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Executive summary. Nearly two-thirds of participants adopting a managed account advisory service saw a sharp increase in their equity exposure. Expected returns rose by 82 basis points (after fund expenses but before any managed account fee), while Sharpe ratios improved by 22%.

Participant adoption. Eight percent of participants were early adopters of a managed account program offered during 2005. On a variety of parameters, including age, income, and plan savings rate, these early adopters were not materially different from other participants, though they had longer job tenure and much higher account balances.

Equity exposure. Sixty-two percent of participants in the program saw their equity exposure increase by an average of 39 percentage points. Conversely, 30% of participants saw an average equity reduction of 18 percentage points. At the extremes, 27% of participants moved from an all- or no-equity portfolio to a balanced portfolio.

Company stock. Participants invested in company stock saw their exposure to it drop by an average of 38 percentage points. Before enrollment in the program, 70% of participants owning company stock had more than one-fifth of their portfolios

in company stock. Ninety days after enrollment, only 11% exceeded the 20% threshold, a figure that was expected to decline over time.

Risk/return characteristics. Because of the shift to equities among managed account participants, expected portfolio returns rose 82 basis points (after fund expenses but before any managed account fee) for those adopting a managed account. This jump in expected return was accompanied by a smaller increase in risk, so Sharpe ratios improved by 22%.

Implications. For a variety of reasons, some participants have asset allocations that are too risky, too conservative, or too concentrated in company stock. For plan sponsors, a managed account option is one way of addressing these concerns. Sponsors seeking to reduce the fiduciary liability associated with company stock may also want to consider a managed account option.

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Background

Academic and industry research has suggested that many defined contribution (DC) participants may lack the knowledge or motivation to manage their retirement accounts properly. Inertia is often a common decision-making strategy, with many participants taking a passive approach to savings and investment decisions. Several solutions to this problem have been offered, including enhanced financial education programs in the workplace, life-cycle funds, autopilot 401(k) designs, and most recently, managed account programs.¹

A managed account program is a form of participant investment advice based upon a 2001 advisory opinion issued by the U.S. Department of Labor.² Under a managed account program, a plan sponsor selects a third-party advisor to provide independent investment advice to participants. Participants who enroll in the service provide the advisor with their financial information, risk tolerance, goals, and time horizon; they also authorize the advisor to set their portfolios' asset allocations, choose investments, and monitor and rebalance their portfolios, all on a continuing basis. In effect, with a managed account service, participants turn over management of their entire DC plan account to a third-party professional advisor. For this service, participants pay a fee that usually varies with the size of the assets under management.

Currently it's estimated that more than 10% of larger DC plans offer a managed account option.³ In addition, 50% of participants in a recent survey indicated that they would prefer to rely on an outside expert to monitor their retirement savings plans, suggesting that managed account usage may grow in the coming years.⁴ The growth in managed accounts may get a boost from federal pension legislation that could clarify fiduciary responsibilities associated with offering investment advice in DC savings plans.

Although managed accounts may be poised to transform the retirement landscape, little is known about their usage or the effect the service has on participants' portfolios. To better understand the role of managed accounts in retirement savings plans, we examined the portfolios of nearly 12,000 participants who signed up for the Vanguard® Managed Account Program (VMAP™) in 2005. This report considers, among other topics, the impact the service has on participant equity holdings, company stock exposure, and expected portfolio risk and return.

Data

The participants in our study came from 19 companies and 37 distinct DC plans, representing a variety of plan sizes, designs, and demographic characteristics. During 2005 these 37 plans added the Vanguard Managed Account Program, and close to 12,000 participants adopted the service gradually over the course of the year. A few plans introduced the service in November and December 2004, and the small number of participants who signed up during this period are also included in our analysis. Five companies accounted for 85% of the participants in our analysis. A more detailed description of the data is provided in Appendix A.

Vanguard is the provider of recordkeeping services for all the plans in our sample. The plan sponsor selects the investment funds available to participants from those made available by Vanguard as their plan recordkeeper. The fund universe includes a wide array of funds both from Vanguard and from other investment firms. Under VMAP, Vanguard acts as investment advisor for the program and Financial Engines serves as sub-advisor. Financial Engines' advice methodology is the "advice engine" that determines advisory recommendations for participants.

1 For obstacles due to financial literacy, see Lusardi and Mitchell, 2005. For lack of motivation in decision-making, see the behavioral finance literature as summarized in Vanguard, 2004, and Mitchell and Utkus, 2004. For a summary of the literature on participant trading, see Mitchell, Mottola, Utkus, and Yamaguchi, 2006.

2 DOL Advisory Letter 2001-09A, the so-called "SunAmerica" decision. <http://www.dol.gov/ebsa/regs/AOs/ao2001-09a.html>.

3 Profit Sharing/401(k) Council of America, 2005, reports that 13% of plans with more than 1,000 participants have adopted a managed account option.

4 Transamerica, 2005. The Transamerica survey did not ask participants if they were willing to pay a fee for the advice. In addition, Vanguard research conducted in 2003 found that 65% of participants surveyed said that it is "extremely or very important" for their employer to offer investment advice.

Figure 1. Demographic Characteristics by Managed Account Adoption Status

Among participants offered managed account program

	Managed account participant	Not a managed account participant	Relative difference
Total	8%	92%	
Demographics			
Mean age	47.4	45.0	5%
Mean household income	\$95,497	\$99,298	-4%
Male (%)	51%	48%	6%
Mean job tenure (years)	13.9	12.1	15%
DC plan account			
Mean account balance	\$68,050	\$55,660	22%
Median account balance	\$36,203	\$20,361	78%
Mean savings rate*	10.3%	9.4%	10%
Web-registered (%)	56%	47%	19%

Note: Managed account adopters as of December 2005.

*Based on 2005 compliance testing data and excludes employees not contributing to their plans.

Source: Vanguard, 2006.

Participant adoption

During the introductory period for the Vanguard managed account service, 8% of active participants who were offered the program became early adopters. On several parameters, early adopters were not materially different from nonadopters. Early adopters tended to be slightly older and were more likely to be male. They also had lower incomes and higher plan savings rates, though the relative differences were small (**Figure 1**).⁵

But on some parameters, there were large differences. Managed account adopters had longer job tenure, and median balances (which rise with tenure) were 78% higher for adopters than for nonadopters. There also was a difference in Web registration rates: 56% for adopters compared with 47% for nonadopters, a 19% relative difference.

⁵ Agnew, 2006, who studied a managed account service in a single plan, found that a managed account appealed equally to individuals in different demographic groups.

While these participant adoption results are preliminary, they suggest that it is more the size of participants' account balances, and less their income or savings rates, that contribute to the initial demand for managed account services. The higher prevalence of Web registration, which we often take as a proxy for investor sophistication and their level of engagement, also suggests that early adopters are not simply the unmotivated or the poorly informed but may also include some measure of experienced and active decision-makers.⁶ That said, because we are examining the demographic characteristics of early adopters, different trends might emerge as the adoption rate increases and as more plans offer a managed account program.

Equity exposure

After deciding to contribute to a retirement savings plan, the most important decision that participants face is how to allocate their portfolio assets—in particular, how to divide their holdings among the major asset classes. The allocation to equities is particularly crucial, given its influence on the long-term risk/return potential of the participant's portfolio. The selection of individual investment options and ongoing rebalancing also are critical portfolio-management tasks.

To examine the impact of the managed account program on participant equity exposure, we compared their plan equity holdings as of September 30, 2004, before the service was introduced to any plans in our sample, and

December 31, 2005, the end of our study period. Because it takes time for participants to receive information on the service, enroll in the program, and have the recommended portfolio changes implemented, we included only those participants who signed up for the service through September 30, 2005—a total of nearly 12,000 participants.

The impact of the managed account service on equity exposure was striking. Before implementation, a large proportion of participant portfolios tended to congregate at the tails of the equity exposure distribution. Twenty-seven percent of our participants had extreme portfolio positions of either 0% or 100% in equities (**Figure 2, top panel**). There was also a spike in the middle of the equity distribution—the result of several plans using a balanced fund (with roughly 50% of fund assets in equities) as the default fund.⁷ This is yet another example of how inexperienced participants rely on default choices to guide their portfolio decisions.

The introduction of a managed account service resulted in a large shift in the distribution of equity exposure (**Figure 2, bottom panel**). The extremes were eliminated and replaced by a normal or bell-shaped distribution with a mean equity exposure of 76% and a standard deviation of 12%. After the managed account implementation, nearly 90% of participants had an equity exposure between 50% and 90%.

⁶ Registering for Internet access was not a requirement for participation in the managed account program.

⁷ The equity exposure of nonadopters was comparable to the distribution of adopters (before managed account implementation), suggesting that adopters and nonadopters have similar investments.

Figure 2. Impact of Managed Account on Equity Exposure

Before managed account adoption

Percentage of participants



After managed account adoption

Percentage of participants



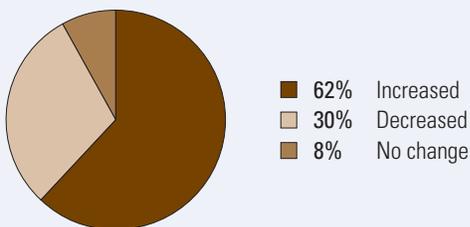
Note: Among managed account adopters.

Source: Vanguard, 2006.

Figure 3. Change in Equity Exposure

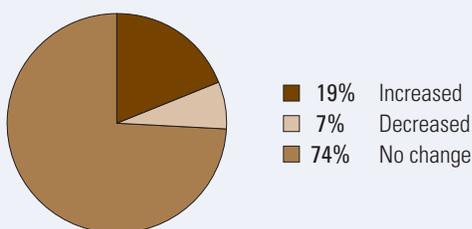
Among managed account adopters

Percentage of participants



Among nonadopters

Percentage of participants



Note: Equity exposure change based on difference between September 2004 and December 2005 balance allocations. An equity change of 3% or less was classified as no change. Source: Vanguard, 2006.

Overall, 62% of managed account adopters saw their equity exposure increase and 30% saw their equity exposure decrease after implementing the managed account service (Figure 3).⁸ By comparison, among nonadopters, inertia was the dominant theme: 74% of participants in this group made no change to their equity exposure over our analysis period. In reality, the percentage of nonadopters making changes to their portfolios is probably overstated. Our previous research shows that most participants are inattentive investors and seldom

trade their investments.⁹ In calculating the change in equity holdings, we compared balances between two points in time, and so some of the change in equity allocations by nonadopters may simply reflect a rising market, rather than active decision-making by participants.

The magnitude of the equity changes was also quite large. Managed account adopters who saw their equity exposure increase experienced, on average, a 39 percentage point jump in equity exposure (Figure 4, top panel). Those who saw their equity exposure fall experienced an 18 percentage point drop.

Nonadopters who made changes to their portfolios also saw changes of a similar magnitude (Figure 4, bottom panel). But as noted earlier, the group of nonadopters making active portfolio choices was relatively small. In fact, the large drop of 24 percentage points for nonadopters was attributed to a group of participants who decreased their equity exposure by 100%—which we presume to be a portfolio error and an overreaction to market risk. By comparison, none of the managed account adopters saw equity decreases as extreme as 100% and only a handful of adopters saw equity decreases greater than 50%.

Demographics and changes in equity exposure

Clearly, most managed account adopters face either an increase or decrease in their equity exposure after enrolling in a managed account service. Which participants are being “increased” and which are being “decreased”? To gain some perspective on this, we grouped participants who adopted the service by those whose equity exposure rose or fell by more than five percentage points, and then we compared

⁸ Equity exposure had to change by more than plus or minus three percentage points to be classified as an increase or a decrease.

⁹ Vanguard, 2006, and Mitchell, Mottola, Utkus, and Yamaguchi, 2006.

Figure 4. Magnitude of Change in Equity Exposure

Equity allocation among managed account adopters

Portfolio change	Before managed account offered	After managed account offered	Change
Increased equity exposure	37%	76%	39%
Decreased equity exposure	92%	74%	-18%

Equity allocation among managed nonadopters

Portfolio change	Before managed account offered	After managed account offered	Change
Increased equity exposure	39%	66%	27%
Decreased equity exposure	75%	51%	-24%

Source: Vanguard, 2006.

the demographic characteristics of the two groups. Presumably, participants who saw their equity exposure fall were taking too much risk, according to the managed account advisory methodology, while those that saw an increase in equity exposure were taking too little risk.

Those who saw their equity exposure fall tended to be older, long-tenured males with higher account balances (Figure 5). This result is consistent with the broader research regarding the overconfidence of affluent, male investors, who may trade too much and overinvest in equities. Conversely, those who saw their equity exposure rise were more likely to be women with somewhat lower household incomes and much lower balances. Since gender and wealth are correlated, it is difficult to tease apart their relationship with managed account changes, but clearly there appears to be meaningful demographic differences between the two groups.

Figure 5. Participant Demographics by Equity Change

Among participants adopting managed account program

	Equity increase >5%	Equity decrease >5%
Participants	60%	28%
Demographics		
Mean age	47.8	51.5
Mean household income	\$93,044	\$100,013
Male (%)	43%	58%
Mean job tenure (years)	13.2	18.3
DC plan account		
Mean account balance	\$55,004	\$95,028
Median account balance	\$29,473	\$61,324
Web-registered (%)	52%	62%
Mean savings rate*	10.5%	11.5%

*Based on 2005 compliance testing data and excluding employees not contributing to their plans.

Source: Vanguard, 2006.

Company stock

For participants in plans that offer company stock, one of the most common portfolio errors is taking a too-concentrated position in their employer's stock. Not only are participants exposed to the higher risk of holding an individual security, but that specific investment risk is correlated with employer-related job risk. In other words, financial difficulties at the company can potentially lead to investment losses and loss of a job. The risk of concentration is particularly acute in plans where the employer provides matching or other contributions in the form of company stock. In such cases, participants build up substantial holdings, and few make any effort to diversify these concentrated positions.

Although the risks of a concentrated position in employer securities have been well publicized in recent years, many participants with concentrated stock positions have failed to take any action. Among Vanguard-administered plans, for example, the level of concentration in company stock has remained essentially unchanged over the past five years.

In our current study, we analyzed company stock exposure for a smaller group of plans and participants with company stock—specifically, five

plans and 2,026 participants. Before enrolling in a managed account program, 70% of participants investing in company stock had more than 20% of their assets in company stock (**Figure 6, top panel**). Six percent of participants investing in company stock had 100% of their assets in company stock.

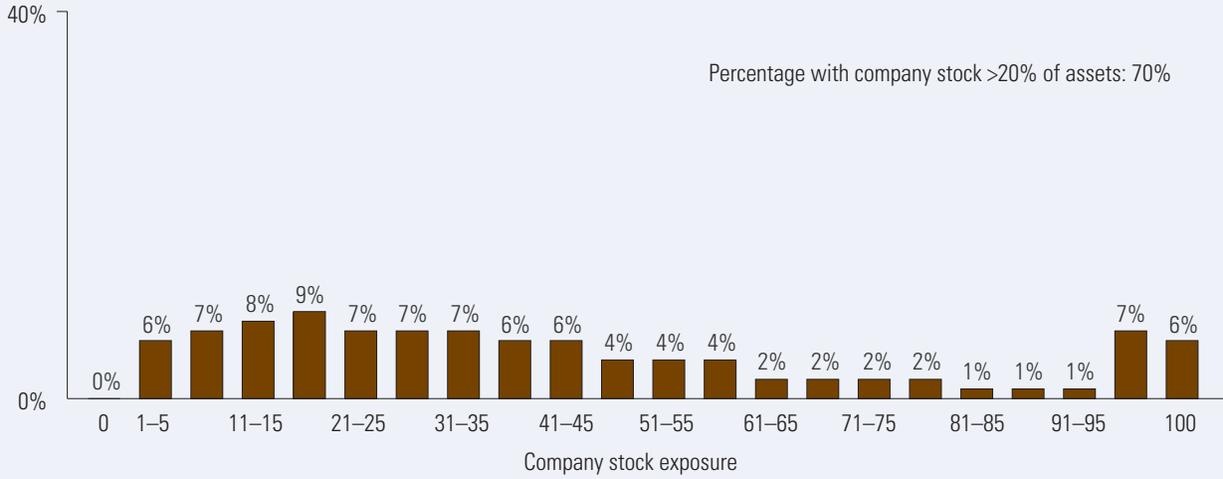
As was the case with overall equity exposure, we see the managed account service having a positive effect on participants' company stock exposure. After managed account implementation, company stock exposure was reduced to significantly lower levels (**Figure 6, bottom panel**). The managed account service generally eliminated concentrated positions in employer stock. After implementing the service, 89% of the participants had 20% or less of their plan assets in company stock; only 11% of participants were above the 20% level.

VMAP does not allow company stock concentrations to exceed 20%. At any point in time, however, there will be some participants with holdings that temporarily exceed this threshold. One reason is that concentrated stock positions may be reduced gradually over time. A second reason is that between portfolio rebalancings, a sudden increase in a company's stock price can temporarily drive the percentage allocation to company stock above the 20% threshold.

Figure 6. Impact of Managed Account on Company Stock Exposure

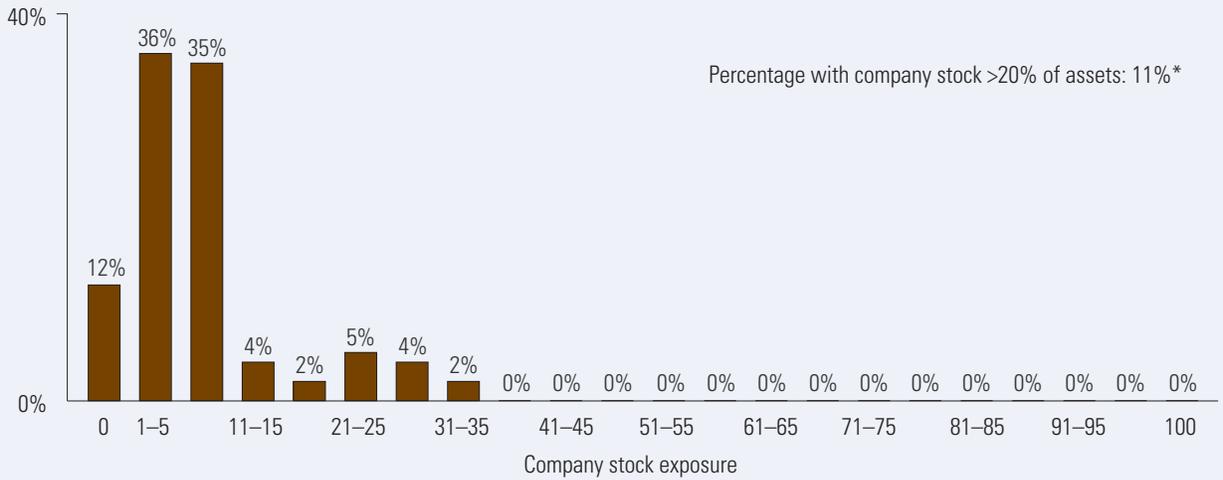
Before managed account adoption

Percentage of participants



After managed account adoption

Percentage of participants



*Company stock holdings may exceed the 20% threshold temporarily because a position is being diversified gradually or because of a spike in the stock price after portfolio rebalancing.

Note: Among managed account adopters.

Source: Vanguard, 2006.

Among participants investing in company stock and signing up for the managed account service, 89% saw their company stock exposure decrease, 10% saw no change, and 1% saw an increase because of market fluctuations (Figure 7). By comparison, among the nonadopters, 30% saw a decrease in company stock,¹⁰ more than half saw no change, and 17% saw an increase.

Once again, the magnitude of the changes is considerable, both for adopters and nonadopters (Figure 8). Most noteworthy is that, on average, adopters saw their company stock exposure fall by 38 percentage points. By comparison, nearly 1 in 5 participants who did not adopt the service saw their company stock exposure increase by an average of 12 percentage points during our analysis period. (Again, much of the change among nonadopters may simply reflect the volatility of individual stock prices, not active decision-making by participants.)

Portfolio risk/return characteristics

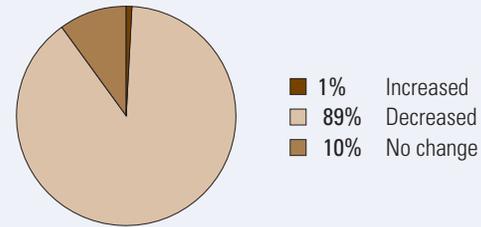
As these initial results suggest, adopting a managed account service leads to an increase in equity holdings among many adopters and reduces concentrated company stock positions. These two steps alone should enhance portfolio returns and reduce portfolio risk in meaningful ways.

The managed account advisory methodology takes additional steps to improve portfolio risk/return characteristics. These steps may include improving allocations to mid- and small-capitalization U.S. equities and international stocks, and optimizing fund and manager selection.¹¹ To better understand these effects, we estimated portfolio risk/return characteristics for adopters before and after implementing the managed account service.

Figure 7. Change in Company Stock Exposure

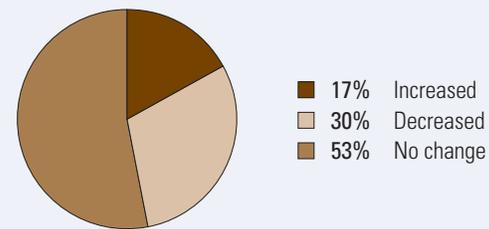
Among managed account adopters

Percentage of participants



Among nonadopters

Percentage of participants



Note: Company stock exposure change based on difference between September 2004 and December 2005 balance allocations for participants investing in company stock as of September 2004. A change of 3% or less was classified as no change.

Source: Vanguard, 2006.

¹⁰ This percentage may be slightly overstated because of a company stock tender offer that took place during this study. Although settlement did not occur until after our study period, some participants may have moved money out of their company stock fund in anticipation of the tender offer. Any effect the tender offer had on company stock exposure in our study appears to be small, as evidenced by the fact that the percentage of plan assets in company stock at the end of our study was only between 1.1 and 3.8 percentage points lower (depending on the plan examined) than at the beginning.

¹¹ Financial Engines may choose not to increase allocations to international or small-cap equities if the available funds are too expensive or unattractive in investment terms.

Figure 8. Magnitude of Change in Company Stock

Among company stock investors

Company stock allocation among managed account adopters

Portfolio change	Before managed account offered	After managed account offered	Change
Increased company stock exposure*	10%	19%	9%
Decreased company stock exposure	46%	8%	-38%

Company stock allocation among managed nonadopters

Portfolio change	Before managed account offered	After managed account offered	Change
Increased company stock exposure	34%	46%	12%
Decreased company stock exposure	45%	17%	-28%

*Only 1% of adopters saw their company stock exposure increase because of a spike in the stock's price between portfolio rebalancings.

Source: Vanguard, 2006.

Our analysis relies on Financial Engines' proprietary estimated returns (and covariance matrices) for plan investment options. We used this data to calculate portfolio returns and risk characteristics for all participant accounts. The returns are real returns—expected returns after projected inflation. Returns also are net of fund expenses. However, the cost of the managed account service has not been deducted from any of the returns reported in this paper.

Importantly, the projected returns are based upon Financial Engines' forecasting methodology, which projects the likelihood of various investment outcomes that are hypothetical in nature. The expected returns do not reflect actual results and are not a guarantee of future results.

One issue with our analytical approach is that we are using the advisory methodology's assumptions to evaluate that same methodology. However, our review of Financial Engines' expected returns for major asset classes suggests that they are broadly consistent with long-term historical return patterns. As a result, we believe our findings are not biased by overly optimistic assumptions about future stock returns or overly pessimistic assumptions about future fixed income returns.

That said, a second issue is that Financial Engines revises its return and correlation assumptions over time, and over the period of our study, their forward-looking returns became slightly more optimistic. For example, their expected return for a broad U.S. stock market index fund rose by 13 basis points. We make what we call "methodology adjustments" to compensate for this effect.¹²

¹² Specifically, for those adopting the managed account service, we took their September 2004 holdings and calculated expected returns using the return and covariance matrix at time t_1 (July 2004) and at time t_2 (October 2005). The difference between the two figures represents the amount of change in expected return that is solely attributed to Financial Engines updating their return estimates. For the Sharpe ratio calculation, we calculated adjustments to portfolio variance in the same way, with both the numerator (returns) and denominator (portfolio standard deviation) figures being adjusted.

On average, the managed account service led to a substantial increase in expected returns. This result is not surprising, given that on average the program made a large shift upward in equity holdings. Participants adopting the service saw average expected real returns after expenses rise from 4.86% to 5.83%. This represents an increase of 82 basis points and a relative improvement of nearly 17%, after the methodology adjustment for changing assumptions (**Figure 9, top panel**). This increase is after plan fund expenses but before any separate fee charged for the managed account service.¹³

For comparative purposes, nonadopters saw a 12-basis-point jump during the same period. This increase was due to both rising equity markets over the period (in rising markets, participant equity allocations drift upward) as well as any portfolio changes that participants made.

However, these averages are a somewhat unrepresentative measure, as some participants saw equity exposure and presumably expected returns decline, while the most pronounced gains occurred for participants with little or no equity exposure to begin with. To examine these effects, we separated the managed account adopters into five equal groups (or quintiles) based on their expected return before managed account implementation. Participants in Quintile 5 had the highest expected returns before enrolling in the managed account program; participants in Quintile 1 had the lowest expected returns.

The results by quintile provide a better view of the changes brought about by the managed account service. Participants in Quintile 1 experienced a 360-basis-point increase in expected return, compared with participants in the top quintile who saw their expected return drop by 146 basis points.

(Again, changes in expected return are after plan fund expenses but before any separate fee for the managed account service.)

To assess portfolio risk, we estimated Sharpe ratios both before and after managed account implementation—again, for the total group of participants as well as for quintiles (**Figure 9, lower panel**).¹⁴ Across the board, there was an improvement in Sharpe ratios. The average Sharpe ratio jumped from 0.256 to 0.318, a 22% improvement after methodology adjustments. The participants in the lowest quintile, Quintile 1, experienced the greatest improvement: Their Sharpe ratios almost tripled. Meanwhile, participants in Quintile 5, where equity exposure and expected returns fell, still experienced a nearly 15% improvement in their Sharpe ratios.

With the Financial Engines advisory methodology, a variety of factors can influence these changes—not only equity and company stock allocations, but also other efforts to improve asset class diversification and manager and fund selection. How much of the 82-basis-point increase can be attributed to the change in equity exposure alone? To answer this question, we regressed the change in each participant's incremental return against the percentage point shift in equities for each participant and the methodology adjustment we discussed earlier. The results of the regression indicate that the methodology adjustment only explains 5% of the change in incremental return, whereas the equity shift explains 85% of the change.¹⁵ The remaining 10% is probably explained by a combination of fund selection (which includes choosing funds with lower expense ratios) and random variation. Appendix B contains a full description of the regression model and the complete results.

13 Of course, sponsors should reduce this expected increase in return by the fee that their managed account provider charges.

14 Sharpe ratios are a common measure of return per unit of risk. They are calculated by dividing the portfolio's excess return (the return of the portfolio minus the risk free rate) by the portfolio's standard deviation. Bill Sharpe, the creator of the Sharpe ratio, is a founder of Financial Engines.

15 We ran a sequential regression, so the 85% figure cited is the Type I squared semipartial correlation coefficient and represents the unique contribution of equity shift after advisor adjustment contributed its share to the prediction of the dependent variable.

Figure 9. Portfolio Risk/Return Characteristics

Expected real returns after fund expenses (1)

Quintile	Before managed account	After managed account	Methodology adjustment (2)	Change in expected return	Percentage change
5	7.36%	6.10%	-0.20%	-1.46%	-20%
4	5.68%	5.92%	-0.18%	0.06%	1%
3	4.54%	5.83%	-0.14%	1.15%	25%
2	3.51%	5.74%	-0.11%	2.12%	60%
1	1.74%	5.42%	-0.08%	3.60%	207%
Total	4.86%	5.83%	-0.15%	0.82%	17%

Sharpe ratios (1)

Quintile	Before managed account	After managed account	Methodology adjustment(2)	Change in Sharpe ratio	Percentage change
5	0.271	0.316	-0.0057	0.040	15%
4	0.293	0.319	-0.0057	0.021	7%
3	0.309	0.320	-0.0037	0.008	2%
2	0.273	0.318	-0.0026	0.043	16%
1	0.112	0.316	-0.0067	0.197	176%
Total	0.256	0.318	-0.005	0.057	22%

Projected returns are based upon Financial Engines' forecasting methodology, which projects the likelihood of various investment outcomes that are hypothetical in nature. The expected returns do not reflect actual results and are not guarantees of future results.

Note: Among managed account adopters for whom we could calculate portfolio returns in both September 2004 and December 2005.

(1) Expected returns (used to calculate portfolio returns and Sharpe ratios) are after fund expenses but before any separate fee charged by the managed account service.

(2) These adjustments reflect changes over time in Financial Engines' expected returns and/or covariance matrix. See text.

Implications

The ongoing trend away from defined benefit (DB) plans and toward DC plans requires workers to take an even more active role in managing their retirement assets. Some participants are prepared to make these choices; others are unable to, or may simply be uninterested in doing so. Inertia and procrastination prevent many participants from making active portfolio choices; past performance and the framing effects of investment menus also can influence portfolio selection in unintended ways. In addition, the sponsor's choice of a conservative default fund can inadvertently direct participants into an investment that is inconsistent with their retirement goals.

By enrolling in a managed account service, participants can avail themselves of one aspect of the DB paradigm—namely, access to professional management of their entire DC portfolio. Participants must pay for this service, but it appears that, on average, an increase in expected portfolio performance could offset any reasonable additional cost.

Our findings on managed accounts have several implications for plan sponsors. First, plan sponsors should consider how managed accounts might improve questionable portfolio diversification decisions made by participants. The impact of a managed account seems particularly pronounced in the case of overly conservative investment allocations.

Second, for plans offering company stock, the adoption of a managed account service will lead to a reduction in concentrated company stock holdings. As such, the service may help reduce fiduciary liability. A managed account also may be a vehicle by which boards of directors and senior management teams encourage participant diversification based on the advice of an independent third party.

Third, a managed account may be suitable as a default investment option within a plan, similar to life-cycle or balanced funds, and it could be used as part of an automatic or autopilot 401(k) plan. Plan sponsors will need to consider both the potential risk/return benefits as well as the higher cost compared with other default fund alternatives.

Finally, for policymakers in the United States and abroad, managed accounts represent yet another strategy to consider in their efforts to improve investment allocations within participant-directed retirement programs, whether publicly or privately administered.

Appendix A

Data for this study were derived from 19 Vanguard clients for whom Vanguard provides recordkeeping services and who added a managed account option to their plans as of September 2005. These 19 clients offer 37 plans with 242,412 unique participant accounts. Five client organizations accounted for 85% of the sample.

The average participant in the study was 46 years old, worked for his employer for 9 years, had a household income of \$99,013, and accumulated \$21,491 in retirement savings in his retirement plan. In addition, 48% of the participants were male and 47% were registered for online access to their retirement plan accounts. These statistics suggest that our sample is not completely representative of the broader Vanguard plan universe (Figure 10). For example, our study sample is longer tenured and has a lower concentration of males than the Vanguard universe. From an investment standpoint, the sample was significantly more conservative than Vanguard's plan universe. Across all Vanguard plans, 71% of assets were invested in equities as of December 2005 compared with 58% for this sample.

In terms of sample sizes, as of December 2005, 17,018 accounts from this sample adopted a managed account option. However, for most of the analyses we required that the adopters be enrolled by September 2005 (to allow enough time for portfolio changes to occur), reducing the sample to 15,066. The change in participant portfolios was calculated by comparing portfolios at two points in time—September 2004 and December 2005, and 11,729 participants had balances at these two points in time. The company stock analysis was based on a subset of 2,026 managed account adopters who were invested in company stock in September 2004.

The expected returns/covariance matrices used in this paper were provided by Financial Engines for two points in time (i.e., July 2004 and October 2005). We were able to calculate pre- and post-adoption expected returns and Sharpe ratios for 10,326 adopters. The pre-adoption, or time 1, portfolio characteristics were calculated using the participant's holdings from September 2004 and the expected return/covariance matrix from July 2004. The post-adoption, or time 2, portfolio characteristics were calculated using the participant's holdings from December 2005 and the expected return/covariance matrix from October 2005.

Figure 10. Comparison of Study Sample and Vanguard Population

	Study sample	Vanguard population
Median age	46	44
Median tenure (years)	8.8	7.0
Mean household income	\$99,013	\$92,941
Male (%)	48%	61%
Web-registered (%)	47%	50%
Equity exposure (%)	58%	71%
Median account balance	\$21,491	\$23,851

Note: Data as of December 2005.

Source: Vanguard, 2006.

Appendix B

We calculated an Ordinary Least Squares (OLS) sequential regression with *change in incremental return* as the dependent variable and *change in equity exposure* and *methodology adjustment* as the independent variables. Key variable definitions are as follows:

$$\text{Change in incremental return} = (r_{p,t2} - r_{f,t2}) - (r_{p,t1} - r_{f,t1})$$

$$\text{Change in equity exposure} = \text{equity}\%_{t2} - \text{equity}\%_{t1}$$

$$\text{Methodology adjustment} = r_{p,Ctrl} - r_{p,t1}$$

The $r_{p,t}$ is the portfolio's expected return at time t ; $r_{f,t}$ is the expected risk-free rate at time t , proxied by the expected return on a money market fund; $\text{equity}\%_t$ is the participant's overall allocation to equities at time t ; $r_{p,Ctrl}$ is a control portfolio return based on the participant's holdings at t_1 and the expected returns at t_2 .

Figure 11. Regression Results

Dependent variable: Incremental change in expected return

Analysis of variance

Source	DF	Sum of squares	Mean square	F value	Pr > F
Model	2	3.34282	1.67141	47,147.60	<0.0001
Error	10294	0.36493	0.00004		
Corrected total	10296	3.70775			

Parameter estimates

Variable	DF	Parameter estimate	Standard error	t value	Pr > t	Squared semi-partial Correlation Type I
Intercept	1	-0.00029	0.00008	-3.40	0.0007	
Methodology adjustment	1	-0.36371	0.03246	-11.21	<0.0001	0.05237
Change in equity exposure	1	0.05294	0.00018	298.02	<0.0001	0.84921

Fit statistics

Root MSE	0.00595
Dependent mean	0.00942
Coefficient Variable	63.2399
R-square	0.90160
Adjusted R-Square	0.90160

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