Tontine Pensions: A Solution to the State and Local Pension Underfunding Crisis

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ABSTRACT

Tontines are investment vehicles that can be used to provide retirement income. Basically, a tontine is a financial product that combines features of an annuity and a lottery. In a simple tontine, a group of investors pool their money together to buy a portfolio of investments, and, as investors die, their shares are forfeited, with the entire fund going to the last surviving investor. Over the years, this last-survivor-takes-all approach has made for some great fiction. For example, on the television show “Mash,” Colonel Sherman T. Potter, as the last survivor of his World War I unit, got to open the bottle of French cognac that he and his buddies bought (and share it with his Korean War compatriots). On the other hand, sometimes the fictional plots involved nefarious characters trying to kill off the rest of the investors and “inherit” the fund.

To be sure, a tontine can be designed to avoid such mischief. For example, instead of distributing all of the contributions to the last survivor, a tontine could make periodic distributions. Each time a member dies, her contribution would be distributed among the survivors. The tontine could solicit new investors to replace those that die. In that regard, elsewhere, one of us (Sabin) has described how these tontine funds could be used to create perpetual “tontine annuities” that could be sold to individual investors.

In this Article, we consider how the tontine principle could be used to create “tontine pensions” that could be adopted by large employers to provide retirement income for their employees. We also show that these tontine pensions would have several major advantages over most of today’s pensions, annuities, and other retirement income products.
At the outset, Part II of this Article explains how the current U.S. retirement system works and how retirees can use pensions, annuities, and other financial products to generate retirement income.

Next, Part III of this Article offers a step-by-step explanation of how tontine funds, tontine annuities, and tontine pensions could work today. Part III then compares tontine pensions with traditional defined benefit pension plans, with defined contribution plans, and with so-called “hybrid pensions” (i.e., cash balance plans). In particular, Part III shows that tontine pensions have the two major advantages over traditional pensions. First, unlike traditional pensions—which are frequently underfunded, tontine pensions would always be fully funded. Second, unlike a traditional pension—where the pension plan sponsor must bear all the investment and actuarial risks, with a tontine pension, the plan sponsor bears neither of those risks. These two features should make tontine pensions a particularly attractive alternative for employers who care about providing retirement income security for their employees but who want to avoid the risks associated with having a traditional pension.

Part IV of this Article then develops a model tontine pension for a typical large employer, and we use that model to estimate the benefits that would be paid to retirees. For simplicity, the model assumes that, each year, an employer would contribute 10% of salary to a tontine pension for each employee each year (in the real world, employers could choose to contribute a greater or lesser percentage of salary on behalf of their employees). The model generates tontine pension benefits for each retiree that would closely resemble an actuarially fair variable annuity (i.e. one without high insurance company fees [“loads”]). More specifically, unlike commercial annuities which must support insurance agent commissions and insurance company reserves, risk-taking,
and profits; the management and recordkeeping fees involved with running a tontine pension would be minimal. That means that tontine pensions would provide significantly higher retirement benefits than commercial annuities.

Part V of this Article then shows how such a model tontine pension could be used to replace a typical, large traditional pension plan like the California State Teachers’ Retirement System (CalSTRS). Pertinent here, like so many other state-run pension plans, CalSTRS is underfunded; for example, as of June 30, 2012, the CalSTRS traditional pension plan was just 67.0% funded, with an unfunded liability of almost $71 billion. While replacing CalSTRS with a tontine pension would do nothing to reduce that $71 billion obligation, it would ensure that California would never again have to worry about underfunding attributable to future benefit accruals.

Finally, Part VI of this Article discusses how to solve some of the technical problems that would arise in implementing a tontine pension, and Part VII of this Article offers some concluding remarks.
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I. INTRODUCTION

Tontines are investment vehicles that can be used to provide retirement income. Basically, a tontine is a financial product that combines features of an annuity and a lottery. In a simple tontine, a group of investors pool their money together to buy a portfolio of investments, and, as investors die, their shares are forfeited, with the entire fund going to the last surviving investor. Over the years, this last-survivor-takes-all approach has made for some great fiction. For example, on the television show “Mash,” Colonel Sherman T. Potter, as the last survivor of his World War I unit, got to open the bottle of French cognac that he and his buddies bought (and

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* Copyright © 2014, Jonathan Barry Forman & Michael J. Sabin. This Article will be presented at a panel for the American Bar Association Section of Taxation Committee on Employee Benefits, Washington, DC, May 10, 2014; and at the international pension conference on Social Security Systems and Demographical Challenges, Poznań University of Technology, Poznań, Poland, October 16-17, 2014.

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♣ Independent consultant, Sunnyvale, CA; B.S. (Electrical Engineering) 1977, University of Florida; M.S. 1979, Ph.D. 1984 (Electrical Engineering), Stanford University; Member of Technical Staff, Bell Laboratories, 1977-1981; Assistant Professor (EECS), University of California Berkeley, 1984-1986.

1 See, e.g., Moshe A. Milevsky & Thomas S. Salisbury, *Optimal Retirement Tontines for the 21st Century: With Reference to Mortality Derivatives in 1693* (May 28, 2013), http://papers.ssrn.com/abstract_id=2271259. An annuity is a financial instrument (e.g., an insurance contract) that converts a lump sum of money into a stream of income payable over a period of years, typically for life. The person holding an annuity is called an annuitant. See infra Part II.C.2.

share it with his Korean War compatriots). On the other hand, sometimes the fictional plots involved nefarious characters trying to kill off the rest of the investors and “inherit” the fund.

To be sure, a tontine can be designed to avoid such mischief. For example, instead of distributing all of the contributions to the last survivor, a tontine could make periodic distributions. Historically, for example, governments issued tontines instead of regular bonds. In those tontines, the government would keep the tontine investors’ contributions but make high annual dividend payments to the tontine, with those payments being divided among the surviving investors; and when the last survivor died, the government had no further debt obligation. For example, in 1693 the English government issued a tontine as a way to raise one million British pounds to help pay for one of its wars against France. At a time when the regular bond interest rate was around 6%, King William’s 1693 tontine, as it is known, entitled the surviving investors to share in 10% dividend payments to the tontine for the first 7 years and to 7% dividend payments thereafter.

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5 Having an incentive to kill someone in order to earn a profit is an example of what actuaries call a “moral hazard.” See, e.g., Moral Hazard, INVESTOPEDIA, http://www.investopedia.com/terms/m/moralhazard.asp (accessed January 30, 2014).
6 Milevsky & Salisbury, supra note 1, at 3; Moshe A. Milevsky, Portfolio Choice and Longevity Risk in the Late 17th Century: A Re-examination of the First English Tontine 3 (paper presented at the Society of Actuaries’ Living to 100 Symposium 5, Orlando, Florida, January 8, 2014) (in Professor Forman’s possession).
7 Milevsky & Salisbury, supra note 1, at 4; Milevsky, supra note 5, at 4.
Over the years, tontines like King William’s tontine became quite popular.\(^7\) Indeed, at one point Alexander Hamilton, the United States’ first Secretary of the Treasury, suggested that the United States could use a tontine to pay off its Revolutionary War debt.\(^8\) All in all, government tontines played an important role in government finances over a couple of centuries, but they have since disappeared.\(^9\)

After the Civil War, tontines emerged as a popular investment for individuals in the United States, but they fell out of favor at the beginning of the 20\(^{th}\) century.\(^10\) The problem was not with the tontine form, but with embezzlement and fraud by the holders of tontine funds. Investigations of the insurance industry in New York led to the enactment of legislation in 1906 that all but banned tontines, and they have since largely been replaced by life insurance and similar financial products.\(^11\)

We believe that the time has come to revive tontines as a way of providing reliable, pension-like income for retirees. More specifically, we believe that variations on the tontine principle—that the share of each, at her death, is enjoyed by the survivors—can be used to develop a variety of attractive retirement income financial products. In that regard, elsewhere, one of us has described how these tontine funds could be used to create “tontine annuities” that

\(^7\) See, e.g., ROBERT W. COOPER, AN HISTORICAL ANALYSIS OF THE TONTINE PRINCIPLE (1972); Kent McKeever, A Short History of Tontines, 15(2) FORDHAM JOURNAL OF CORPORATE & FINANCIAL LAW 491 (2009).
\(^8\) Robert M. Jennings, Donald F. Swanson & Andrew P. Trout, Alexander Hamilton’s Tontine Proposal, 45(1) WILLIAM AND MARY QUARTERLY 107 (1988).
\(^9\) See, e.g., COOPER, supra note 7, at 2-9.
\(^10\) See, e.g., id. at 10-17; McKeever, supra note 7.
could be sold to individual investors. ¹² These tontine annuities would make periodic distributions to surviving investors, but unlike traditional tontines, tontine annuities would solicit new investors to replace those that have died. Structured in this way, a tontine annuity could operate into perpetuity.

In this Article, we consider how the tontine principle could be used to create “tontine pensions” that could be adopted by large employers to provide retirement income for their employees. We also show that these tontine pensions would have several major advantages over most of today’s pensions, annuities, and other retirement income products.

At the outset, Part II of this Article explains how the current U.S. retirement system works and how retirees can use pensions, annuities, and other financial products to generate retirement income.

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employers who care about providing retirement income security for their employees but who want to avoid the risks associated with having a traditional pension.

Part IV of this Article then develops a model tontine pension for a typical large employer, and we use that model to estimate the benefits that would be paid to retirees. For simplicity, the model assumes that, each year, an employer would contribute 10% of salary to a tontine pension for each employee (in the real world, employers could choose to contribute a greater or lesser percentage of salary on behalf of their employees). The model generates tontine pension benefits for each retiree that would closely resemble an actuarially fair variable annuity (i.e. one without high insurance company fees [“loads”]). More specifically, unlike commercial annuities which must support insurance agent commissions and insurance company reserves, risk-taking, and profits; the management and recordkeeping fees involved with running a tontine pension would be minimal. That means that tontine pensions would provide significantly higher retirement benefits than commercial annuities.

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13 A variable annuity is an annuity that offers a range of investment options. Accordingly, the value of the annuity and the monthly payments will vary depending on the performance of the underlying investments. See, e.g., Securities and Exchange Commission, Variable Annuities: What You Should Know (last modified April 18, 2011), http://www.sec.gov/investor/pubs/varannty.htm.
a tontine pension would do nothing to reduce that $71 billion obligation, it would ensure that
California would never again have to worry about underfunding attributable to future benefit
accruals.

Finally, Part VI of this Article discusses how to solve some of the technical problems that
would arise in implementing a tontine pension, and Part VII of this Article offers some
concluding remarks.

II. PENSIONS, ANNUITIES, AND OTHER LIFETIME INCOME MECHANISMS TODAY

Longevity risk—the risk of outliving one’s retirement savings—is probably the greatest
risk facing current and future retirees.15 At present, for example, a 65-year-old man has a 50% chance of living to age 88 and a 25% chance of living to age 96, and a 65-year-old woman has a
50% chance of living to age 90 and a 25% chance of living to age 97.16 The joint life expectancy
of a 65-year-old couple is even more remarkable: there is a 50% chance that at least one 65-year-
old spouse will live to age 94 and a 25% chance that at least one will live to 100.17 In short, most
individuals and couples will need to plan for the possibility of retirements that can last for 30
years or more.

Elderly Americans can generally count on Social Security benefits to cover at least a
portion of their retirement income needs. In addition, retirees use pensions, annuities, and a

15 The top risks for today’s retirees include: longevity, inflation, market volatility, withdrawal rate, health care
expenses, and unexpected events. Ameriprise Financial, Making your retirement income last a lifetime (2010),
http://hwcdn.net/v3n9d4af6/cds/alwp/advisor/david.p.weidman/cdocuments-and-settingsandrewdesktopwebsite-
downloadsmaking-your-retirement-income-last-a-lifetime634532517160486099.pdf; Youngkyun Park, Retirement
Income Adequacy With Immediate and Longevity Annuities (Employee Benefit Research Institute, Issue Brief No.
managing three types of risk: investment income, longevity, and long-term care).
16 Prudential, Should Americans Be Insuring Their Retirement Income? 3 (2012),
&ref=website&cid=2.
variety of other mechanisms to ensure that they have adequate incomes throughout their retirement years. These are discussed in turn.

A. SOCIAL SECURITY

Social Security provides monthly cash benefits to most retirees and their families. Social Security protects by working in employment that is covered by Social Security and paying the applicable payroll taxes. Workers over the age of 62 generally are entitled to Social Security retirement benefits if they have worked in covered employment for at least 10 years. Benefits are based on a measure of the worker’s earnings history in covered employment. Most importantly, benefits are indexed each year for inflation as measured by the consumer price index. While historically “full retirement age” was age 65, it is currently age 66, and it is gradually increasing to age 67 for workers born after 1959 (who reach that age in or after 2027). In January of 2014, Social Security paid retirement benefits to around 38 million retired workers, and the average monthly benefit paid to a retired worker was $1,295.84.

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17 Id.
19 For 2014, employees and employers each pay a Social Security retirement tax of 5.3% on up to $117,000 of wages, for a combined Old-Age and Survivors Insurance (OASI) rate of 10.6%—the lion’s share of the total 15.3% collected for OASI, Disability Insurance, and Medicare. Social Security Administration, 2014 Social Security Changes (2013), http://www.socialsecurity.gov/pressoffice/factsheets/colafacts2014.pdf. Self-employed workers pay an equivalent OASI tax of 10.6% on up to $117,000 of net earnings. Id.
21 See, e.g., Social Security Administration, supra note 19.
B. PENSIONS

The United States has a voluntary pension system, and employers have considerable choice about whether and how to provide pension benefits to their employees. However, when employers do provide pensions, those pensions are typically subject to regulation under the Employee Retirement Income Security Act of 1974 (ERISA).

1. Retirement Savings are Tax-Favored

Most pension plans qualify for favorable tax treatment. Basically, employer contributions to a pension are not taxable to the employee; the pension fund’s earnings on those contributions are tax-exempt; and workers pay tax only when they receive distributions of their pension benefits. Nevertheless, the employer is allowed a current deduction for its contributions (within

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26 I.R.C. § 402.  
27 I.R.C. § 501(a).  
28 I.R.C. §§ 72, 402. See generally Internal Revenue Service, Pension and Annuity Income (Publication No. 575, 2013), http://www.irs.gov/pub/irs-pdf/p575.pdf. In general, a participant’s pension benefits will be fully taxable if the participant’s employer contributed all of the cost for the pension without any of the contributions being included in the employee’s taxable wages. On the other hand, if an individual made after-tax contributions to a pension or annuity, she can exclude part of her pension or annuity distributions from income. More specifically, under I.R.C. §§ 72 and 402, the individual can exclude a fraction of each benefit payment from income. That fraction (the “exclusion ratio”) is based on the amount of premiums or other after-tax contributions made by the individual. The exclusion ratio enables the individual to recover her own after-tax contributions tax free and to pay tax only on the remaining portion of benefits which represents income. Taxpayers who begin receiving annuity payments from a qualified retirement plan after November 18, 1996, generally can use the so-called Simplified Method to figure the tax-free part of their benefits. Internal Revenue Service, supra, at 12. Under the Simplified Method, the Code provides a table with a fixed number of anticipated payments that depends upon the annuitant’s age as of the annuity starting date. The taxpayer then divides the total of her after-tax contributions over the applicable number of anticipated payments and excludes the amount so determined each year.
limits). Favorable tax rules are also available for individual retirement accounts (IRAs) and Roth IRAs.

2. Types of Pension Plans

Pension plans generally fall into two broad categories based on the nature of the benefits provided: defined benefit plans and defined contribution plans.

a. Defined benefit plans

In a defined benefit plan, an employer promises employees a specific benefit at retirement. To provide that benefit, the employer typically makes payments into a trust fund, contributed funds grow with investment returns, and eventually the employer withdraws funds from the trust fund to pay the promised benefits. Employer contributions are based on actuarial valuations, and the employer bears all of the investment risks and responsibilities.

For example, a plan might provide that a worker’s annual retirement benefit \((B)\) is equal to 2% times the number of years of service \((yos)\) times final average compensation \((fac)\) \((B = 2\% \times yos \times fac)\). Under this traditional, final-average-pay formula, a worker who retires after 30 years of service with final average compensation of $50,000 would receive a pension of $30,000 a year for life \((30,000 = 2\% \times 30 yos \times 50,000 fac)\). While many defined benefit plans allow

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29 I.R.C. § 404.
30 I.R.C. § 219. Almost any worker can set up an IRA with a bank or other financial institution. In 2014, individuals without pension plans can contribute and deduct up to $5,500 to an IRA, although individuals over age 50 can contribute and deduct another $1,000 (for a total of up to $6,500); and spouses can contribute and deduct similar amounts. Internal Revenue Service, IRS Announces 2014 Pension Plan Limitations: Taxpayers May Contribute up to $17,500 to their 401(k) plans in 2014 (IR-2013-86, October 31, 2013), http://www.irs.gov/uac/IRS-Announces-2014-Pension-Plan-Limitations;-Taxpayers-May-Contribute-up-to-$17,500-to-their-401(k)-plans-in-2014.
31 I.R.C. §§ 408A. Unlike regular IRAs, contributions to Roth IRAs are not deductible. Instead, withdrawals are tax-free. Like regular IRAs, however, Roth IRA earnings are tax-exempt.
32 Final average compensation is often computed by averaging the worker’s salary over the last three or five years prior to retirement. Alternatively, some plans use career-average compensation instead of final-average compensation. Under a career earnings formula, benefits are based on a percentage of an average of career earnings for every year of service by the employee.
for lump sum distributions, the default benefit is a retirement income stream in the form of an annuity for life.\(^{33}\)

Pertinent here, for a variety of reasons, traditional defined benefit plans in the real world are often underfunded.\(^{34}\) In that regard, for example, the Pension Benefit Guaranty Corporation (PBGC) has already bailed out thousands of failed private-sector pension plans. Indeed, according to its most recent annual report, the PBGC paid $5.5 billion to 900,000 retirees in more than 4,600 failed private pension plans in its Fiscal Year 2013, and the PBGC expects that another 620,000 workers will receive benefits when they retire.\(^{35}\) For that matter, at the end of January 2014, the pension plans sponsored by S&P 1500 companies were only 89% funded, reflecting a total deficit of $234 billion.\(^{36}\) Many government pension plans are also underfunded. For example, state public pensions in the United States were only 72.9% funded in 2011, reflecting unfunded liabilities of $833 billion.\(^{37}\)
b. Defined contribution plans

Under a typical defined contribution plan, the employer simply determines a specified percentage of the worker’s compensation, which it contributes to an individual investment account for the worker. For example, contributions might be set at 10% of annual compensation. Under such a plan, a worker who earned $50,000 in a given year would have $5,000 contributed to an individual investment account for her ($5,000 = 10% \times $50,000). Her benefit at retirement would be based on all such contributions plus investment earnings. Unlike traditional defined benefit plans, defined contribution plans usually make distributions in the form of lump sum or periodic distributions rather than life annuities.

There are a variety of different types of defined contribution plans, including money purchase pension plans, target benefit plans, profit-sharing plans, stock bonus plans, and employee stock ownership plans (ESOPs). Of particular note, profit-sharing and stock bonus plans often include a feature that allows workers to choose between receiving cash currently or deferring taxation by placing the money in a retirement account, according to Internal Revenue Code section 401(k). Consequently, these plans are often called “401(k) plans,” and they are the most popular type of retirement plan in the United States. The maximum amount of such elective deferrals that can be made by an individual in 2014 is $17,500, although workers over

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38 Defined contribution plans are also known as “individual account” plans because each worker has her own account, as opposed to defined benefit plans, where the plan’s assets are pooled for the benefit of all of the employees.


the age of 50 can contribute another $5,500 (for a total of up to $23,000).\textsuperscript{41} Also, since 2006, employers have been permitted to set up Roth 401(k) plans.\textsuperscript{42}

Pertinent here, because retirement benefits are based on the balance in the retiree’s individual account, benefits can vary dramatically depending upon investment returns and interest rates. For example, over the last 10 years, a withdrawal strategy that was based on taking, say, 4% of the balance in a retiree’s account each year would have led to dramatically different payouts in peak stock market years (2007 and 2013) as opposed to trough years like 2009 (at the bottom of the recent recession).\textsuperscript{43} Nor would using her account balance to buy an annuity fully offset those risks, as fixed annuity payouts vary with market interest rates;\textsuperscript{44} and variable annuity payouts vary with the performance of the underlying assets (just as they would with payouts under a 4% strategy).\textsuperscript{45}

c. Hybrid retirement plans

So-called “hybrid” retirement plans mix the features of defined benefit and defined contribution plans. For example, a cash balance plan is a defined benefit plan that looks like a

\textsuperscript{41} Internal Revenue Service, \textit{supra} note 30.
\textsuperscript{42} Internal Revenue Code (I.R.C.) § 402A. Contributions to these plans are not excludable, but neither the plan’s investment returns nor distributions are taxable.
\textsuperscript{43} For example, the Dow Jones Industrial Average hit 14,000 in October of 2007 but it fell to just 7,000 in February of 2009, before rising to more than 16,000 in November of 2013. Google, \textit{Dow Jones Industrial Average}, https://www.google.com/finance?q=INDEXDJX%3A.DJI&ei=bXBqUsidGJC2lAOrxQE (accessed December 16, 2013). For a discussion of the so-called 4% rule, see infra Part II.C.1.
\textsuperscript{44} \textit{See}, e.g., Annuity Digest, \textit{The Dangers of Buying an Annuity When Interest Rates are Low}, http://www.annuitydigest.com/blog/tom/dangers-buying-annuity-when-interest-rates-are-low (last viewed November 13, 2013).
defined contribution plan. Like other defined benefit plans, employer contributions are based on actuarial valuations, and the employer bears all of the investment risks and responsibilities. Like defined contribution plans, however, cash balance plans provide workers with individual accounts (albeit hypothetical). A simple cash balance plan might allocate 10% of salary to each worker’s account each year and credit the account with 5% interest on the balance in the account. Under such a plan, a worker who earned $50,000 in a given year would get an annual cash balance credit of $5,000 ($5,000 = 10% × $50,000), plus an interest credit equal to 5% of the balance in her hypothetical account as of the beginning of the year.

3. The Regulation of Employment-based Plans
Since the enactment of ERISA, a whole system has grown up to regulate pensions. Pension plans must be operated for the exclusive benefit of employees or their beneficiaries, and plan assets generally must be held in a trust. To protect the interests of plan participants, ERISA requires significant reporting and disclosure in the administration and operation of employee benefit plans. ERISA also imposes extensive fiduciary responsibilities on employers and administrators of employee benefit plans. ERISA and the Internal Revenue Code also impose

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49 See, e.g., ERISA §§ 101(a) et seq., 29 U.S.C. §§ 1021 et. seq.
50 I.R.C. § 401(a); ERISA § 404, 29 U.S.C. § 1104. In addition, prohibited transaction rules prevent parties in interest from engaging in certain transactions with an employee benefit plan. I.R.C. § 4975; ERISA § 406, 29 U.S.C. § 1106. For example, an employer usually cannot sell, exchange, or lease any property to the plan.
many other requirements on retirement plans, including rules governing normal retirement age,\textsuperscript{51} participation,\textsuperscript{52} coverage,\textsuperscript{53} vesting,\textsuperscript{54} benefit accrual,\textsuperscript{55} contribution and benefits,\textsuperscript{56} nondiscrimination,\textsuperscript{57} and funding.\textsuperscript{58}

Pertinent here, federal laws outside of ERISA and the Internal Revenue Code can also impose limits on pension plans. For example, even though women tend to have longer life expectancies than men,\textsuperscript{59} Title VII of the Civil Rights Act of 1964 bars pension plans from requiring higher contributions from women than men or paying women lower benefits than men.\textsuperscript{60}

\textbf{C. Other Sources of Lifetime Income}

In addition to accumulating retirement assets through the Social Security and pension systems, individuals can save on their own. Investment income is generally subject to federal personal income tax rates of up to 39.6\% in 2014;\textsuperscript{61} however, dividend income and capital gains

\begin{itemize}
\item \textsuperscript{51} I.R.C. § 411(a)(8); ERISA § 3(24), 29 U.S.C. § 1002(24).
\item \textsuperscript{52} I.R.C. § 410(a); ERISA § 202, 29 U.S.C. § 1052.
\item \textsuperscript{53} I.R.C. § 410(b).
\item \textsuperscript{54} I.R.C. § 411(a); ERISA § 203, 29 U.S.C. § 1053.
\item \textsuperscript{55} I.R.C. § 411(b); ERISA § 204, 29 U.S.C. § 1054.
\item \textsuperscript{56} I.R.C. § 415.
\item \textsuperscript{57} I.R.C. § 401(a)(4).
\item \textsuperscript{58} I.R.C. § 412; ERISA § 302, 29 U.S.C. § 1082.
\item \textsuperscript{59} See, e.g., supra note 16 and accompanying text; Appendix Table 1, infra.
\item \textsuperscript{60} Pub. L. No. 88-352, 78 Stat. 241 (codified at 42 U.S.C. § 2000e–2); \textit{City of Los Angeles Department of Water and Power v. Manhart}, 435 U.S. 70 (1978) (finding that Title VII of the Civil Rights Act of 1964 prohibits an employer from requiring female employees to make larger contributions to its pension plan than male employees because of mortality table differentials between the sexes); \textit{Arizona Governing Committee for Tax Deferred Annuity and Deferred Compensation Plans v. Norris}, 463 U.S. 1073 (1983) (finding that Title VII prohibits an employer from paying lower monthly retirement benefits to a woman than to a man who has made the same contributions).
\item \textsuperscript{61} I.R.C. § 1; Rev. Proc. 2013-35, 2013-47 \textsc{Internal Revenue Bulletin} 537.
\end{itemize}
are generally taxed at no more than a 20% rate.\textsuperscript{62} Also, there are various tax advantages associated with investments in homes,\textsuperscript{63} state and local bonds,\textsuperscript{64} annuities,\textsuperscript{65} and life insurance.\textsuperscript{66}

Pertinent here, retirees can use a variety of approaches to generate retirement income from their voluntary savings.\textsuperscript{67} One approach is for retirees to commit to systematic withdrawals of, say, 4% of their account balances each year—a strategy that has a relatively low risk of running out of money before death. Traditional lifetime annuities offer another approach for spreading retirement savings out over a lifetime. Another alternative involves buying longevity insurance, for example, buying a deferred annuity at age 65 that starts making payments only if the annuitant lives past age 85. Retirees can also invest in other financial products that can provide guaranteed lifetime benefits. These are discussed in turn.

\textit{1. Systematic Withdrawals}

One of the simplest and most common strategies to manage retirement savings is to invest all of one’s retirement savings in a diversified portfolio and then use a conservative withdrawal rate and a systematic withdrawal plan designed to have a high probability that the retirement

\begin{footnotesize}
\begin{itemize}
\item[\textsuperscript{62}]I.R.C. § 1(h).
\item[\textsuperscript{63}]For example, home mortgage interest is generally deductible, and gains from the sale of a personal residence are often excludable. I.R.C. §§ 163(a), 121.
\item[\textsuperscript{64}]I.R.C. § 103 (interest exclusion).
\item[\textsuperscript{65}]As more fully explained in note 28, supra, under I.R.C. § 72, an annuitant can often exclude a fraction of each annuity payment from income.
\item[\textsuperscript{66}]I.R.C. § 101(a) (exclusion for insurance proceeds paid by reason of the death of the insured).
\end{itemize}
\end{footnotesize}
savings will last for 20 or 30 years. In that regard, financial planners often suggest following the so-called “4% rule.”\textsuperscript{68} The basic idea is to set spending at 4% of retirement savings and invest those savings in a 50% stock/50% bond portfolio. Each year thereafter, spending is increased to keep up with inflation. For example, assuming that an individual has a $1,000,000 nest egg, in the first year of retirement she would withdraw 4% ($40,000), and each year thereafter that dollar amount would be increased to keep up with inflation.\textsuperscript{69} Assuming a 3% annual inflation rate, annual withdrawals would increase to $41,200 in the second year, $42,436 in the third year, and so on. While there is some possibility of running out of money before death, many financial planners believe this strategy can usually work for 30 years. To minimize the prospect of outliving their nest eggs, however, in the recent economic recession, some financial advisors have advised retirees to skip their scheduled inflation adjustments or to withdraw less than 4% of their new balances.\textsuperscript{70}

\textsuperscript{68} Hardy, Research and Reality – A Literature Review on Drawing Down Retirement Financial Savings (Society of Actuaries 2011), \url{http://www.soa.org/WorkArea/DownloadAsset.aspx?id=19866}.


2. Lifetime Annuities

Traditional lifetime annuities can also be used to provide lifetime retirement income. For example, for a 65-year-old man who purchased a $100,000 immediate, level-payment annuity without inflation protection as of January 1, 2014, the annual payout would be around $6,864 or 6.86% of the annuity’s purchase price. Because women tend to live longer than men, the annual payout for a 65-year-old woman who elected an immediate, level-payment annuity as of January 1, 2014 would be just $6,408 or 6.41% of the annuity’s purchase price.

With inflation-adjusted annuities, annual payouts would start lower but could end up higher. For example, if our hypothetical 65-year-old man instead chose an annuity stream with a 3% escalator, the annual payout for the first year would be just $5,064.

3. Longevity Insurance (e.g., Deferred Annuities)

Alternatively, retirees can protect against longevity risk by purchasing longevity insurance. The typical approach is to buy a “deferred annuity” at age 65 that starts making annual payments only if the annuitant lives past age 80 or 85. For example, in February of 2012, a 65-year-old man could invest $100,000 in a MetLife deferred annuity, and beginning at age 85, ...
he would receive a level lifetime income of $25,451.04 per year. With a relatively small upfront investment, a retiree can secure an income stream that starts sometime in the future, and the retiree can then use the rest of her savings to cover the fixed number of years until the year that the deferred annuity payments start. There is some risk of running out of money before the year that the deferred annuity starts, but that is certainly a more manageable risk than trying to manage one’s retirement savings over the indefinite future.

4. Other Lifetime Income Products

Retirees can also choose to purchase variable annuities with guaranteed lifetime withdrawal benefit (GLWB) funds to manage their longevity risk. A GLWB is based on a

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77 *See, e.g.*, Stephen Sexauer, Michael Walter Peskin & Daniel Cassidy, *Making Retirement Income Last a Lifetime* 68(1) FINANCIAL ANALYSTS JOURNAL 74 (2012) (proposing a “decumulation benchmark” that would use about 88% of retiree savings to purchase a laddered portfolio of Treasury Inflation-Protected Securities [TIPS] for the first 20 years and a deferred life annuity purchased with the remaining 12%); Rick Wurster, *DC 20/20: Pathways to a Secure Retirement*, 4(2) ROTMAN INTERNATIONAL JOURNAL OF PENSION MANAGEMENT 54, 58 (Fall 2011) (suggesting that an annuity providing 35% real income replacement at age 85 would cost about 7.5% of a participant’s average account balance at retirement).

78 Finally, it is worth noting that workers might be able to buy deferred annuities in installments, starting at a young age. For example, a worker could use a portion of her retirement savings each year to purchase a deferred annuity that starts at age 65, or at the advanced ages of 70, 75, 80, 85, or even 90. Accordingly, this type of deferred annuity product could be used to provide retirement benefits that mimic the lifetime pensions provided by traditional defined benefit plans. *See, e.g.*, Moshe A. Milevsky, *Real Longevity Insurance with a Deductible: Introduction to Advanced-Life Delayed Annuities (ALDA)*, 9(4) NORTH AMERICAN ACTUARIAL JOURNAL 109 (2005); see also Zorast Wadia, *Longevity Risk & Retirement*, 31(1) ACTUARIAL DIGEST 4 (Spring 2012), [http://www.theactuarialdigest.com/For%20Website/actuarial_digest.spring2012.pdf](http://www.theactuarialdigest.com/For%20Website/actuarial_digest.spring2012.pdf).

variable annuity, but it allows investors to lock in a minimum guarantee for life. Similarly, so-called “stand-alone living benefits” are similar to GLWBs, except that instead of using a variable annuity chassis, stand-alone living benefits use mutual funds or managed accounts as the base.

III. TONTINE PENSIONS

After discussing the tontine principle, this Part discusses how to design a tontine fund, a tontine annuity, and, finally, a tontine pension.

A. THE TONTINE PRINCIPLE

In a simple tontine, members contribute equally to buy a portfolio of investments that is awarded entirely to the last surviving member. Alternatively, each time a member of a tontine pool dies, her account balance could be divided among the surviving members of the pool. This latter type of tontine could be used to develop new financial products that would provide reliable, pension-like income for retirees. The point here is that variations on the tontine principle—that the share of each, at her death, is enjoyed by the survivors—can be used to create a variety of attractive retirement income financial products.

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80 Mechanically, the investor or retiree deposits or rolls over a sum of money into a variable annuity with subaccounts that are invested in a portfolio of stocks, bonds, and other generic investments. Depending on market performance, that investment portfolio grows (or shrinks). In any event, at retirement, the annuitant starts taking guaranteed withdrawals from the account. Payouts come from the invested funds, but if those funds are ever depleted due to long life and/or poor investment returns, the guaranteed minimum kicks in. On the other hand, if the investment portfolio performs well, payouts can be increased.

81 Tomlinson, supra note 76.

82 See, e.g., Tomlinson, supra note 76; Milevsky, supra note 5 at 3.

83 See, e.g., Sabin, supra note 12; Milevsky & Salisbury, supra note 1; Ralph Goldsticker, A Mutual Fund to Yield Annuity-Like Benefits 63(1) FINANCIAL ANALYSTS JOURNAL 63 (2007); Paul Newfield, The Tontine: An Improvement on the Conventional Annuity?, 1(3) JOURNAL OF RETIREMENT 37 (2014).
At the outset, imagine that 1,000 65-year-old retirees each contribute $1,000 to an investment fund that purchases a $1,000,000 Treasury bond paying 4% interest coupons. The bond will generate $40,000 interest per year, which will be split equally among the surviving participants. A custodian holds the bond, and because the custodian takes no risk and requires no capital, the custodian charges a trivial fee. Assuming that all the investors live through the first year, they will each receive a $40 dividend from the fund ($40 = $40,000 ÷ 1,000). If only 800 original investors are alive a decade after the tontine started (when the survivors are 75), then each will receive a $50 dividend ($50 = $40,000 ÷ 800). If only 100 are alive two decades after that (when the survivors are 95), then each will receive a $400 dividend ($400 = $40,000 ÷ 100). Later, when only 40 remain, each will receive a $1,000 dividend ($1,000 = $40,000 ÷ 40). If the terms of the tontine call for liquidation at that point, then each of the 40 survivors would also receive a liquidating distribution of $25,000 ($25,000 = $1,000,000 ÷ 40). Alternatively, the tontine could be designed so that the last survivor receives the entire $1,000,000.

To be sure, most retirees would probably prefer to have reasonably level benefits throughout their retirement years, rather than benefits that increase so sharply at the very end of their lives. Accordingly, it would make sense to design tontine financial products with benefits that are level throughout retirement (like an immediate, level-payment annuity) or, alternatively, that increase gradually throughout retirement (like an immediate, inflation-adjusted annuity). Of note, unlike these conventional annuities—which have to support insurance agent commissions and insurance company reserves, risk-taking, and profits; an early death in a tontine only benefits

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other investors, not some amorphous insurance company; and that should make tontines very popular.  

B. A TONTINE FUND

Before explaining how the tontine principle can be used to create a tontine pension, this Subpart shows how the tontine principle can be used to create a tontine fund, and the next Subpart explains how to create a tontine annuity. We have already seen how a tontine fund could work for a group of 65-year-old investors who all invested the same amount (i.e., $1,000). This Subpart shows how to create a tontine fund that is fair to all investors, regardless of their age or gender, or the amount of their investments.

In a simple tontine, when a member dies, the balance in her account (i.e., her contribution plus investment earnings) is distributed to the surviving members of the pool as “mortality gains.” In a simple tontine, those forfeitures are divided equally among the survivors. Unfortunately, that approach results in an unfair situation—for example, because it favors younger members who are likely to live longer and receive more distributions.

In a tontine fund with participants who have differing ages, genders, and investment levels, the surviving members should not get equal portions of a dying member’s balance.

85 For example, Professor Suzanne Shu suggests that a tontine for one’s fellow firefighters will be perceived as fairer than the typical commercial annuity that they could buy from an insurance company: with an annuity, an early death seems to benefit the insurance company, but with a tontine, an early death benefits fellow firefighters. Shlomo Bernartzi, Behavioral Finance and the Post-Retirement Crisis: A Response to the Department of the Treasury/Department of Labor Request for Information Regarding Lifetime Income Options for Participants and Beneficiaries in Retirement Plans 15 (Allianz, April 29, 2010), [http://www.dol.gov/ebsa/pdf/1210-AB33-617.pdf](http://www.dol.gov/ebsa/pdf/1210-AB33-617.pdf).


87 See supra note 84 and accompanying text.

88 Individuals who invest in annuity-like products have mortality gains and losses depending on when they die. Individuals who live longer than their peers get mortality gains from those who precede them, while individuals who
Instead, the distributions should be made in unequal portions, carefully chosen to provide fair bets for all investors. In short, a tontine fund should be governed by a “fair transfer plan” (FTP) that takes into account each member’s life expectancy (i.e., death probability) and her investment level. In this Subpart we describe how such a tontine fund would be designed.

1. A Fair Transfer Plan

We can design a fair transfer plan (FTP) to build a tontine fund that provides fair bets for all investors. The concept is straightforward: members join the tontine fund by contributing a desired amount, and each time a member dies, her contribution (and investment earnings) is distributed to the surviving members according to a fair transfer plan. New members may join at any time, by making a contribution of a desired amount; however, no member may withdraw her contributions (or investment earnings), ever. Structured in this way, a tontine fund could operate into perpetuity.

a. Tontine funds can be fair to members of different ages

Tontine funds can easily be designed to be fair to members of different ages. For example, Table 1 illustrates a tontine fund with just four members of different ages. To keep this example as simple as possible, we assume that each member has contributed $1,000 to the fund and that contributions do not earn any interest; and we use unisex life tables rather than gender-based life tables. For example, member 4 in Table 1 is an 80-year-old who has a life expectancy die earlier than their peers suffer mortality losses. See, e.g., Mortality drag, WIKIPEDIA, http://en.wikipedia.org/wiki/Mortality_drag (accessed February 3, 2014).

89 The term “fair transfer plan” is Dr. Sabin’s. See Sabin, supra note 12, at 5.

90 The situation is identical to a conventional annuity: once the premium is paid, there is no refund of it, ever.

91 That is, the underlying investments do not pay interest or dividends, nor are there any sales that result in gains or losses. We relax this assumption later in the paper. See, e.g., infra Part III.B.1.d.

92 The life expectancies (e) and death probabilities (q), in Table 1 come from Social Security Administration, United States life table functions and actuarial functions at 2.9 percent interest for unisex in calendar year 2009.
of 8.95 years, and a 5.2% chance of dying before reaching age 81 (i.e., a death probability, \( q_i \), of 0.051906).

### Table 1. A Tontine Fund with Four Members, Unisex

<table>
<thead>
<tr>
<th>Member (i)</th>
<th>Age (x)</th>
<th>Life Expectancy (years) ((e_i))</th>
<th>Death Probability ((q_i))</th>
<th>Force-of-Mortality Probability ((f_i))</th>
<th>Fair-Transfer-Plan Weight ((w_i))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>18.88</td>
<td>0.013181</td>
<td>0.013269</td>
<td>0.053815</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>15.22</td>
<td>0.020314</td>
<td>0.020523</td>
<td>0.086183</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>11.89</td>
<td>0.032111</td>
<td>0.032638</td>
<td>0.146795</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>8.95</td>
<td>0.051906</td>
<td>0.053302</td>
<td>0.713207</td>
</tr>
</tbody>
</table>

*Source: Social Security Administration, United States life table functions and actuarial functions at 2.9 percent interest for unisex in calendar year 2009 based on the Alternative 2 mortality probabilities used in the 2013 Trustees Report (2013), via personal communication to Professor Forman, November 12, 2013, and authors’ computations.*

Table 1 also shows a parameter known as the force-of-mortality probability \((f_i)\). Here is the logic. Suppose that at time \( t \) a member of the pool dies. Pretend that we do not know which member has died at time \( t \); we only know that some member has died. The force-of-mortality probabilities indicate the relative probability of death for each member of the pool. If, at the instant in time that a member has died, one member has a force-of-mortality probability with a value \( f \), and another has a value \( 2f \), then the second member is twice as likely as the first to be the one who died. In Table 1, for example, member 4 (our 80-year-old) has a relatively large force-of-mortality probability (0.053302), while member 1 (our 65-year-old) has a relatively small force-of-mortality probability (0.013269). In short, member 4 is quite clearly the member who is more likely (of the two) to be the one who died at time \( t \); indeed, of the four members in Table 1,
member 4 is the most likely to die. These force-of-mortality probabilities \((f_i)\) are relatively easy to compute from the death probabilities \((q_i)\) in a mortality table.\(^93\)

Table 1 also shows another parameter that we call the “fair-transfer-plan weight” \((w_i)\).

Here is the logic. When a member of a tontine fund dies, she forfeits her entire contribution, and it is divided among the surviving members, with each surviving member receiving some fraction of the decedent’s account. For example, if member 4 (the 80-year-old) is, in fact, the member who died, her $1,000 contribution would be distributed to members 1, 2, and 3 based on their respective fair-transfer-plan weights \((w_i)\). Those fair-transfer-plan weights \((w_i)\) are relatively easy to compute from the force-of-mortality probabilities \((f_i)\).\(^94\)

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93 The force-of-mortality probabilities in Table 1 were computed from the death probabilities in column 4 of that table. See, e.g., Sabin, supra note 12, at 10-11, 12. Here is the explanation. At the outset, we make the simplifying assumption that the force of mortality is constant during each year of age. Next, suppose that the probability of dying during a specific year of age is 5%. Then the probability of surviving the year is \(1 - .05 = 95\%\). Now suppose the probability of surviving the first 6 months is \(1 - .05/2 = 97.5\%\), and the probability of surviving the second 6 months is the same. Then the probability of surviving the year is \((.975)^2 = 95.063\%\). Now suppose the probability of surviving the first month is \(1 - .05/12\), same for the second month, third month, etc. Then the probability of surviving the year is \((1 - .05/12)^{12} = 95.113\%\). Generalizing this, if the probability of surviving each of \(n\) periods within the year is \(1 - .05/n\), then the probability of surviving the year is \((1 - .05/n)^n\). In the limit, as \(n\) grows to infinity, the probability of surviving the year becomes \(e^{-0.05} = 95.123\%\) (where \(e\) is Euler’s number \([-2.71828]\)). The probability of dying sometime during the year is \(1 - 0.95123 = 4.877\%\), and the force-of-mortality probability is 5%.

Now let us work it in reverse. Suppose the mortality table says that the death probability during a specific year is 5%. What is the force-of-mortality probability for the year? It is the value \(x\) that satisfies \(e^{-x} = 1 - 0.05\). The solution is \(x = -\ln(1 - .05) = 5.129\%\), where “\(\ln\)” is the natural logarithm.

Accordingly, the force-of-mortality probabilities in Table 1 were computed from the death probabilities in Table 1 by using the formula, \(f_i = -\ln(1 - q_i)\). For example, for member 4, \(f_4 = -\ln(1 - q_4) = -\ln(1 - 0.051906) = 0.053302\). Of note, the force-of-mortality probabilities are fairly close in value to the death probabilities, except at older ages. See, e.g., Appendix Table 1, infra.

94 Here is the explanation. Our goal is to design a fair transfer plan, meaning one that provides fair bets to all the members. This means we want the expected return \((ER_i)\) received by each member \(i\) to be zero. Mathematically, we want

\[
0 = -f_i s_i + \sum_{j\neq i} f_j s_j w_j / (1 - w_j) \text{ for each member } i,
\]

where: \(f_i\) is the force-of-mortality probability of member \(i\), \(s_i\) is the contribution made by member \(i\), and \(w_j\) is the fair-transfer-plan weight for member \(i\) that we need to provide fair bets. See Sabin, A Fast Bipartite Algorithm for Fair Tontines, supra note 86, at 7-8.

The formula above gives us a set of \(m\) equations, one equation for each member \(i\). The solution to those equations is unique, meaning there is only one set of fair-transfer-plan weights \((w_i)\) that solve those equations. The
More specifically, if member \( j \) dies, each surviving member \( i \) would receive some fraction of \( j \)'s \$1,000\) contribution: mathematically, the fraction that each member \( i \) would receive of member \( j \)'s contribution \( (s_j) \) is equal to \( w_i/(1 - w_j) \), for \( i \neq j \). The fair-transfer-plan weights \( (w_i) \) are positive values that sum to 1, so the denominator \( (1 - w_j) \) is the sum of all fair-transfer-plan weights \( (w_i) \) except that of member \( j \). Meanwhile, member \( j \) would forfeit her entire \$1,000\) contribution.

Finally, we can use our fair-transfer-plan weights to determine the amounts that each member \( i \) would receive when member \( j \) dies. For example, if member 4 in Table 1 dies, then:

- member 1 would receive \( $187.64 = $1,000 \times w_1/(1 - w_4) = $1,000 \times 0.053815/(1 - 0.713207) \);
- member 2 would receive \( $300.51 = $1,000 \times w_2/(1 - w_4) = $1,000 \times 0.086183/(1 - 0.713207) \);
- member 3 would receive \( $511.85 = $1,000 \times w_3/(1 - w_4) = $1,000 \times 0.146795/(1 - 0.713207) \);
- and, of course, member 4 would forfeit her \$1,000\).

We refer to the distributions to members 1, 2, and 3 as “mortality-gain distributions”; meanwhile, member 4 has a mortality loss.

In short, a tontine fund can fairly accommodate members of different ages. The key is to design a fair transfer plan that uses each member’s death probability \( (q_i) \) to determine her force-

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We can verify that similar equations for \( i = 1, 2, \) and 4 also work. Therefore, we can be certain that the fair-transfer-plan weights \( (w_i) \) in Table 1 accomplish our goal for a fair transfer plan (i.e., \( ER_i = 0 \)).
of-mortality probability \((f_i)\) and her fair-transfer-plan weight \((w_i)\). The result is a tontine investment fund that offers a fair bet to all members. Of note, the iterative method used to determine the fair-transfer-plan weights \((w_i)\) is fast and could easily handle large tontine funds involving millions of members.

b. Tontine funds can be fair to men and women

Tontines can also be designed to take gender into account. Pertinent here, women tend to live longer than men, and women have lower death probabilities than same-age men. For example, Table 2 shows that the life expectancy \((e_i)\) for a 65-year-old man in 2009 was 17.51 years, and his death probability \((q_i)\) was 0.16182; meanwhile, the life expectancy \((e_i)\) of a 65-year-old women that year was 20.19 years and her death probability \((q_i)\) was 0.010298. Compare those numbers with their 18.88-year unisex life expectancy \((e_i)\) and their 0.013181 unisex death probability \((q_i)\) shown in Table 1.

Table 2. A Tontine Fund with Four Members, Gender-based

<table>
<thead>
<tr>
<th>Member ((i))</th>
<th>Age ((x))</th>
<th>Gender</th>
<th>Life Expectancy ((e_i)) (years)</th>
<th>Death Probability ((q_i))</th>
<th>Force-of-Mortality Probability ((f_i))</th>
<th>Fair-Transfer-Plan Weight ((w_i))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>male</td>
<td>17.51</td>
<td>0.016182</td>
<td>0.016314</td>
<td>0.330931</td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>male</td>
<td>17.51</td>
<td>0.016182</td>
<td>0.016314</td>
<td>0.330931</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>female</td>
<td>20.19</td>
<td>0.010298</td>
<td>0.010351</td>
<td>0.169069</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>female</td>
<td>20.19</td>
<td>0.010298</td>
<td>0.010351</td>
<td>0.169069</td>
</tr>
</tbody>
</table>


95 Checking our answer, $187.64 + $300.51 + $511.85 = $1,000.
97 See, e.g., *supra* note 16 and accompanying text; Appendix Table 1, *infra*.
A tontine fund can take gender into account by using gender-based death probabilities \((q_i)\) rather than unisex death probabilities. For example, Table 2 illustrates a tontine fund with two men and two women. For simplicity, we assume that all the members of this tontine fund are age 65, that each contributed $1,000 to the fund, and that contributions do not earn any interest; however, as the prior Subsection showed, a tontine fund could easily accommodate members of different ages, as well.

Assuming that member 4 in Table 2 dies, then members 1 and 2 would each receive mortality-gain distributions of $398.27 ($398.27 = $1,000 \times w_{1(\text{or}2)}/(1 – w_4) = $1,000 \times 0.330931/(1 – 0.169069)$); member 3 would receive a mortality-gain distribution of just $203.47 ($203.47 = $1,000 \times w_3/(1 – w_4) = $1,000 \times 0.169069/(1 – 0.169069)$); and, of course, member 4 would forfeit her $1,000 balance (a mortality loss of $1,000). On the other hand, if these mortality-gain distributions had instead been determined under a unisex mortality table, it is easy to see that when one member died each survivor would get one-third, $333.33 ($333.33 = $1,000 \times w_j/(1 – w_j) = $1,000 \times 0.25/(1 – 0.25)$). It looks as if women would be short-changed if a tontine fund used a gender-based life expectancy table; however, remember that the 65-year-old women in any tontine fund are likely to live longer and receive more mortality-gain distributions than their 65-year-old brethren. All in all, the expected returns for both men and women would be equal, and both genders should get fair returns on their $1,000 investments (i.e., fair bets). Implicitly, as gender-based tontine funds would be fair for both women and men, unisex tontine funds must be “unfair” to one gender or the other. In fact, unisex tontine funds would be

99 Checking our answer, $398.27 + $398.27 + $203.47 = $1,000.01$ (error due to rounding).
100 That is, \(ER_i = 0\).
unfair to men – in precisely the same way that unisex annuities are “unfair” to men: because the distributions each year would be identical for men and women with a unisex tontine fund (or unisex annuity) but women tend to live longer and so can be expected to collect more distributions than men, women would tend to collect more money from unisex tontine funds (and unisex annuities) than men. The bottom line is that women would generally fare better than men in any tontine fund that used unisex life tables. Accordingly, to attract both male and female investors, the free market would force tontine funds to take gender into account in designing their tontine funds (i.e., use gender-based, not unisex, life tables), just as the free market already forces insurance companies to take gender into account when they sell annuities.  

In short, a tontine fund can fairly accommodate members of different genders by using gender-based life tables rather than unisex life tables.

c. Tontines can fairly accommodate members with differing levels of contribution

Tontine funds can also be designed to allow members to make differing levels of contributions. For example, Table 3 illustrates a tontine fund with four members with different contribution levels ($s_i$). For simplicity, all the members of this tontine fund are 65-year-old men (and contributions do not earn any interest), although as the previous Subsections have shown, a tontine fund can easily accommodate members of different ages and genders as well.

Mathematically, if the dying member is member $j$, then each surviving member $i$ would receive a mortality-gain distribution equal to $s_j w_i / (1 - w_j)$, for $i \neq j$. For example, assuming that member 4 in Table 3 dies, then member 1 would receive a mortality-gain distribution of $579.21

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101 We have much more to say about gender issues later in this article. *See, e.g.*, Part VI.D, *infra.*

102 Table 3 is drawn from Social Security Administration, *supra* note 98, and authors’ computations.
($579.21 = $4,000 \times s_1w_1/(1 – w_4) = $4,000 \times 0.06651/(1 – 0.540682)); member 2 would receive a mortality-gain distribution of $1,265.16 ($1,265.16 = $4,000 \times s_2w_2/(1 – w_4) = $4,000 \times 0.145278/(1 – 0.540682)); member 3 would receive a mortality-gain distribution of $2,155.63 ($2,155.63 = $4,000 \times s_3w_3/(1 – w_4) = $4,000 \times 0.247530/(1 – 0.540682)); and, of course, member 4 would forfeit his $4,000 balance (a mortality loss of $4,000).

Table 3. A Tontine Fund with Four Members, Different Levels of Contribution

<table>
<thead>
<tr>
<th>Member (i)</th>
<th>Age (x)</th>
<th>Contribution (s_i)</th>
<th>Life Expectancy (years)</th>
<th>Death Probability (q_i)</th>
<th>Force-of-Mortality Probability (f_i)</th>
<th>Fair-Transfer-Plan Weight (w_i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>$1,000</td>
<td>17.51</td>
<td>0.016182</td>
<td>0.016314</td>
<td>0.066510</td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>$2,000</td>
<td>17.51</td>
<td>0.016182</td>
<td>0.016314</td>
<td>0.145278</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$3,000</td>
<td>17.51</td>
<td>0.016182</td>
<td>0.016314</td>
<td>0.247530</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$4,000</td>
<td>17.51</td>
<td>0.016182</td>
<td>0.016314</td>
<td>0.540682</td>
</tr>
</tbody>
</table>


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103 Checking our answer, $579.21 + $1,265.16 + $2,155.63 = $4,000.

Intuitively, some readers may be wondering why, for example, member 2 (who contributed $2,000) would get *more than twice* as much as member 1 (who contributed $1,000). Asked differently, some readers may be wondering why member 2’s fair-transfer-plan weight (w_2), 0.145278, would be *more than twice* as much as member 1’s fair-transfer-plan weight (w_1), 0.066510.

Here, a slightly different example can help. Imagine a tontine fund with four otherwise-identical 65-year-old men, except that while members 1, 2, and 3 each contribute $1,000 to the tontine fund, member 4 contributes $3,000. Now assume that member 1 dies, leaving members 2, 3, and 4 alive. Intuitively, it might seem that member 1’s $1,000 contribution should be divided in proportion to the relative contributions (s_i) of members 2, 3, and 4, in which case member 2 (s_2 = $1,000) and member 3 (s_3 = $1,000) would each get $200, one-fifth of dying member 1’s $1,000 contribution ($200 = $1,000/($1,000 + $1,000 + $3,000)), while member 4 (s_4 = $3,000) would get $600, or three-fifths ($600 = $3,000/($1,000 + $1,000 + $3,000)). In fact, however, member 4 must get 100% of dying member 1’s contribution, and she must also get 100% of member 2’s contribution or 100% of member 3’s contribution if either of them is the one who dies. It has to come out that way, otherwise member 4’s expected return from the investment would be less than zero. After all, if member 4 dies, she will lose her entire $3,000 contribution; therefore, in effect, she must get 100% of the contributions of any other member who dies.

In short, all other things being equal, members who make larger contributions to a tontine fund must get disproportionately higher mortality-gain distributions from the fund in order to receive a fair bet. The fair-transfer-plan weights (w_i) do the work; for example, in Table 3, that is why member 2’s fair-transfer-plan weight (s_2 = $2,000; w_2 = 0.145278), is more than twice as much as member 1’s fair-transfer-plan weight (s_1 = $1,000; w_1 = 0.066510).
In short, a tontine fund can fairly accommodate members with differing levels of contributions by using fair-transfer-plan weights \((w_i)\) that take into account those different levels of contributions. There is one caveat, however: no one member can own more than half of the total risk of a tontine fund; otherwise, the tontine fund could not provide that person with a fair bet for surviving the rest.\(^{104}\)

d. Tontine funds can properly account for investment earnings

In the simple tontine funds we have considered so far, we have assumed that contributions do not earn any interest. In the real world, however, each member’s contributions would be invested, and each member’s balance would grow (or shrink) according to its investment performance. As members of a tontine fund died, mortality-gain distributions would be based on the balance in each member’s account at the time of that death.

We can continue to use the variable \(s_i\) (that we have so far used only to denote member contributions) to denote the balance in member \(i\)'s account at any time \(t\); and, again, if the dying member is member \(j\), then each surviving member \(i\) would receive a mortality-gain distribution equal to \(s_j w_i / (1 - w_j)\), for \(i \neq j\). If the pool of tontine fund investors is large, then members would die often, and each survivor would receive frequent payments of mortality-gain distributions that would continue until her own death.

Again, no member would be allowed to take any other distributions, ever (i.e., no voluntary withdrawals). Once a contribution is made, it would remain in the tontine fund, along with any investment earnings; at the member’s death, the balance in her account would be

\(^{104}\) Here, a member’s risk means the product \(f_i s_i\), of his force-of-mortality probability \(f_i\) times his contribution \(s_i\), and the total risk means the sum of all members’ risks. See, e.g., Sabin, supra note 12, at 14. Additional rules may be imposed that limit the total amount that a member may contribute. Id.
distributed to the surviving members as mortality-gain distributions. This restriction is necessary because, otherwise, a member in failing health would seek to withdraw her contributions and the earnings on those contributions. Such “adverse selection” would invalidate the assumptions of the mortality table used to compute the fair-transfer-plan weights \( w_i \).

e. Tontine funds could also take increasing longevity into account

Finally, in the simple tontine funds we have considered so far, we have used the Social Security Administration’s 2009 life tables.\(^{105}\) Over time, however, life expectancies are likely to increase, and these 2009 life tables will soon be out of date.\(^{106}\) Consequently, a real-world tontine fund should be designed to use the latest life tables: that way the tontine fund would always be making its mortality-gain distributions based on the most recent death probability estimates.\(^{107}\)

2. Expected Benefits of a Tontine Fund

We have shown how easy it is to design a tontine fund that is fair to members of differing ages, genders, and contribution levels. To be sure, those who survive the longest would get better than average returns (i.e., mortality gains), while those who die young might not even recover their initial investment (i.e., mortality losses). On average, however, each member could expect to recover her initial contribution and any returns on that investment (less only a modest management and recordkeeping fee).

\(^{105}\) See, e.g., Tables 1 and 2, supra (using the Social Security Administrations 2009 unisex and gender-based life tables, respectively).


\(^{107}\) As a legal matter, the tontine fund agreement would need to specify how, and when, it would choose a new life table for use in its fair transfer plan.
Figure 1 shows a computer simulation of how a tontine fund with around 220 members might work. This simulation was designed by creating a tontine fund where one new member joins each month. Each new member’s gender was randomly selected, equiprobably male or female; each new member’s age was exactly 65; that is, his or her 65th birthday coincided with the joining date; and each member’s contribution was a randomly selected amount between $100 and $100,000. The number of members grows for several decades until it reaches an equilibrium of about 220 members, where, on average, one member dies each month, offsetting the new member who joins each month. Figure 1 shows the mortality gains that a typical long-lived male could expect after that equilibrium has been reached.

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108 Sabin, supra note 12, at 24-25.
More specifically, Figure 1 plots the mortality-gain distributions paid to one of the longer-lived male members in the simulation (normalized to a contribution of $1). The plot began at the member’s joining age, 65, and ended at the time of his death. As the plot shows, benefits would be received at random times (i.e., at other members’ deaths) and in random amounts (i.e., varying with the contributions of the dying member). The average value of his benefit would increase with age, since the member’s own death probability ($q_i$) and, consequently, his fair-transfer-plan weight ($w_i$) would increase with his age. In fact, it can be shown that the average value of a tontine fund member’s benefit depends only on that member’s
age and gender (for $q_i$) and that member’s contribution ($s_i$): the ages, genders, and contribution amounts of other members do not affect that member’s average benefit.\textsuperscript{109}

3. Two Problems with a Tontine Fund

Two features of the tontine fund in Figure 1 stand out as serious negatives. First, mortality-gain distributions vary dramatically both in amount and timing, because they depend on when members die and how much those dying members had contributed: in short, payouts are noisy. Second, a member’s mortality-gain distributions start out slow and low but increase rather dramatically towards the end of life, as the member’s death probability ($q_i$) increases with age: in short, payouts are backloaded.

While the tontine fund always provides a fair bet to investors, these two disadvantages will discourage retirees from investing in them, as, presumably, most retirees would prefer to have benefits that are level throughout retirement (like an immediate, level-payment annuity) or, alternatively, that increase gradually throughout retirement (like an immediate, inflation-adjusted annuity).

a. Reducing the Noisiness of a Tontine Fund

The noisiness of a tontine fund can be reduced by accumulating mortality-gain distributions over some period (e.g., a month) rather than paying them at the time of each member’s death, and by increasing the number of investors in the tontine fund. First, for example, a tontine fund could be designed to make monthly mortality-gain distributions as follows:

\begin{itemize}
  \item Each member would have an individual account that holds her contribution;
\end{itemize}

\textsuperscript{109} See, e.g., Sabin, \textit{supra} note 12, at 5.
• When a member dies, the balance in her account would be distributed to the accounts of the surviving members based on their respective fair-transfer-plan weights \( w_i \); and

• At end of each month, each living member would receive a monthly mortality-gain distribution equal to excess of the balance in her account over the amount of her initial contribution.

Second, increasing the number of members in a tontine fund would further decrease the noisiness of payouts. For example, imagine a tontine fund with approximately 5,000 members of varying ages and genders who have made varying contributions. Again, for simplicity, this example assumes that contributions do not earn any interest. Table 4 shows a sample monthly statement for a member who had contributed $250,000 to a tontine fund and who lived through the month. More specifically, Table 4 shows that this member got a single end-of-the-month distribution of $1,041.67, rather than getting varying amounts throughout the month (ranging from a low of $0 on most days to a high of $184.32 on April 7\textsuperscript{th}).\textsuperscript{110} In short, the noisiness of this tontine fund would be reduced by making monthly mortality-gain distributions (rather than as each death occurs) and by having more members in the pool.

\textsuperscript{110} In this example, two other members happened to die on April 7\textsuperscript{th}, and this hypothetical member had $184.32 credited to her account ($184.32 = $135.41 + $48.91).
Table 4. Sample Monthly Tontine Fund Statement for a Living Member

<table>
<thead>
<tr>
<th>Date</th>
<th>Amount ($)</th>
<th>Balance ($)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/31</td>
<td>250,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04/02</td>
<td>67.17</td>
<td>250,067.17</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/03</td>
<td>25.21</td>
<td>250,092.38</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/05</td>
<td>55.14</td>
<td>250,147.52</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/07</td>
<td>135.41</td>
<td>250,282.93</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/07</td>
<td>48.91</td>
<td>250,331.84</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/12</td>
<td>52.29</td>
<td>250,384.13</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/15</td>
<td>102.54</td>
<td>250,486.67</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/20</td>
<td>159.46</td>
<td>250,649.13</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/21</td>
<td>139.68</td>
<td>250,785.82</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/22</td>
<td>17.82</td>
<td>250,803.63</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/25</td>
<td>124.81</td>
<td>250,928.44</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/28</td>
<td>55.32</td>
<td>250,983.76</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/30</td>
<td>57.91</td>
<td>251,041.67</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/30</td>
<td>(1,041.67)</td>
<td>250,000.00</td>
<td>Payout of FTP proceeds</td>
</tr>
</tbody>
</table>

Notes: This hypothetical tontine fund has approximately 5,000 members of varying ages and genders who have made varying contributions; mortality-gains are based on a fair transfer plan (FTP); and surviving members get a single payout at the end of the month.

Pertinent here, Table 5 shows the sample monthly statement for another member who is of the same age and gender and contributed the same amount as the member in Table 4, but who died during the month. When she died—on April 12th, she forfeited the balance in her account on that date, and it was divided among the surviving members of the tontine fund (i.e., with the surviving member in Table 4 receiving $52.29 of it on that date).111

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111 In the real world, it would certainly take some time for the tontine fund manager to discover and record deaths and to compute the resulting mortality-gain distributions. Accordingly, actual monthly mortality-gain distributions might be delayed for a month or two. Accordingly, it would be more accurate to say that the surviving member in Table 4 is entitled to, and will eventually receive, the $52.29 attributable to the April 12th death of the member whose account is shown in Table 5.
Table 5. Sample Monthly Tontine Fund Statement for a Member Who Dies in the Middle of the Month

<table>
<thead>
<tr>
<th>Date</th>
<th>Amount ($)</th>
<th>Balance ($), Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/31</td>
<td>250,000.00</td>
<td>0</td>
</tr>
<tr>
<td>04/02</td>
<td>67.17</td>
<td>250,067.17 Proceeds from FTP</td>
</tr>
<tr>
<td>04/03</td>
<td>25.21</td>
<td>250,092.38 Proceeds from FTP</td>
</tr>
<tr>
<td>04/05</td>
<td>55.14</td>
<td>250,147.52 Proceeds from FTP</td>
</tr>
<tr>
<td>04/07</td>
<td>135.41</td>
<td>250,282.93 Proceeds from FTP</td>
</tr>
<tr>
<td>04/07</td>
<td>48.91</td>
<td>250,331.84 Proceeds from FTP</td>
</tr>
<tr>
<td>04/12</td>
<td>(250,331.84)</td>
<td>0 Forfeited to FTP</td>
</tr>
</tbody>
</table>

Notes: This hypothetical tontine fund has approximately 5,000 members of varying ages and genders who have made varying contributions; mortality-gains are based on a fair transfer plan (FTP); surviving members get a single payout at the end of the month; and dying members forfeit the balance in their accounts on the date of death.

Unfortunately, accumulating mortality-gains for monthly distributions and increasing the number of members in the tontine fund would do nothing to counteract the volatility that would invariably result from fluctuations in the value of the underlying investment assets. For example, if all of the tontine fund assets were invested in equities, then average monthly distributions could fall from, say, $1,000 a month for a typical member when the Dow Jones Industrial Average hit 14,000 (i.e., in October of 2007) to just $500 a month when the Dow Jones Industrial Average fell to 7,000 (i.e., in February of 2009).\(^{112}\)

To be sure, market fluctuations also play havoc with the prices and yields of traditional annuities and variable annuities that could be purchased by a retiree or by a pension plan. For example, if the market is down when a retiree decides to buy an annuity, she will only be able to buy a smaller annuity. Similarly, if interest rates are low when she decides to buy an annuity, the

\(^{112}\) See, e.g., Google, Dow Jones Industrial Average, supra note 43. Monthly distributions would also fluctuate with changes in the dividend and interest yields on the underlying assets.
lifetime income stream that she purchases will also be low.\textsuperscript{113} Also, as already mentioned, variable annuity payouts would also vary with the performance of the underlying assets.\textsuperscript{114}

\textbf{b. Reducing Backloading in a Tontine Fund}

Unfortunately, it is \textit{impossible} to reduce the backloading that is inherent in a tontine fund. The longer a member lives, the more she would get, as her mortality-gain distributions would generally increase with her age and her increasing death probability ($q_i$).\textsuperscript{115} In the next Subpart, however, we show how we can solve this backloading problem by adding an “annuity-payback mechanism.” The annuity-payback mechanism has the added benefit of further reducing the noisiness of the payouts. We call the resulting product a “tontine annuity.”

\textbf{C. A TONTINE ANNUITY}

In this Subpart, we propose a tontine annuity which would closely resemble a variable annuity. A tontine annuity is constructed by adding two enhancements to a tontine fund. First, as already discussed, to reduce noisiness, we would build in a monthly payment period; and, second, to eliminate backloading, we would add an annuity-payback mechanism.

\textit{1. Monthly accrual of fair transfer plan payouts.}

In a tontine annuity, mortality-gain distributions would not be paid out immediately; instead, they would be accrued within the individual accounts of the surviving members. If a member is alive at the end of the month, she would be paid the accrued mortality-gain distributions in her account as a monthly mortality-gain distribution. If she is not alive at the end of the month, she would receive nothing, as the balance in her account, including any mortality-gain distributions

\textsuperscript{113} See, e.g., \textit{The Dangers of Buying an Annuity When Interest Rates are Low}, \url{http://www.annuitydigest.com/blog/tom/dangers-buying-annuity-when-interest-rates-are-low} (accessed October 24, 2013).

\textsuperscript{114} See \textit{supra} note 45 and accompanying text. We have more to say about how tontine financial products can help investors deal with market volatility in Part VI.C, \textit{infra}. 38
that accrued that month, would have been distributed to surviving members when she died during
the month (e.g., see Table 5). Thus, a member would receive payments on a monthly schedule,
just as she would if she had instead purchased a variable annuity from an insurance company.

2. Annuity Payback

In addition to receiving a monthly mortality-gain distribution, each surviving member
would also receive a portion of her original contribution at the end of each month that she is
alive. Our approach is to make monthly “tontine annuity distributions” to surviving members that
are designed to cancel out the age-related increase in mortality-gain distributions that is inherent
in simple tontine funds like the one in Figure 1 (i.e., the backloading).

It turns out that a tontine annuity constructed in this way would closely resemble an
actuarially fair variable annuity (i.e., one without insurance agent commissions or insurance
company reserves, risk-taking, and profits). To be sure, because of the fluctuation in the value of
the assets in the tontine annuity, monthly tontine annuity distributions would still be volatile. But
if we pretend that the underlying investment assets grow at a fixed, assumed rate of return, then
the tontine annuity would provide monthly payouts that are approximately constant for life.

Moreover, it is relatively easy to determine the proper amounts of these tontine annuity
distributions. Here is the logic. The monthly payout of any actuarially fair annuity is simply equal
to the account balance divided by a monthly annuity factor. The monthly annuity factor is the
premium for an actuarially fair annuity that pays $1 per month for life, and these monthly annuity

\textsuperscript{115} See \textit{supra} note 109 and accompanying text.
factors can easily be calculated from a mortality table and depend only on the age of the annuitant and the assumed interest rate.\textsuperscript{\textasteriskcentered116}

For example, Table 6 shows a sample monthly statement for a member of a tontine annuity who lives through the first month after turning age 65 and who had exactly $250,000 in her account at the end of the prior month. The only difference between the monthly statement in Table 4 and the monthly statement in Table 6 is that instead of receiving a monthly mortality-gain distribution of $1,041.67 (as in Table 4), our hypothetical member would receive a monthly tontine annuity distribution of $2,133.01. That $2,133.01 is computed by dividing the account balance on the last day of the month (i.e., $251,041.67 on 4/30) by the applicable monthly

\textsuperscript{\textasteriskcentered116} For simplicity, this footnote explains how to compute a yearly annuity factor, meaning the actuarial present value of a life annuity that pays $1 each year for life. The monthly annuity factor is approximately 12 times the yearly annuity factor.

We compute the annuity factor at each birthday by working backwards from the terminal age of the mortality table. For the 2009 Social Security Administration table that we use (see Appendix Table 1, \textit{infra}), the last entry is for age 119; thus the terminal age is 120, meaning that the table implies an individual always dies before her 121\textsuperscript{st} birthday. If the individual is alive at birthday 120, she receives $1. Since she does not survive to birthday 121, the only payment she receives is the single dollar at age 120, so the actuarial present value of the annuity is $1. Thus:

\[ a_{120} = 1. \]

If the individual is alive at birthday 119, she receives $1. In addition, if she survives to birthday 120, she will receive a future payment stream having an actuarial value of \( a_{120} \). Thus, at birthday 119, the actuarial present value of payments is

\[ a_{119} = 1 + (1 - q_{119}) \times a_{120} / (1 + d), \]

where: \( q_{119} \) is the probability of dying during age 119 (i.e., before birthday 120), which is given in the mortality table; and \( d \) is the discount rate (e.g., \( d = .07 \), or 7%).

Similarly, if the individual is alive at birthday 118, she receives $1, and if she survives to birthday 119, she will receive a future payment stream having an actuarial value of \( a_{119} \). Thus, at birthday 118, the actuarial value of payments is:

\[ a_{118} = 1 + (1 - q_{118}) \times a_{119} / (1 + d). \]

Continuing in this manner, we calculate the annuity factor \( a_{117} \) for birthday 117, \( a_{116} \) for birthday 116, and so on, until we reach the birthday of interest. For example, for the 2009 Social Security Administration table and a discount rate of 7\%, continuing until birthday 65 gives \( a_{65} = 10.359 \). As mentioned, the monthly annuity factor is approximately 12 times the yearly annuity factor, and column 5 of Appendix Table 1, \textit{infra}, shows that the monthly annuity factor for 40
annuity factor (i.e., 117.693880).\textsuperscript{117} That is, the monthly tontine annuity distribution for the just-
turned-65-year-old member in Table 6 is $2,133.01 ($2,133.01 = $251,041.67/117.693880).

Table 6. Sample Monthly Tontine Annuity Statement for a Living Member (for the first 
month after the member turned 65)

<table>
<thead>
<tr>
<th>Date</th>
<th>Amount</th>
<th>Balance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/31</td>
<td>250,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04/02</td>
<td>67.17</td>
<td>250,067.17</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/03</td>
<td>25.21</td>
<td>250,092.38</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/05</td>
<td>55.14</td>
<td>250,147.52</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/07</td>
<td>135.41</td>
<td>250,282.93</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/07</td>
<td>48.91</td>
<td>250,331.84</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/12</td>
<td>52.29</td>
<td>250,384.13</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/15</td>
<td>102.54</td>
<td>250,486.67</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/20</td>
<td>159.46</td>
<td>250,649.13</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/21</td>
<td>139.68</td>
<td>250,785.82</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/22</td>
<td>17.82</td>
<td>250,803.63</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/25</td>
<td>124.81</td>
<td>250,928.44</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/28</td>
<td>55.32</td>
<td>250,983.76</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/30</td>
<td>57.91</td>
<td>251,041.67</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/30</td>
<td>(2,133.01)</td>
<td>248,547.82</td>
<td>Tontine Annuity Distribution</td>
</tr>
</tbody>
</table>

Notes: This hypothetical tontine annuity has approximately 5,000 members of varying ages and 
genders who have made varying contributions; mortality-gains are based on a fair transfer plan 
(FTP); surviving members get a single payout at the end of the month, based on the applicable 
monthly annuity factor; and dying members forfeit the balance in their accounts on the date of 
death.

Alternatively, a tontine annuity could be designed to make distributions that mimic an 
inflation-adjusted variable annuity. That inflation-adjusted tontine annuity would make lower 
monthly tontine annuity distributions in the early years but greater distributions for those who 
live to later years. For example, if inflation is assumed to be 3\% per year, then the first monthly 
tontine distribution for the hypothetical 65-year-old in Table 6 would be just $1,651.72

\textsuperscript{117} Column 5 of Appendix Table 1, \textit{infra}, shows the applicable monthly annuity factors for the first month of each 
year starting with age 65, when monthly tontine annuity distributions are expected to commence.

the first month of the year in which our hypothetical retiree turns 65 is 117.693880, or about 12 \times 10.359.
($1,651.72 = $251,041.67/151.987601),\footnote{Column 6 of Appendix Table 1, infra, also shows the inflation-adjusted applicable monthly annuity factors for the first month of each year starting with age 65, when monthly tontine annuity distributions are expected to commence. Again, for simplicity, this footnote explains how to compute a yearly inflation-adjusted annuity factor, meaning the actuarial present value of a life annuity that pays $1 the first year and then increases future annual payments by the assumed inflation rate. The monthly annuity factor is approximately 12 times the yearly annuity factor. The annuity factor is computed in a manner similar to the uniform case in note 116, supra, except that now it includes the inflation adjustment. Letting $i$ denote the inflation rate (e.g., $i = 0.03$ or 3\%), then:}

\begin{align*}
a_{120} &= 1, \\
a_{119} &= 1 + (1 + i) \times (1 - q_{119}) \times a_{120} / (1 + d), \\
a_{118} &= 1 + (1 + i) \times (1 - q_{118}) \times a_{119} / (1 + d),
\end{align*}

but distributions in subsequent months would be larger and would eventually surpass the initial not-adjusted-for-inflation monthly distribution of $2,133.01 in Table 6.

In short, a tontine annuity could be designed to resemble an actuarially fair variable annuity or an actuarially fair inflation-adjusted variable annuity. These tontine annuities would still be volatile (because of fluctuations in the value of the underlying investment assets), but backloading would be eliminated.

3. Adding in Investment Income

In the simple tontine annuities we have considered so far, we have assumed that contributions do not earn any interest. In the real world, however, each member’s contributions would be invested, and the member’s balance would grow or shrink according to its investment performance. Accordingly, account balances at the end of each month would tend to be higher, and monthly tontine annuity distributions would also tend to be higher. For example, if the tontine annuity in Table 6 had earned $1,000 of investment interest in that month, the balance in the account at the end of the month would have been $1,000 higher, and, consequently, the

\begin{align*}
a_{120} &= 1, \\
a_{119} &= 1 + (1 + i) \times (1 - q_{119}) \times a_{120} / (1 + d), \\
a_{118} &= 1 + (1 + i) \times (1 - q_{118}) \times a_{119} / (1 + d),
\end{align*}
monthly tontine distribution would have been $8.49 higher—$2,141.50 instead of the $2,133.01 shown in Table 6 ($2,141.50 = $252,041.67/117.693880). See Table 7.

Table 7. Sample Monthly Tontine Annuity Statement for a Living Member, with investment earnings (for the first month after the member turned 65)

<table>
<thead>
<tr>
<th>Date</th>
<th>Amount</th>
<th>Balance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/31</td>
<td>250,000.00</td>
<td>250,000.00</td>
<td></td>
</tr>
<tr>
<td>04/02</td>
<td>67.17</td>
<td>250,067.17</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/03</td>
<td>25.21</td>
<td>250,092.38</td>
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<td>04/05</td>
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<td>250,147.52</td>
<td>Proceeds from FTP</td>
</tr>
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<td>04/07</td>
<td>135.41</td>
<td>250,282.93</td>
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<td>04/07</td>
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<td>Proceeds from FTP</td>
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<td>04/12</td>
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<td>250,384.13</td>
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<td>102.54</td>
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<td>250,928.44</td>
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</tr>
<tr>
<td>04/28</td>
<td>55.32</td>
<td>250,983.76</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/30</td>
<td>57.91</td>
<td>251,041.67</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/30</td>
<td>1,000.00</td>
<td>252,041.67</td>
<td>Interest for the month</td>
</tr>
<tr>
<td>04/30</td>
<td>(2,141.50)</td>
<td>249,900.17</td>
<td>Annuity Distribution</td>
</tr>
</tbody>
</table>

Notes: This hypothetical tontine annuity has approximately 5,000 members of varying ages and genders who have made varying contributions; mortality-gains are based on a fair transfer plan (FTP); surviving members get a single payout at the end of the month, based on the applicable monthly annuity factor; and dying members forfeit the balance in their accounts on the date of death.

4. Managing Investments

Investments in a tontine annuity would most likely be managed collectively for the entire pool, although it would be possible to design a tontine annuity that allowed members to direct their own investments, just as people often do today with their self-directed 401(k) plans and so forth. For example, we can show that when the inflation parameter is set to 3, $a_{65} = 13.216.$
IRAs. Pertinent here, rates of return are likely to be much higher if the investments are managed by professionals rather than allowing individuals to direct their own investments.

In theory, a tontine annuity could be managed by a discount broker, and no money would have to be set aside for insurance agent commissions or insurance company reserves, risk-taking, or profits. Those commercial insurance charges can be pretty hefty. For example, a recent Morningstar survey of 1998 variable annuities showed an average administrative fee of 1.34% of assets under management in 2013, and that fee is on top of the cost of managing the underlying investments, which itself can easily run another 1.0%. To be sure, some discount brokers have

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119 Similarly, default investments might be offered to individual investors, just as target date funds are a typically default for self-directed 401(k) plans. See, e.g., U.S. Department of Labor, Employee Benefits Security Administration, Target Date Retirement Funds - Tips for ERISA Plan Fiduciaries (February 2013), http://www.dol.gov/ebsa/pdf/fsTDF.pdf.


121 Indeed, experts estimate that the typical commercial life annuity has a 12% “load” factor due to the combination of administrative expenses and adverse selection; that is, the typical commercial life annuity provides benefits that are worth just 88% of an actuarially fair annuity (i.e., a “money’s worth ratio” of 88%). See, e.g., MARK WARSHAWSKY, RETIREMENT INCOME: RISKS AND STRATEGIES 66 (2012). Put differently, the payouts from actuarially fair annuities would be around 15% higher than in current annuity markets. James Poterba, Steven Venti & David Wise, The Composition and Drawdown of Wealth in Retirement, 25(4) JOURNAL OF ECONOMIC PERSPECTIVES 95, 102 tbl. 3 (Fall 2011) (e.g., 17.6% = [9.95% ÷ 8.46%] – 1, where the actuarially fair life annuity for a 65-year-old-man in 2008 was 9.95% and the ANNUITY SHOPPER price for a commercial life annuity was just 8.46%). See also Jeffrey R. Brown, Olivia S. Mitchell & James M. Poterba, The Role of Real Annuities and Indexed Bonds in an Individual Accounts Retirement Program, in RISK ASPECTS OF INVESTMENT-BASED SOCIAL SECURITY REFORM 247 (John Y. Campbell & Martin Feldstein, eds., 2001); James M. Poterba & Mark Warshawsky, The Costs of Annuitizing Retirement Payouts from Individual Accounts, in ADMINISTRATIVE ASPECTS OF INVESTMENT-BASED SOCIAL SECURITY REFORM (John B. Shoven, ed., 2000); Benjamin M. Friedman & Mark J. Warshawsky, The Cost of Annuities: Implications for Saving Behavior and Bequests, 104 QUARTERLY JOURNAL OF ECONOMICS 135 (1990); Olivia S. Mitchell, James M. Poterba, Mark Warshawsky & Jeffrey R. Brown, New Evidence on the Money’s Worth of Individual Annuities, 89 AMERICAN ECONOMIC REVIEW 1299 (1999).

122 See, e.g., Charles Schwab & Co., Inc., Variable Annuity Expense Analyzer footnote 1 (2014), http://www.schwab.wallst.com/Tools/VAAnalyzer/public. See also INSURED RETIREMENT INSTITUTE, IRI ANNUITY FACT BOOK 2011 56 fig. 3.5 (2011), available at http://www.advisorsexcel.com/downloads/2011FactBook.pdf (showing that the average administrative expense for variable annuities in 2010 was 2.33% [plus another 0.96% for managing the underlying investment assets], compared with an average administrative expense for mutual funds that
recently teamed up with insurance companies to offer low-cost variable annuities. For example, Charles Schwab & Co., Inc., markets variable annuities with insurance charges that range from 0.60% to 0.85%, and The Vanguard Group, Inc., offers a variable annuity with an insurance charge of less than 0.52%. Again, these insurance changes do not include the additional administrative expenses involved with managing the underlying investments.

We are confident that discount brokers will be able to offer tontine annuities at even lower costs. As there are no insurance guarantees associated with tontine annuities, we believe that discount brokers could offer these products with annual costs, perhaps, as low as 0.30% of assets under management, depending on the nature of the underlying investments; and that means that retirees would get significantly more benefits than they do with today’s high-cost variable annuities. For example, imagine a tontine annuity that invested entirely in an S&P 500 stock index fund. We know that most discount brokers offer an S&P 500 index fund with expense ratios of 0.10% or less, we believe that the tontine annuity management and recordkeeping functions could be performed for as little as 0.20%; and that means the total costs would run just 0.30%.

(year of just 1.32%). The additional administrative expenses associated with variable annuities include both so-called “mortality and expense” (M&E) charges and separately stated administrative expenses.  

123 Charles Schwab & Co., Inc., supra note 122; Vanguard also offers a number of low cost variable annuities. See, e.g., American General Life Insurance Company, Group Immediate Variable Annuity Contract 9 (May 1, 2013), http://www.agincome.com/iva/PDF/AGL%20Vanguard%20Group%20variable%20combo%20packet%20rev.pdf. (with an insurance charge of less than 0.52% per year).

In that regard, TIAA-CREF Financial Services has been offering a low-cost tontine-type product for years.\(^{125}\) Created in 1952, the College Retirement Equity Fund (CREF) was the world’s first variable annuity.\(^{126}\) Today, CREF operates eight investment accounts that differ by objective: stocks, bonds, money market, and social choice,\(^{127}\) and CREF keeps its costs for managing those accounts at between 0.41% to 0.53% of assets under management.\(^{128}\) CREF participants choose which fund to invest in; and later on, they choose from among a variety of distribution options including one-life and two-life annuities.\(^{129}\) When a retiree selects a life annuity, the annuity payments will depend on both the investment experience of the chosen accounts and on the mortality experience of the other participants.\(^{130}\) Basically, within each investment account, CREF periodically adjusts annuity payments so that the present value of the aggregate amount expected to be paid out over the participants’ remaining lifetimes matches the current value of the assets in the account. If participants in the fund live longer than expected, the amount payable to each will be less than if they as a group die sooner than expected.\(^{131}\)


\(^{126}\) Id. See also Poterba & Warshawsky, supra note 121, at 191-98.


\(^{129}\) Id. at 74-76.

\(^{130}\) Id. at 75.

like a tontine, the mortality risk falls on the annuitants and is not guaranteed by CREF (or TIAA).  

As mentioned, tontines were popular at the end of the 19th century, but they fell out of favor at the beginning of the 20th century, largely because of fraud and mismanagement of those early tontine funds. In today’s post-ERISA world, however, it would be relatively easy for the Securities and Exchange Commission and the U.S. Department of Labor’s Employee Benefits Security Administration to regulate tontine annuities and the fiduciaries that would manage them. Moreover, private-sector record-keepers and custodians would also help protect tontine annuity assets.

We live in an era in which new financial products and new lifetime income products are created all the time. Indeed, guaranteed lifetime withdrawal benefit (GLWB) funds were only

132 TIAA-CREF Financial Services, supra note 128, at 75. Of note, rather than using a fair transfer plan to share mortality gains from each dying member (as our tontine annuity would), CREF’s method shares aggregate mortality gains and losses. Consequently, some participants will get a better deal, and some will get a worse deal than they would with a fair transfer plan. Cf., Sabin, supra note 12, at 59-62.

Also, while our tontine pension (discussed in Part III.D., infra) results in forfeitures by workers as well as retirees, CREF participants do not face any forfeitures at all until participants voluntarily elect to take their distribution in the form of a one-life or two-life annuity, and typically such elections are not made until retirement after age 59½. TIAA-CREF Financial Services, supra, at 71, 85.

recently developed in Canada, before spreading to the United States and other countries, and as mentioned, a number of discount brokers have recently teamed up with insurance companies to offer low-cost variable annuities. Accordingly, we anticipate that a number of discount brokers and insurance companies will want to develop new tontine annuity products and seek any regulatory approvals that might be needed.

5. Adverse Selection is Always a Challenge for Annuities

To be sure, underutilization would be a problem for tontine annuities, just as it is for traditional annuities. All in all, people rarely choose to buy annuities voluntarily. In fact, over the years, there has been a significant decline in the annuitization of retirement savings by American workers. The shift from traditional defined benefit plans to defined contribution plans is a large part of the story, as defined contribution plans typically distribute benefits in the form of lump sum distributions rather than as annuities. Indeed, relatively few defined contribution plans even offer annuity options, and, in any event, relatively few participants elect those annuity options. In short, the demand for annuities is lower than expected, and this shortfall has come to be known as the “annuity puzzle.”

133 See supra notes 10-11 and accompanying text.
134 Milevsky & Shao, supra note 79, at 50, 56.
135 See supra note 123 and accompanying text.
138 See, e.g., Beverly I. Orth, Approaches for Promoting Voluntary Annuitization, 2008 RETIREMENT 20/20 CONFERENCE (Society of Actuaries, Monograph No. M-RS08-1, 2009), http://www.soa.org/library/monographs/retirement-systems/retirement2020/2008/november/mono-2008-m-rs08-01-
There are many reasons for this low demand for annuities, but adverse selection is one of the most important reasons. Basically, those who voluntarily purchase annuities tend to live longer than those that do not, and, consequently, annuities are not priced very well for those with normal life expectancies.

a. **Adverse Selection and Tontine Annuities**

Adverse selection would also be a problem for tontine annuities. Just as the people who voluntarily purchase traditional annuities tend to live longer than those that do not, people who would choose to invest in a tontine annuity would tend to live longer than those who would not. To be sure, the tontine annuity would offer a better expected return than a commercial variable annuity, but coverage would nevertheless be skewed towards longer-lived investors. In short, as with traditional annuities, tontine annuities would be underutilized.

b. **Solving the Adverse Selection Problem**

In general, problems with adverse selection are solved with broad coverage. For example, group health insurance premiums are low for large employers: they can generally ignore adverse

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140 See chapter one of GEORGE A. (SANDY) MACKENZIE, ANNUITY MARKETS AND PENSION REFORM (2006) for a survey of the influences on annuity demand. Financial literacy is often low among consumers, and distrust of insurance companies may be a factor. See, e.g., Annamaria Lusardi, Olivia S. Mitchell & Vilsa Curto, *Financial
selection as long as they provide health care coverage for virtually all of their employees. Similarly, Social Security and large defined benefit plan pensions can generally ignore adverse selection because they cover large numbers of employees. In short, the solution to adverse selection is to cover a broad group of individuals, and in the next Subpart, we show how a large employer could overcome the adverse selection against tontine annuities by adopting a “tontine pension” for a large group of its employees.

D. TONTINE PENSIONS

As just mentioned, while tontine annuities would be attractive investments in their own right, they are likely to be as underutilized as traditional annuities and other lifetime income products. Individual investors generally underestimate their life expectancies and shy away from annuities and other lifetime income products. That is where pensions come in. Just as group health insurance spreads health risks over large groups, traditional defined benefit pension plans spread longevity risk over large groups: traditional pensions either provide annuity-like retirement benefits to their participants or purchase group annuities for them.

Unfortunately, as we have seen, traditional defined benefit pension in both the private and public sector are often underfunded, and in recent years we have seen numerous plan sponsors freeze, terminate, or replace their plans. Market volatility, shrinking labor forces, and increasing life expectancies have all exerted pressure on traditional defined benefit plans and


See supra Part III.C.5.

See supra note 34-37 and accompanying text.

Id. Pertinent here, for example, the Pension Benefit Guaranty Corporation took over 111 newly failed single-employer plans in Fiscal Year 2013, PENSION BENEFIT GUARANTY CORPORATION, supra note 35, at 5; and the City of Detroit went into bankruptcy, in large part because of the their pension debts. See, e.g., Monica Davey, Bill Vlasic
their sponsors. It is no wonder that we have seen defined contribution plans supplant defined benefit plans in the private sector, and there is increasing pressure on public employers to also consider replacing their traditional defined benefit plans with defined contribution plans. For example, 50% of full-time private industry workers in the United States participated in defined contribution plans in 2011, up from 40% in 1989-90; meanwhile, participation in defined benefit plans fell from 42% in 1989-90 to just 22% in 2011. All in all, the era of the traditional defined benefit plan is largely over.

That is where tontine pension plans can come in. Like a typical defined contribution plan, a tontine pension would always be fully funded. Like a traditional defined benefit plan, however, a tontine pension would make annuity-like payments for as long as its retirees lived. This Subpart explains how a tontine pension would work.


These are ERISA-covered plans and do not include non-ERISA plans such as IRAs and Roth IRAs. Of these ERISA-covered plans, just 45,256 were defined benefit plans (with 40.9 million participants and $2.5 trillion in assets), while 638,390 were defined contribution plans (with 88.7 million participants and $3.8 trillion in assets). Id. at 3 tbl. A1. Of these defined contribution plans, 513,000 were 401(k)-type plans. Id. at 1, 2.


1. A Simple Tontine Pension

An employer who wanted to provide a tontine pension for its employees would set up a defined-contribution-style pension plan, only instead of investing its contributions in stocks and bonds, the employer would invest in a tontine annuity for its employees. For example, each year, an employer might make contributions of, say, 10% of salary. Those contributions would be held in trust and invested in a tontine annuity, and allocated to the individual tontine pension accounts of the participants. The difference is largely in the payouts. Rather than being able to get lump sum distributions (or periodic payments or a life annuity), each tontine pension plan participant would get benefits based on the tontine principle. That is, the employer contributions for each participant, and the investment earnings on those contributions, would be held in a tontine annuity, and monthly “tontine pension distributions” would be the only kind of distributions made to retirees.

More specifically, starting at the participant’s normal retirement age (or later, if she so elected), the balance in her tontine pension account would be paid out to her in the same manner as if she had purchased her own tontine annuity with the employer contributions made on her behalf. No other form of distribution would be permitted, ever. For example, for a typical worker who had accumulated $250,000 at her retirement, her monthly statement would look just like the sample monthly statement for the tontine annuitant in Table 7.

In short, a tontine pension would provide lifetime retirement income from a defined-contribution-like platform. Essentially, the tontine pension is like a defined contribution plan that only pays benefits in the form of an actuarially fair life annuity. The difference is that rather than having the plan sponsor purchase annuities for each retiring employee or otherwise bear the risks
and costs of providing the promised annuity benefits, with a tontine pension, the plan sponsor bears no investment or actuarial risks at all. The tontine pension would make distributions to retirees out of the funds accumulated in the underlying tontine annuity and in accordance with the fair-transfer-plan and annuity-payback protocols. Pertinent here, these monthly tontine pension distributions could be designed to mimic immediate, level-payment annuities; immediate, inflation-adjusted annuities, deferred annuities, or joint and survivor annuities.

2. A Comparison of a Tontine Pension with other Pension Alternatives
   a. Tontine Pensions v. Traditional Defined Benefit Plans
      A tontine pension could easily be designed to pay benefits that were, on average, comparable to those paid by a traditional, final-average-pay defined benefit plan. To be sure, the benefits paid by a tontine pension would vary from month to month because of fluctuations in the value of the underlying assets and the variability inherent in the indeterminateness of the deaths of other participants in the tontine pension. But, on average, benefits paid by a tontine pension would approximate an actuarially fair life annuity.

      With a defined benefit plan, variation in monthly payments is eliminated, but only because the plan sponsor (employer) guarantees the promised payments. The plan sponsor bears all the contribution, mortality, and investment risks, and we have, of course, seen how poorly that has worked out, with thousands of failed plans in the private sector and a multitude of

\[146\] See Part IV.B, infra.
\[147\] Id.
\[148\] At the outset, we note that a tontine pension basically is a kind of deferred annuity: for example, unless an unmarried participant survives until retirement, she would forfeit the balance in her tontine pension account (just like an unmarried participant in a traditional defined benefit plan). If she wanted to defer her payouts even longer, say, until age 85, then her account would simply reinvest the mortality gain distributions from dying participants until then. Because of adverse selection, it might be necessary for such deferral elections to be made years in advance.
\[149\] For more on how to design such a qualified joint and survivor tontine annuity, see infra Part.VI.D.3.
underfunded plans in both the private and public sectors.\textsuperscript{150} While plan sponsors do a much better job growing investments than individuals,\textsuperscript{151} plan sponsors do not always have the discipline to make the contributions that are needed to keep their traditional defined benefit plans fully funded.\textsuperscript{152} On the other hand, tontine pensions would always be fully funded, just as defined contribution plans are almost always fully funded—through regular contributions equal to, say, 10% of salary.\textsuperscript{153}

In short, tontine pensions have two major advantages over traditional defined benefit plan pensions. First, unlike traditional pensions which are frequently underfunded, tontine pensions would always be fully funded. Second, unlike traditional pensions where the plan sponsor must bear all the investment and actuarial risks, with a tontine pension, the plan sponsor bears neither of those risks.

b. Tontine Pensions v. Typical Defined Contribution Plans

So how do tontine pensions stack up against typical defined contribution plans? The answer is very well, indeed. Like a typical defined contribution plan, a typical tontine pension might start with employer contributions equal to, say, 10% of salary. In the typical defined contribution plan, however, the participants are often allowed to direct the investment of their individual accounts, and payouts almost always take the form of lump sum and periodic distributions rather than annuities.\textsuperscript{154} On the other hand, with a tontine pension, the plan sponsor

\textsuperscript{150} See \textit{supra} notes 34-37 and accompanying text.
\textsuperscript{151} See, e.g., Munnell et al., \textit{supra} note 120; Forman & Mackenzie, \textit{supra} note 24, at 6-39–6-40; Forman, \textit{supra} note 120.
\textsuperscript{152} See \textit{supra} notes 34-37 and accompanying text.
\textsuperscript{153} To be sure, employers sometimes cut their contribution rates, but such plans are still fully funded by the contributions that are made.
\textsuperscript{154} See \textit{supra} note 137 and accompanying text.
could, and should, manage the investments, and benefits would be paid out only as a tontine pension that approximates an actuarially fair variable annuity.

To be sure, a plan sponsor could design a defined contribution plan where the plan sponsor manages all the investments and where benefits are only paid out in the form of a life annuity. But we know of no defined contribution plans like that, and we doubt that any employer with a defined contribution plan would have the discipline to design and continue such a plan in the face of employee expectations and demands 1) that the employees be allowed to direct their investments, and 2) that the employees be allowed to get the balance in their accounts as periodic or lump sum distributions rather than only as life annuities.

In fact, we believe that a tontine pension is reasonably analogous to a defined contribution plan with mandatory annuitization. There are a couple of key differences, however. First, with a tontine pension, those who survive until retirement would also benefit from the forfeitures of the accounts of those who did not; and, as far as we know, that does not happen with any defined contribution plans. Second, while a tontine pension would automatically provide benefits that approximate an actuarially fair life annuity, a defined contribution plan would have to purchase a lower-yielding commercial annuity to provide a mandatory annuitization benefit.

c. **Tontine Pensions v. Cash Balance Plans**

A tontine pension is also a lot like a cash balance plan with mandatory annuitization. In a cash balance plan, the sponsor credits hypothetical individual accounts with contributions of, say, 10% of compensation. As with traditional defined benefit plans, the default benefit in a cash balance plan is a life annuity; however, cash balance plans typically do allow lump sum and
periodic distributions, as well.\textsuperscript{155} Indeed, we doubt that there are any cash balance plans that require the benefits to be taken in the form of a life annuity, and we doubt that there are any employers that would have the discipline to design and continue such a plan in the face of employee expectations and demands that the employees be allowed to get the balance in their accounts as periodic or lump sum distributions rather than only as annuities.

Moreover, as cash balance plans are defined benefit plans, like traditional pensions, cash balance plans are often underfunded. On the other hand, with a tontine pension, the plan sponsor’s contributions would be fixed at, say, 10\% of compensation; and the plan would then be fully funded with those actual contributions. The plan sponsor would then manage and grow the investments, and tontine pension distributions would approximate an actuarially fair annuity.

3. \textit{Summary of the Advantages and Disadvantages of Tontine Pensions}

In essence, a tontine pension would be like a traditional defined benefit pension plan, except that it would always fully funded and the plan sponsor would never bear any of the investment or actuarial risks. Participants would receive monthly tontine pension benefits for as long as they lived, and for that matter, a tontine pension could be designed to provide inflation-adjusted annuities, deferred annuities, or joint and survivor annuities.\textsuperscript{156} Conceivably, individual participants could be allowed to make additional elective contributions to their accounts, just as they do now under 401(k)-type plans.\textsuperscript{157}

The principal disadvantage of a tontine pension is that monthly payments would vary in amount. One source of variation is the randomness of member deaths, but the more participants


\textsuperscript{156} \textit{See supra} notes 146-149 and accompanying text.
there are in the plan, the less significant that noisiness would be. For a tontine pension that
covered thousands of participants, the variation due to random deaths would be minimal.
However, there could still be considerable variation due to volatility in both the value of the
underlying assets and the rate of return on those assets.\textsuperscript{158}

Finally, as with traditional defined benefit plans, participants who live the longest would
collect the most benefits, and those who died young might not even recover the amounts
contributed on their behalf. Of course, that is the nature of traditional defined benefit plans, life
annuities, and most other lifetime income products, so it is not a “disadvantage” that is unique to
a tontine pension plans.

\section*{IV. \textsc{Modeling a Simple Tontine Pension}}

In this Part we design a model tontine pension for a large employer and then use a
computer simulation to see what kind of tontine pension benefits the participants could expect to
receive.

\textit{A. The Parameters of the Simulation}

Our computer simulation uses a pool of approximately 170,000 members (approximately
100,000 active employees and 70,000 retirees). The parameters of the simulation are as follows:

- The employer hires 3,600 employees each year (300 each month).
- The employee’s gender is randomly selected, equiprobably male or female.
- Each employee is hired on her 35\textsuperscript{th} birthday and works continuously for the
  employer for 30 years until age 65, or earlier death.\textsuperscript{159}

\textsuperscript{157} But see the discussion in Part VI.D.2, \textit{infra}.
\textsuperscript{158} See \textit{supra} note 112 and accompanying text.
\textsuperscript{159} We chose 30 years as a reasonable career. Obviously, workers who work 35 years would earn proportionately
larger tontine pension benefits, and those who work 25 years would earn proportionately smaller benefits. Tontine
pension benefits would also vary if workers started working before or after our assumed start age of 35 or retired
before our assumed retirement age of 65.
Each employee is hired at a salary of $50,000 a year, and her salary increases 4.0% each year.\footnote{In that regard, for example, the California State Teachers’ Retirement System’s defined benefit plan uses a 3.75% annual wage growth assumption. Milliman, supra note 14, at 55.}

At retirement, each employee receives a tontine pension until death.

- In this simple simulation, nobody is married (so no joint and survivor benefits are needed).

The account balances of those who die are forfeited.\footnote{If we had assumed that living workers could leave, their account balances would go with them to their new employer’s plan, and vice versa, so we ignore them. To make the simulation less complicated, only the retirement phase was simulated, i.e., the payouts to those age 65 and older. The account balance at age 65 was set equal to the expected value (i.e., the statistical average) of the account of a worker who survives to age 65. The number of workers surviving to retirement was set to its expected value from the Social Security Administration’s 2009 unisex life table. Social Security Administration, supra note 92.}

- Every year, the employer contributes 10\% of salary for every employee to the tontine pension.\footnote{We use the very plausible 10\% contribution rate. That rate has the added advantage that it is easy to extrapolate away from it. For example, if one thinks that 15\% is a better contribution rate, one need only multiply most of our model’s results by 150\%. Nor must the contributions necessarily come from the employer: the results would be exactly the same if the employer and employee each contributed 5\% of salary, for a total of 10\%.}

- Investment return: funds are professionally managed and earn 7.0\% net of investment expenses each and every year, compounded annually\footnote{Our 7\% investment return assumption is also fairly reasonable. For example, the California State Teachers’ Retirement System’s defined benefit plan uses 7.5\% as its estimate of investment return (net of investment and administrative expenses). Milliman, supra note 14, at 55. While many public pension plans have higher assumed rates of return and have historically achieved even higher rates of return, many analysts believe we are in a low return environment for the indefinite future. See, e.g., James J. Rizzo & Piotr Krekora, The Goldilocks Principle & Investment Return Assumptions 41 (Florida Government Finance Officers Association 2013 Annual Conference, Boca Raton, Florida, June 25, 2013), http://www.fgfoa.org/Assets/Files/Jim_Rizzo_Presentation_PDF.pdf (finding that 6.78\% was the average rate of return projected by eight national investment consulting firms for public pension plan portfolios over the next 15 years, compared with the 8\% rate of return that those plans commonly use).}

- Inflation is 3.0\% each year.\footnote{For example, the California State Teachers’ Retirement System’s defined benefit plan uses a 3.0\% inflation assumption. Milliman, supra note 14, at 55.}
• Workers receive no payouts until age 65, and then retirees receive either uniform (fixed annuity-type) payouts or, alternatively, inflation-adjusted annuity-type payouts.\textsuperscript{165}

• The mortality model is based on the Social Security 2009 unisex mortality table\textsuperscript{166}
  
  o Therefore, at equilibrium, approximately 3,000 out of the 3,600 initial hires each year make it to age 65; approximately 100,000 are actively employed at any time; and there are approximately 70,000 retirees at any point in time.

\textbf{B. Calculation of the Retirement Balance}

At the outset, Table 8 shows how this tontine pension would work for workers age 35 through 64. Column 1 of Table 8 shows the age of each worker from 35 through 64. Column 2 shows the salary of that worker each year. Column 3 shows the amount of the 10%-of-salary contribution that her employer makes to the tontine pension each year. Column 4 shows the account balance at the end of the year, not including the mortality gains that would result from the forfeitures from other members who died that year.\textsuperscript{167} Column 5 shows the worker’s probability of dying during that year. Finally, Column 6 shows the closing balance in the worker’s account including the mortality gains that result from the forfeitures from other members who died that year.\textsuperscript{168} The final row of Table 8 shows that a worker who lived (and worked) from age 35 through age 64 and retired at 65 would have a final preretirement salary of

\textsuperscript{165} That is, the expected value of payouts is either uniform or inflation-adjusted.
\textsuperscript{166} See Social Security Administration, \textit{supra} note 92.
\textsuperscript{167} It is calculated as the sum of the prior year’s balance times (one plus the interest rate) + the current year’s contribution times the square root of (one plus the interest rate).
\textsuperscript{168} This is the expected value of the balance that results from mortality gains. See \textit{supra} note 161. It is computed by taking the preliminary balance and dividing it by (one minus the death probability). For example, the closing balance in the account of a worker age 64 is $843,376 ($843,376.82 = $833,161/(1 – 0.012113) (minor error due to rounding).
$155,933 (column 2) and would have a starting retirement balance in her tontine pension account of $843,376 (column 6).

Table 8. Calculation of the Retirement Balance

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<th>Age</th>
<th>Salary</th>
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</table>

C. Calculation of the Monthly Tontine Pension Distributions

At retirement, the expected monthly payout is identical to the actual monthly payout of an actuarially fair annuity. As we have seen, the monthly payout of an actuarially fair annuity equals
the account balance divided by the applicable monthly annuity factor.\textsuperscript{169} For example, consider a new retiree, that is, a worker who lived (and worked) from age 35 through age 64 and retired at retired on the last day of that year. We can see from the last entry in Table 8 that the closing account balance for that worker/retiree was $843,376. Assuming that she wants to draw level monthly tontine pension payments for the rest of her life, she should start by looking at the first entry in column 5 of Appendix Table which shows the uniform monthly annuity factor for the first month after she turns 65 is almost 118. Therefore, the first monthly distribution for a uniform tontine pension would be $7,166 ($7,166 = $843,376 /117.693880).

Alternatively, if she, instead, wanted inflation-adjusted payments, column 6 of Appendix Table 1 shows an initial monthly annuity factor of almost 152. Accordingly, the first monthly distribution for an inflation-adjusted tontine pension would be just $5,549 ($5,549 = $843,376 /151.987601).

Figure 2 plots the expected payouts from these uniform and inflation-adjusted tontine pensions over time. The plot is for a member retiring on her 65th birthday. The uniform payout is the amount of the monthly payment, in dollars. Ideally it is a constant $7,166 per month for life—and that is what an actuarially fair life annuity would pay.\textsuperscript{170} The actual payments would fluctuate a little bit around that value, but as the plot shows, the uniform payout curve is relatively smooth. Of course, that is what we would expect given that the model assumes a constant 7% rate of return and a constant 3% inflation rate. Consequently, monthly fluctuations

\textsuperscript{169} See \textit{supra} note 117-118 and accompanying text.
\textsuperscript{170} For comparison, an annuity purchased from an insurer would make a fixed monthly payment, but of a lower amount depending on the insurer’s load charge. For a typical load of, say, 10%, the payment would fall to just $6,494 per month ($6,449.40 = $7,166 \times 90\%).
result only from the randomness of deaths in the population, but with approximately 70,000 retirees, those fluctuations are minor.

By contrast, the inflation-adjusted payout starts at $5,549 per month and increases at an annual rate of 3% per year—that is what an actuarially fair life annuity with a 3% escalator would pay (and we have assumed a constant 3% inflation rate). Again, the actual payments will fluctuate a little bit around those values, but as the plot shows, the inflation-adjusted payout curve is also relatively smooth.

D. ADEQUACY

All in all, we have shown how a large employer could use a tontine pension to provide retirement benefits for its employees. Given the assumptions in our model, our hypothetical
retiree would have a final salary of $155,933 at age 64 and would have accumulated $843,376 by age 65; and the latter sum would support a uniform tontine pension of $7,166 per month for life or an inflation-adjusted tontine pension that starts at $5,549 per month at age 65 and increases in later months.

It is relatively easy to determine how much of preretirement income this 30-year, 10%-of-salary tontine pension would replace. For example, multiplying the uniform monthly benefit of $7,166 times 12 month yields an annual tontine pension of $85,992 ($85,992 = 12 × $7,166), and it is easy to see that the tontine pension would replace of 55.1% of preretirement earnings in the first year of retirement (i.e., a “replacement ratio” of 55.1% [0.5514676 = $85,992 ÷ $155,933]).

Similarly, the inflation-adjusted monthly benefit should yield an annual tontine pension of at around $66,588 ($66,588 = 12 × $5,549) and a replacement ratio of around 42.7% of preretirement earnings (0.4270295 = $66,588 ÷ $155,933). In addition to these tontine pensions, however, our retiree would almost certainly receive Social Security benefits, and those Social Security benefits would replace another 35% or 40% of her preretirement income.

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171 The replacement ratio is the ratio of income in retirement to income preretirement. The desired replacement ratio is almost always assumed to be less than 100%, because of elimination of work-related expenses, the fact that some income has been devoted to saving for retirement, and because Social Security benefits are taxed more favorably than earned income. See, e.g., Aon Consulting, 2008 Replacement Ratio Study 24 (2008), http://www.aon.com/about-aon/intellectual-capital/attachments/human-capital-consulting/RRStudy070308.pdf (estimating that required replacement ratios ranged from 77% for a person earning $80,000 a year in 2008 to 94% for a person earning $20,000 that year).

172 Because of the impact of 3% inflation assumption and the passage of time on the monthly tontine pension annuity factors, our retiree could expect that her monthly tontine pension benefits in 11 months following the initial month should be slightly larger than $5,549. Accordingly, she should get an annual pension of more than $66,588 and have a replacement ratio of more than 42.7%.

All in all, it seems that a 10%-of-salary tontine pension would generate pretty substantial retirement benefits for the typical worker. Moreover, raising the tontine pension contribution rate or increasing the number of working years covered by the tontine pension would result in retirees receiving more benefits and having higher replacement ratios.

**E. TONTINE PENSIONS IN THE REAL WORLD**

Our model does a pretty respectable job of showing how a tontine pension could work in the real world. To be sure, the assumptions of the model are a little bit rigid. In the real world inflation is not always 3% per year, wages do not always go up by 4% per year, and investments do not always earn 7% rates of return. In the real world, each of those parameters are highly variable, although their average values are probably pretty close to our assumed values. In general, that real world variability could easily result in retirees receiving smaller (or larger) monthly distributions from their tontine pensions. To the extent that that real-world volatility puts retirement income security at risk, it is worth emphasizing that either raising the tontine pension contribution rate or increasing the number of working years covered by the tontine pension would result in retirees receiving more benefits and having higher replacement ratios.

**V. REPLACING CALIFORNIA STATE TEACHERS’ RETIREMENT SYSTEM (CALSTRS) WITH A TONTINE PENSION**

In this Part we consider how a tontine pension for a large employer would work. Given the strictures of ERISA and federal securities regulation laws, we acknowledge that it may be a challenge for a private pension plan sponsor to create a tontine pension under current law. On

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174 For a more thorough discussion of the legal issues involving tontine pensions, see Part VI.B, *infra*. 64
the other hand, public employers are exempt from most of ERISA’s pension regulations. Accordingly, we believe that a state government could easily create a tontine pension that would not run afoul of federal law. As we have seen, such a tontine pension would be fully funded and would make annuity-like payments to retirees for as long as they lived.

As most states already have pension plans that cover most of their employees, what we are really talking about here is the prospect of replacing an existing state pension plan with a tontine pension. In particular, some states might want to replace their underfunded traditional defined benefit pension plans with tontine pensions. For our example, this Part considers whether California might want to replace the $71 billion underfunded California State Teachers’ Retirement System (CalSTRS) defined benefit plan with a tontine pension.

A. SOME BACKGROUND ON CALIFORNIA STATE TEACHERS’ RETIREMENT SYSTEM (CALSTRS)

The California State Teachers’ Retirement System (CalSTRS) is the largest educator-only pension in the world, with a membership of 862,192 and assets of approximately $181.1 billion as of December 31, 2013. One of the largest programs that CalSTRS administers is its traditional defined benefit retirement plan, where benefits are based on a member’s years of service, age, and highest compensation. Basically, members get an annual retirement benefit

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176 See supra Part III.D. We recognize, that many governments use their pension plans to provide disability benefits, and some also use their pension plans to provide retiree health benefits; however, for simplicity, in this Article, we have ignored both disability benefits and retiree health benefits.
177 See infra note 183 and accompanying text.
(B) that is equal to 2% times the number of years of service (yos) times final average compensation (fac) (B = 2% \times yos \times fac).

For the fiscal year ended June 30, 2012, the CalSTRS traditional defined benefit pension had 421,499 active members with an average annual salary of $60,233 and 262,038 retired members and beneficiaries with an average annual retirement benefit of $42,204.\textsuperscript{180} Also as of June 30, 2012, the CalSTRS defined benefit plan was just 67.0% funded, with an unfunded liability of almost $71 billion.\textsuperscript{181} The normal retirement benefit cost, expressed as a percentage of total compensation was 16.831%.\textsuperscript{182} In addition, as of June 30, 2012, CalSTRS needed another 15.816% of compensation to amortize its $71 billion unfunded liability over 30 years.\textsuperscript{183}

\textbf{B. REPLACING THE CALSTRS DEFINED BENEFIT PLAN WITH A TONTINE PENSION}

There are a variety of possible ways to replace a traditional pension like the CalSTRS defined benefit plan with a tontine pension. Perhaps the most likely approach would be to keep the current defined benefit plan for all current employees but to close entry to that plan and require all new employees to join a newly created tontine pension.\textsuperscript{184}

A more interesting approach would be for CalSTRS to freeze its current defined benefit plan and add a new tontine pension for all future benefit accruals. At retirement, beneficiaries would then receive the defined benefit plan benefits that they have already accrued, but they would not accrue any additional benefits under their traditional defined benefit plan; instead

\textsuperscript{180} Milliman, supra note 14, at 10.
\textsuperscript{181} Id.
\textsuperscript{182} Id. at 17 tbl. 1. Under the entry-age normal cost method, the normal cost is calculated to produce a level cost over each employee’s career (i.e., a level percentage of payroll). The normal cost generally represents the expected cost of projected benefits attributable to work performed and pension benefits earned in the current plan year. Id. at 15.
\textsuperscript{183} Id. at 40 tbl. 15.
future contributions would be made to a new tontine pension. Theoretically, CalSTRS would freeze its defined benefit plan and add a tontine pension with future retirement contributions set at, say, 16.831% of compensation (i.e., the current CalSTRS defined benefit plan’s normal cost rate).\(^\text{185}\) Going forward, such a plan would be roughly as generous as the current plan, but CalSTERS would never again have to worry about underfunding attributable to future benefit accruals. To be sure, this way of replacing the CalSTRS defined benefit plan with a tontine pension would do nothing to reduce its current $71 billion unfunded liability, and that obligation would still need to be met by the State of California.

Needless to say, we do not mean to suggest that replacing the CalSTRS defined benefit plan with a tontine pension would be politically easy. We merely suggest that a tontine pension could provide an alternative way of providing lifetime retirement income to California teachers, and we note, again, that unlike traditional defined benefit plans—which are often underfunded, a tontine pension can never become underfunded.

VI. SOLVING THE TECHNICAL PROBLEMS OF REPLACING A TRADITIONAL PENSION WITH A TONTINE PENSION

This Part addresses some of the technical issues raised by tontine pensions.

A. TAXATION OF BENEFITS

Presumably, tontine pension benefits would be taxed like other pension benefits.\(^\text{186}\) Basically, employer contributions to a tontine pension should be excluded from the income of employees; the tontine pension fund’s earnings should be exempt from tax; and retirees should


\(^{185}\) See supra note 182 and accompanying text.

\(^{186}\) See supra Part II.B.1.
only be taxed when they receive their monthly tontine pension distributions. At the same time, the employer should be allowed a current deduction for its contributions to the tontine pension.187 Pertinent here, we note in passing that the prospectus for the College Retirement Equity Fund (CREF) suggests that CREF’s tontine-style pensions and annuities are taxed in accordance with these principles.188

B. LEGAL ISSUES

Although it is not free from doubt, it appears that tontine funds, tontine annuities, and tontine pensions are all legal. As already mentioned, investigations of the insurance industry in New York led to the enactment of legislation in 1906 that all but banned tontines.189 To be sure, the legislation did not specifically prohibit the sale of tontines; instead, it just made it difficult for companies to defer payments beyond one year.190 Many other states followed New York’s lead, and tontines soon fell out of favor.191

Much has changed since the beginning of the 20th Century, however. In particular, financial products today do a much better job at record-keeping, and investment assets are usually held by independent custodians. Also, most states have also softened their views on lotteries and gambling. Accordingly, there should be less suspicion about tontine financial products. In fact, these days, only Louisiana and South Carolina have statutes that actually ban

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187 To the extent that any employees make (or are deemed to make) any after-tax contributions to their tontine pension funds, they should be allowed to recover those contributions tax-free, just as they could with a typical pension or annuity. See supra note 28.
188 See, e.g., TIAA-CREF Financial Services, supra note 128, at 84-90.
189 See supra note 11 and accompanying text.
190 COOPER, supra note 7, at 56.
191 Id. at 57.
tontines. All in all, these days it seems likely that tontine financial products could be designed in ways that would survive state regulatory scrutiny. Indeed, as we have seen, the College Retirement Equity Fund (CREF) is at least arguably a tontine, and it operates in, and is expressly regulated, by the State of New York as well as by the insurance regulators of certain other states. In any event, any state that wished to set up a tontine pensions for its own workers could certainly enact a statute to permit it.

Tontine financial products should also be able to withstand federal regulatory scrutiny. As long as those tontine financial products keep good records, make adequate disclosures, and have the underlying investment assets held by independent custodians, the Securities and Exchange Commission should be satisfied.

To be sure, the Employer Retirement Income Security Act (ERISA) might present some regulatory hurdles, at least for some tontine pensions. At the outset, however, it is worth noting that tontine funds and tontine annuities are not employee benefit plans within the meaning of ERISA, so they would not be subject to ERISA.

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192 McKeever, supra note 7, at 514.
193 See supra notes 125-132 and accompanying text.
194 See TIAA-CREF Financial Services, See supra note 131, at B-38.
195 ERISA §§ 3(1), 4, 29 U.S.C. §§ 1002(1), 1003(a). Pertinent here, to the extent that any tontine annuities might otherwise be subject to ERISA, we believe that ERISA’s insurance savings clause is relevant, at least with respect to any tontine annuity that is viewed as an insurance product under the applicable state’s law. ERISA’s preemption clause provides that ERISA “shall supersede any and all State laws . . . [that] relate to any employee benefit plan”; however, the savings clause then exempts from preemption any state law “which regulates insurance, banking, or securities.” ERISA §§ 514(a), (b)(2)(A), 29 U.S.C. §§ 1144(a), (b)(2)(A). In short, Congress generally left the regulation of insurance products to the states. Presumably, tontine annuities sold by insurance companies would be subject to regulation by state insurance regulators. But what about tontine annuities sold by, say, a discount broker? Are these just investment products, or are they insurance? We are not certain, but again, as tontine annuities, without more, are not employee benefit plans, we believe that they are outside the scope of ERISA.
On the other hand, tontine pensions clearly are employee benefit plans within the meaning of ERISA. As mentioned, government plans are exempt from ERISA, so state and local governments could easily set up tontines pensions for their employees without having to worry about ERISA.

Conversely, private tontine pension plans would certainly be subject to ERISA. The question here is whether there are any provisions of ERISA that would prevent private employers from creating tontine pensions for their employees. At the outset, we note that traditional pensions exhibit tontine characteristics, for example, those who live longer will collect more (monthly) benefits than those who die younger. On the other hand, several provisions of ERISA may pose regulatory challenges for tontine pensions.

For example, with respect to defined benefit plans, Internal Revenue Code Section 401(a)(8) says that “forfeitures must not be applied to increase the benefits any employee would otherwise receive under the plan. Recall that with a tontine pension, all participants would be entitled to a benefit that approximates an actuarially fair annuity. Of course, that means that those who live longer will get more (monthly) benefits than those who die younger. As this is exactly what happens with a traditional defined benefit plan, we believe that tontine pensions should not be viewed as applying forfeitures to increase the benefits of other employees in violation of Section 401(a)(8); and we believe that the Internal Revenue Service would be willing to issue guidance to that effect (e.g., a private letter ruling). Moreover, we note that defined benefit plans have always been allowed to invest in annuities for their employees, and, accordingly, we believe

197 See supra note 175 and accompanying text.
that they would be allowed to invest in tontine annuities, as well. Of course, employers might
prefer to operate their tontine pensions on a fully-funded defined contribution plan platform, in
which case, by its terms, Internal Revenue Code Section 401(a)(8) would not be applicable.

ERISA’s vesting rules may also pose a regulatory challenge for tontine pensions. For
example, could a tontine pension meet the three-year cliff vesting rule that is generally applicable
to employer contributions? The question is what to make of the fact that a single worker with a
tontine pension account would lose everything in her account at her death, even if she had
worked for the employer for more than three years. Is forfeiture at death allowed in a defined
contribution plan investment? One way to look at this problem is to ask whether an employer
could use its employer contributions each year to buy conventional life annuities for each
employee, and we think the answer to that question is yes. Accordingly, as tontine annuities
would work just like conventional annuities, an employer should be able to design a defined
contribution plan that invests in tontine annuities for its employees, even if those tontine
annuities would become worthless at death.

198 COOPER, supra note 7, at 61.
200 Another way to think about this problem is to start by considering an individual with a individual retirement
account (IRA). IRAs are not subject to ERISA, but the Internal Revenue Code rules that govern IRAs are very
similar to the ERISA rules governing defined contribution plans. In any event, we do not believe that there is
anything in the Internal Revenue Code that would prevent an individual from having her IRA invest in a tontine fund
or in a tontine annuity. Nor do we think that there is anything in ERISA that would prevent a participant with a self-
directed 401(k) plan from investing in a tontine fund or annuity. Finally, there is no doubt that an employer can
create a defined contribution plan, make contributions on behalf of its employees to that plan, and invest those
contributions for the benefit of its employees. So the question really comes down to whether a plan sponsor can
invest those employer contributions in a tontine fund or tontine annuity, knowing as we do that each employee will
lose the balance in her account when she dies. We see no reason why not.
ERISA’s fiduciary obligation rules might also pose some regulatory challenges for tontine pensions.\textsuperscript{201} For example pension plans must be operated for the exclusive benefit of employees or their beneficiaries.\textsuperscript{202} But, again, we see no reason to be concerned about a pension operating as a tontine pension or investing in tontine annuities; and we believe that the government would be willing to issue guidance to that effect.\textsuperscript{203}

All in all, we believe that tontine funds, tontine annuities, and tontine pensions could be designed in ways that would comply with applicable state and federal laws.\textsuperscript{204}

\textbf{C. \textit{Dealing with Market Volatility}}

Unlike a traditional defined benefit pension plan that makes fixed or inflation-adjusted benefit payments, tontine pensions would be volatile. Monthly tontine pension distributions would vary both with fluctuations in the value of the underlying assets and also with the variability inherent in indeterminateness of the deaths of other participants in the tontine pension. As we have shown, the noisiness due to the randomness of the deaths of other participants would largely disappear as long as there are enough participants in the tontine pension.\textsuperscript{205}

On the other hand, the volatility due to fluctuations in the value of the underlying assets will not. This, of course, is the same problem that any investor with a defined contribution plan or variable annuity has.\textsuperscript{206} For example, an investor who used the 4% rule to withdraw $40,000

\textsuperscript{201} See, e.g., I.R.C. § 401(a); ERISA § 404, 29 U.S.C. § 1104.
\textsuperscript{202} I.R.C. § 401(a); ERISA §§ 403(a), 404(a)(1)(A), 29 U.S.C. §§ 1103, 1104(a)(1)(A).
\textsuperscript{204} We note in passing that private tontine pension plans would clearly be employee benefit plans within the meaning of ERISA. See ERISA §§ 3(1), 4, 29 U.S.C. §§ 1002(1), 1003(a). Consequently, ERISA’s preemption clause would preempt any state laws that might otherwise prohibit a tontine pension, including state laws that prohibit tontines. See ERISA § 514(a), 29 U.S.C. § 1144(a).
\textsuperscript{205} See \textit{supra} Part III.B.3.a.
\textsuperscript{206} See \textit{supra} Part III.C.2.
from her individual account in 2007 when her stock portfolio was worth $1,000,000 could only withdraw around $20,000 in 2009 when if that portfolio was worth just $500,000. To be sure, an investor can always minimize the effects of such market volatility by investing conservatively in bonds, but then the expected earnings on her portfolio might fall dramatically.207

The key to managing financial market volatility is to plan on it. Individuals do this all the time. For example, wise consultants with periodic earnings generally spend no more money in the months that they get commissions than they do in the months that they do not. So, too, the investor in the last paragraph could have spent just $30,000 of the $40,000 distribution she received in 2007 and saved the other $10,000 to spend in 2009 when she received just $20,000. In short, individuals can smooth their consumption by underspending in the good years so that they can spend more in the lean years. In effect, individuals can create their own “rainy day funds.” Alternatively, smoothing products, even “smoothed income annuities” can be purchased in the marketplace.208

For that matter, a tontine pension could itself be designed to provide for smoother distributions. For example, monthly distributions might be smoothed over a five-year period. When the tontine pension determines that a given monthly distributions would be higher than the average for the past five years, the distribution could be split, with a basic distribution going to the participant’s bank account, and the excess going into a holding account for that participant. In

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207 For example, according to one projection, over the next 10 years, the expected return on U.S. stocks is 7.25%, while the expected return on U.S. Treasury bonds is just 0.50%. BNY Melon, 10-Year Capital Market Return Assumptions: Calendar Year 2013 (2013), http://us.bnymellonam.com/core/library/documents/knowledge/market_commentary/bny_mellon_10_Year_capital_market_return_assumptions_2013.pdf.
a later month when the tontine pension determines that the distribution would otherwise be lower than the average for the past five years, the holding account would be tapped to provide a larger distribution. Presumably, the funds in the holding account would be invested along with all of the other assets held by the tontine pension, and presumably the balance in that holding account at the member’s death, if any, could be paid to the member’s estate.

In short, income smoothing could be accomplished either inside, or outside, of a tontine pension. In any event, the volatility in monthly distributions that is attributable to fluctuations in the value of the underlying investment assets held in a tontine pension is no worse a problem for tontine pensions than it is for defined contribution plans or variable annuities.

D. GENDER ISSUES

1. In General

While insurance companies can typically price the annuities that they offer to men and women differently, pension plans are not allowed to discriminate in that manner.209 Pension plans are simply not permitted to require higher contributions from women nor pay them lower benefits.210 Accordingly, when an employee retires with a traditional defined benefit pension, that retiree will see the same monthly pension benefits for life, regardless of gender. For example, CalSTRS pays identical pensions to retired men and women teachers who have the same service records: gender is just not a factor in the benefit formula.211 To be sure, defined benefit plan actuaries do take the gender of participants and their partners into account in determining the contributions that the plan sponsor needs to make, and retiring women can reasonably expect to

209 See supra note 60 and accompanying text.
210 Id.
211 See Part V.A, supra.
collect more monthly benefit checks than their male counterparts, but the monthly check amount must be the same for both men and women.\textsuperscript{212}

To be sure, tontine funds and tontine annuities could take gender into account.\textsuperscript{213} A tontine pension, however, would not be allowed to discriminate based on gender for the same reasons that traditional pensions cannot discriminate based on gender: Title VII of the Civil Rights Act of 1964 forbids it.\textsuperscript{214} A tontine pension can comply with the non-discrimination requirement by using unisex life expectancy tables, as this Article did with its model tontine pension.\textsuperscript{215}

2. Employee Contributions

Pertinent here, the Title VII gender-neutrality requirement somewhat undermines the attractiveness of allowing participants to make additional voluntary contributions to their employer-provided tontine pensions. To be sure, allowing employees to make supplement contributions to their tontine pensions would enhance their retirement incomes, just as voluntary contributions to 401(k) plans increase participant nest eggs and their retirement income. But tontine pensions would just not be as good an investment for men as for women, given their relative life expectancies. The typical man would be better off investing in a 401(k) plan or IRA (where gender is irrelevant) or in a tontine annuity sold by an insurance company (where gender could be taken into account).

\textsuperscript{212} On the other hand, a defined contribution plan can distribute lump sums to its retirees with the knowledge that the annuities available to them from private insurers will differ on gender lines. For example, as already noted, a 65-year-old man who purchased a $100,000 annuity in December of 2012 could get $6,864 a year for life, while a 65-year-old woman would get just $6,408 a year because of her longer life expectancy. See supra Part II.C.2.

\textsuperscript{213} See Subparts III.B & C, supra.

\textsuperscript{214} See supra note 60 and accompanying text.
3. Qualified Joint and Survivor Annuities (QJSAs) & Qualified Domestic Relations Orders (QDROs)

Under ERISA, defined benefit plans (and some defined contribution plans) are required to provide a qualified joint-and-survivor annuity (QJSA) as the normal benefit payment for married participants, unless the spouse consents to another form of distribution.²¹⁶ These plans are also required to provide a qualified preretirement survivor annuity (QPSA) option in case the worker dies before retirement.²¹⁷ ERISA-covered pension plans also allow state courts to divide the pension benefits of married couples through “qualified domestic relations orders” (QDROs).²¹⁸ Although not covered by ERISA, many public pension plans also provide similar spousal protections.²¹⁹

Tontine pensions could also be designed to provide spousal protections. First, with respect to survivor benefits, rather than having a married participant forfeit the entire balance in her account at her death, a tontine pension could be designed to provide qualified joint and survivor annuities and qualified preretirement survivor annuities. For example, at death the participant might simply forfeit only half of the balance in her account, and the remaining half

²¹⁵ Unisex tables are not a perfect solution, because they introduce inaccuracy compared to the use of gender-specific tables. But unisex tables would ensure that same-age men and women who have made identical contributions would receive identical monthly distributions, and that is what is required of pensions.
²¹⁶ I.R.C. §§ 410(a)(11), 417; ERISA § 205, 29 U.S.C. § 1055. A QJSA is an immediate annuity for the life of the pension plan participant and a survivor annuity for the life of the participant’s spouse. The amount of the survivor annuity may not be less than 50%, or more than 100%, of the amount payable during the time the participant and spouse are both alive.
²¹⁷ Id. A QPSA typically pays an annuity that is equal to the survivor’s portion of the QJSA.
would be retitled in the name of the surviving spouse. Second, a tontine pension could be designed to allow divorcing spouses to secure domestic relations orders that transferred a portion of the participant spouse’s tontine pension to the other spouse, perhaps even allowing the transferred half to be retitled in the name of the transferee spouse.

VII. CONCLUSION

In this Article, we showed how large employers could use tontine pensions to provide retirement income for their employees. More specifically, we developed a model tontine pension, and we used that model to show the retirement benefits that a typical worker could earn with a 10%-of-salary tontine pension. We estimated that over the course of a 30-year career, a typical retiree would earn a uniform tontine pension that would replace around 55% of her preretirement earnings or, alternatively, an inflation-adjusted tontine pension that would replace around 43% of her preretirement earnings.

These tontine pensions would have two major advantages over traditional defined benefit plan pensions. First, unlike traditional pensions—which are frequently underfunded, tontine pensions would always be fully funded. Second, unlike traditional pensions—where the plan sponsor must bear all the investment and actuarial risks, with a tontine pension, the plan sponsor would bear neither of those risks. These two features should make tontine pensions a particularly attractive alternative for employers who care about providing retirement income security for their employees but who want to avoid the risks associated with having a traditional pension.

220 Alternatively, the tontine pension of a married couple might be shared between the two spouses, along the lines of earnings sharing. See, e.g., FORMAN, above note 18, at 205-06.

221 Of course, QDROs can present some knotty adverse selection and moral hazard issues. For example, what, if anything, should be done to prevent a dying spouse from getting a divorce and using a QDRO to transfer her tontine pension to her ex-spouse rather than forfeiting it to the surviving members in her tontine pension plan.
In particular, we believe that tontine pensions offer a possible solution to the chronic underfunding of state and local pension plans. For example, we showed how California could replace the $71 billion underfunded California State Teachers’ Retirement System (CalSTRS) defined benefit plan with a tontine pension and never again have to worry about underfunding attributable to future benefit accruals.

Finally, we want to emphasize another feature of tontine pensions that we find particularly attractive. A tontine pension would closely resemble an actuarially fair variable life annuity, but it could be run by a low-fee discount broker. Accordingly, no money would need to be set aside for insurance agent commissions or for insurance company reserves, risk-taking, and profits. That means that tontine pensions would be able to provide significantly higher benefits to retirees than commercial annuities.

**APPENDIX**

Appendix Table 1 is based on the Social Security Administration’s 2009 unisex life table. For individual aged 35 through 119, column 1 shows their age (\(x\)), column 2 shows their life expectancy (\(e_i\)), and column 3 shows their death probability (\(q_i\)). Column 4 shows the force-of-mortality probabilities that we derived, and columns 5 and 6 show the uniform and inflation-adjusted monthly annuity factors for the first month of each year starting with age 65 that we derived.

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222 Social Security Administration, *supra* note 92.
223 See *supra* note 93 and accompanying text.
224 See *supra* notes 117 and accompanying text and 118 and accompanying text, respectively.
Appendix Table 1. Unisex Life Tables, 2009, with Force-of-Mortality Probabilities, and Monthly Annuity Factors

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<tr>
<th>Age (x)</th>
<th>Life Expectancy (years) $(e_x)$</th>
<th>Death Probability $(q_x)$</th>
<th>Force-of-Mortality Probability $(f_x)$</th>
<th>Uniform Monthly Annuity Factors for the First Month of the Year</th>
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Source: Social Security Administration, *United States life table functions and actuarial functions at 2.9 percent interest for unisex in calendar year 2009 based on the Alternative 2 mortality probabilities used in the 2013 Trustees Report* (2013), via personal communication to Professor Forman, November 12, 2013, and authors’ computations.

Notes: The monthly annuity factors were determined using an interest rate of 7% and an inflation rate of 3%.