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PAYOUTS FROM INDIVIDUAL ACCOUNTS

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**ABSTRACT**

This paper presents new evidence on the costs of purchasing private annuity contracts to spread a given stock of assets over an uncertain future lifetime. It also describes the operation of individual annuity arrangements within two large group retirement saving plans. First, the paper presents information on life annuity contracts that are now available in the individual single-premium-immediate annuity marketplace. For a 65-year-old male annuity buyer, the expected present discounted value of the payouts offered by the average policy available in June 1998 was approximately 85 percent of the purchase price. This assumes that the individual faces the mortality risks of the average individual in the population, and that the payouts are discounted at a riskless interest rate. The expected present value of payouts rises if we assume that the buyer faces the mortality rates of the typical annuitant, while it declines if we assume a higher, and riskier, interest rate for discounting. Second, the paper considers individual annuity policies available to participants in the government's Thrift Savings Plan. Because these annuities are purchased through a large group retirement saving program, some of the administrative costs are lower than those in the national individual annuity market. The expected present value of payouts is correspondingly higher than that in the "public" market. Third, the paper describes the individual annuity products offered by TIAA-CREF, the retirement system for college and university employees. TIAA offers annuities with non-guaranteed elements, which have among the highest payouts in the individual annuity market, mainly due to superior investment returns and low expenses. CREF annuities offer valuable payouts that reflect, on at least an annual basis, the investment experience of the accounts.

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One of the crucial questions about the operation of "individual accounts" systems of retirement saving is how participants will draw down their account balances when they reach retirement. Most defined contribution plans do not specify how accumulated assets will be drawn down. By contrast, most defined benefit plans sponsored by private companies or by the government provide retirees with mandatory life annuities. Private pension plans purchase these annuities as part of a group annuity contract with an insurance company or underwrite the annuities themselves. In public pension plans like Social Security, the government underwrites the annuities.

Some but not all current participants in defined contribution plans wish to obtain life annuities. Roughly one-third of 401(k) plans and most 403 (b) plans currently offer participants a voluntary life annuity payout. The annuities purchased with funds from accounts in these pension plans are individual annuities purchased through the group plans. If an individual participates in a pension plan that does not offer life annuities and nevertheless desires such a distribution method, it is necessary to purchase an individual life annuity through an agent or broker representing a commercial insurance company. The costs of such annuities, including both administrative and sales costs, the "adverse selection" costs associated with voluntary purchase behavior, and return on capital for the insurance company offering the annuity policy, affect the retirement income that participant receives for a given level of wealth accumulation.

Questions about the cost of annuitization also arise in discussions of "individual account" Social Security reform proposals. Under the present Social Security system, the federal government provides life annuities to all retirees. Because these are compulsory annuities, the adverse selection problems that may arise in private, voluntary annuity markets are not a concern. In addition, the existing Social Security arrangement involves none of the sales or marketing costs that might be charged by insurance companies that sell individual annuities, although there are some administrative costs associated with the current Social Security system.

Most proposals that suggest the use of individual accounts as a supplement to, or partial substitute for, the existing Social Security system would mandate some type of annuitization when the account holder retires. This is true, for example, of the proposals advanced by the Committee on Economic Development, the CSIS, and a subset of participants on the 1994-96 Social Security Advisory Council ("the IA proposal"). While the mandatory

annuitization aspects of these proposals reduce concern about adverse selection, structuring annuity options to achieve equitable payouts, at low cost, is nevertheless an important issue.

Previous research on annuity markets provides only limited guidance on the potential operation of an annuity mechanism involving the purchase of individual annuity contracts within a defined contribution “group” system. Most existing research has focused on the very limited agent-dominated individual annuity market in the United States. Previous studies, including Warshawsky (1988), Friedman and Warshawsky (1990), and Mitchell, Poterba, Warshawsky, and Brown (hereafter MPWB) (1999), have calculated the expected present discounted value of annuity payouts, relative to policy premiums, for individual annuity policies. Because the sales and administrative costs of current individual annuity policies are likely to be substantially greater than those of individual annuities provided in a group plan or a reformed Social Security system, existing calculations probably provide a lower bound on potential payouts in a “private accounts” system.

The “PSA” proposal put forward by a subset of the Social Security Advisory Council (see Gramlich (1996)) would not mandate annuitization from individual Social Security accounts or create any group mechanism for providing life annuities. Rather, individuals who desired to convert their account accumulations to a life annuity would have to purchase an annuity from an insurance agent. Calculations of the expected discounted present value of payouts from private annuities therefore provide information that is likely to bear on an evaluation of the PSA proposal. It is possible, however, that administrative costs per policy and the degree of adverse selection in the market would change if wealth accumulation in individual accounts became universal.

In this paper, we present new findings on the costs of individual annuities, both in the individual annuity market and in two large defined contribution pension systems, the federal government’s Thrift Savings Plan and TIAA-CREF. While we do not assess directly the cost of annuitization for any particular individual-accounts Social Security system, we report background information that should be helpful in evaluating such costs. We provide a detailed summary of the structures employed by the TSP and by TIAA-CREF to offer individual

annuities to their participants. Our goal is to inform discussion of potential options and structures for providing annuities under individual account systems that might be considered as part of a Social Security reform plan.

The paper is divided into four sections. The first presents updated information on the expected present discounted value of annuity payouts in the market for individual single-premium-immediate annuities. These calculations draw on data for annuity premiums and payouts in June 1998, and extend the analysis in MPWB (1999) to consider individual annuities purchased through agents and brokers as part of qualified retirement saving plans (like IRAs) as well as in non-qualified accounts. The results in this section indicate that the present value of annuity payouts, relative to premium costs, has increased in recent years.

Section two examines the annuity options that are available to individuals who participate in the federal government's TSP. This is a large, voluntary, 401(k) plan that is available to federal employees. We present information on the structure of the "request for proposals" that the TSP issues when it solicits bids from private insurance companies that may wish to provide life annuities to TSP participants. We also present information on the payouts associated with individual annuities purchased through this plan.

Section three describes the annuities offered by TIAA-CREF, which provides basic and supplementary pension plans to the employees of universities and other nonprofit educational and research institutions. TIAA annuities, which include a non-guaranteed element, offer payouts that are among the highest in the individual annuity market owing to their superior investment returns and low expenses. TIAA-CREF variable annuities offer payouts that reflect, on at least an annual basis, the investment experience of various underlying equity, fixed income, and real estate investment portfolios.

The conclusion provides a summary and suggests several topics related to the cost of annuitization that require further investigation and analysis.

### 1. Individual Annuities Offered through Agents by Commercial Insurance Companies

With individual non-participating, single-premium-immediate life annuities offered by commercial life insurance companies, individuals make an initial premium payment and typically begin receiving annuity payouts in the month after their purchase. We focus on non-participating annuities, which provide a fixed and guaranteed benefit payment.

Premiums for life annuities are reported each year in A. M. Best's publication Best's Review: Life and Health. We analyze data from the August 1998 issue, which presents the results of an annuity market survey carried out at the beginning of June 1998. The Best's data corresponds to single-premium annuities with a \$100,000 premium. Ninety-nine companies responded to the survey, reporting information on the current monthly payouts on individual annuities sold to men and women at ages 55, 60, 65, 70, 75, and 80. Companies also reported their payouts for similar annuities purchased with funds in qualified retirement saving plans. Qualified annuities must begin payouts by age 70, so there is no data for qualified annuities that start at ages 75 or 80. Roughly two-thirds of the companies reported the same payout value for both the qualified and non-qualified annuity, while one-third reported different values. Virtually all companies reporting differences between qualified and non-qualified annuities for men, or women, at a given age reported the same qualified annuity payouts for men and women of the same age, reflecting their use of a "unisex" mortality table in pricing the qualified annuities.

Table 1 provides summary information on the monthly annuity payouts associated with a representative set of annuity products. Each entry in the table shows the monthly payout per \$100,000 of annuity premium. Since earlier research has documented wide dispersion in the annuity payouts offered by different companies, we report both the average payout across companies as well as the average payout for the ten firms that offered the highest payout products. A 65-year-old man purchasing a \$100,000 single-premium annuity would receive, on average, a monthly payment of \$733, or \$8,793 per year, for life. Because women live longer than men on average, a 65-year-old woman paying the same \$100,000 premium would receive about 10 percent less, \$662 per month or \$7939 per year. These average payouts are roughly eight percent lower than the payouts in the 1995 Best's survey, which

provided the basis for the analysis in MPWB (1999). This presumably reflects the decline in interest rates since 1995.

One important feature of annuity prices, which is present in the June 1998 data as well as in that for earlier dates, is the substantial variation in the payouts offered by different insurance companies. The average monthly payout for the ten companies with the highest payout for a 65-year-old man, for example, is \$807, which is ten percent higher than the average payout for all firms. There are similar differences in the prices offered to annuitants at other ages. In MPWB (1999), we explored a variety of possible explanations for these payout differences, such as apparent differential riskiness of different insurance companies, but we did not find any systematic pattern in the payouts. (The companies offering the “Ten Highest Payout” annuities in Table 1 generally are small and medium-size life insurers.) Payout differences across firms may reflect different assumptions about mortality rates, different rate of return assumptions in pricing policies, and differences in administrative costs and expense ratios. The heterogeneity in annuity prices suggests that if individuals were allowed to purchase their own annuity contracts in a system of “individual accounts,” different individuals might receive substantially different annuity benefits.

Unfortunately, we do not have data on the volume of annuities sold by different firms in the Best’s database, which would help judge the actual extent of payout dispersion in the annuitant population. In addition, such information would help to determine whether the surveyed rates represent active lines of business or are just used to bolster illustrations in sales materials for deferred annuities. Our calculations below focus on cases in which individuals purchase annuities that offer the average payout, but it should be recognized that in practice, some individuals would purchase policies that offered lower payouts, and some would purchase policies with higher payouts.

Table 1 presents information on non-qualified as well as qualified annuities. For men, the average monthly payout on qualified annuities is below that on non-qualified annuities, as a result of the use of “unisex” mortality tables in pricing the qualified annuities offered by some insurance companies. For a 65-year-old man, a qualified

annuity offers payouts that average about 1.8 percent less than payouts on non-qualified annuities. For women, the pattern is reversed. The average payout from qualified annuities is greater than that from non-qualified annuities. For a 65-year-old woman, qualified annuities offer an average payout that is roughly 1.5 percent greater, each month, than the average payout for non-qualified annuities.

To provide insight on the administrative and other costs associated with individual annuity products, we compute the expected present discounted value (EPDV) of payouts for the average annuity product. We compare this EPDV with the premium cost of the annuity. This yields a measure of the “money’s worth” of the individual annuity, as in Warshawsky (1988), Friedman and Warshawsky (1988, 1990), and MPWB (1999).

The formula we use to calculate the EPDV of a nominal annuity with a monthly payout  $A$ , purchased by an individual of age  $b$ , is:

$$(1) \quad V_b(A) = \sum_{j=1}^{12*(115-b)} \frac{A * P_j}{\prod_{k=1}^j (1 + i_k)}$$

The upper limit of the summation,  $12*(115-b)$ , is the number of months that a person of age  $b$  would live if he or she reached age 115. We assume that no one survives beyond this age.  $P_j$  denotes the probability that an individual of age  $b$  years at the time of the annuity purchase survives for at least  $j$  months beyond this purchase.

The term  $i_k$  denotes the one-month interest rate  $k$  months after the annuity purchase. In our baseline calculations, we measure these interest rates using the term structure of yields for zero-coupon Treasury “strips.” We estimate the pattern of monthly interest rates that are implied by these yields. The data on the zero-coupon yield curve is published each Thursday in the Wall Street Journal, and we use the data from the first Thursday in June 1998 to coincide with the timing of Best’s annuity price data. This approach to measuring discount rates differs from that in previous studies of the EPDV of nominal annuities. Friedman and Warshawsky (1990) assumed a constant nominal discount rate for all periods. MPWB (1999) used a term structure of riskless government bond yields but they did not use the yields on zero-coupon bonds to construct this yield curve. We used the zero-coupon yields because they seem the best available information on the discount rates for the present calculations.



We also consider a second set of discount rates that correspond to a risky corporate bond. To construct these discount rates we measure the difference between the yield on a BAA corporate bond and a 10-year Treasury bond in early June 1998. This yield spread was 137 basis points. We then add this “risk premium” to the entire term structure of riskless interest rates that we estimate from the Treasury yield curve.

We evaluate equation (1) using two sets of projected survival probabilities. Projections are needed because  $P_j$  describes the prospective survival experience of today’s annuity buyers. The first set of survival probabilities corresponds to the population at large. We use cohort mortality rate projections developed by Bell, Wade, and Goss (1992) at the Social Security Administration’s Office of the Actuary. One of the key difficulties in evaluating the effective cost of purchasing an annuity, however, is that the pool of actual annuity purchasers has different mortality experience than the population at large. There is “adverse selection” in this market; annuitants tend to have longer life expectancies than individuals in the broader population. From the standpoint of an insurance company writing annuities, the annuitant mortality table must be used to determine the relationship between premium income and the expected present discounted value of payouts. Adverse selection is a “cost” of annuitization from the perspective of an individual in the population at large.

One important question about the potential impact of expanding individual account retirement saving vehicles is how this expansion would affect the degree of adverse selection in the annuity market. A universal system of individual accounts, coupled with mandatory annuitization, would reduce adverse selection, although it would not eliminate it entirely because individuals would still presumably be allowed choices among annuity options and the age of settlement. The account-balance-weighted mortality table might, however, differ from the population mortality table because of income-related differences in mortality rates.

The second set of projected mortality rates that we use corresponds to that for current annuitants. MPWB (1999) develop an algorithm that combines information from the new Annuity 2000 mortality table (Johansen (1996)), the older 1983 Individual Annuitant Mortality table, and the projected rate of mortality improvement in the Social Security Administration’s population mortality tables. The algorithm generates projected mortality rates for

the set of annuitants that purchase annuity contracts in a given year. There are substantial differences between the population and annuitant mortality rates. MPWB (1999) show that in 1995, the annual mortality rate for annuitants between the ages of 65 and 75 was roughly half the mortality rate for those in the general population. This translates into a substantially larger EPDV of annuity payouts when we use the annuitant mortality table, rather than the population mortality table, for valuation.

We focus exclusively on valuing annuities in a pre-tax environment. While this follows in the tradition of most previous studies, MPWB (1999) also report information on the after-tax value of annuity payouts, recognizing that payouts from non-qualified annuities are partially taxable and using an after-tax nominal interest rate for discounting. The expected present discounted value of annuity payouts relative to premium costs was very similar in the pre-tax and post-tax cases, however, so we focus on the simpler pre-tax case in this analysis.

Table 2 reports our estimates of the expected discounted value of annuity payouts using the all-company average payout rates from Table 1. The first column shows calculations based on our estimate of the 1998 cohort mortality table for the general population, while the second column presents calculations based on the 1998 cohort mortality table for annuitants. The first panel presents results using riskless Treasury bond discount rates, while the second panel corresponds to our “risk adjusted interest rate” discount factor. We report the expected present discounted value of annuity payments per premium dollar. Using the general population mortality tables for a 65-year-old man, and the Treasury yield curve, the value per premium dollar for a life annuity is 0.849 for a non-qualified annuity. For a woman of the same age the average value is 0.875. When we value the same annuities using the annuitant mortality table, the expected present discounted value of payouts rises to 0.970 for men, and 0.952 for women. These values are closer to unity than the estimates in previous studies that have used the riskless yield curve to discount annuity payouts.

The lower panel of Table 2 reports our findings using riskier interest rates. In this case the expected discounted value of payouts is lower than in the first panel. The calculations using the population mortality table suggest that the EPDV of payouts is between 75 and 80 cents per premium dollar. Using the mortality table for

annuitants raises this estimate to between 82 and 87 cents per dollar. Whether it makes more sense to use the riskless or the risky discount rate is open to some question. The historical default risk on annuity payouts has been extremely low, so annuity purchasers probably view their annuity income stream as riskless. Yet, the portfolio held by insurance companies that offer annuity products is not restricted to riskless Treasury securities. It is clear from the results in Table 2 that assumptions about the risk premium that should be included in the discount factor have an important effect on the estimated level of annuity payouts relative to premium costs.

In Table 2, payout values per premium dollar that are less than unity imply that an annuity purchaser would effectively face a "transaction cost" when purchasing an annuity from a commercial insurance carrier. This is equivalent to purchasing an actuarially fair annuity, defined as one for which the expected present discounted value of payouts equals the policy's premium cost, but which involves having to give up a fraction of one's wealth before investing the remainder in this annuity product. An annuity with payouts that have an expected present discounted value equal to the premium cost is likely to be unattainable, since this does not allow for any administrative costs, premium taxes, corporate taxes, commissions, advertising, overhead, assumption of risks, or other costs on the part of the insurance company selling the policy.

The difference between the EPDV calculations based on the population mortality table, and those based on the annuitant mortality table, provides some insight on the costs of adverse selection in the individual annuity market. For example, for an annuity sold to a 65-year-old man, the cost of adverse selection is 12.1 percent of the annuity premium (97.0 – 84.9). This is slightly less than the estimated cost of adverse selection in several previous studies of the annuity market, but still of roughly the same magnitude. When we use the "risky term structure" to perform the annuity valuation exercise, the resulting estimates suggest that adverse selection accounts for a smaller fraction of the differential between the EPDV of payouts, and the premium cost, for a randomly selected individual in the population.

The findings in Table 2 suggest that the insurance companies offering annuities are currently charging annuitants less for the administrative, sales, and other charges associated with individual annuity products than

previous studies have suggested. This move toward more aggressive pricing may alternatively reflect declining investment risks to insurance companies, rising competition in the annuity market, or slow adaptation of the assumed mortality tables to improvements in life expectancy. An important issue for further analysis is the source of time series variation in the EPDV, relative to premium costs, for individual annuities.

Calculations like those in Table 2 are often interpreted as suggesting that annuities are “expensive,” because a 65-year-old buyer with the average mortality in the population gives up at least 15 cents per dollar of premium in order to buy an annuity. Although it is true that the expected present discounted value of annuity payouts is less than the cost of the annuity, it does not follow that annuities are unattractive to those in the population at large. Results on the utility gains associated with annuitization for representative individuals, with plausible risk tolerance and facing the population mortality risk, suggest that the gains from avoiding uncertainty about length of life are sufficient to warrant purchasing an annuity, even if the EPDV is substantially below the premium amount. MPWB (1999) report simulation results that support this conclusion. They also suggest that these results are sensitive to several features of the economic environment. In particular, individuals who already have a substantial share of their retirement wealth in an annuitized form, such as Social Security or a defined benefit pension plan, will be willing to pay less for an annuity. Married individuals also tend to value annuities less than single individuals. Brown and Poterba (1998) show that this is because of the partial “mortality-risk pooling” that takes place within the household. Finally, there may be a perception among investors of better value from life annuities when interest rates are low.

## 2. Individual Annuities Available to Participants in the Federal Thrift Saving Plan

The last section described individual annuity policies that are universally available in the private annuity market. In this section and the next, we describe policies that are available only to participants in two large group retirement saving plans. The experience with these plans may provide some insight on the potential operation of annuitization options under various government “individual accounts” saving programs.

The Thrift Savings Plan (TSP) is a 401(k) defined contribution retirement plan for federal employees. Congress established the TSP in the Federal Employees' Retirement System (FERS) Act of 1986. For federal employees hired after December 31, 1983, the TSP is an integral part of the retirement income package, which also includes Social Security and the FERS Basic Annuity, a standard defined benefit pension plan. For federal employees hired before 1984 who did not elect to switch to FERS, the TSP is a voluntary supplement to the Civil Service Retirement System (CSRS) annuity, a generous backloaded defined benefit plan.

Employees in FERS can contribute up to 10 percent of pay to the TSP. The federal government contributes 1 percent of pay automatically, matches the first 3 percent of pay contributed by the employee dollar for dollar, and matches the next 2 percent at 50 cents on the dollar. Employees in CSRS can contribute up to 5 percent of pay to the TSP, but receive no federal government contributions. For all employees, contributions to the TSP are capped at \$10,000 per year. There are no non-discrimination requirements limiting contributions, as occurs in the private sector, although the same dollar limits on contributions apply. There is full and immediate vesting for employee and government matching contributions and earnings, while the service requirement to vest in the automatic government contribution and earnings is generally three years. The service requirement for TSP eligibility is as long as one year.

Contributions can be directed to three investment funds: a short-term government securities (G) fund, a common stock index (S&P500) (C) fund, and a fixed-income index (Lehman Brothers Aggregate) (F) fund. There are plans to add two more investment choices: a small-capitalization stock index fund and an international stock index fund. All investment funds use only a passive indexation strategy. Valuation occurs on a monthly basis; interfund transfers occur at the end of the month. Redirection of future contributions among the various investment funds as well as enrollment can only be done during semiannual open seasons in the winter and summer months. Account balance statements are sent out semiannually. Loans are allowed from employee contributions and earnings while the participant is in federal service. Limited in-service withdrawals for financial hardship or after reaching age 59 ½ are also allowed.

After a Federal employee leaves government service, there are three ways to withdraw assets from the TSP: a life annuity, a lump sum, or a series of monthly payments that may be used in any combination. The lump sum or monthly payments can be rolled over to another qualified retirement plan, such as an IRA. Like other retirement plans, balances in a TSP account are subject to the federal minimum distribution requirements, mandating distributions after age 70 ½ according to IRS life expectancy tables. Warshawsky (1998) provides a detailed description and analysis of these requirements.

The Federal Retirement Thrift Investment Board (FRTIB), an independent federal agency, administers the TSP. Governance of the agency is carried out by a five-person, part-time Board of presidential appointees and by a full-time Executive Director selected by the appointees. The Board members and Executive Director are fiduciaries for the TSP, and they are required to act solely in the interest of participants. Administrative and most investment expenses are paid out of investment earnings and forfeitures of the automatic one-percent-of-pay contributions, not through any annual congressional appropriation. In 1997, these expenses were 0.09 percent of assets, or nine basis points. This gross expense ratio has declined rapidly from 67 basis points in 1988 as average TSP account size has grown. The FRTIB controls a single record keeping system, coordinating among 130 different Federal agency payroll systems. Administrative personnel throughout the Federal Government also assist with administration for, and education of, participants.

The latest available data show that participation in the TSP by FERS employees is 86.1 percent, and by CSRS employees is about 61 percent. As of October 1998, the TSP had 2.4 million individual accounts, \$71.5 billion in investment assets (\$28.3 billion in the G fund, \$39.2 billion in the C fund, and \$4.0 billion in the F fund), and loans totaling more than \$2.4 billion outstanding. During 1997, the TSP received \$7 billion in contributions and disbursed almost \$1.4 billion in benefits. In dollar terms, most payments are disbursed as transfers to IRAs and other qualified plans; the second and third largest disbursement categories are lump sums and death benefits. Net investment income, which equals the net change in market value plus investment earnings, was over \$8.6 billion.

## 2.1 TSP Life Annuity Payment Options

Federal law requires the FRTIB to make available to participants who have left federal service five types of life annuities: a single life annuity with level payments, a single life annuity with increasing payments, a joint life annuity (with spouse) with level payments, a joint life annuity (with spouse) with increasing payments, and a joint life annuity (with someone other than a spouse who has an insurable interest in the participant) with level payments. Monthly payouts begin thirty days after a TSP annuity is purchased. Joint life annuities are available either as 50 percent or 100 percent survivor annuities. In an increasing payment annuity, the amount of the monthly payment can change each year on the anniversary date. The amount of the change is based on the change in the Consumer Price Index (CPI-W). Increases cannot exceed 3 percent per year, but monthly payments cannot decrease even if the CPI declines. The fact that the TSP offers a kind of inflation-indexed annuity is of some note. One concern sometimes raised about the private annuity market in the United States has been that most annuities are specified in nominal rather than real terms and that, as such, they expose annuitants to inflation risk. It is noteworthy that partially-indexed TSP annuities were offered by a private insurance carrier prior to the introduction of inflation-linked Treasury bonds in the United States.

The FRTIB offers two additional annuity features: cash refund and ten-year certain. Under these features minimum amounts will be paid to a named beneficiary if the participant (and his or her joint annuitant, if applicable) dies before the minimum amounts have been paid out. In particular, under a cash refund, if the participant dies before an amount equal to the balance used to purchase the annuity has been paid out, the difference between the purchase balance and the sum of monthly payments already made will be paid to the beneficiary in a lump sum. Under a ten-year certain annuity, if the participant dies before receiving annuity payments for a 10-year period, payments will continue to the beneficiary for the rest of the 10-year period. This latter feature, however, cannot be combined with a joint life annuity in the TSP. The TSP does not offer any variable annuities with payouts linked to the investment performance of an underlying fund or asset class.

## 2.2 The Most Recent Request for a Private Insurance Carrier to Supply TSP Annuities

TSP annuities are purchased from a commercial annuity vendor. They are not guaranteed by the federal government, but depend on the annuity issuer's claims-paying ability. These tax-qualified, single-premium immediate annuities are currently provided through a Master Annuity Contract between the FRTIB and Metropolitan Life Insurance Company (MetLife), a company chosen by the FRTIB. The competitive bidding process is handled through a request for proposal (RFP) inviting submissions to provide annuity services. The following is a summary of the RFP issued in July 1995 by the FRTIB inviting submissions to provide annuity services. The prior RFP was issued in 1990 and was also awarded to MetLife for three years and a two-year extension. With some exceptions noted below, the 1990 RFP was identical to the 1995 RFP.

The RFP stated that the annuity program had to conform to certain requirements. In particular, the amount of the monthly payment from a life annuity provided by the insurance company (Contractor) per \$1,000 of single premium had to be an "interest-adjusted tabular monthly annuity payment for the specified annuity option times the Contractor annuity payment rate." The higher the annuity payout rate, the more attractive the annuity contracts are from the standpoint of the annuitant. The specified annuity options have been described above. The interest adjustment and tabular monthly annuity payment methods, described explicitly in the RFP, were based generally on actuarial formulas and will be summarized below. The Contractor annuity payment rate is the single number indicating the relative value of the entire bid; it has to be guaranteed for the term of the contract. In the 1990 RFP, there were two Contract rates, one for the first three years of the contract, and another for the last two years, if the TSP decided to extend the contract. Our calculations suggest that MetLife's winning 1995 bid had a Contractor rate of 1.039. This is not a statistic supplied by the FRTIB; it is based on our estimates, which have not been validated by the FRTIB.

The tabular monthly annuity payment approach was chosen as a mechanism to readily adjust annuity payments for new purchases to reflect changes in market interest rates over the course of the contract with the insurance company. This approach tends to reduce the interest rate risk of the Contractor and it was hoped would



lead to a more competitive Contractor annuity payment rate. Tabular monthly annuity payments were specified in the RFP based on two assumptions: (1) an interest rate index and (2) a mortality table. No explicit provision for expenses was allowed. The mortality table selected was the 1983 Individual Annuity Mortality table (1983 IAM) on a unisex basis, assuming 50 percent females and 50 percent males would be using the annuity program. Selection of the 1983 IAM was based on very limited mortality experience with TSP annuities since the start of the TSP in 1987. The gender distribution for the TSP population, as of December 1994, was 42 percent female and 58 percent male, although in older groups, the male share was higher, at 63 percent. In the 1990 RFP, the indicated mortality table was the 1971 IAM table based on 80 percent males and 20 percent females. In joint life situations, the second life was assumed to be 20% male and 80% female. The 1971 IAM was selected, according to the RFP, because its rates were similar to 90 percent of the mortality experienced between 1983 and 1987 under the CSRS; the 10 percent reduction of CSRS experience factors was to recognize projected future mortality improvement and adverse selection.

The interest rate index, calculated monthly, is a three-month moving average of the 10-year Treasury note constant maturity series. The monthly calculation of the interest rate index applies to new annuity purchases only; payments under previously issued annuities are not affected.

The table of monthly annuity payments presented in the RFP was based on the mortality table described above and a 7 percent interest rate. Table 3, copied from the RFP, shows the worksheet that describes the interest adjustment calculations. The interest adjustment factors were also presented in the RFP in tables for given age ranges and annuity option combinations. The factors were calculated as a simple linear interest rate adjustment by taking the ratio of the monthly payment at an 8 percent interest rate to the monthly payment at a 7 percent interest rate and subtracting 1; that is, the factors are just a linear interpolation. The adjustment factors are to be multiplied by the difference in the current interest rate index and 7 percent; this product in turn is to be multiplied by the tabular monthly annuity payment to produce the change in the monthly annuity payment, finally resulting in the interest-adjusted monthly annuity payment.

The RFP states that the interest adjustment factors are highly accurate at market interest rates between 7 percent and 8 percent. It also noted, however, that accurate adjustment would not be achieved if market rates were to differ greatly from the base 7 percent interest rate assumption. Therefore, if annuitants were disadvantaged, the FRTIB retained the right to recalculate the tabular monthly payments based on a revised interest rate index assumption reflecting significant long-term changes in market conditions. The November 1998 interest rate index is 5.25 percent; for a single life level payment annuity of \$1,000 issued to a participant age 65, the difference between a precisely calculated monthly annuity payment of \$7.02 and an interest-adjusted monthly annuity payment of \$7.40 is \$0.38, to the advantage of the annuitant. This outcome, of course, results in an unexpected loss for the insurance company.

As noted above, the Contractor also had to offer an increasing life annuity tied to year-over-year CPI changes (calculated as an average over July, August, and September), capped at 3 percent. The actuarial formula used in the RFP to produce the tabular monthly annuity payment assumes that the annual increases will always be 3 percent; if inflation, however, runs below 3 percent, as in recent quarters, the insurance company issuing these annuities will reap a windfall profit. Furthermore, newly purchased increasing level annuities are priced to the disadvantage of the TSP annuitant in the current economic environment with inflation rates below 2 percent.

The contract was to run for three years; the current contract expires at the end of December 1998. The FRTIB, however, has the option to extend the contract for two more years. Administration and reporting for annuities purchased under the terms of the contract are the responsibility of the insurance company through the termination of the last annuity purchased. There are numerous reporting requirements placed on the Contractor, pertaining to the types and amounts of annuities purchased, mortality experience, and significant corporate events of the Contractor. If the FRTIB views corporate events, such as loss of customers or change in agency rating, as particularly harmful, it has the right to terminate the contract at any time or to demand corrective actions.

In picking a winning bid, the RFP indicated that technical quality was more important than cost. Technical quality factors included the contractor's rating by Standard & Poor's, Moody's or Duff & Phelps (required to be

AA or higher), ability to do business nationally, a balance sheet indicating financial strength, demonstrated continuing profitability, diversification in lines of business, experience with large master annuity contracts, a sound business plan, and the quality of past performance. Cost factors were evaluated by sole reference to the Contractor annuity payment rate bid.

### 2.3 Current Annuity Payout Rates and Utilization Rates

The amount of the monthly payment coming from a TSP life annuity depends on the annuity options chosen, the age of the participant when the annuity is purchased (and the age of the joint annuitant, if applicable), the balance in the TSP account used to purchase the annuity, the market interest levels when the annuity is purchased, and the Contractor annuity payment rate. Table 4 shows initial monthly payments per \$100,000 premium for various issue ages and options for life annuities purchased in June 1998. For example, a level payment single life annuity purchased by a 65-year-old will provide \$763 monthly per \$100,000 premium. This is 4.2 percent greater than the average payout on a nonqualified annuities offered to men by commercial insurance firms (Table 1), and 6 percent greater than their average payout on qualified annuities. As a point of comparison, a qualified SPIA issued by Metropolitan Life through an agent to a 65-year-old in June 1998 will provide \$664 monthly per \$100,000 premium. The TSP interest rate index in June 1998 was 5.625 percent.

Table 4 demonstrates that initial monthly payments are increasing function of the age at which the annuity is issued, that they are higher for single as opposed to joint-and-survivor annuities, and that they are higher for level as opposed to increasing payment annuities. For example, for an individual age 65, the initial payment is 31 percent higher with a level payment compared to an increasing payment annuity. For someone age 65, the level monthly single life annuity payment is 25 percent higher compared to a level payment joint-and-survivor annuity.

Almost 12 percent of the TSP participant population is age 55 or older. Hence, each year, there should be a considerable number of retiring participants settling their TSP accounts potentially interested in purchasing a life annuity. At the same time, because most of the retiring federal workers are still CSRS as opposed to FERS participants, the TSP system currently represents a relatively unimportant component of the retirement resources of

the average retiring worker settling his TSP account. The significance of the TSP system for federal workers' retirement incomes will grow over time as the average size of the account balance increases and as FERS participants begin to retire.

Table 5 shows the basic type, number and amount of TSP annuities purchased between the inception of the program and September 1998. Over one thousand annuities worth over \$30 million were purchased in 1995, the high point thus far for TSP annuity activity. Since then, annual activity has fallen to about 700 purchased. It is possible that the absence from the option menu of a variable annuity whose payout is tied to the performance of the equity market, which boomed in 1996 and 1997, led to reduced interest in TSP annuities. The average size of a TSP annuity purchased has increased significantly, however, in line with the increase in the average size of a TSP account balance as the overall TSP program begins to mature. In 1990, the average annuity purchased was worth only \$8,500; by 1998, the average was over \$42,000.

Table 5 indicates that the majority of annuities purchased contain the joint-and-survivor option, most providing 100 percent benefit to the survivor. A large minority of annuities purchased, however, are for single lives. FRTIB statistics through March 1995 indicate that most annuities purchased, whether single or joint-and-survivor, are level payment with no cash refund or ten-year certain features chosen. The increasing payment annuity was chosen by less than 12 percent of annuity purchasers. Female participants are more likely than male participants to choose a single-life annuity over a joint-and-survivor annuity.

These statistics provide important information on the operation of the TSP annuitization program. The most important finding is that annuity payouts within the TSP annuity contract are approximately five percent greater than those in the private annuity market. This may reflect cost reductions associated with selling a large volume of annuities of a specified type, or a weakened competitive position of the annuity provider when negotiating with the federal government. If we use the TSP annuity payouts for a 65-year-old man in our EPDV algorithm, since these payouts are 4.2 percent greater than the average payout for commercial single premium non-qualified annuity policies at the same time, the expected present discounted value of payouts will also be 4.2

percent greater than the value reported in Table 2. In this case, we conclude that the EPDV is 0.886 times (or  $1.042 \times 0.850$ , where 0.850 is the entry in Table 2, column 2, row 2) the premium payment.

### 3. Individual Annuities Offered by TIAA-CREF for Pension Plan Participants

The Teachers Insurance and Annuity Association (TIAA) is a nonprofit stock life insurance company, organized under the laws of New York State. It was founded on March 4, 1918, by the Carnegie Foundation for the Advancement of Teaching, to aid education and research institutions by providing low-cost retirement products and counseling about lifelong financial security to their employees. TIAA is the companion organization of the College Retirement Equities Fund (CREF), the first company in the United States to issue a variable annuity. CREF was established in 1952 by a Special Act of the New York State Legislature and since 1988 has been registered with the SEC as an open end investment company. Together, TIAA and CREF form the principal retirement system for the nation's education and research communities. TIAA-CREF also offers, in addition to funding vehicles for employer-sponsored pension plans, a variety of other financial services including Individual Retirement Accounts, individual and group insurance products, mutual funds, trust services, and tuition saving plans.

The basic principles of the TIAA-CREF pension system in higher education, established as a result of a 1917 study by a group of educators and actuaries, still generally hold: (1) institutions provide immediately vested defined contribution plans sponsored by the employer (obviating the need for insurance agents selling individual annuity policies); (2) plans are funded by contributions from employers and employees adequate to provide acceptable incomes in retirement under reasonable assumptions; and (3) retirement accounts are owned by employees through individual TIAA and CREF retirement annuity contracts (creating portability as employees, particularly faculty and administrators, move from institution to institution). In this system, TIAA-CREF acts as a kind of multi-employer pension plan; achieving economies of scale and scope in investment management, plan design, and account administration; pooling risks; and acting in the best interests of plan sponsors and participants.

The “classic” TIAA-CREF basic pension plan consists of an immediately vested individual contract arrangement with a 7.5 percent-of-pay contribution from the employer and a 5 percent-of-pay contribution from the employee. Because each TIAA-CREF pension plan is sponsored by a separate institution, however, the contribution rates and other plan rules will differ across institutions. TIAA-CREF assists each institution in the establishment and administration of its pension plans, but the final decision on plan features is made by the sponsoring institution. If an employee wishes to make additional tax-favored contributions, he or she may do so through salary reductions paid to the basic pension plan or to a supplemental retirement annuity plan sponsored by the institution. Most pension plans established by educational institutions are governed by the requirements of section 403(b) of the tax code.

As of 1998, participants in TIAA-CREF pension plans may allocate their contributions and accumulations among ten different investment accounts, which can be categorized into four asset classes. There is some institutional control at each participating institution with respect to the accounts offered, and some institutions do not offer all of the accounts.

Table 6 shows these accounts and classes, with their inception dates, and asset amounts as of October 31, 1998. Ameriks, King, and Warshawsky (1997) trace the choices that TIAA-CREF participants have been making in recent years in their allocation of contributions and of accumulations under basic employer-sponsored pension plans. Although each of the investment accounts has unique risk and return characteristics, we will describe only the two largest and oldest accounts -- TIAA Traditional Annuity and CREF Stock Account.

For the Traditional Annuity -- a stable value account -- TIAA guarantees principal and a 3% interest rate for accumulations. All major ratings agencies currently give TIAA the highest possible ratings for its claims-paying ability. In addition, there are dividends declared by the TIAA Board of Trustees that remain in effect through the end of the “dividend year” and are added to the guaranteed interest rate. Dividends have been paid every year since 1948. The dividend schedules are somewhat complex, tied to the timing of past contributions and

intended to assure equity across groups of participants who contributed to TIAA at varied interest rate levels. Dividend levels are set at the discretion of the TIAA Board and reflect TIAA's investment experience.

To back its guarantees and to maximize dividends, TIAA invests in publicly traded bonds, direct loans to business and industry, commercial mortgages, and real estate. Many of the loans and mortgages (both domestic and foreign) entail long-term commitments, are relatively illiquid, and hence offer higher returns than publicly traded securities. TIAA's investment returns are consistently among the highest of general accounts in the life insurance industry. Because of the illiquidity of many of its loans, TIAA restricts payouts from the Traditional Annuity to life annuities or over a ten-year period. (Investment in the Traditional Annuity through SRAs, however, does not entail these restrictions, although the dividends paid on these accumulations are 50 basis points less than those on accumulations in the basic pension plans. Beginning in 1999, restrictions on converting from a TIAA lifetime annuity income to an equity based variable annuity will be relaxed, with transfers of up to 20 percent of income in each year permitted.) This restriction on payouts also encompasses the transfer of TIAA Traditional Annuity accumulations to the other TIAA and CREF investment accounts. All other accounts are variable, marked to the market daily, and generally have no restrictions on transfers or withdrawals. Individual institutions may impose restrictions on withdrawals by participants in their basic pension plans from the TIAA Traditional Annuity and from the variable accounts.

The CREF Stock Account is an omnibus growth and income equity account, investing in U.S. and foreign stocks, using a blend of investment styles. The domestic portion of the account, currently over 80 percent of the portfolio, is invested according to an "enhanced" index strategy. The index is the Russell 3000, and the enhancement refers to various quantitative trading techniques intended to take advantage of arbitrage opportunities. The remainder of the portfolio employs active management for domestic and foreign stocks. There are no guarantees of principal or investment return for CREF Stock or the other variable accounts. For the variable accounts, valuation occurs on a daily basis; interfund transfers occur at the end of each trading day.

Transfers of accumulated assets and redirection of future contributions among the various investment accounts can be done at any time through an automated telephone service and via the Internet. Account balance statements are sent out quarterly; balances are also available daily through telephone service centers and the Internet. An annuity benefit report is sent out annually, projecting for the individual, under reasonable assumptions, future retirement income flows under certain life annuity options and investment returns. Consultants offer individual and group counseling at regional offices or participating institutions.

Administrative and investment expenses for the TIAA-CREF pension system are paid from investment earnings. At the current level of about 30 to 35 basis points, these expenses are among the lowest in the insurance and mutual fund industries. The responsibility for oversight of TIAA-CREF management lies with its boards of trustees. Because TIAA and CREF, the main components of the parent organization, are incorporated under different laws and are regulated by different governmental agencies, there is one board for TIAA and another for CREF. A Board of Overseers ensures that TIAA-CREF is meeting its charter purposes; this Board also elects trustees to the TIAA Board. CREF participants directly elect CREF trustees, in the same manner as mutual fund shareholders who have votes in proportion to the shares they own. Members of the Boards are a diverse group of men and women, representing academic (faculty and administration), business, and philanthropic institutions, with a wide range of expertise and interests, including education, management, government, economics, finance, law, and corporate governance. Most Board members are themselves longtime TIAA-CREF participants; only two are TIAA-CREF executives.

Warshawsky and Ameriks (1996) report that pension coverage (at over 95 percent) and participation (at 80 percent) are significantly greater in the higher education sector than in the rest of the full-time labor force (71 percent and 59 percent, respectively). As of October 31, 1998, there were 1,792,942 participants in the accumulation phase and 290,616 participants receiving annuity income payments in the TIAA-CREF pension system, and 8,711 institutions of all sizes sponsored TIAA-CREF pension plans.



### 3.1 Life Annuity Payment Options

At one time, all TIAA-CREF basic pension plans allowed for distributions only through a life annuity or death benefit (supplemental plans have always been “cashable”). In 1988, this system-wide restriction was removed for basic plans, although a small number of sponsoring institutions chose to retain it. Hence, with the exception of accumulations in the TIAA Traditional Annuity, for most TIAA-CREF pension plans, when an employee leaves the service of his or her employer, accumulations can be withdrawn as a life annuity, in a lump sum, in a systematic series of payments, or in any combination of lump sum, systematic withdrawals and life annuities. In addition, for all plans, participants over age 70 ½ can, since 1991, withdraw funds through a minimum distribution option (MDO), and participants ages 55 and over can, since 1989, receive payments of current interest credited to TIAA accumulations through an interest-only payment retirement option (IPRO). A retirement transition benefit is also available from TIAA and CREF, whereby 10 percent of accumulations are available as a lump sum upon retirement.

Despite the flexibilities available, most TIAA-CREF participants still choose a life annuity when they retire. TIAA-CREF offers both single- and two-life annuities, with or without guaranteed periods of 10, 15, or 20 years. The options available for two-life annuities are two-thirds benefit to survivor, full benefit to survivor and half benefit to second annuity partner. Payout levels reflect the option chosen. Payments can be made on a monthly, quarterly, semi-annual, or annual basis.

Life annuities can be drawn from any of the investment accounts. The TIAA Traditional Annuity guarantees the interest rate (2½ percent) and mortality assumptions for payouts through life annuities. These payout guarantees actually begin in the accumulation phase and hence can be in effect for several decades. In addition, the TIAA Board declares annual dividends to annuitants.

There are two different life annuity payment methods available from TIAA -- standard and graded. For both methods, payment is based on assumed mortality, guaranteed interest, and dividends. Under the standard payment method, the initial income level is maintained until there is a change in dividends; year-over-year dividend

changes in the payout phase historically have been small. Under the graded payment method, initial income is based on a 4% payout. Any remaining dividends are reinvested and used to buy additional future income. This method was first proposed by Biggs (1969) and put in place by TIAA in 1982 to help protect annuitants from inflation. King (1995) calculated hypothetical payments under the graded method for various periods beginning in the 1970s and found that purchasing power was preserved, indeed enhanced, through 1995, although in the years of high inflation in the late 1970s and early 1980s, purchasing power lagged somewhat. Annuitants who initially choose the graded method can later switch to the standard method, but not vice versa.

Life annuities can also be drawn from any of the variable accounts. Payouts are entirely variable, reflecting the investment performance and expenses of the account and the mortality experience of annuitants using the account. Initial payments are calculated using the accumulation, the income option chosen, an assumed effective interest rate of 4%, and mortality assumptions, currently the unisex version of the 1983 IAM table set back two months for each complete year that has elapsed since March 31, 1986, to account for ongoing gains in longevity. After the initial payment, payment amounts change to reflect the performance of the investment portfolio either annually or monthly, at the option of the participant.

Although income from the variable accounts is generally more volatile than that from TIAA Traditional, participants with variable annuities are able to devise a retirement income portfolio more aligned with their risk tolerances. For the equity accounts, over long time periods, variable annuitants participate in general economic performance, which has been significantly positive in the United States and other countries over most recent historical periods. Annuitants may switch among the variable accounts or to TIAA Traditional Annuity on any business day, as often as once per calendar quarter. Income options, annuitant(s), and guaranteed period, however, must be maintained upon the switch.

### 3.2 Current Annuity Payout Rates and Annuity Utilization

Table 7 shows initial monthly payments per \$100,000 accumulation in a basic pension plan for various issue ages and options for life annuities issued by TIAA-CREF on June 1, 1998. For TIAA, the annuity payout

reflects current dividend levels assuming that the participant has made contributions from salary, increasing at 5 percent annually, to TIAA since June 1, 1968; various TIAA vintages are represented in this example and produce a blended investment return of 6.9 percent. For CREF, the assumed interest rate is 4 percent. Future payouts on a CREF annuity will reflect investment performance in an underlying variable investment account, and if returns exceed 4 percent, payouts will increase.

For a single life annuity issued to a 65-year-old, TIAA is paying, as of June 1, 1998, an initial monthly payout of \$759 per \$100,000 accumulation under the standard payment method. This value is higher than the average commercial market payout for men (\$732 in non-qualified accounts) and even more dramatically greater than that for women (\$662). For a joint-and-survivor annuity issued to a couple, both of whom are 65 years old, TIAA is paying \$670 monthly per \$100,000, higher than the payout rate for TSP annuities. With a 4 percent assumed interest rate, CREF is initially paying on any of its accounts \$597 monthly for the single-life annuity, and \$507 monthly for the joint-life annuity.

Comparing the TSP (Table 4) and TIAA (Table 7), we note that TIAA offers superior rates on joint-and-survivor annuities at all ages except the oldest, and higher rates on single life annuities at the younger ages. These generally higher rates result from TIAA's superior investment performance. Comparisons between the TSP and TIAA should be done cautiously, as payouts from TIAA may fluctuate somewhat, either downward or, as has occurred in the last several years, upwards. Moreover, as noted above, with current market interest rates significantly below the 7 percent assumption of the tabular annuity rates, the TSP offers higher rates than it would if its annuity rates were set precisely like TIAA's. In addition, where mortality is a more important consideration, for example in single-life annuities issued at older ages, the mandated use of a liberal, that is, old and outdated, mortality table by the TSP will lead to higher annuity income rates. It is impossible to compare the increasing payment TSP annuity with a CREF annuity because the assumed interest rate is fixed at 4 percent for CREF, while it is (implicitly) constantly changing for TSP. In June 1998, the (implicit) TSP assumed interest rate for its increasing payment annuity was 2.625 percent = (5.625 percent – 3 percent).

About 16,300 TIAA-CREF participants converted some or all of their accumulations into streams of periodic income in 1997. Of these, 11,700 chose a life annuity, 2,200 the MDO, 1,500 the IPRO, and 900 systematic withdrawals. The MDO is particularly popular among participants age 70 1/2 and older; nearly three-quarters of this age group chose this form of income stream in 1997. This opting for flexibility represents an expected movement away from life annuities since 1988, when a life annuity was the only distribution form available. Settlements into life annuities are occurring at older ages and partial settlements into life annuities are becoming more common, as participants choose to keep their options open longer. The graded benefit payment method for TIAA Traditional accumulations has also grown more popular: Almost a quarter of new TIAA annuitants now select this method compared to 2 percent when it was first introduced in 1982.

King (1996) looked at the choices in 1994 of TIAA-CREF participants among the life annuity payout options. About three-quarters of male primary annuitants chose the two-life annuity, while about two-thirds of female primary annuitants chose the single life annuity. About a third of the male and female annuitants choosing the single life annuity selected no guaranteed period; the rest chose fairly evenly among 10-, 15-, and 20-year guaranteed periods. Nearly all annuitants choosing a two-life annuity selected a guaranteed period. Male annuitants among the two-life annuity group predominantly selected the full benefit to survivor form. Female annuitants in this group also favored the full benefit to survivor, but were more likely than men to select the half benefit to second annuitant form. Among payout sources, the majority of annuity payouts in 1994 came from TIAA, but a sizable minority of payouts were from a CREF variable annuity. More recently, there has been a trend toward payouts from the variable accounts. This may provide some guidance for the design of annuitization systems within other individual account structures. In particular, it suggests a substantial demand for variable as opposed to fixed annuities.

#### 4. Conclusions and Future Directions

The results in this paper provide information on the costs of obtaining an individual annuity in three different market environments. The first environment, the current market for single-premium individual annuities, is one in which each annuity buyer has full discretion in choosing among different insurance carriers, and no economies of scale occur through participation in a group retirement saving program. The costs in this environment are higher than in the other two settings that we consider, namely the federal government's Thrift Saving Plan and the TIAA-CREF retirement system that is available to college and university employees. This is reflected in the higher average annuity payouts offered in these plans, for a given premium, than in the market at large. We show that the annuity payouts available to TSP participants in June 1998 were roughly four percent greater than those available (on average) in the private market. It is difficult to make a precise comparison between the annuity payouts of TIAA-CREF, the private market, and the TSP, because of differences between non-guaranteed-element, variable, and non-participating annuity products. However, the TIAA-CREF payouts appear to be greater than those of the TSP or (on average) the private market.

Our results provide some potential guidance on the costs of annuitization, but also raise questions. One concerns the time series pattern of annuity payouts relative to the premiums for single-premium annuity policies. Comparing the calculations in Warshawsky and Friedman (1990), MPWB (1999), and the present paper suggests that the expected present discounted value of annuity payouts has been rising, relative to premiums, for the last decade. Explaining this trend is an important issue for further investigation. It may result from declining risk perceived by the insurance companies that offer these products, particularly with respect to interest rate fluctuations. It could also reflect a failure to take into account ongoing improvements in mortality. For example, consider what would happen if annuity providers were to use information from a given past year (say 1983, the date of the last major release of annuitant mortality rates by the Society of Actuaries) on the mortality rates of annuitants. If actual mortality rates are declining, then the expected present discounted value of payouts will be

rising. While this explanation is consistent with what we observe in the annuity market, we are not aware of any way to distinguish this possibility from alternative explanations.

A second question concerns the design of a menu of annuity options that might be available for potential annuitants. Experience with TIAA-CREF suggests that a substantial number of participants are interested in variable as opposed to fixed annuities. While TSP participants can choose annuities which are partially inflation-indexed, relatively few do; the TSP experience, however, does not provide any evidence on whether annuitants would choose real (fully indexed), partially indexed, or nominal annuities if they could make such a decision. Further work should investigate the behavior of individual annuitants in settings where they can choose among different potential annuity options.

## REFERENCES

- Ameriks, John, Francis King, and Mark Warshawsky. 1997. Premium Allocations and Accumulations in TIAA-CREF -- Trends in Participant Choices among Asset Classes and Investment Accounts. TIAA-CREF Research Dialogues Issue Number 51, July.
- Bell, Felicitie, A. Wade, and S. Goss. 1992. Life Tables for the United States Social Security Area 1900 – 2080. Actuarial Study No. 107, Social Security Administration, Office of the Actuary.
- Biggs, John H. 1969. Alternatives in Variable Annuity Benefit Design. Transactions of the Society of Actuaries, 21 (November), 495-528 (including discussion).
- Brown, Jeffrey R. and James M. Poterba. 1998. Joint and Survivor Annuities and the Demand for Annuities by Married Couples. Cambridge: Massachusetts Institute of Technology. Mimeograph.
- Friedman, Benjamin, and Mark Warshawsky. 1988. Annuity Prices and Saving Behavior in the United States. In Z. Bodie, J. Shoven, and D. Wise, eds., Pensions in the US Economy. Chicago: University of Chicago Press, pp. 53-77.
- Friedman, Benjamin, and Mark Warshawsky. 1990. The Cost of Annuities: Implications for Saving Behavior and Bequests. Quarterly Journal of Economics, February, 105 (1), pp. 135-154.
- Gramlich, Edward M. 1996. Different Approaches for Dealing With Social Security. Journal of Economic Perspectives 10 (Summer), pp. 55-66.
- Johansen, R. 1996. Review of Adequacy of 1983 Individual Annuity Mortality Table. Transactions of the Society of Actuaries, 47, pp. 101 - 23.
- King, Francis. 1995. The TIAA Graded Payment Method and the CPI. TIAA-CREF Research Dialogues Issue Number 46, December.
- King, Francis. 1996. Trends in the Selection of TIAA-CREF Life-Annuity Income Options, 1978-1994. TIAA-CREF Research Dialogues Issue Number 48, July.
- Mitchell, Olivia, James M. Poterba, Mark Warshawsky, and Jeffrey R. Brown. 1999. New Evidence on the Money's Worth of Individual Annuities. American Economic Review 89 (forthcoming).
- Warshawsky, Mark. 1988. Private Annuity Markets in the United States. Journal of Risk and Insurance, September, 55(3), pp. 518-528.
- Warshawsky, Mark. 1997. The Market for Individual Annuities and the Reform of Social Security. Benefits Quarterly, Third Quarter, pp. 66-76.
- Warshawsky, Mark. 1998. Distributions from Retirement Plans: Minimum Requirements, Current Options, and Future Directions. TIAA-CREF Research Dialogues Issue Number 57, September.
- Warshawsky, Mark and John Ameriks. 1996. Pensions and Health Benefits for Workers in Higher Education," TIAA-CREF Research Dialogues Issue Number 49, December.

Table 1: Payouts on Individual Annuity Policies Offered By Commercial Insurers, June 1998

Age and Gender of Annuity Buyer	Average Monthly Annuity Payout (Per \$100,000 Premium)		Average Monthly Annuity Payout for Ten Annuity Products Offering Highest Payouts (Per \$100,000 Premium)	
	Qualified	Non-Qualified	Qualified	Non-Qualified
Male, 55 Years Old	596.22	606.44	671.60	675.70
Male, 65 Years Old	719.91	732.73	809.30	806.58
Male, 75 Years Old	n.a.	988.84	n.a.	1084.69
Female, 55 Years Old	568.46	563.04	639.70	630.62
Female, 65 Years Old	671.47	661.62	748.77	728.35
Female, 75 Years Old	n.a.	857.69	n.a.	948.51

Source: Best's Review: Life and Health Edition (August 1998), and authors' tabulations.

Table 2: Expected Present Discounted Value of Annuity Payouts, Per Dollar of Premium Payment, Individual Annuity Policies Offered by Commercial Insurers, June 1998

Age and Gender of Annuity Buyer	EPDV/Premium Using Population Mortality Table		EPDV/Premium Using Annuitant Mortality Table	
	Qualified	Non-Qualified	Qualified	Non-Qualified
Treasury Discount Rates				
Male, 55 Years Old	0.873	0.888	0.953	0.970
Male, 65 Years Old	0.835	0.850	0.953	0.970
Male, 75 Years Old	n.a.	0.815	n.a.	0.966
Female, 55 Years Old	0.902	0.893	0.959	0.950
Female, 65 Years Old	0.888	0.875	0.966	0.952
Female, 75 Years Old	n.a.	0.815	n.a.	0.940
"BAA Discount Rate"				
Male, 55 Years Old	0.773	0.786	0.835	0.849
Male, 65 Years Old	0.759	0.772	0.856	0.871
Male, 75 Years Old	n.a.	0.794	n.a.	0.891
Female, 55 Years Old	0.790	0.782	0.833	0.825
Female, 65 Years Old	0.797	0.785	0.860	0.847
Female, 75 Years Old	n.a.	0.794	n.a.	0.861

Source: Authors tabulations based on data in Table 1 and information described in the text.



**Table 3: Annuity Calculation Worksheet From RFP For Annuities Provided to Federal Thrift Saving Plan Participants**

## PARTICIPANT INFORMATION

(1) Annuity option	<u>J&amp;S-50%, level, no cash refund</u>
(2) Participant age	<u>62</u>
(3) Joint annuitant age (if a joint life annuity)	<u>59</u>
(4) Age difference (if a joint life annuity): line (2) line (3). Joint annuitant is	<u>3 years younger/older</u>
(5) TSP account balance	<u>\$30,000.00</u>

## CALCULATION OF MONTHLY ANNUITY PAYMENT (BEFORE INTEREST ADJUSTMENT)

Amount available for annuity in thousands of dollars: line (5) ÷ \$1,000	<u>30.00000</u>
Monthly annuity factor per \$1,000 account balance For single life annuity, use Table J.2.1.a. For joint life annuity, use Table J.2.1.b.	<u>7.64 (see B.3., Step 1)</u>
(8) Preliminary estimate of monthly annuity payment	<u>\$226.20 (see B.3., Step 2)</u>

## INTEREST ADJUSTED MONTHLY ANNUITY PAYMENT

(9) Current interest rate index	<u>6.625</u>
(10) Interest rate index used in monthly annuity factor tables	<u>7.000</u>
(11) Index increase (decrease): line (9) line (10)	<u>(0.375)</u>
(12) Interest adjustment factor For single life annuity, use Table J.2.2.a. For joint life annuity, use Table J.2.2.b.	<u>0.086</u>
(13) Adjustment multiplier: line (11) x line (12)	<u>(0.032)</u>
(14) Increase (decrease) to estimate: line (8) x line (13)	<u>(\$7.24)</u>
Interest adjusted monthly annuity payment Line (8) + line (14)	<u>218.96 (see B.3., Step 3)</u>

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Source: RFP-TIB-95-02.

**Table 4****Initial Monthly Payments per \$100,000 Accumulation from TSP Annuities  
Purchased in June 1998**

<u>Age</u>	<u>Single Life Annuity</u>		<u>Joint and Survivor Annuity</u>	
	<u>Level Payment</u>	<u>Increasing Payment</u>	<u>Level Payment</u>	<u>Increasing Payment</u>
55	\$635	\$446	\$568	\$382
60	688	504	601	422
65	763	581	650	477
70	858	676	709	540
75	996	813	796	628

**Notes:** Increasing payment annuity is based on the year-over-year change in the CPI, up to 3%. The joint-and-survivor annuity rates quoted here are for benefits of 100% to a survivor the same age as the annuitant. All annuity rates are unisex. There are no guaranteed periods or cash refund features chosen.

**Table 5**

**Basic Type, Number and Amount of TSP Annuities Purchased,  
1988 through September 1998**

**Number of Annuities Purchased**

<u>Year</u>	<u>Single Life</u>	<u>Joint Life - 50%</u>	<u>Joint Life - 100%</u>	<u>Insurable Interest</u>	<u>Total</u>
1988	3	4	10	0	17
1989	56	33	51	1	141
1990	126	57	103	1	287
1991	248	114	221	2	585
1992	246	111	188	0	545
1993	394	173	226	4	797
1994	366	177	285	7	835
1995	483	220	338	4	1,045
1996	340	137	249	3	729
1997	326	135	240	6	707
1998*	241	108	180	7	536

**Amount of Annuities Purchased (in Millions)**

<u>Year</u>	<u>Single Life</u>	<u>Joint Life - 50%</u>	<u>Joint Life - 100%</u>	<u>Insurable Interest</u>	<u>Total</u>
1988	\$0.015	\$0.026	\$0.049	\$0.000	\$0.090
1989	0.359	0.240	0.39	0.005	0.914
1990	1.050	0.498	0.892	0.005	2.445
1991	2.664	1.516	2.599	0.018	6.797
1992	3.409	1.847	3.044	0.000	8.300
1993	6.544	3.201	4.322	0.037	14.105
1994	7.080	4.565	6.927	0.117	18.691
1995	12.187	7.392	10.524	0.133	30.236
1996	9.751	5.370	8.815	0.123	24.060
1997	11.475	5.916	9.875	0.209	27.476
1998*	9.287	5.749	7.399	0.149	22.585

\* Through September  
Source: FRTIB

**Table 6****TIAA-CREF Investment Accounts and Asset Classes**

<u>Asset Class</u>	<u>Investment Account</u>	<u>Inception Date</u>	<u>Asset Amounts as of October 31, 1998</u> (In millions)
Guaranteed	TIAA Traditional Annuity (General Account)*	April 23, 1918	\$99,008*
Equity	CREF Stock	July 1, 1952	104,069
	CREF Social Choice**	March 1, 1990	2,987
	CREF Global Equities	May 1, 1992	5,405
	CREF Growth	April 29, 1994	6,108
	CREF Equity Index	April 29, 1994	2,889
Fixed Income	CREF Money Market	April 1, 1988	5,976
	CREF Bond Market	March 1, 1990	2,939
	CREF Inflation-Linked Bond	May 1, 1997	138
Real Estate	TIAA Real Estate	October 2, 1995	1,082
Total			<u>\$229,973</u>

\* Also includes investments held for after-tax (non-pension) fixed annuities and various reserves and liabilities.

\*\* The CREF Social Choice account is a balanced account composed of bonds and, mainly, equities.

## Table 7

### Initial Monthly Payments per \$100,000 Accumulation from TIAA and CREF Annuities Issued in June 1998

<u>Age</u>	<u>Single Life Annuity</u>		<u>Joint and Survivor Annuity</u>	
	<u>TIAA Standard</u>	<u>CREF</u>	<u>TIAA Standard</u>	<u>CREF</u>
55	\$665	\$489	\$612	\$435
60	704	534	636	465
65	759	597	670	507
70	838	683	719	566
75	953	807	792	648

**Notes:** Issuance of annuity on June 1, 1998. The joint-and-survivor annuity rates quoted here are for benefits to a survivor the same age as the annuitant. TIAA rates reflect 30 years of participation (6/1/68 - 6/1/98) in TIAA and past salary growth of 5% per year; TIAA vintages are recognized. All annuity rates are unisex. There are no guaranteed periods chosen.