FEDERAL RESERVE BANK *of* ATLANTA

Understanding 401(k) Plans

Ramon P. DeGennaro and Deborah L. Murphy

Working Paper 2004-21
September 2004

WORKING PAPER SERIES

FEDERAL RESERVE BANK *of* ATLANTA WORKING PAPER SERIES

Understanding 401(k) Plans

Ramon P. DeGennaro and Deborah L. Murphy

Working Paper 2004-21
September 2004

Abstract: Questions about the future of the Social Security system continue to surface. As a result, interest in employer-sponsored retirement plans and other retirement investment options increases. But the restrictions and rules associated with various defined benefit plans such as 401(k), 403 (b), and 457 plans can be confusing, and these plans have risks of their own. The authors explore these plans and explain the need to view retirement savings as only one part of a portfolio.

JEL classification: G11, G20, G29

Key words: asset, allocation, savings, taxes, pension, retirement

---

The views expressed here are the authors' and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Any remaining errors are the authors' responsibility.

Please address questions regarding content to Ramon P. DeGennaro, SunTrust Professor of Finance, the University of Tennessee, Knoxville, Tennessee 37996, 865-974-3216 and Visiting Scholar, Federal Reserve Bank of Atlanta, 1000 Peachtree Street, N.E., Atlanta, Georgia 30309-4470, rdegenna@utk.edu and Deborah L. Murphy, Associate Professor of Finance and Reagan Scholar, the University of Tennessee, Knoxville, Tennessee 37996, 865-974-8396, dgunthor@utk.edu.

Federal Reserve Bank of Atlanta working papers, including revised versions, are available on the Atlanta Fed's Web site at www.frbatlanta.org. Click "Publications" and then "Working Papers." Use the WebScriber Service (at www.frbatlanta.org) to receive e-mail notifications about new papers.

Understanding 401(k) Plans

Historically, defined benefit plans have been designed to promise a specified stream of benefits at retirement with the employer bearing the investment risk. The employer must cover any shortfall if investment earnings cannot meet the obligations of the plan. By contrast, defined contribution plans let employees contribute a portion of their pre-tax income to a retirement savings account while giving them some discretion over the way the funds are invested. However, with defined contribution plans, employees bear all of the investment risk of the portfolio.

In the United States, retirement investing has moved towards defined contribution plans and away from defined benefit plans. Currently, the most popular types of defined contribution plans in the United States are 401(k) plans (offered by private employers such as publicly traded companies), 403(b) plans (offered by non-profit entities such as universities), and 457 plans (offered by state and local governments), and several types of individual retirement accounts (IRAs). Each type of plan is governed by somewhat different rules, and we focus on 401(k) plans and Roth IRAs.

The Evolution of 401(k) Plans

Laws governing the establishment of 401(k) plans took effect in the United States on January 1, 1980, through a provision of The Revenue Act of 1978 known as Internal Revenue Code Section 401(k). The Employee Benefit Research Institute (2003) reports that in 1981, growth of 401(k) plans received a major boost when the United States Internal Revenue Service sanctioned the use of pre-tax salary contributions by employees. According to the Hay Group (2002), the maximum annual contribution to 401(k) plans ranged from $7,000 in 1987 to

$11,000 in 2002 (see Table 1). House Resolution 1836, Economic Growth and Tax Relief Reconciliation Act of 2001 (H.R. 1836) increases the ceiling $1,000 per year through 2006, reaching a maximum of $15,000.

INSERT TABLE 1 HERE

These increased limits make 401(k) plans considerably more attractive to both employees and their employers. This is because the tax savings 401(k) plans provide is a function of the size of the investment. The diagram below shows the events that occur for an employee who earns income in 2004 and retires in 2044:

Year	2004 …….	2004 – 2044 ……	2044
Event	Employee earns income (no taxes)	Investment earnings accrue without taxes	Principal and earnings withdrawn

This is essentially tax arbitrage through time. The employee uses an employer-sponsored investment vehicle to shift a tax liability to a different (and presumably more favorable) future period. Viewed this way, it is somewhat comparable to shifting the tax liability to a different person with a lower marginal tax rate in the same time period. For example, owners and managers of companies can hire their children to mow the lawn at property they rent to others, or hire a retired parent for bookkeeping or receptionist work. The employer deducts the wage expense, saving the marginal corporate tax rate, while the child or parent pays income tax at the lower rate applicable to low-income individuals. The company and the employee share the net tax savings.

Although the premise behind each retirement account is essentially the same, 401(k) plans, 403(b) plans and 457 plans do have regulatory differences. All of the plans allow

individuals to defer current income taxes by deducting plan contributions from taxable income. Employees pay taxes when funds are withdrawn from the plan, presumably at retirement when their personal income tax rate is expected to be lower. Yet, the precise details of these plans are unique to the employer, and there are differences among them. For example, an employer offering a 401(k) plan sets eligibility requirements for employee participation in the plan and sets a minimum tenure of employment. Employers also have considerable discretion regarding the plan's features. For example, they can decide the extent to which contributions they match employee contributions (say $1 for $1, $.50 per $1, or no match at all). By law, employee contributions are fully vested at the time each contribution to the plan is made, but employers can delay vesting matching contribution for up to seven years.[1]

The trend in current legislation has been to eliminate many of the differences among 401(k), 403(b) and 457 plans. Still, regulatory differences remain. For example, regulations permit purchases of individual securities such as common stock, for 401(k) plans, but not for 403(b) plans. Contributions to 403(b) plans can *only* be invested in annuities or mutual funds. Before 2002, federal law prohibited the rollover of funds into a 401(k) plan from either 403(b) or 457 plans (and vice versa). However, under H.R. 1836, new portability rules allow monies invested in 403(b) plans or 457 annuity plans to be rolled into an employer-sponsored 401(k) plan. The ability to do so, however, is at the full discretion of the employer. Likewise, rollovers into 403(b) and 457 plans from an employer sponsored 401(k) plan are at the discretion of the plan sponsor.

[1] Portions of the rest of this section draw on ExpertPlan, Inc. (2003), www.calpers.ca.gov/employer/cirltrs/01cl20007501.pdf, and Fairmark Press (2003).

Although 401(k) plans are strictly employer sponsored plans and cannot be established by an individual, a possible alternative, the Roth IRA, was established as part of the Taxpayer Relief Act of 1997. Roth IRAs differ from 401(k), 403(b) and 457 defined contribution plans in two fundamental ways. First, annual contributions are *after-tax* dollars instead of pre-tax dollars. Second, Roth IRA investors incur no tax liability when funds are withdrawn if certain criteria are met. Essentially, taxes are paid "up-front" with a Roth IRA and at the "back-end" with 401(k), 403(b) and 457 plans. Very young and very old workers can enjoy the benefits of a Roth IRA, because regulations impose no minimum or maximum age limits on the contributor. Since the only caveat is that the contributor must have earned income, essentially a ten-year old child who mows lawns during the summer can contribute to a Roth IRA. Likewise, a ninety-year old individual who works as a ranger at a golf course can contribute. Another benefit of a Roth IRA is that minimum withdrawals are not required at age 70½. The absence of mandatory withdrawals can be a significant advantage for individuals not needing additional annual monies at retirement and may also prove useful in developing one's estate plan. With 401(k) and 403(b) plans, normal withdrawals can be taken after age 59½, but must begin by age 70½. Since contributions to a Roth IRA are permitted even if an individual is contributing to an employer sponsored plan, many individuals find it advantageous to coordinate their contributions to both a Roth IRA and, for example, a 401(k) plan.

Certain restrictions and limitations do apply to Roth IRAs. Annual contributions are limited to $3,000 for participants until age 50 and to $3,500 after age 50, and may be reduced or even eliminated depending on one's income level and federal income tax filing status. As an individual's modified adjusted gross income rises, the permissible annual contribution falls. The contribution limit also depends on the contributions made to other retirement plans. Recent

legislation prohibits rolling over contributions made to a Roth IRA into either a 403(b) or a 457 plan. Rollovers into other defined contribution plans such as a 401(k) plan are at the discretion of the plan's sponsor and strict accounting is required with respect to pre-tax and after-tax contributions. This detailed accounting requirement could effectively deter employers from permitting Roth rollovers.

The tax advantages associated with these retirement savings accounts can be large. Equation (1) gives the terminal value of a fully taxable portfolio (TV_T^{FT}) worth P_0 before taxes at time $t=0$, assuming that the portfolio earns a return of r before taxes in each period, is taxed at an annual rate τ, and the investment period is over a period of T years. Note that it is also assumed that the initial investment (P_0) is taxed at a rate τ_0. Equation (2) gives the terminal value of a similar investment in a portfolio allocated to a Roth account. The initial investment is taxed at the same rate as the taxable account and the before-tax return is identical. However, the earnings on the investment escape tax in a Roth IRA. Equation (3) gives the corresponding terminal value for an investment in a 401(k) account. Unlike the fully taxable account and the Roth account, the initial investment in a 401(k) plan escapes taxation initially, but monies are taxed when they are withdrawn at time T.

$$TV_T^{FT} = P_0 * (1-\tau_0) * [(1+(r * (1-\tau))]^T \quad (1)$$

$$TV_T^{Roth} = P_0 * (1-\tau_0) * (1+r)^T \quad (2)$$

$$TV_T^{401(k)} = P_0 * (1+r)^T * (1-\tau_T) \quad (3)$$

Equations (1-3) assume that the tax rate after time $t=0$ and the rate of return per period are constant. This simplifying assumption does not affect the intuition and results. Consider the following numerical example: Suppose that the initial before-tax investment (P_0) is \$1000, the initial tax rate (τ_0) is 35%, and the holding period (T) is 40 years. If during those 40 years the

return on the investment (r) averages 8% and the taxes at withdrawal (τ_T) are 30%, then the terminal values are:

$$TV_T^{FT} = \$5,747$$

$$TV_T^{Roth} = \$14,121$$

$$TV_T^{401(k)} = \$15,207.$$

In this case, the 401(k) plan yields the greatest terminal value ($15,207). If, however, the tax rate at withdrawal increases to 40%, the Roth IRA becomes a more tax efficient investment with the corresponding terminal values of $4,240, $14,121, and $13,035. This illustrates the critical importance of the relative tax rates. Krishnan and Lawrence (2001) develop the concept of a break-even terminal tax rate and show that for terminal tax rates above break-even, the Roth IRA is better, but if the expected tax rate at withdrawal is below this break-even rate, then the 401(k) plan is better. Krishnan and Lawrence also show that this break-even rate is a decreasing function of the investment return, the investment horizon, and the tax rate on fully taxable investments. For all positive investment returns, however, the break-even rate is below the current tax rate.[2]

Investment Factors

A defined contribution plan such as a 401(k) plan is simply a label attached to an investment that has the benefit of preferential tax treatment. Therefore, investors in these plans face the usual investment considerations, and determining the appropriate plan entails evaluating not only the above benefits and restrictions, but also the plan's risk and return characteristics. The recent retirement account losses experienced by the employees of companies such as Enron

[2] Krishnan and Lawrence explicitly analyze the choice between a Roth IRA and a deductible IRA. However, because of the similar tax treatment of a deductible IRA and a 401(k) plan, their results also apply when comparing a Roth IRA to a 401(k) plan.

and WorldCom, Inc. serve to highlight the need for 401(k) plan contributors to view their retirement savings in a portfolio context. While the mathematics of optimal portfolio construction may be daunting, the basic principles are easily understood. Clearly, all investors want to earn the highest possible return. However, greater returns tend to come with greater risk. One way to reduce the risk associated with any financial investment, including 401(k) plans, is diversification.

Academic researchers and investment professionals have explored two forms of diversification – across assets and across time. Modern portfolio theory shows that, as long as assets are not perfectly correlated, then risk can be reduced by investing across different assets (hence the term, diversification across assets). As assets are not perfectly correlated, the overall risk of one's portfolio is reduced since the price of stocks tends to change in a different way in response to changes in the economy. In addition, Merton and Samuelson (1974) and Samuelson (1990) show that the risk associated with a specific firm (called firm specific risk) is minimized by diversifying across different assets. It is tempting to overlook the need to diversify within a 401(k) plan, especially if an employer matches the employees' purchases of company stock. Investment professionals typically suggest that the benefits of diversification across assets occur when a portfolio consists of at least ten to fifteen different stocks. As different assets are added to the portfolio, the benefits associated with diversification increase. However, these benefits increase at a decreasing rate.

Another form of diversification sometimes advocated by investment professionals is diversification across time. Supporters of this form of diversification argue that buying an asset and holding it over a long period can reduce the risk of that investment. Specifically, some

advocate that for a long investment horizon (ten or more years), diversification across time can serve as an effective substitute for diversification across assets. Gunthorpe and Levy (1996) show that while diversification across time may sometimes stabilize returns, it does not serve as a substitute for diversification across assets.[3] One need only recall the recent losses experienced by the former employees of Enron and WorldCom, Inc. to understand the risk exposure associated with attempting to diversify solely across time.

The wide latitude that plan sponsors have in determining the specific details of a retirement plan introduces additional sources of risk. Although the U. S. Department of Labor oversees employer sponsored 401(k) plans, these plans are not guaranteed by any federal agency. Therefore, since 401(k) plans are uninsured, the solvency and liquidity of the employer become extremely relevant. Some plan sponsors address this source of risk by naming an independent custodian to manage the plan. Another possible source of risk stems from restrictions placed on withdrawals from some 401(k) plans. While withdrawals are regulated under federal law, plan sponsors may impose additional restrictions. For example, employers often impose tenure constraints on employer matching contributions. Proper diversification can also be impeded by the limited investment choices offered by a plan sponsor. Some argue that limiting the choices available to 401(k) contributors simplifies the plan and lowers administration costs. However, this limitation may result in inadequate diversification, and the risk may be magnified in the case of plans funded by substantial holdings of a company's stock, since the contributor's wages are highly correlated with the return on the stock.

[3] For a discussion of optimal portfolio construction, see Gunthorpe and Levy (1994).

These limitations reduce the advantages of a 401(k) plan from the perspective of both the employer and the employee. This is because the 401(k) plan provides a mechanism for the employer and the employee to minimize their combined tax burden. In the numerical examples above, the differences in values – all due to tax savings -- between the terminal values of the 401(k) contribution and a fully taxable investment (per $1000 initial investment before taxes) is $9,460 if the terminal tax rate is 30%, and a still healthy $8,795 if the terminal tax rate is 40%. All else equal, an employer who offers a 401(k) plan can reduce his wage expenses by the present value of that amount, while leaving employees equally well off. Alternatively, the employer can increase his wages paid by that same amount, making his employees better off, while maintaining his own wealth level. Labor market competition determines the ultimate sharing of the tax savings.

Viewed in this context, restrictions on investments limit this combined tax reduction. The most obvious example is the annual contributions limitation. If limitations on contributions were relaxed, then the joint tax savings for the employer and employee could increase. Other restrictions, though, also reduce the possible tax savings. First, restrictions on investment options or portability impose a penalty in the form of reduced diversification and liquidity, respectively. For example, inadequate diversification reduces what economists call the risk-adjusted rate of return. A well-diversified portfolio with an expected return of 5% might be as highly valued as an imperfectly diversified (and therefore riskier) portfolio with an expected return of 7%. Second, because these restrictions reduce the benefits of a 401(k) contribution, employees may contribute less. This reduces the total tax savings still more.

Limiting the Damage

All 401(k) plans face investment restrictions, and in some cases the constraints are rather tight. Many participants complain that the available choices fail to fit their needs. However, plan participants can alleviate many of the problems associated with limited investment options by remembering that 401(k) investments are only one part of their total portfolio. For example, a company's investment options might not contain a fund with enough exposure to international markets to suit a participant. If so, then he can gain the desired exposure by investing in an international fund held *outside* of his 401(k) plan. Another participant may find the investments offered to be too risky. In that case, he can reduce his overall risk exposure by holding only safe assets outside the plan. DeGennaro (2004) and Domian and Racine (2002) show that the key is that plan participants can circumvent investment restrictions by tailoring their *total* portfolio. By following strategies such as these, employees and employers can regain some of the joint tax savings that might otherwise go uncaptured.

The Future

Altig and Gokhale (1997) believe that the fundamental structure of defined-contribution plans such as 401(k) accounts and their close cousins, 403(b), 457, and Roth IRAs, represent the future of retirement savings plans. They cite two main forces. First, defined-benefit plans are demonstrating that ultimately, the risk of funding the promised retirement benefits remains – whether that risk is shifted initially from the employee to the corporation or not. One of several examples attracting attention is the recent termination of US Airways Group Inc.'s retirement plan with its pilots.[4] The growing number of such terminations is placing a strain on the Pension

[4] For more information about US Airways Group Inc.'s action, see, for example, http://cnnfn.cnn.com/2003/03/28/news/companies/usairways.reut/index.htm.

Benefit Guaranty Corporation (PBGC), a government-sponsored agency that insures over 40 million workers' defined-benefit retirement plans. In recent testimony before the House Committee on Education and the Workforce, the agency's executive director, Steven Kandarian, said that the PBGC's obligations exceed its assets by about US $5.7 billion. The first line of defense against such underfunding is an increase in the premiums paid by healthy companies. If that proves politically or economically infeasible, Kandarian said, then U.S. taxpayers could be forced to bail out the PBGC.[5]

The second reason experts believe that defined-contribution plans such as 401(k) accounts represent the future of retirement savings is that the nation's public retirement plan, officially named Old-Age and Survivors and Disability Insurance and commonly known as Social Security, is widely recognized to be unsustainable in its current form. In testimony submitted to the United States' Senate Budget Committee, Jagadeesh Gokhale (1999), an Economic Advisor at the Federal Reserve Bank of Cleveland, said that either a payroll tax increase (to 17.1% from 12.4%) or a benefit reduction on the order of 25% would have been necessary even as early as 1999 in order to place the program on sound financial footing. Gokhale believes that these estimates are, if anything, too small, because they use optimistic estimates of longevity and of growth in labor productivity. Moreover, delays in introducing reforms only exacerbate the problems. Altig and Gokhale (1997) propose augmenting the present system with a privatized system of 401(k) pension plans, and phasing out entirely the existing Social Security program, beginning with workers older than about 32 years of age. Such a major political step is more likely to be possible if the voting public becomes more familiar with 401(k) plans.

[5] For a discussion of the circumstances surrounding a similar bailout and its cost, see DeGennaro and Thomson (1996).

Summary

Retirement savings plans are trending toward defined contribution plans versus defined benefit plans. Dissatisfaction with defined benefit plans and questions regarding the sustainability of Social Security point to increased interest in 401(k), 403(b), 457 plans as well as Roth accounts. The risk associated with each depends on the parameters established by the plan sponsors as well as the future tax rates plan participants expect to pay. To maximize return and minimize risk, retirement savings should be viewed in a total portfolio context. As such, it may be appropriate to combine different plan options. For example, investors might choose to contribute both to an employer sponsored 401(k) plan and a Roth account. Issues relating to estate planning should also be considered in determining one's choice of retirement plans.

Table 1: Percentage Change in the Maximum Annual Contributions Permitted[a]

Year	Maximum Deferral Limits[b]	Percentage Change in Limits
1987	$7,000	-----
1988	7,313	4.47%
1989	7,627	4.29
1990	7,979	4.62
1991	8,475	6.22
1992	8,728	2.99
1993	8,994	3.05
1994	9,240	2.74
1995	9,240	0.00
1996	9,500	2.81
1997	9,500	0.00
1998	10,000	5.26
1999	10,000	0.00
2000	10,500	5.00
2001	10,500	0.00
2002	11,000	4.76
2003	12,000	9.09
2004	13,000	8.33
2005	14,000	7.69
2006	15,000[c]	7.14

[a]Provisions currently exist which permit individuals to exceed the above maximum annual contribution limits if they either were ineligible to contribute or did not contribute the maximum allowed in previous years.
[b]Source: The Hay Group (2002).
[c]After 2006, the maximum annual contributions will be indexed to inflation in $500 increments. The provisions of H.R. 1836 remain in effect until December 31, 2010 at which time they revert to prior law unless further action is taken by the U. S. President and Congress.

References

Altig, David E. and Jagadeesh Gokhale. "Social Security Privatization: One Proposal." *Cato Project on Social Security Privatization*, no. 9 (May 29, 1997).

CalPERS, from www.calpers.ca.gov/employer/cirltrs/01cl20007501.pdf, visited October 16, 2003.

DeGennaro, Ramon P. "Asset Allocation and Section 529 Plans." *International Journal of Business 9*, No. 2, 2004, 125-132.

DeGennaro, Ramon P. and James B. Thomson. "Capital Forbearance and Thrifts: Examining the Costs of Regulatory Gambling," *Journal of Financial Services Research 10*, No. 3 (September 1996), 199-211.

Domian, Dale L. and Marie D. Racine. "Wealth and risk from leveraged stock portfolios," *Financial Services Review 11*, (1), 2002, 33-46.

Employee Benefit Research Institute. www.ebri.org/facts/1102fact.htm, visited on October 8, 2003.

ExpertPlan, Inc. www.expertplan.com/faq401k/general.jsp, visited October 12, 2003.

Fairmark Press. http://www.fairmark.com/rothira/roth101.htm, visited October 15, 2003.

Gokhale, Jagadeesh. Testimony submitted to the United States' Senate Budget Committee, Washington, D.C., January 19, 1999.

Gunthorpe, Deborah and Levy, Azriel. (1996) "Optimal Growth Portfolios Reconciling Theory and Practice," *Review of Quantitative Finance and Accounting*, 7, 177-186.

Gunthorpe, Deborah, and Levy, Haim. (1994) "Portfolio Composition and the Investment Horizon," *Financial Analysts Journal*, January/February, 51-56.

Hay Group, Inc. *The Hay Benefits Reference Guide*, Philadelphia, PA, 2002, www.haygroup.com, visited October 8, 2003.

Krishnan, V. Sivarama and Shari Lawrence. "Analysis of investment choices for retirement: A new approach and perspective," *Financial Services Review* 10 (2001), 75-86.

Merton, R., and P. A. Samuelson. (1974) "Fallacy of the Lognormal Approximation of Optimal Portfolio Decision Making over Many Periods." *Journal of Financial Economics 1*, 67-94.

Samuelson, P. A. (1990) "Asset Allocation Could be Dangerous to Your Health." *Journal of Portfolio Management*, 5-8.