could result in a nontrivial reduction in resources available for retirement.

A third issue that we address is the effect of investment restrictions. This is particularly relevant to those individual account proposals that restrict an individual to hold a minimum fraction of one's portfolio in a particular asset class, such as bonds. In our 401(k) data, we observe investment restrictions of two types. First some companies require that individuals hold employer contributions in the form of company stock. Second, some firms impose ceilings on the fraction of an individual's portfolio that can be invested in company stock. In each case, we find evidence that these restrictions influence behavior well beyond the mechanical imposition of the constraint. For example, we provide evidence that when individuals are required to invest employer contributions in company stock, they react by investing even more of their employee portfolio in company stock, and that these funds are primarily being redirected from safer asset categories, such as fixed income funds, rather than from other equity funds. We also show that when a company places a ceiling on company stock investment, it results in an overall reallocation away from all equities, not just company stock, and towards safer assets. In each case, these results are consistent with a view that participants view the employer restrictions as an implicit form of investment advice (i.e., the "endorsement" effect proposed by Benartzi (2001)).

This paper proceeds as follows. Section 2 provides background information on the range of investment options offered in selected pension systems around the world, as well as in some U.S. reform proposals. We also review the relevant literature relating to the influence of investment options on portfolio allocation. In section 3, we describe our data on 401(k) plans and provide some

¹ These results are obtained from an additional data set that we have constructed from 11-k forms that contains information on the identity of the specific fund options offered for roughly 600 firms over the period 1999-2002, enabling us to identify index versus actively-managed equity funds.

initial summary statistics about the range of investment options available. In section 4, we provide evidence on how the number and mix of investment options influences the allocation of contributions in 401(k) plans. Section 5 concentrates on investment restrictions and past returns. Section 6 concludes with a discussion of policy implications.

2. Background

2.1 Brief Overview of Range of Investment Options in Public Pension Plans Around the World

Over the past two decades, a large number of countries have incorporated individual accounts into their public pension systems. These countries span the globe, and include highly developed economies of Western Europe, transition economies from the former Soviet Union, and developing countries. A notable exception to this trend is the United States, whose public Social Security program is entirely a traditional pay-as-you-go, defined benefit system. Even in the U.S., however, proposals to introduce personal accounts as part of, or in addition to, the Social Security system have been forwarded by numerous commissions, think tanks, academics, members of Congress, and even the President.

The plans that have been implemented around the world, as well as those proposed in the U.S., vary along many dimensions, including account size, the source of funding, and the degree of access to funds before and during retirement, just to name a few. One particularly important difference is the degree of portfolio choice provided to individuals, particularly during the account accumulation phase. In general, architects of alternative plans have made different choices when faced with the trade-offs between allowing individual choice, ensuring some minimum level of portfolio diversification, and keeping administrative costs low. As a result, different plans provide very different degrees of choice.

At one end of the spectrum are plans that provide very limited choice. As discussed in a recent survey by the GAO, “initially, several countries offered individuals choice among a limited number

of investment options and often restricted the portion of assets that could be invested in certain products, such as publicly traded equities, private equities and foreign securities.” (GAO, 2005). For example, in Australia as of the late 1990s, the employer was generally given the authority to select the fund for the workers, and thus most workers had minimal choice in how to invest their retirement savings (CBO 1999). Some U.S. reform proposals, such as Rep. Shaw’s “Social Security Guarantee Plus Act of 2003,” severely restrict choice. For example, Shaw’s plan would require individuals to hold all account assets in a single fund that can be changed at most once per year.² The default option would be a portfolio allocation of 60 percent stock index funds and 40 percent high-grade corporate bond index funds. The only two alternative options simply allow slight deviations in the allocations (65 percent stock / 35 percent bonds or 70 percent stock / 30 percent bonds). Another plan that starts out with tight restrictions on choice is the Rep. DeMint’s “Social Security Savings Act of 2003,” in which account balances would initially be maintained in a default portfolio with 65 percent in a specified broad index fund of equities of U.S. corporations and 35 percent in long-term bonds issued by the Federal government.³

At the other end of the spectrum are plans that provide an extraordinarily wide range of choice. In Sweden, for example, participants are able to choose from a menu of approximately 650 mutual funds (Palme, et al, 2004). However, participants are restricted to selecting at most five funds from this extensive menu (GAO 2005). In the U.S. context, the Personal Security Account option (commonly referred to as the Schieber/Weaver plan) from the 1994-96 Social Security Advisory Council would have allowed virtually unfettered access to a broad universe of private sector investments.

² Details on Rep. Shaw’s proposal are taken from the January 7, 2003 memorandum to Rep. Shaw from the Social Security Office of the Chief Actuary “OASDI Financial Effects of the Social Security Guarantee Plus Act of 2003 (H.R. 75) – Information.”

³ Once the IA balance reaches a specified level, two additional investments are available – a broad index of small-cap equities and a broad index of mid-cap equities. Details on Rep. DeMint’s proposal are taken from the September 26, 2003 memorandum to Rep. DeMint from the Social Security Office of the Chief Actuary “Estimated Financial Effects of H.R. 3177, the Social Security Savings Act of 2003 – Information.”

In between these two extremes is a wide range of plans. For example, Mexico now has age-based investment options available. Chile requires each pension administrator to offer four types of funds with varying degrees of risk, including a higher risk fund and a fixed income fund (GAO 2005). For younger workers, a fifth option (higher risk) is also available.

How does the degree of investment choice affect portfolio behavior? In some cases, the answer is obvious. For example, in the U.S. Shaw proposal mentioned above, individuals are clear forced into one of three pre-specified combinations equities and bonds. In most other cases, however, there are enough choices available that individual decisions about general asset allocations are not restricted. Even in these cases, however, the potential exists for the menu of investment options to influence participant decisions about how to invest their individual account balances. For example, if, as the number of investment options rises, the fraction of investments that are in actively managed equity funds also rises, might this influence overall portfolio allocations? Would floors or caps on the amount that one can invest in a particular fund alter an individual's equity/bond mix, even if enough alternative equity and bond funds are available to permit any desired allocation?

The objective of this study is to provide empirical evidence on how the menu of investment options offered in an individual accounts system is likely to influence participant portfolio choices. We will do this by using data on private sector 401(k) plans, which like individual account programs around the world, are defined contribution retirement plans that provide participants with a specified set of investment options. We can use both the time-series and cross-sectional variation in the number and type of investment options available to employees to learn how portfolio allocation is influenced by plan parameters. This is an area that has been receiving increased attention in the economics literature, which we now briefly review.

2.2 Literature on Investment Options and Portfolio Choice

Within a neoclassical economics framework, the number of investment options available to an investor should matter only insofar as it alters one's ability to diversify. For example, if participants

in a defined contribution account were provided with bond investment options only, and no equity investment options, then their portfolio choices would be constrained in an obvious way. In reality, however, most 401(k) plans do not restrict investments in such an overt way. Rather, the typical 401(k) plan offers participants a range of funds that invest in equities and bonds and allow participants to cover a wide range of the risk/return spectrum. As such, in a world where all participants behave according to standard finance theory, the constraints imposed by the firm's choice of options are unlikely to have a first order effect on an individual's portfolio allocation across different asset classes.

Nonetheless, more recent "behavioral" research has shown that the menu of investment options selected by an employer can have a significant influence on participant portfolio allocation. For example, Benartzi (2001) and Brown, Liang and Weisbenner (2002) examine the effect of employer 401(k) match policy, and find that when employers restrict individuals to hold employer stock, employees tend to purchase *more* employer stock in their own accounts, rather than less, as would be predicted by standard portfolio models. Also in the context of employer stock, Bernartzi and Thaler (2001) find evidence consistent with employees following "naïve diversification strategies," i.e., allocating $1/n$ of their contributions to employer stock when there are n investment choices available.

Plan design can influence numerous other behaviors as well. Juberman, Sethi-Iyengar and Jiang (2003) show that the availability of an employer match increases participation and contributions, especially among low-income employees. Samuelson and Zeckhauser (1988) and Ameriks and Zeldes (2001) show that investors are slow to rebalance portfolios, which can lead to allocations of total holdings that look very different than allocations of contributions. Madrian and Shea (2001), Choi, Laibson, Madrian, and Metrick (2001), and Agnew, Balduzzi, and Sunden (2003) document the importance of plan design and employee inertia as they show that many new plan participants invest in the plan's default investment option and are slow to move out of that option for potentially higher-return assets. Agnew and Szykman (2004) also provide evidence that individuals with below

average financial knowledge become “overwhelmed” by making investment decisions.

3. Data

3.1 Data Source

The primary source of data for this project is 401(k) plan level financial data from the 1990s. This rich source of data is compiled by hand from 11-k filings with the SEC, which a company files when it provides an option to invest in company stock that is deemed an offering of securities. From these filings, we collect information about the number and type of investment options offered. We categorize each investment option into one of four categories – company stock, other equity funds, fixed income funds (which includes money market, guaranteed investment contracts, government bonds, and corporate bond funds), and balanced funds. For each investment option, we collect total participant contributions, total employer contributions, and total assets. For the few firms with multiple plans, we collect data for the largest plan.

Starting with all U.S. firms listed in Compustat any year from 1993 to 1999, we identify firms that filed an 11-k at least once during this period.⁴ We were able to hand-collect data for 770 companies for which we could accurately classify their investment option, yielding 2,362 firm-year observations. As reported in table 1, most of the data are in the period 1993 to 1998, with the largest number of firms, 444, in 1998. On average, there are approximately three observations per firm, with 48 percent of the firms with two observations or less and 52 percent of the firms with three or more observations. In 1999, there was a change in ERISA reporting requirements that led to fewer companies reporting contributions by asset category, leaving us with contribution data for far fewer plans in 1999 and 2000 than in 1998. The 1999 and later filings, while lacking good contribution data, still provide asset balances and also provide more detailed information on the fund type. We

⁴ 11-k filings are available on the SEC’s Edgar website starting in 1994. The 1994 filing reports plan activity during 1993. Some firms will report not only plan activity during the past year, but also plan activity over the past three years. Thus, we have 138 observations in 1992 and 38 observations in 1991.

will make use of this data (and describe it more fully) when we examine the active vs. passive mutual fund choice below.

To characterize our initial sample, we focus on firms in the sample in 1998, one of the more recent years with the largest number of firms. As shown in table 2a, about one-half of the sample was a member of the S&P 1500 during 1998.⁵ Thus, the typical firm in our sample is smaller, measured by both market value and employees, than the typical S&P 1500 firm, but is larger than the average of all public companies as available from Compustat. The sample represents a broad cross-section of industries. As noted in the table, 17 percent of the sample is in the technology sector, somewhat less than the overall market.

Companies that issue shares for their retirement plan, rather than purchase shares on the open market, are required to file an 11-k. While this raises the possibility that the sample could be biased toward firms that do not repurchase stock, in separate work (Brown, Liang & Weisbenner 2004) we document that repurchase activity by firms in our sample does not differ from that at other publicly-traded firms.⁶

We also compare our sample of plans to those at publicly-traded firms as reported on Form 5500 filed with the DOL.⁷ In the aggregate, for our sample of the largest plans at 444 companies in 1998, total plan assets were \$150 billion, representing 21 percent of the \$698 billion in plan assets at all publicly-traded companies (table 2b). Total contributions by participant and company for our sample totaled \$9.2 billion, just under 19 percent of the \$49.2 billion for publicly traded firms. Estimates from the DOL for 1998 for all US companies, public and private, are \$1.54 trillion in assets and \$135 billion in contributions.

⁵ The S&P 1500 consists of the 1500 stocks that comprise the S&P 500 index, the S&P 400 MidCap index, and the S&P 600 SmallCap index.

⁶ In the uncommon event that the plan does not allow employees to purchase company stock but does provide the employer match in company stock, it would generally not be deemed an offer of securities, and the plan would not be required to file an 11-k. In our discussion with SEC staff, the onus is on the company to determine whether it needs to file an 11-k.

⁷ Publicly-traded companies in the DOL Form 5500 data set were identified by whether they had a CUSIP and matching EINs with those in Compustat.

A key advantage to this data over data used in prior studies on portfolio options and investment allocations is that we have a panel comprised of companies with multiple years of plan information. As such, we are able to trace how changes in investment structure influence portfolio behavior over time, while controlling for cross-sectional differences in firms.

3.2 Summary Statistics on Fund Options

In table 3, we report the number of distribution of the number of investment options available to 401(k) plan participants in our sample. The median firm (across plans and years) provides 6 investment options, and the modal offerings are to have 5 or 6 fund available. Over 70 percent of the firm-year observations offer between 4 and 8 options, inclusive. Only 10 percent of the sample offers 11 or more funds, with the highest single number in our sample reaching 31 funds.

Table 3 also shows how, for the average firm in our sample, the total fund options offered at the end of the year are divided between four investment classes: employer stock, other equity funds, fixed income funds, and balanced funds. Because the 11-k filing is triggered for firms when they offer company stock, and because firms typically only have one company stock fund available to employees, it is nearly always one of the investment options.⁸ More interesting is the relative numbers of equity, fixed income and balanced funds. If a firm provides only two investment options in our sample, it is always a company stock fund plus a fixed income (usually money market) fund. If the firm offers a third fund, 81 percent of the time it is an equity fund, 14 percent of the time it is a balanced fund, and 6 percent of the time it is a second fixed income fund.

As the number of options rises from three to four, about 40 percent of firms add an equity fund, 40 percent add a fixed income fund, and 20 percent add a balanced fund. Beyond this point, as the number of options rises to five, then six, and on up to 11+, equity funds account for the vast majority of the increase. For example, moving from four fund options to ten fund options, the average

⁸ A handful of firms that started the year with a company stock option in the plan may have dropped it by year-end. These firms would be reported as having no company stock option.

number of equity funds increases by 4.5, while the number of fixed income options rises by less than one, with balanced funds comprising the small remainder.

In short, table 3 illustrates the interesting fact that as firms increase the number of options available to employees, it is predominantly concentrated in an increase in the number of equity funds. If employees are not unduly influenced by the mix of options, for example by following an optimal portfolio strategy or by allocating according to a fixed allocation rule (e.g., a 60/40 equity/bond mix), then increasing the proportion of equity fund options should not have a large effect on the individual's overall equity exposure. In contrast, if the mix of options does influence behavior, as would be the case if participants follow a naïve $1/n$ diversification heuristic, then we would expect to see higher equity allocations when there are more equity funds available.

4. How the Number and Mix of Investment Options Influence Portfolio Decisions

4.1 Composition of Investment Options and Investment Choices by Number of Funds

The results of the previous section indicate that as firms increase the number of options available, an ever-increasing proportion of these options are in equity funds, with a declining proportion in fixed income funds. Here, we begin by investigating whether the share of contributions follows a similar pattern.

Table 4 reports how the share of funds matches up with the share of contributions to those funds (numbers are reported in percentage points). Across all asset types, there is a striking relation between the share of fund options available in each asset class and the share of contributions made to funds in that asset class. The share of contributions made to company stock falls nearly proportionally with the number of total funds.

As we move from a total of three fund options to a total of ten, the fraction of equity funds rises from 27 percent to 57 percent, while the fraction of contributions made to equity funds rises from just under 20 percent to just over 60 percent. Similarly, the decline in the fraction of

contributions directed toward fixed income funds closely follows the decline in the fraction of fund options in this category. To a lesser extent, the relationship holds with balanced funds as well.

Thus, table 4 provides strong suggestive evidence that the mix of investment options made available to employees influences their portfolio allocations. Specifically, as employers provide more options, they appear to be doing so primarily by adding additional equity funds, and to a lesser extent, balanced funds. Correspondingly, participants appear to be placing a higher fraction of their portfolio in equities as the fraction of equity options rises. Similarly, participant allocations to balanced funds rise, and allocations to bond funds fall, as the share of those funds changes.

4.2 Regression Analysis

The prior table provides initial evidence that employees may be influenced in their overall portfolio allocation behavior by the mix of investment choices provided to them. To investigate this idea more completely, we turn to a regression framework.

We begin by estimating simple regressions in which the dependent variable is the share of contributions allocated to each of our four investment categories. On the right hand side, we include the fraction of investment options that are in this category. Thus, when testing for employer stock, we regress the share of contributions to company stock against $1/n$, which represents the share of total investment options that are comprised by the employer stock fund. For equity funds, we regress the share of contributions against e/n , where e is the number of equity funds and n is the total number of investment options. We follow a similar approach for bonds and balanced funds.

If the coefficient on the share of fund options is zero, it indicates that individual portfolio allocations are not influenced by the mix of investment choices available. At the other extreme, a coefficient of one suggests that individuals, on average, follow a “ $1/n$ ” strategy, implying that the mix of investment options translates nearly one-for-one into changes in portfolio allocations. Significant intermediate results would indicate that the mix of investment choice clearly matters, though not to the full extent predicted by a strict $1/n$ hypothesis.

In the first row of table 5, we report the results of univariate regressions with no other controls. Each coefficient in this row is from a separate regression of the share of contributions for the particular asset class against the share of funds in this same asset class. For all four asset classes, we find coefficients that are highly significantly different from zero. For company stock and equity funds, the coefficients are approximately 0.83. To assist in the literal interpretation of this coefficient, imagine a firm has five investment options available, three of which are equity funds and two of which are fixed income funds. If the firm added another equity option, the share of equity choices changes from 3/5 to 4/6, or an increase of 6.7 percentage points. Multiplying by the 0.83 coefficient means that participants would be expected, on average, to increase their allocation to equities by 5.5 percentage points. The coefficient is a smaller, but still highly significant, 0.5 for fixed income funds, and 0.74 for balanced funds. The smaller sensitivity for fixed income funds is not surprising given that fixed income funds are often chosen as the “default” investment for participants who do not make an active alternative selection.

It is worth noting that there are at least two possible explanations that are consistent with there being a positive relation between contribution shares and the share of options. The first possibility is that all workers naively diversify across multiple options and thus an increase in the number of options would reduce all workers’ allocations to company stock. A second possibility is that workers randomly put all of their 401(k) portfolio in one option, with different workers concentrating their purchases in different options, in which case an increase in the number of options would reduce the fraction of workers that concentrate all of their holdings in company stock. Benartzi and Thaler (2001) provide evidence of the former and Huberman and Jiang, 2004, Agnew, 2002, and Holden and VanDerhei, 2001 provide evidence for the latter, suggesting that both types of investors may exist. With plan-level rather than worker-level data, it is not possible for us to distinguish which of these two stories is driving the result.

A more important caveat to the literal interpretation of the coefficient estimates just provided

is that there is an implicit assumption that differences in portfolio allocations across firms are not driven by other factors that could be spuriously correlated with a firm's choice of investment options. Yet there are reasons to be concerned about alternative explanations. One concern is that the results might be spuriously driven by year effects, for two reasons. First, given the unbalanced nature of our panel, as discussed in table 1, it is important to ensure that the "naïve diversification" results are not being driven by differences in market returns. For example, if firms increase the number of options over time, in our sample this corresponds with a period of rising equity markets. Thus it is important to ensure that the results are not being driven by individuals placing more money into equity funds in response to rising equity markets. Second, it is likely that the increase in the number of investment alternatives over time was due in large part to the proliferation of different types of mutual funds offered over the past decade. For example, the ICI reports that the total number of mutual funds rose from 3,405 in 1991 to 8,171 in 2000 (Investment Company Institute, 2001).

We address both of these concerns in the second row of table 5 by including year fixed effects. Consistent with the concern that our original coefficient estimate was picking up a gradual increase in the number of options, especially during a bull market, inclusion of year effects does reduce the magnitude of the coefficient on both equity funds and fixed income funds. Importantly, however, the coefficients remain strongly positive and significantly different from zero.

Another potential concern is that there is tremendous heterogeneity across firms, and thus one might be concerned about other forms of spurious correlation, such as differences in risk tolerance that are correlated among workers within a firm. To address this, we add firm fixed effects, both alone (row 3) and in addition to year effects (row 4). The inclusion of these 770 firm specific fixed effects soak up all variation in the allocation of contributions that can be attributed to time-invariant differences in the characteristics of firms and their employees. In other words, with firm fixed effects in place, these coefficients are identifying the relationship of interest from *within-firm changes over time* in the number of investment options offered. In addition, the row 4 results control

for year effects, to counteract previously discussed concerns about market returns.

Not surprisingly, controlling for firm heterogeneity has an important effect on the magnitude of the company stock effect, with the coefficient falling to 0.27 with no year effects, and 0.26 with year effects, although still highly significant. Importantly, the influence of the number and mix of investment options on portfolio choice is still quite strong for other equity funds. Even in a regression that controls for both year and firm fixed effects, the coefficient of 0.368 is highly significant (with a t-statistic of nearly 12). To put this into perspective, imagine a firm that began with one company stock fund, one equity fund, and one bond fund added a fourth investment option. If this fourth option were a second equity fund, then the fraction of fund options in equity would rise from 1/3 to 1/2. Applying the 0.368 coefficient indicates that this change would be expected to increase the allocation of contributions to equity by 6.1 percentage points, which represents a significant change in the risk/return profile of participant portfolios. In the year and firm fixed effects specification (row 4), the coefficient on fixed income funds is a nearly identical 0.36. The coefficient on balanced funds is even stronger, at 0.50.

These results provide clear evidence that the number and mix of investment options matter. An important policy implication of this finding is that the choice of investment options to make available in an individual accounts program is likely to have a first-order effect on the portfolio allocations that individuals make. In short, plan design appears to matter for portfolio allocations.

4.3 Index versus Actively Managed Funds

The number of mutual funds available to investors in the U.S. has grown dramatically, driven by the surge in actively managed equity funds over the past decade. The mutual fund literature finds that actively managed funds charge substantially higher annual fees than do index funds (such as S&P 500 funds), without earning higher before-expense returns on average (at least historically). Do trends in 401(k) plan fund offerings mirror the aggregate trends in the mutual fund industry? If so, this raises the concern that change in the composition of investment options offered

in 401(k) plans could result in more money being allocated to high-cost funds that will on average result in lower net returns.

Using an additional data set, we are able to shed some light on these questions. In particular, we have augmented the initial sample used in this paper with data for roughly 600 firms over the period 1999-2002 (we followed the firms that had 11-k data during 1998 in the original sample over the next four years to obtain our second sample). Unlike the earlier sample, this later sample contains sufficiently detailed information on the identity of the specific fund options offered to allow us to distinguish index equity funds from actively-managed equity funds. One disadvantage of the later data is that we are restricted to looking at the allocation of asset balances rather than the flow of contributions.⁹

In our 1999-2002 sample, the average plan has 12 investment options. Figure 1 demonstrates that almost half of these options are actively-managed funds (just over 5 of 12), while plans typically offer only one equity index fund (typically an S&P 500 fund). Of course, investors interested in low cost index funds really only need one broad market index, and thus it is possible that the majority of allocations flow to this low-cost option (as opposed to the higher-cost actively managed alternatives). Figure 2 demonstrates that this is not the case. Across all of the plans during the period 1998-2002, index funds represent only 8% of the options in the plan (i.e., 1 out of 12 options) and only 9.5% of total fund assets. Regression analysis confirms that the share of assets in index funds declines substantially with the share of index funds in the plan (we cannot reject a one-for-one relation). This result is consistent with the notion that the burgeoning number of actively-managed funds makes it harder for investors to find the lower-cost index fund in the plan (with less money flowing to this option as a result).

⁹ The reason for the differences between the 1993 – 1998 and the 1999 – 2002 data is that the SEC changes the reporting requirements on the 11-k.

Figure 3 confirms that the vast majority of new funds (over three-fifths) added to 401(k) plans over 1999-2002 are actively-managed equity funds (mirroring the broader trends in the mutual fund industry), while a mere 5% of the new options represent an index fund (typically adding a small-cap index fund to a S&P 500 fund already in place). Coupled with our earlier findings, this trend in new fund offerings has strong implications for the relation between the investment performance of these retirement plans and the number of fund options provided.

Figure 4 demonstrates that while the actively managed and index equity funds offered in our sample of 401(k) plans have similar performance *before* accounting for expenses (index funds actually slightly outperformed), the difference in performance widens considerably once we account for expenses, to over one percent per year. We find that the average expenses paid increases with the number of equity options offered in the plan (thus depressing overall portfolio performance). For example, we estimate that a move from one equity fund in a plan to five equity funds is associated with a 22 basis point increase in the annual plan-wide expense ratio paid by participants (as participants are investing more in higher-cost funds). Given historically that actively-managed funds do not outperform index funds (even before expenses), these investment patterns (coupled with the composition of the new funds offered) could result in a nontrivial reduction in resources available for retirement. The fact that individual investors may not be fully considering the important role that expenses play in reducing their retirement wealth is consistent with the compelling findings of Choi, Laibson and Madrian (2006) who show that highly educated subjects (Harvard undergrads and Wharton MBAs) are surprisingly unresponsive to differences in expense ratios, even when the underlying investment is otherwise nearly identical.

5. Effect of Other Attributes: Investment Restrictions

5.1 Investment Restrictions

The previous section has established that the number and mix of investment options matters for the portfolio choices of account participants. Policymakers interested in understanding or influencing portfolio decisions in an individual accounts system may also wish to understand the role of explicit investment restrictions. Specifically, how would individuals respond to a requirement that they invest a minimum proportion in a particular asset (such as government bonds) or a requirement that limits the maximum exposure to particular asset class (such as international equities). Beyond the obvious mechanical effect for those individuals who find these constraints binding, what is the impact of such restrictions on overall portfolio allocations? For example, would a ceiling on international equity holdings result in reallocations toward the next riskiest asset class, or would it result in reallocations across all available funds?

There are two types of investment restrictions that occur within private 401(k) plans that allow us to provide some indirect evidence on these questions. First, some companies require that individuals invest the company contributions to their 401(k) plan in company stock. The effect of this restriction has been carefully studied in work by Benartzi (2001) and Brown, Liang, & Weisbenner (2004). A second type of investment restriction is that, for just over three percent of the firm-year observations, there is a ceiling on company stock holdings.

To explore the effect of these investment restrictions, we merge our sample of 11-k filings with Center of Research in Security Prices (CRSP) and Compustat data and regress the share of contributions in each investment category against a number of controls. These include binary variables for whether the firm restricts its employer match to company stock, and whether the firm places limits on a participant's allocation to company stock.

We also control for past 5 year returns on each employer's stock, overall equity markets (i.e., large-cap equity returns), long-term government bonds, and money market funds. The company stock returns are taken from CRSP and the latter three returns are reported in Ibbotson Associates (2002). We also control for each individual company's stock price volatility (measured as the

standard deviation of total returns over the past 24 months), market-to-book ratio, log of plan assets, whether the firm has a defined benefit plan, and the whether the firm's bonds are investment grade as a proxy for bankruptcy risk.

Table 6a reports the results of a cross sectional analysis, while table 6b includes firm fixed effects and thus identifies relationships solely off of within-firm variation. We report both because we do not have any time variation within firms with regard to investment ceilings, and the inclusion of firm fixed effects in table 6b renders it impossible to econometrically identify the effect of an investment limit. Tables 6a and 6b report past returns by asset class instead of year dummies. If we instead run the results from these tables using year dummies, the coefficients on the three main variables of interest (share of fund options, whether company stock is the required match, and whether there is a limit on company stock) are virtually identical. In other words, the use of past 5 year asset returns and the use of time dummies are virtually identical in terms of their effect on the other coefficients. The results in tables 6a and 6b are consistent with our previous results regarding the importance of the mix of plan options.

In table 6a, we are able to identify the effect of the company stock match as well as the effect of investment restrictions in the form of ceilings on company stock. Our results are consistent with previous findings (Benartzi 2001; Brown, Liang, & Weisbenner 2004) that employees at firms where the employer match is restricted to company stock direct, on average, 8 percentage points more of their own contributions to company stock. Interestingly, only about one-third of this 8 percentage point increase comes out of allocations to other equity funds, while nearly 46% comes out of fixed income investments. One interpretation of this finding is that participants view the employer's match policy as an endorsement on the part of the firm that company stock is a good investment.

In table 6b, the inclusion of firm fixed effects reduces the magnitude of the match policy variable, although it is still significant. Specifically, even with firm fixed effects, so that we are identifying off of changes in match policy within a firm, a switch to requiring the match to be in

company stock increases the employee's own discretionary contributions to employer stock by 3.2 percentage points. The reallocation appears to be coming not from other equity funds, but from fixed income funds.

Table 6a also allows us to examine the impact of investment ceilings on company stock. For just over three percent of the firm-year observations, there is a ceiling on how much of the employee contribution can be made in company stock, ranging from 10 to 50 percent of total contributions. Among plans with a ceiling, just over one-third have an upper limit of 50 percent and an additional third have a limit of 25 percent. An even smaller fraction, less than one percent, put a floor on purchases of company stock.

Results suggest that employees at firms that place a cap on allocations to company stock allocate, on average, 11 fewer percentage points of their contributions to company stock. A striking finding is that employees do not respond simply by shifting this 11 percentage points into other equity funds. Rather, they respond by substantially increasing allocations to fixed income funds, and, slightly *reducing* other equity allocations. These results suggest that placing portfolio limitations on individual accounts, such as a cap on international equities, may be interpreted by participants as a form of implicit investment advice, and could cause a change in the overall risk and return profile that differs substantially from what standard portfolio theory would predict. Further, a limitation placed on one asset class (in this case company stock) may have spillover effects reducing allocations to similar asset classes (in this case general equity funds).

One alternative explanation for these investment limit results from table 6a is that the firms which impose a ceiling on employer stock also provide a more conservative mix of investment options, and thus the apparent "reallocation" is really being driven by cross sectional differences in the mix of fund options available. To address this, we regressed the share of options that are in equities against firm controls, including the limit variable. If anything, the results suggest that firms which impose a limit on employer stock holdings provide more equity options and fewer balanced or

bond options, rather than the other way around. Thus, the correlation observed in table 6a does not appear to be spuriously driven by a fund composition effect.

Taken together, these results are consistent with the presence of an endorsement effect. In other words, when an employer forces a match in employer stock, employees may view that as a positive signal that employer stock is an especially good investment, and respond by allocating a higher fraction of their own contributions to employer stock. Similarly, when employers place overt limits on the amount of employer stock that an individual can hold, employees respond not just by holding less employer stock (the mechanical effect), but by holding less of all equities and more fixed income.

5.2 Other controls

Prior research (e.g., Bernartzi 2001, Agnew 2002, Huberman & Sengmueller 2004, and Choi, Laibson, Madrian, & Metrick 2004) suggests that individuals are more likely to invest in their employer's stock if it has performed well in recent years. Our results are consistent with these findings. For example, holdings of own employer stock are positively related to past 5 year returns on that stock (and negatively related to the stock's price volatility), but negatively correlated with the overall market portfolio. In contrast, the share of contributions directed toward other equity investments is significantly positively related to past 5 year market performance, and negatively related to own company stock performance. These results suggest that, on the margin, the relative performance of company stock and broader equity markets influences an individual's equity allocation between company stock and more diversified equity funds. Given an "adding up constraint," it is not surprising that we also find that higher equity market returns also predict lower allocations to bond funds.

Past returns on money market and bond instruments are negatively correlated with allocations to equity funds, and positively correlated with allocations to bonds. Because blended funds are, by definition, a mix of equities and bonds, it is not surprising that most of the return coefficients are not

significantly different from zero.

The coefficients on the firm-characteristics variables are in general similar to those found in other studies. The company stock purchase rate is higher at less volatile firms, larger firms, and firms with higher market-to-book ratios (a proxy for growth opportunities). The presence of a defined benefit plan or an investment grade bond rating has little effect on participant investment decisions.

7. Conclusions

A key policy issue in the design and implementation of any defined contribution pension system, whether publicly or privately provided, is how to structure the investment options that will be made available to participants. While it is well understood that the structure of investment options can have an important effect on the level of administrative expenses of an individual accounts program, we show that the number and mix of investment options can also have a first order effect on the risk and return profile of average portfolios. Even after controlling for individual firm and year fixed effects, we find a strong positive relationship between the share of investment options provided to employees that are in each asset class and the share of their portfolios invested in each asset class. This strongly suggests that average participants are not optimally allocating their portfolios according to standard finance theory predictions, but instead are following naïve strategies that subjects them to “manipulation” by non-binding changes in the number and mix of investment options. A key policy implication is that the number and mix of investment options will have an important effect on overall asset allocation in the individual accounts. In short, it appears to be possible to influence the portfolio allocation of individual participants by altering the mix of equity and bond funds, even if the overall investment opportunity set remains unchanged.

A second finding is that the proliferation of actively-managed equity funds in general (which has trickled down to offerings in 401(k) plans as well), has resulted in the vast majority of money in

retirement plans flowing into higher-cost actively managed equity funds as opposed to lower-cost equity index funds (such as S&P 500 funds). This results in plan participants paying higher fees, which will depress overall portfolio performance, and thus, in the long-term, retirement wealth.

A third finding is that investment restrictions can alter the risk and return profile of a portfolio beyond what the restriction itself imposes. We find that when individuals are required to hold their company contributions in company stock, for example, that these employees also increase their own allocations to company stock. This finding is consistent with a view that individuals view such investment restrictions as an endorsement of company stock, or implicit investment advice from the company. Similarly, we find that placing a maximum limit on the amount of company stock in one's 401(k) plan does not simply result in a shift from company stock into other equity funds. Rather, it results in a reduction in overall equity allocations, and an increase in bond allocations. This suggests that minimum or maximum portfolio allocations to specific asset classes might have stronger effects than would be predicted in a standard portfolio model.

References

- Agnew, Julie, 2002, Inefficient choices in 401(k) plans: Evidence from individual level data, Working paper, The College of William and Mary.
- Agnew, Julie, Pierluigi Balduzzi, and Annika Sunden, 2003, Portfolio choice and trading in a large 401(k) plan, *American Economic Review* 93-1, 193-215.
- Agnew, Julie and Lisa R. Szykman, 2004, Asset allocation and information overload: The influence of information display, asset choice, and investor experience. Boston College Center for Retirement Research Working Paper 2004-15.
- Ameriks, John and Stephen Zeldes, 2001, How do household portfolio shares vary with age? Working paper, Columbia University, December.
- Benartzi, Shlomo, 2001, Excessive extrapolation and the allocation of 401(k) accounts to company stock, *Journal of Finance* 56, 1747-64.
- Benartzi, Shlomo and Richard H. Thaler, 2001, Naïve diversification strategies in retirement savings plans, *American Economic Review* 91-1, 79-98.
- Brown, Jeffrey, Nellie Liang and Scott Weisbenner, 2004. 401(k) Matching Contributions in company stock: costs and benefits for firms and workers. NBER Working Paper 10419.
- Choi, James, David Laibson and Brigitte Madrian, Why does the law of one price fail? An experiment on index mutual funds, working paper, March 30, 2006.
- Choi, James, David Laibson, Brigitte Madrian, and Andrew Metrick, 2004, Employee's investment decisions about company stock, NBER Working paper 10228.
- Choi, James, David Laibson, Brigitte Madrian, and Andrew Metrick, 2001, For better or for worse: Default effects and 401(K) savings behavior, NBER Working paper 8651, December.
- Congressional Budget Office, "Social Security Privatization: Experiences Abroad." January 1999.
- Government Accountability Office, "Social Security Reform: Other Countries' Experiences Provide Lessons for the United States." GAO-06-126, October 2005.
- Holden, Sarah and VanDerhei, Jack, 2001, The impact of employer-selected investment options on 401(k) plan participants' asset allocations: Preliminary findings, Working Paper, Investment Company Institute and Temple University.
- Huberman, Gur and Paul Sengmueller, 2004, Performance predicts asset allocation: Company stock in 401(k) plans, *Review of Finance*, September.
- Huberman, Gur, Sheena Sethi-Iyengar and Wei Jiang, 2003, Defined contribution pension plans: determinants of participation and contribution rates.
- Huberman, Gur and Wei Jiang, 2004, The 1/N heuristic in 401(k) plans, working paper, Columbia Business School, April.

Ibbotson Associates, 2002, SBBI (Stocks, bonds, bills, and inflation) 2002 yearbook: Market results for 1926-2001, Chicago, IL: Ibbotson Associates.

Investment Company Institute, 2001, Mutual Fund Handbook, 41st edition, Washington, DC.

Madrian, Brigitte, and Dennis Shea, 2001, The power of suggestion: Inertia in 401(k) participation and savings behavior, *The Quarterly Journal of Economics* 116, 1149-1525.

Palme, Marten, Annika Sunden and Paul Soderlind, "Investment Choice in the Swedish Premium Pension Plan," Working Paper, December 21, 2004.

Ryst, Sonia, 2003, Guide to fixing your 401(k), *Wall Street Journal*, August.

Samuelson, William and Richard Zeckhauser, 1988, Status quo bias in decision making, *Journal of Risk and Uncertainty* 1 (March), 7-59.

Table 1: Sample Composition

Data collected for all U.S. companies listed in Compustat any year from 1993 to 1999 that filed an 11-k at least once during 1994-2001, and for which complete fund classification was possible. See text for further details.

| Year | Number of observations | Number of years in sample | Number of firms | Number of observations |
|--------------|------------------------|---------------------------|-----------------|------------------------|
| 1991 | 38 | 1 | 198 | 198 |
| 1992 | 138 | 2 | 170 | 340 |
| 1993 | 246 | 3 | 139 | 417 |
| 1994 | 263 | 4 | 87 | 348 |
| 1995 | 336 | 5 | 63 | 315 |
| 1996 | 401 | 6 | 62 | 372 |
| 1997 | 428 | 7 | 38 | 266 |
| 1998 | 444 | 8 | 11 | 88 |
| 1999 | 51 | 9 | 2 | 18 |
| 2000 | 17 | | | |
| TOTAL | 2362 | TOTAL | 770 | 2362 |

Table 2a: Characteristics of 1998 Sample, S&P 1500, and Public Firms

| | 1998 Sample | S&P 1500 | Public Firms |
|---|----------------|------------------|-----------------|
| Market Value (\$ millions) | | | |
| Mean | 4,695 | 7,283 | 2,438 |
| Median | 716 | 1,329 | 192 |
| [10 th % – 90 th %] | [70 – 9,010] | [238 – 14,211] | [26 – 3,260] |
| Employees (000s) | | | |
| Mean | 11.7 | 19.9 | 5.4 |
| Median | 4.0 | 6.6 | 0.5 |
| [10 th % – 90 th %] | [0.5 – 27.5] | [0.9 – 45] | [0.02 – 10.2] |
| Member of S&P 1500 (%) | 51 | 100 | 20 |
| Technology Sector (%) | 17 | 19 | 24 |

Data are from Compustat. Public firms include 7,501 U.S. firms.

Table 2b: Aggregate 401-k Plan Assets and Contributions for 1998 Sample, Public Firms, and All Firms

| | 1998 Sample | Public Firms | All Firms |
|---|-------------|--------------|-----------|
| Total 401-k Assets (\$ billions) | 150 | 698 | 1,541 |
| Employee and Employer Contributions (\$ billions) | 9.2 | 49.2 | 134.7 |

Data on 401-k assets for public firms are from 1998 5500 filings with the Department of Labor. Data for all firms (public and private) are estimated by the Department of Labor. Company stock for public firms and all firms excludes stock indirectly held in trusts and pooled accounts. Employer contributions constitute 29 percent of total contributions for the 1998 sample and 31 percent for all public firms.

Table 3. Mix of Fund Type by Number of Fund Options in Plan

Data from 11-k forms. "Number of Funds" is the mean number of funds of each asset class offered within 401(k) plans. See text for further information.

| Total # of Fund Options Offered by Plan | Number of Observations | Number of Company Stock Funds | Number of Equity Funds | Number of Fixed Income Funds | Number of Balanced Funds |
|---|------------------------|-------------------------------|------------------------|------------------------------|--------------------------|
| 2 | 11 | 1.0 | 0.0 | 1.0 | 0.0 |
| 3 | 109 | 1.0 | 0.8 | 1.1 | 0.1 |
| 4 | 312 | 1.0 | 1.2 | 1.5 | 0.3 |
| 5 | 382 | 1.0 | 1.8 | 1.7 | 0.5 |
| 6 | 379 | 1.0 | 2.7 | 1.8 | 0.6 |
| 7 | 319 | 1.0 | 3.4 | 2.0 | 0.6 |
| 8 | 292 | 1.0 | 4.2 | 2.3 | 0.5 |
| 9 | 181 | 1.0 | 4.9 | 2.4 | 0.8 |
| 10 | 131 | 1.0 | 5.7 | 2.4 | 0.9 |
| 11+ | 246 | 1.0 | 7.8 | 3.0 | 1.4 |

Table 4. Comparison of Percent of Funds Offered to Percent of Contributions

| Total # of Funds Offered by Plan | Company Stock* | | Equity Funds | | Fixed Income Funds | | Balanced Funds | |
|----------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|
| | Percent of Fund Options | Percent of Contributions | Percent of Fund Options | Percent of Contributions | Percent of Fund Options | Percent of Contributions | Percent of Fund Options | Percent of Contributions |
| 2 | 50.0 | 38.9 | 0 | 7.1** | 50.0 | 51.8 | 0 | 2.2** |
| 3 | 33.0 | 36.0 | 26.9 | 19.4 | 35.5 | 40.6 | 4.6 | 4.1 |
| 4 | 24.8 | 24.6 | 30.4 | 31.3 | 36.6 | 38.2 | 8.2 | 5.9 |
| 5 | 19.8 | 23.1 | 36.3 | 39.2 | 34.1 | 29.3 | 9.7 | 8.5 |
| 6 | 16.2 | 16.6 | 44.8 | 50.0 | 29.6 | 25.7 | 9.4 | 7.7 |
| 7 | 14.1 | 18.0 | 48.9 | 52.4 | 28.6 | 22.5 | 8.4 | 7.0 |
| 8 | 12.4 | 16.8 | 52.5 | 53.5 | 28.2 | 23.4 | 6.8 | 6.3 |
| 9 | 10.9 | 14.4 | 54.0 | 57.4 | 26.6 | 20.0 | 8.5 | 8.2 |
| 10 | 9.8 | 12.0 | 56.9 | 60.5 | 23.9 | 20.1 | 9.3 | 7.4 |
| 11+ | 7.6 | 13.0 | 59.2 | 59.8 | 22.7 | 20.3 | 10.5 | 7.0 |

* A handful of firms that started the year with a company stock option in the plan may have dropped it by year-end (when we measure the composition of fund offerings), and thus the share of funds that are company stock may very slightly diverge from 1/(total number of options).

** It is possible for the percent of contributions to be positive even though the percent of options at year-end is zero when, during the course of the year, the fund options may have changed. Thus, a firm may have started the year with an equity fund, but ended the year with no equity funds available.

Table 5. Regression of Share of Contributions Against Share of Fund Options

Each cell of this table represents a separate regression. The dependent variable is the share of contributions in each asset class, and the independent variable is the share of funds in the same asset class. The robust standard errors, which are reported in parentheses, are clustered on each firm in order to account for correlation across time for a given firm.

| | Fixed Effects? | Share of Contributions in: | | | |
|-----------------------|-----------------------|----------------------------|---------------------|---------------------|---------------------|
| | | Company Stock Funds | Equity Funds | Fixed Income Funds | Balanced Funds |
| Share of Fund Options | None | 0.836*** (0.101) | 0.833*** (0.031) | 0.497*** (0.049) | 0.743*** (0.034) |
| Share of Fund Options | Year Effects | 0.876*** (0.139) | 0.656*** (0.039) | 0.258*** (0.055) | 0.739*** (0.035) |
| Share of Fund Options | Firm Effects | 0.273*** (0.049) | 0.708*** (0.027) | 0.784*** (.0048) | 0.511*** (0.032) |
| Share of Fund Options | Firm and Year Effects | 0.258*** (0.063) | 0.368*** (0.032) | 0.363*** (0.051) | 0.503*** (0.034) |

*, **, and *** denote significance at the .10, .05, and .01 level respectively.

Table 6a. Regression of Share of Contributions Against Share of Fund Options, Controlling for Returns and Firm Characteristics

Each column of this table represents a separate regression. The dependent variable is the share of contributions in each asset class. The robust standard errors, which are reported in parentheses, are clustered on each firm in order to account for correlation across time for a given firm.

| | Share of Contributions in: | | | |
|--------------------------|----------------------------|----------------------|--------------------------|----------------------|
| | Company Stock Funds | Equity Funds | Fixed Income Funds | Balanced Funds |
| Share of Fund Options | 0.850*** (0.141) | 0.646*** (0.046) | 0.194*** (0.056) | 0.714*** (0.042) |
| Co Stock Match Required? | 0.083*** (0.015) | -0.027** (0.013) | -0.038*** (0.012) | -0.021*** (0.005) |
| Limit on Co. Stock? | -0.109*** (0.025) | -0.044* (0.027) | 0.141*** (0.039) | 0.002 (0.012) |
| Past 5 Year Return on: | | | | |
| Company Stock | 0.012*** (0.002) | -0.007*** (0.002) | -0.004*** (0.001) | -0.001* (0.001) |
| Stock Market | -0.025** (0.010) | 0.092*** (0.011) | -0.084*** (0.010) | 0.003 (0.005) |
| Money Market | -0.125 (0.130) | -0.944*** (0.092) | 1.243*** (0.098) | -0.017 (0.037) |
| Gov't Bonds | -0.011 (0.019) | -0.049*** (0.017) | 0.065*** (0.017) | -0.003 (0.008) |
| Std Dev of Co. Stock | -0.491*** (0.160) | 0.277* (0.149) | 0.222 (0.136) | -0.023 (0.062) |
| Market-to-Book (q) | 0.010** (0.005) | -0.002 (0.006) | -0.007* (0.004) | -0.003*** (0.001) |
| Ln (Assets) | 0.025*** (0.005) | -0.018*** (0.004) | -0.0009 (0.005) | -0.005*** (0.002) |
| DB Plan? | -0.007 (0.015) | -0.006 (0.014) | 0.020* (0.012) | -0.006 (0.006) |
| Inv. Grade Bonds? | -0.008 (0.019) | -0.009 (0.014) | 0.004 (0.015) | 0.001 (0.016) |
| Firm Fixed Effects? | No | No | No | No |
| Number of Observations | 1657 | 1657 | 1657 | 1657 |

*, **, and *** denote significance at the .10, .05, and .01 level respectively.

Table 6b. Regression of Share of Contributions Against Share of Fund Options, Controlling for Returns and Firm Characteristics with Firm Fixed Effects

Each column of this table represents a separate regression. The dependent variable is the share of contributions in each asset class. The robust standard errors, which are reported in parentheses, are clustered on each firm in order to account for correlation across time for a given firm.

| | Share of Contributions in: | | | |
|--------------------------|----------------------------|----------------------|--------------------------|----------------------|
| | Company Stock Funds | Equity Funds | Fixed Income Funds | Balanced Funds |
| Share of Fund Options | 0.245*** (0.069) | 0.374*** (0.031) | 0.368*** (0.060) | 0.489*** (0.038) |
| Co Stock Match Required? | 0.032** (0.013) | 0.011 (0.014) | -0.040** (0.019) | -0.001 (0.007) |
| Past 5 Year Return on: | | | | |
| Company Stock | 0.004*** (0.001) | -0.003** (0.001) | 0.000 (0.001) | -0.001** (0.0004) |
| Stock Market | -0.028*** (0.007) | 0.099*** (0.007) | -0.072*** (0.007) | -0.002 (0.004) |
| Money Market | 0.246*** (0.060) | -1.072*** (0.060) | 0.983*** (0.059) | -0.061** (0.027) |
| Gov't Bonds | 0.009 (0.012) | -0.056*** (0.013) | 0.042*** (0.012) | 0.006 (0.007) |
| Std Dev of Co. Stock | -0.171 (0.125) | 0.057 (0.127) | 0.234* (0.140) | -0.073 (0.074) |
| Market-to-Book (q) | 0.014*** (0.003) | -0.014*** (0.003) | 0.000 (0.003) | -0.001 (0.001) |
| Ln (Assets) | 0.047*** (0.008) | -0.029*** (0.008) | -0.014 (0.009) | -0.004 (0.004) |
| DB Plan? | 0.011 (0.009) | 0.005 (0.009) | 0.000 (0.008) | -0.013** (0.007) |
| Inv. Grade Bonds? | 0.004 (0.010) | 0.002 (0.009) | -0.009 (0.013) | -0.001 (0.005) |
| Firm Fixed Effects? | Yes | Yes | Yes | Yes |
| Number of Observations | 1657 | 1657 | 1657 | 1657 |

*, **, and *** denote significance at the .10, .05, and .01 level respectively.

Figure 1: Number of 401(k) Plan Options Across Fund Types, 1999-2002

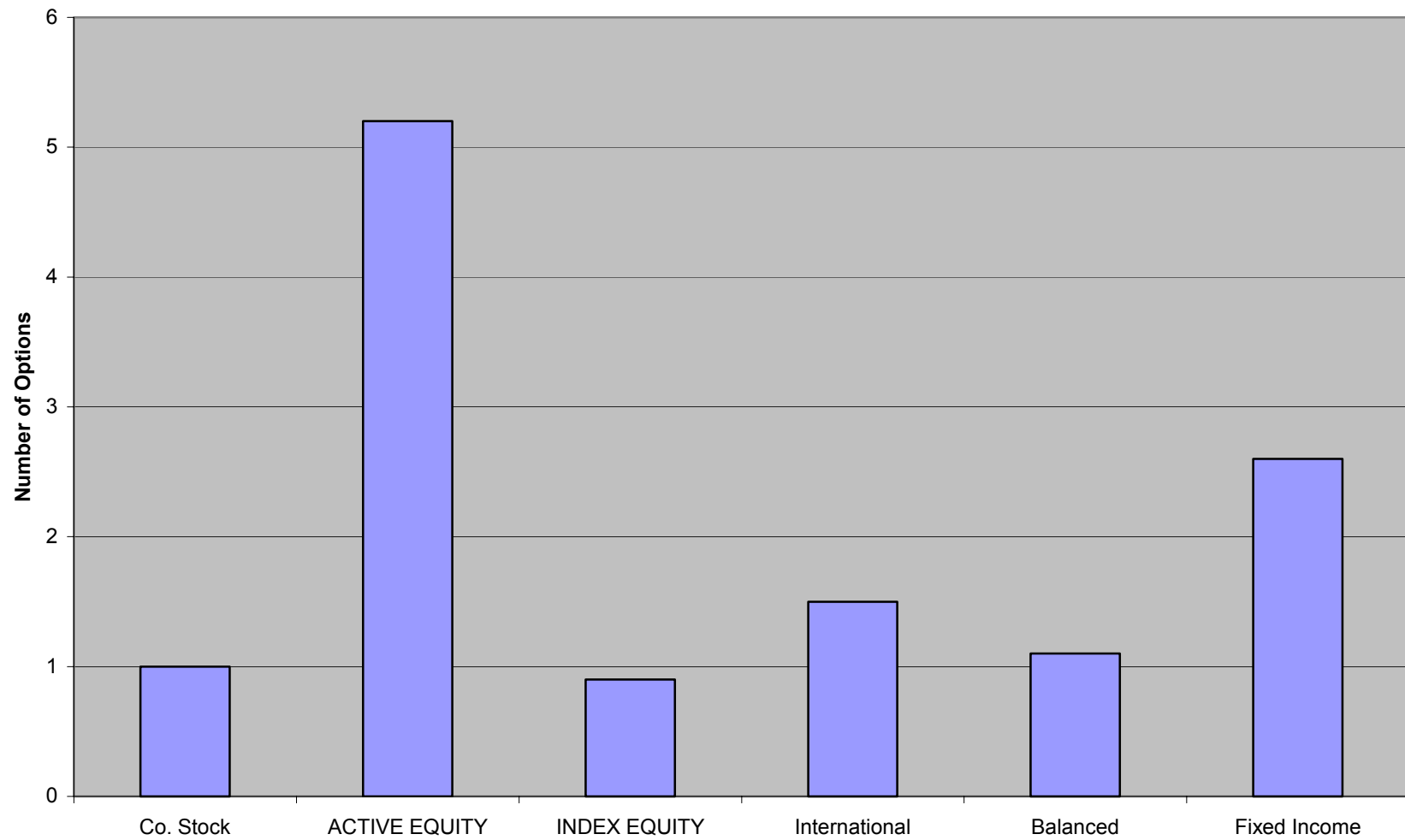


Figure 2: Share of Options & Assets Across Fund Types

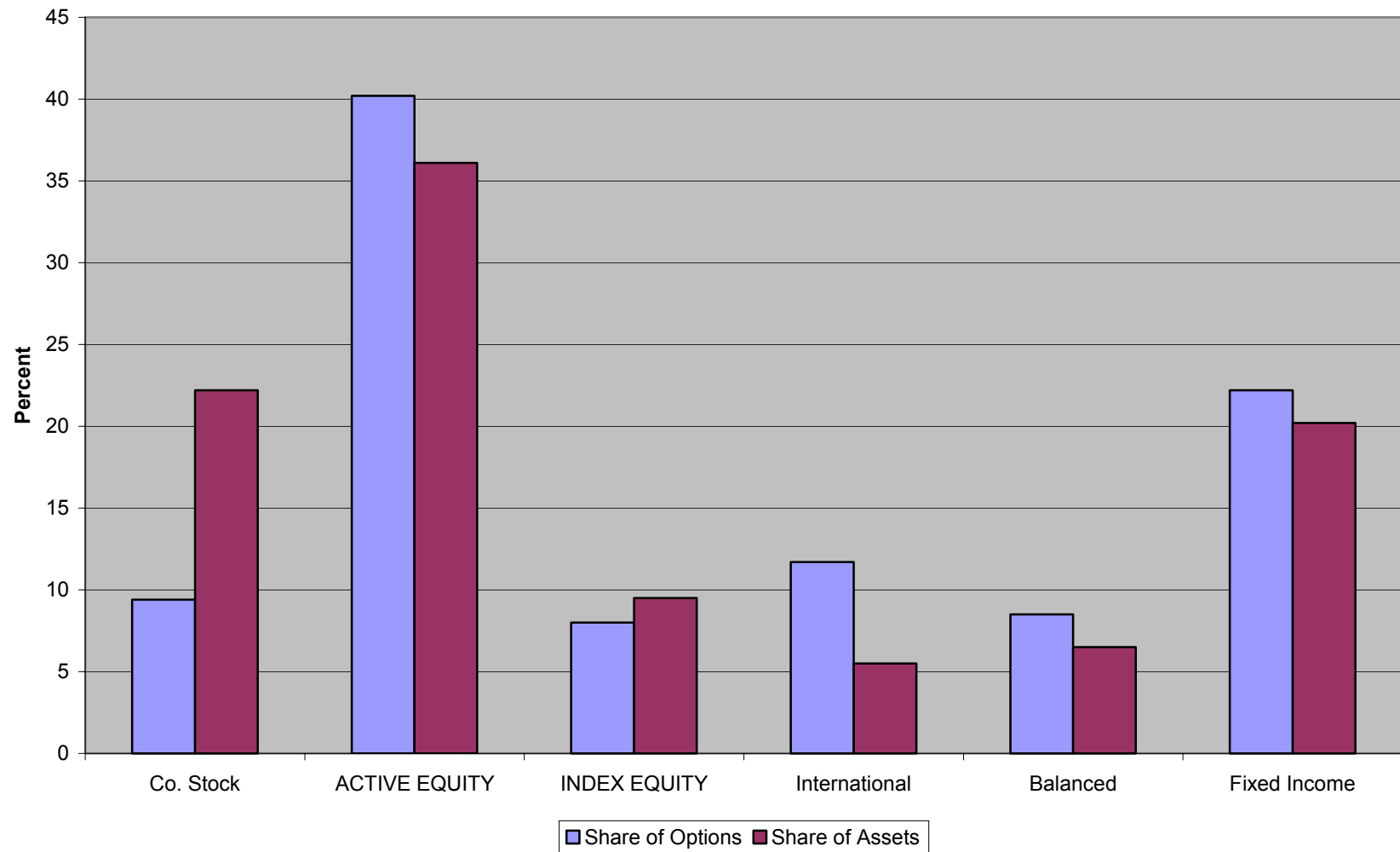


Figure 3: Share of New Options Added to 401(k) Plans, 1999-2002

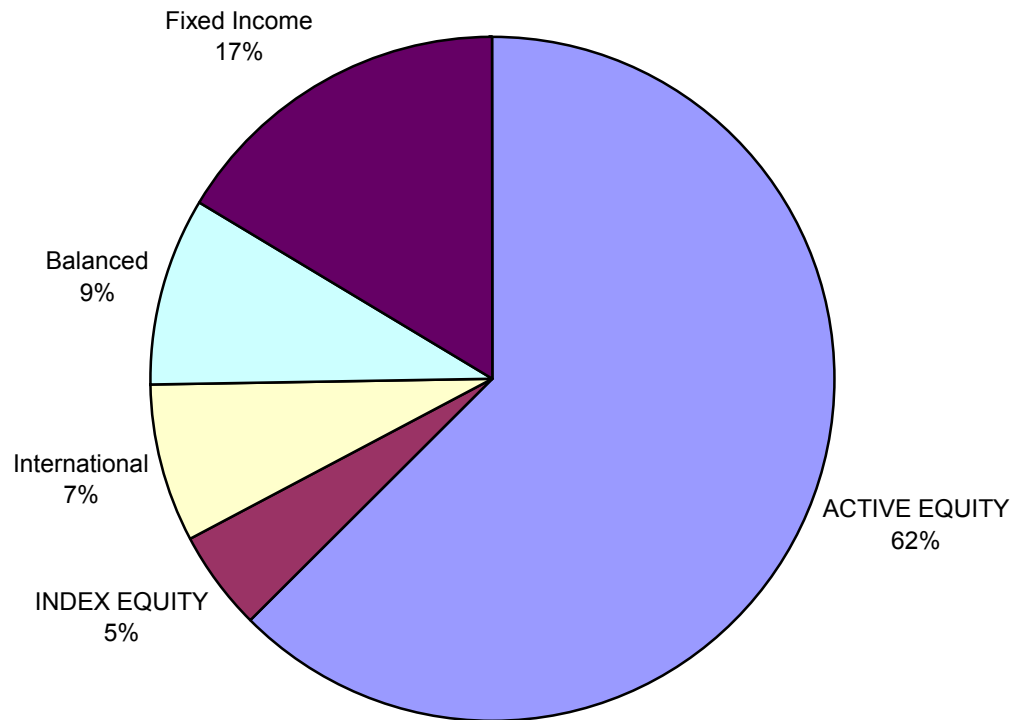


Figure 4: Performance of Equity Funds in 401(k) Plans, 1999-2002

