Systemy zabezpieczenia społecznego wobec wyzwań demograficznych i rynkowych

Social security systems against the challenges of demographics and market

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TONTINE PENSIONS: A SOLUTION TO THE CHRONIC UNDERFUNDING OF TRADITIONAL PENSION PLANS

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 II 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. 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 (Sabin) has described how these tontine funds could be used to create “tontine annuities” that could be sold to individual investors. 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 Paper, 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. These tontine pensions would have several major advantages over most of today’s pensions, annuities, and other retirement income products.

Key words: tontine pension, age fairness, annuity investment

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1. 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 [Milevsky, Salisbury 2013]. 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) [IMDb 1980]. On the other hand, sometimes the fictional plots involved nefarious characters trying to kill off the rest of the investors and “inherit” the fund. \(^2\)

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. 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 could be sold to individual investors [Sabin 2010]. 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 Paper, 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. These tontine pensions would have several major advantages over most of today’s pensions, annuities, and other retirement income products.

2. TONTINE PENSIONS

2.1. The tontine principle

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

\(^2\) See [IMDb 1996] in which Grandpa Simpson reveals to Bart that he and Montgomery Burns were part of a World War II American army unit that stole priceless art from a German castle, which the last surviving unit member will inherit.
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 [Goldsticker 2007; Milevsky, Salisbury 2013; Newfield 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).

2.2. A tontine fund

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 situ-
ation – 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. 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 fair tontine fund would be designed.

2.2.1. 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.\(^4\) Structured in this way, a tontine fund could operate into perpetuity.

2.2.1.1. 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.\(^5\) For example, member 4 in Table 1 is an 80-year-old who has a life expectancy \((e_i)\) 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).

\(^{4}\) The situation is identical to a conventional annuity: once the premium is paid, there is no refund of it, ever.

\(^{5}\) The life expectancies \((e_i)\) and death probabilities \((q_i)\) 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 based on the Alternative 2 mortality probabilities used in the 2013 Trustees Report (2013), via personal communication to Professor Forman, November 12, 2013.
Table 1. A Tontine Fund with Four Members of Different Ages, Unisex

<table>
<thead>
<tr>
<th>Member (i)</th>
<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>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_x). 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) is quite clearly the member who is the most likely to die. These force-of-mortality probabilities (f_x) are relatively easy to compute from the death probabilities (q_x) in a mortality table.

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. 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 ≠ 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. The fair-transfer-plan weights are calculated to provide fair bets for all investors. These fair-transfer-plan weights are relatively easy to compute from the force-of-mortality probabilities (f_x) [Sabin 2011].

For example, if member 4 (the 80-year-old) is, in fact, the one who dies next, then: member 1 (the 65-year-old) would receive $187.64 = $1,000 × w_1/(1 - w_4) = $1,000 × 0.053815/(1 - 0.713207); member 2 (the 70-year-old) would receive $300.51 = $1,000 × w_2/(1 - w_4) = $1,000 × 0.086183/(1 - 0.713207); member 3 (the 75-year-old) would receive $511.85 = $1,000 × w_3/(1 - w_4) = $1,000 × 0.146795/(1 - 0.713207).
0.146795/(1 − 0.713207); and, of course, member 4 would forfeit her $1,000.\(^6\) We call the distributions to members 1, 2, and 3 “mortality-gain distributions”; meanwhile, member 4 has a mortality loss.

### 2.2.1.2. Tontine funds can be fair to all investors

Tontines can also be designed to take gender into account, to take differing levels of contributions into account, and to properly account for investment earnings. 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 investments (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).

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Fig. 1. Normalized mortality gain from FTPs versus age for a typical long-lived male member in a simulated tontine fund.

Source: Michael J. Sabin, Fair Tontine Annuity 25 fig. 5 (March 26, 2010), http://papers.ssrn.com/abstract=1579932

\(^6\) Checking our answer, $187.64 + $300.51 + $511.85 = $1,000.
For example, 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.

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.

2.2.2. 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 on 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 at advanced ages, as the member’s death probability \( q_i \) increases with age: in short, payouts are backloaded.

2.2.2.1. Reducing the noisiness of a tontine fund

The noisiness of a tontine fund can be reduced by 1) making monthly mortality-gain distributions (rather than as each death occurs), and 2) by having a large number of members in the pool.

For example, Table 2 shows a sample monthly statement for a member of a 5,000-person tontine fund who had contributed $250,000 to a tontine fund and who lived through the month. This member would get a single end-of-the-month distribution of $1,041.67, rather than getting varying amounts throughout the month.
Table 2. 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>67.17</td>
<td>250,000.00</td>
<td></td>
</tr>
<tr>
<td>04/02</td>
<td>25.21</td>
<td>250,067.17</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/03</td>
<td>55.14</td>
<td>250,092.38</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/05</td>
<td>135.41</td>
<td>250,147.52</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/07</td>
<td>48.91</td>
<td>250,282.93</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/12</td>
<td>52.29</td>
<td>250,331.84</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/15</td>
<td>102.54</td>
<td>250,384.13</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/20</td>
<td>159.46</td>
<td>250,486.67</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/21</td>
<td>139.68</td>
<td>250,649.13</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/22</td>
<td>17.82</td>
<td>250,785.82</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/25</td>
<td>124.81</td>
<td>250,803.63</td>
<td>Proceeds from FTP</td>
</tr>
<tr>
<td>04/28</td>
<td>55.32</td>
<td>250,928.44</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.

2.2.2.2. Reducing backloading in a tontine fund

Unfortunately, it is impossible to reduce the backloading that is inherent in a tontine fund. The longer a member lives, the more she would get, as her monthly mortality-gain distributions would generally increase with her age and her increasing death probability \((q_t)\). In the next Subpart, however, we show how we can solve this backloading problem by adding an “annuity-payback mechanism,” and we call the resulting product a “tontine annuity”.

2.3. A tontine annuity

A tontine annuity is constructed by adding two enhancements to a simple tontine fund. First, to reduce noisiness, we would build in a monthly payment period; and, second, to eliminate backloading, we would add an annuity-payback mechanism.
2.3.1. The annuity-payback mechanism

The approach we use to convert a tontine fund into a tontine annuity is to make "monthly tontine-annuity distributions" to surviving members that are designed to cancel out the age-related backloading that is inherent in simple tontine funds like the one in Figure 1. The resulting "tontine annuity" mimics an actuarially fair variable annuity.

It turns out that it is relatively easy to determine the proper amounts of these monthly tontine-annuity distributions. Here is the logic. The monthly payout of any actuarially-fair annuity is simply equal to the account balance divided by the appropriate monthly annuity factor. The monthly annuity factor is the premium for an actuarially-fair annuity that pays $1 per month for life. These monthly annuity factors can easily be calculated from a mortality table and depend only on the age of the annuitant and the assumed interest rate.

For example, assume that the hypothetical tontine fund member in Table 2 just turned age 65. Instead of paying her a monthly mortality-gain distribution of $1,041.67, a tontine annuity would make a monthly tontine-annuity distribution of $2,133 ($2,133.00 = $251,041.67 ÷ 117.6939, where 117.6939 is the monthly annuity factor for the just-turned-65-year-old member in Table 2), and the tontine annuity would make similar monthly tontine-annuity distributions in subsequent months.

Alternatively, a tontine annuity could be designed to make inflation-adjusted monthly tontine-annuity distributions. 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-annuity distribution for the hypothetical 65-year-old in Table 2 would be just $1,651.72 ($1,651.72 = $251,041.67 ÷ 151.9876, where 151.9876 is the inflation-adjusted monthly annuity factor for the just-turned-65 year-old member in Table 2), but distributions in subsequent months would be larger and would eventually exceed the payout level of the not-adjusted-for-inflation tontine annuity.

2.3.2. 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 2 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 monthly
tontine-annuity distribution would also be higher—$2,141.52 ($2,141.52 = $252,041.67 ÷ 117.6939) rather than just $2,133 in our earlier example.

2.3.3. Managing tontine annuity investments

Investments in a tontine annuity would most likely be managed collectively for the entire pool. 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. We believe that discount brokers could offer these products with total 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 [Fidelity 2014], and we believe that the tontine annuity management and recordkeeping functions could be performed for as little as 0.20%; and that means that total costs could be as low as 0.30%.

2.4. A tontine pension

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.\(^7\) That is where “tontine pensions” come in.

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. Unlike a defined contribution plan, plan participants would not be able to get lump sum distributions or periodic payments (or a life annuity). Instead, 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.

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\(^7\) People rarely choose to buy annuities voluntarily. 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.
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.

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. Unlike a defined benefit plan – where the plan sponsor must 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 would bear no investment or actuarial risks at all. The tontine pension would simply 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.

3. 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.

3.1. 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 35th birthday and works continuously for the employer for 30 years until age 65, or earlier death.
- Each employee is hired at a salary of $50,000 a year, and her salary increases 4.0% each year.
- At retirement, each employee receives a tontine pension until death.
- In this simple simulation, nobody is married (so no joint and survivor annuity benefits are needed).
- The account balances of those who die are forfeited8.

8 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.
Every year, the employer contributes 10% of salary for every employee to the tontine pension.

Investment return: funds are professionally managed and earn 7.0% net of investment expenses each and every year, compounded annually.

Inflation is 3.0% each year.

Workers receive no payouts until age 65\(^9\), and then retirees receive either uniform (fixed) annuity-type payouts or, alternatively, inflation-adjusted annuity-type payouts.

The mortality model is based on the Social Security 2009 unisex mortality table\(^{10}\).

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.

### 3.2. Calculation of the monthly tontine pension distributions

Given these assumptions, a surviving worker would have a final preretirement salary of $155,933 (at age 64), and she would have a starting retirement balance in her tontine pension account of $843,376 when she turned 65.

![Graph showing monthly payouts](image)

**Fig. 2.** Monthly payout for a typical long-lived member; uniform and inflation-adjusted

\(^9\) 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.

\(^{10}\) *Ibid.*
Assuming that she wants to draw level monthly payments for the rest of her life, the first monthly tontine-pension distribution would be $7,166 ($7,165.84 = $843,376 ÷ 117.6939). If she, instead, wanted inflation-adjusted payments, the first monthly tontine-pension distribution would be just $5,549 ($5,548.98 = $843,376 ÷ 151.9876). Figure 2 plots the expected payouts from these uniform and inflation-adjusted tontine pensions over time.

3.3. Adequacy

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 months yields an annual tontine pension of $85,992 ($85,992 = 12 × $7,166), and it is easy to see that the tontine pension would initially 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 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 insurance benefits from her government. In the United States, for example, this retiree’s Social Security benefits would replace another 35% or 40% of her preretirement income [Reno, Walker 2013].

3.4. Tontine pensions in the real world

Our model tontine pension 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 a 7% rate of return. In the real world, each of those parameters is 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. Of course, that variability in monthly distributions is no worse a problem for tontine pensions than it is for defined contribution plans or for variable annuities.

In any event, tontine pensions could easily be designed to provide for relatively smooth distributions even in the face of real world variability. For example, a tontine pension could be designed to smooth distributions over, say, five years. When the tontine pension administrator determined that a given monthly distribution would be higher than the average for the prior five years, the distribution could be
split, with a basic distribution going to the participant’s bank account immediately, and the excess going into a “holding account” for that participant. In a later month when the tontine pension administrator determined that the distribution would otherwise be lower than the average for the prior five years, the holding account would be tapped to provide a larger distribution. The funds in the holding account could be invested along with all of the other assets held by the tontine pension, and, presumably, at that member’s death, the balance in that holding account, if any, could be paid to that member’s estate.

3.5. Replacing a traditional defined benefit plan with a tontine pension

Finally, we note that a tontine pension could be used to replace an underfunded pension plan like the California State Teachers’ Retirement System (CalSTRS). CalSTRS is the largest educator-only pension in the world, with a membership of 868,493 and assets of approximately $180.8 billion as of February 28, 2014 [California State 2014a]. One of the largest programs that CalSTRS administers is its traditional defined benefit retirement plan [California State 2014b]. Unfortunately, like so many other traditional pension plans, the CalSTRS traditional plan is underfunded; for example, as of June 30, 2013, it was just 66.9% funded, with an unfunded liability of $73.7 billion [California State 2014c]. While replacing the CalSTRS traditional defined benefit plan with a tontine pension would do nothing to reduce that $73.7 billion obligation, it would ensure that California would never again have to worry about underfunding attributable to future benefit accruals.

One approach would be for California to freeze its current defined benefit plan and add a new tontine pension for all future benefit accruals [Forman 2000]. 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 future contributions would be made to the new tontine pension.

4. CONCLUSIONS

In this paper, 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 initially 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 the tontine pension 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.

We also showed that tontine pensions offer a possible solution to the chronic underfunding of traditional defined benefit plans. For example, we could replace an underfunded 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. As no money would need to be set aside for insurance agent commissions or for insurance company reserves, risk-taking, and profits, we believe that a discount broker could manage a tontine plan for as little as 0.30% of assets under management; and that means that tontine pensions would be able to provide significantly higher benefits to retirees than commercial annuities and other retirement income products.

LITERATURE


