
A SIX-COMPONENT INTEGRATED APPROACH TO ADDRESSING THE RETIREMENT FUNDING CHALLENGE*

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This paper offers an integrated approach to addressing the global retirement funding challenge, especially in light of the coronavirus shock that has created an unanticipated and unprecedented impact on lifetime income/consumption. It frames the problem in a six-component approach to the funding challenge with an integrated package presented in a transparent, detailed modular fashion, so that any one module can be replaced with a different version and the rest of the system works. This also means that all six components need not be employed simultaneously, but can be done in a secular fashion. Finally, it develops and proposes in detail a new financial instrument, SeLFIES (Standard-of-Living indexed, Forward-starting, Income-only Securities)—a single financial innovation that provides greatly improved efficiency of implementation to four of the six components. SeLFIES can help complete financial markets and could be a timely innovation given the coronavirus crisis because they are beneficial to governments that seek long-term, local currency debt financing.



1 Background

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Countries as diverse as Brazil, the Netherlands, Portugal, S. Korea, the United Kingdom, and the United States are facing multiple crises and challenges in 2020, including a looming retirement crisis, the challenge of funding infrastructure and Social Development Goals (SDGs), and the various economic challenges associated with the novel coronavirus. While the first two have been developing over many years, the coronavirus has led to a sudden, unanticipated global

shock to lifetime income and the need to fund massive amounts of new debt for economic programs created to mitigate the sharp economic downturn.

Two simple (life-cycle consumption) reality checks make the global retirement challenge easier to understand. The first relates to the role of pensions as a means to ensure sustainable consumption smoothing or what we call the feasibility constraint. Assuming a zero real interest rate, if one works 40 years and lives 10 years in retirement, then one must save 20% of income and can consume 80% to create a sustainable lifetime standard of living. For example, if annual income was \$100, then an individual would consume \$80/year during his or her working life, and after saving \$20/year for 40 work years, would be able to sustain consumption of \$80/year for 10 years. However, if longevity increases for the next generation, and individuals now live 10 years longer, this current-generation saving rule requires adjustment. To work for the same 40 years, with a life cycle now of 60 years, one must save 33% of income or \$33/year and therefore, accept a reduced standard of living of \$67 from \$80/year to cover a longer 20 years of retirement. If instead, one wants to maintain the same \$80 standard of living, and thus saves \$20/work year, his or her balance can only fund 12 years in retirement (greater than the current 10), but that requires an extended work life of 48 years, or 8 years longer. Any combination of work life and standard of living in between these two is feasible, but what is not feasible is to live longer (10 years), work the same number of years (40) and have the same standard of living (\$80/year).

This simple feasibility constraint lays bare the challenge of meeting retirement promises in typical social security systems (and other systems too), given demographic trends. The second reality check expands on the first and recognizes that

for a specified standard of living goal, there are only four ways to *increase* the chances of achieving that goal: (i) Save more; (ii) Work longer; (iii) Take more risk; and (iv) Extract more benefits from the assets that one has accumulated at retirement.¹ Achieving a higher expected return for *the same* risk or lowering the cost of acquiring the same investment performance does not qualify as “one of the ways”. These are always a good thing to do, and thus not a tradeoff and presumed to be pursued as best as possible.

The global retirement crisis is multi-faceted. Defined benefit (DB) social security systems globally are struggling because of worsening demographics and low productivity growth (Modigliani and Muralidhar, 2004) or the feasibility constraint. Furthermore, fewer employer-based DB plans are being offered to individuals, as many of these pension plans are capped/closed because employers and governments are no longer willing to bear this risk. Increasingly, retirement risk is being transferred to individuals by enrolling them in defined contribution (DC) plans (Merton, 2014). These individuals are being asked to make financial decisions that they have not had to make before and that are extremely complex, ranging from how much to save, how to invest, and how to manage the payout phase, to support their lifestyle. To add to the challenges in DB and DC plans, there is a large and growing class of “uncovered” workers—who are currently not in any pension plan. They are in the informal sector, “gig employees”,² or even employees of small firms that do not offer a pension plan. Governments are well-aware that having a large segment of the population retire with limited resources does not bode well for future government finances, as they will have to support the many inadequately funded retirees. In that awareness, a number of countries like Brazil and the United Kingdom and at the state-level in the United States started to contemplate and create

supplementary pension plans to allow individuals to facilitate personal savings to complement their social security paychecks (Muralidhar, 2018a). As a result of these challenges, there is a gap between resources needed for retirement and how much has been set aside in these retirement programs. This requires expanding the lens to create additional funding of retirement from other sources. The coronavirus of 2020 added another unanticipated hurdle to future retirement security as many individuals lost their jobs, and lifetime income (and wealth) fell, virtually overnight. Governments have massively increased debt to support their economies, and many workers have tapped their retirement savings in order to cover their basic consumption needs.³ In the light of this experience, policymakers must re-think the scope of pension systems going forward. To do so effectively, first requires a clear understanding of the objectives of a retirement system.

While there are many stakeholders in a typical pension system, ranging from governments, employers, individuals, financial institutions, and regulators,⁴ each with potentially conflicting objectives, we initially focus just on the individual. Merton (2007, p. 6) articulates the goal of individuals as follows: “[A]ssume the objective function is that employees hope to maintain the same standard of living in their retirement that they enjoyed in the latter part of their work lives.”⁵ Stated differently, individuals seek a guaranteed, real income, ideally from retirement through death, that enables continuation of their pre-retirement lifestyle. This goal for a “good” retirement is understandable for individuals without economic sophistication, fits those objectives long-articulated for employee-benefit plans in practice, and is consistent with the Life-cycle Hypothesis economic theory of consumption (Modigliani, 1986). With this as the posited goal, the present paper proceeds with a six-component, integrated approach to help

countries and individuals fund that objective. To maximize the chances for success, governments should ensure that the retirement system is SUPER (Sustainable, Universal, Portable, Efficient and well Regulated). We lay out the “key design” principles that a candidate integrated retirement system design must satisfy to be considered as a possible “solution”. Given the low level of financial sophistication globally (Klapper *et al.*, 2015), a critical design requirement is that the information needed for members to effectively use/understand and make good decisions within the system requires only knowledge they already have, and is not dependent on improving financial education or providing a how-to-do-it manual (though those are laudable goals to complement any system design).

The six components of the integrated approach are provided in Table 1.

This paper synthesizes all six components into an integrated package, but presents it in a transparent, detailed, modular fashion, so that any one module can be replaced with a different version and the rest of the system still works. This also means that all six components are not required to be employed simultaneously, but can be introduced in a secular fashion. However, given economic and demographic realities in 2020, without all six components, a pension system is unlikely to be long-term sustainable. The paper is structured as follows: Section 2 presents a brief overview of how current pillars of retirement support help manage specific pension risks, and highlights some high-level challenges with the current global pension structure. Section 3 examines Component 1, and details social security challenges globally and the importance of standard-of-living risks in retirement. It also notes how government can help complete markets through the introduction of financial instruments which it has a comparative

Table 1 The six-component, integrated approach to fund retirement.

Number	Component	Purpose
1	Sustainable DB/social security ^a	Ensure social safety net
2	Well-designed DC plan with a comprehensive DC default option	Efficient goal-based design that members can use to implement preferences
3	More retirement benefits from assets accumulated	Use of annuities and one's home to complement retirement savings
4	Creation and issuance of SeLFIES by governments	For those who are either not covered by any pension plan or for those who want to supplement their benefits beyond their plan (and improve management of DC assets to achieve goals). Additionally, completes markets
5	Work longer, but in a retirement friendly structure	To use the comparative advantages of seniors to smoothly taper the work experience and to prepare for new jobs in retirement
6	Allow broader life cycle crisis-coverage in the system	For personal and systemic crises throughout the lifecycle

^aAlthough both define their benefits in terms of guaranteed retirement income, Pillar I Social Security and DB employer plans are institutionally different pension designs. DB employer benefits are debt-like, fixed by contract and SS benefits are periodically reset by government. For design and analysis of the integration of DB employer-plan benefits with Social Security benefits to provide protection against Social Security benefit reduction, see Merton *et al.* (1987). For a functional analysis of pension benefit guarantees in the United States, see Bodie and Merton (1993).

and competitive advantage to issue. Section 4 examines Component 2, DC plans, and highlights four key flaws in their current design that must be addressed: namely, the format of information presentation required to make decisions does not match the financial knowledge of the members who must make them; focus on the wrong goal (wealth instead of retirement income); wrong risk-free asset (short-maturity bonds, which are safe in terms of wealth preservation but quite risky relative to the desired retirement income stream); and ignoring inflation and standard-of-living risk. It then examines a proposal that uses finance science to create better investment products to address the first three challenges. Section 5 examines Component 3 and discusses annuities and using one's home to complement retirement savings, addressing a key aspect of the second reality check. Section 6 describes the new SeLFIES retirement bond of Component 4 and highlights

its key features. It shows how it addresses all four DC plan flaws and benefits individuals and governments, thereby broadly improving retirement security. Section 7 addresses the “work longer” recommendation of Component 5, and Section 8 addresses various prior proposals to support life-cycle consumption-smoothing by drawing on or borrowing against retirement balances as listed in Component 6. Section 9 offers summary and concludes.

2 Current three-pillar pension design

More than quarter-century ago, there was a realization that the world was heading towards a potential retirement crisis because societies were aging and the total resources set aside in all retirement accounts in anticipation of this trend were going to be insufficient (World Bank, 1994). Broadly, the three pillars of retirement

support were (1) government-sponsored pay-as-you-go (PAYGO) programs—Social Security in the United States, (2) employer-sponsored, partially or fully funded, defined-benefit pension arrangements, and (3) personal savings.

As shown in Appendix I, if all three pillars function effectively, it is possible for an individual to earn a reasonable retirement income pegged at 70–75% replacement of final salary (MetLife, 2009), with at least some post-retirement protection against inflation and longevity risk. All systems are not working perfectly as discussed below and, if anything, the situation has deteriorated over the past two decades. Pillar 1 of this model was struggling and continues to struggle from demographic trends and low productivity. At this stage of the economic cycle, benefit cuts or contribution increases cannot be considered as a way to restore solvency. In Pillar 2 of this model, the emphasis was on tying the retirement package to one's employer, but given evolving employment trends, there is a need to potentially disconnect retirement planning from one's employer. The ancillary issue is that a large number of people are “uncovered workers,” typically those employed by smaller companies, gig workers, or individuals working in the informal economy. They do not participate in a pension scheme for any of a host of reasons that range from employers not offering plans to nonparticipation even when such plans are offered. If they do not have access to retirement funding mechanisms, they will face severe challenges in retirement. Finally, personal savings has been limited and the vehicles for personal savings (whether a bank account or investing in one or more houses), do not currently facilitate effective generation of retirement income.

Globally, it appears that there are insufficient resources to pay for a reasonable retirement, with all three traditional pillars struggling. The World

Economic Forum (2017) notes: “The retirement savings gap in 2015 is estimated to be ~\$70 trillion, with the largest shortfall being in the United States. In terms of GDP, this gap represents ~1.5 times the annual GDP across the countries studied. Based on our forward-looking projections, the gap will grow by 5% each year to ~\$400 trillion by 2050.” Countries have a desire to not only bolster the functioning of the three pillars, but also want to broaden the net of pension coverage because individuals retiring poor will become wards of the state and will stretch already extended budgets.

3 Component 1: Towards a better social safety net

3.1 The Social Security challenge and a funding solution

Social Security is a mandatory (with some exceptions) pension plan and pays citizens, who participate for a minimum number of years, a pension through death with some survivor benefits, based on average lifetime income. It is manifestly a pension system but also serves wealth redistribution, as low-income earners get a slightly higher pension replacement rate than higher earners. As such, it is intended to provide a basic safety net to prevent retirement poverty. The first generation of retirees were paid a pension without ever having contributed, which is where the social security financial problem originates. Modigliani and Muralidhar (2004) recognized that the primary issue with social security systems worldwide was the PAYGO funding mechanism, and not the benefits promised or who provided them (i.e., the government). PAYGO was not a sustainable funding approach, given the future demographic imbalance (low population growth and increasing longevity) and low projections for economic growth as highlighted in the feasibility constraint. In short, for small and reasonable changes in these parameters, future social security taxes would be

very volatile and potentially much higher than current levels.

In 1994, the World Bank advocated that countries privatize social security and convert the primary pillar into a DC system. Modigliani and Muralidhar (2004) provided an alternative solution that in the most basic reform, countries need not change benefits and preserve the useful safety net that social security systems provided as in Tables 1 and A.1 (Level 1). They noted that the problem was not that social security systems provided a (largely) guaranteed retirement income till death, but rather in how it was funded. They recommended that countries convert social security into a partially funded pension system—much like traditional pension funds (Level 2A in Table A.1)—and have assets invested in the market under the oversight of a blue-ribbon board—much like the Canada Pension Plan—and with a clear target return.⁶ Furthermore, clear rules were articulated to adjust taxes/benefits if the realized returns were above or below the target (call it the “MM Model”), because future returns are uncertain and hence corrective mechanisms needed to be explicitly built into the management of social security. A key contribution of Modigliani and Muralidhar (2004) was that the simplest way to express the social security contract with citizens was to express a DB plan as nothing more than a guaranteed rate of return on contributions (equal to the target return). Since a portfolio invested in financial assets would have volatile returns, the guaranteed return on contributions would be achieved via a swap between the country’s Treasury and the Social Security Administration. Even these changes were not sufficient back in 2004 to save US Social Security, because US Social Security’s finances already were severely impaired because of the feasibility constraint. Three aspects of the second reality check were addressed in the MM model—work longer, save more, and take more risk.⁷ With respect to “save more”, additional

contributions/taxes were needed to ensure financial stability even under the MM model. By their estimates, a one-time permanent increase in taxes would stabilize contributions permanently at that level (as opposed to forecasts of US Social Security taxes rising by as much as 50% of current levels by 2075). US Social Security had reached a point where it could not invest itself out of the problem. The rationale with the one-time increase in contributions was to ensure intergenerational sharing of the burden and to ensure the lowest possible impact on all citizens. Alternatively, if the country ran budget surpluses, those resources could be used to get the partially funded MM model going.⁸

3.2 An alternative proposal and a focus on a major retirement risk

Well before the World Bank (1994) report, in 1981, US Social Security had faced a mini-crisis—estimates suggested that the Social Security Trust Fund would run out of resources by mid-1983.⁹ Given the widespread interest in the role of a public pension system, Merton (1983) proposed the creation of a mandatory, fully-funded, public system, but different from traditional models considered at that time (and probably since). This system would be a funded, contributory DB plan (much like Modigliani and Muralidhar, 2004), with individual accounts credited with contributions. The assets would then be invested in the market. At retirement, individuals would receive “aggregate per capita consumption indexed life annuities, defined to be an instrument that pays a constant fraction of aggregate per capita consumption to its holder (the member) each period, such payments beginning at a pre-specified date (the date at which the member begins to receive his benefits) and continuing until the member dies. If the member dies before the commencement date, the annuity is worthless.”¹⁰

The “Trust Fund” would be invested in the broadest possible portfolio of marketable securities, as is typical in most DB plans as in Level 2A of Table A.1. “The number of units of life annuities issued to an account is on a ‘mark-to-market’ basis at the time each contribution is received. That is, the value of a unit of a life annuity issued is determined by current market prices and mortality tables. To allow this entity to hedge its obligations to retirees, it would be necessary for the government to issue aggregate per capita consumption indexed bonds of various maturities.”¹¹ This proposed innovation is important to the history of research on retirement security because the critical insight from this recommendation is that traditional pension plans that offer real pensions often link benefit payments to traditional inflation indices; however, since the goal is to sustain the standard living at the time of retirement, a substantial risk to a “good” retirement is standard-of-living risk during the accumulation period. Research has shown that standard-of-living risk can outstrip inflation risk, and incorrect indexation of benefits, as shown in Table A.1, has hurt retirees globally (ING, 2019). The advantage of a plan with benefit payments linked to per-capita consumption is that it protects retirees against both inflation and standard-of-living risk, and gives them a chance to maintain their pre-retirement lifestyle in retirement. This pension plan design recognizes that the purpose of an effective pension plan is to ensure lifetime consumption smoothing, and if standard-of-living risk is not managed, retirees might have to incur a sudden reduction in standard-of-living/consumption. The indexation to per capita consumption makes sense for the goal established and results in much smaller contributions needed with no survivors benefits included, but offers “life insurance” for those who want to bequeath to others. Such a plan works much better, by design, in a world of single people; women and men who do not have

children or are divorced; others with no financial responsibilities for other than themselves.¹²

Moreover, Merton (1983) noted that there is potentially a natural issuer of such bonds. “[I]t appears that the government is a ‘natural’ intermediary to issue consumption linked bonds because it has the power to tax expenditures. That is, the government could institute a consumption tax proportional to the number of consumption-linked bonds outstanding and the revenues from the tax would exactly match the required liability payments. Moreover, there appears to be no significant social cost to the government’s issuing consumption linked bonds, and there may be social benefits from the government’s financing the deficit in this form.”¹³ Given the substantial increase in debt globally to address the coronavirus shock in 2020, intelligent financing of the coronavirus spending (i.e., government balance sheet management) will be critical to prevent additional unintended consequences of rising debt levels.

In short, in addition to focusing on standard-of-living risk in retirement, Merton (1983) also raised the possibility that governments can play an important role in completing markets, by creating new financial instruments to improve retirement security, especially where they have a natural advantage to do so and furthermore, the instrument design also benefits government financing of debt. Finally, this paper also addressed the key point that an effective pension plan design should ensure lifetime consumption (and not just lifetime income) smoothing and will be discussed further in Section 8 (Component 6).

3.3 Recommendation for component 1

We recommend that the first component provide a DB social safety net that is sustainable, universal, portable and efficient (and potentially mandatory, though good design does not require

this). The DB structure would ensure the provision of a basic level of real, guaranteed retirement income. This pension fund would be partially funded and invested in a diversified market portfolio under the oversight of a blue-ribbon board. At retirement, individuals would receive aggregate per capita consumption indexed life annuities so that standard of living¹⁴ and longevity risks are hedged. It could provide survivor benefits as an option, with appropriate adjustments made to overall contributions and benefits, through pre-specified rules, to ensure sustainability. The retirement age would be tied to longevity in the country to manage the feasibility constraint.

4 Component 2: Next-generation DC plan with a comprehensive default DC option

4.1 Current challenges of DC plans¹⁵

A 15-year trend threatening retirement security is the closure of DB plans by employers and governments and the transfer of the retirement risk to the individuals by enrolling them in DC plans instead. For example, in July 2020, the Dutch Parliament, after discussions with its social partners, approved a switch of the Dutch system to one which is a DC contract.¹⁶ Merton (2007, 2010a, 2010b, 2012a, 2012b, 2013, 2014) raises the alarm because while this switch addresses the funding-risk challenge for employers, it now poses a major problem for society and a largely financially unsophisticated global population (Klapper *et al.*, 2015). Since employers found the DB benefits too expensive to fund, it is highly unlikely that the subsequent employer contributions to the DC plans, risk-adjusted, will be adequate to replace those DB benefits. Financial illiteracy is a major issue with moving from DB to DC structure as many individuals who, for instance, do not understand compound interest and the impact of inflation are now called upon to make such calculations for retirement planning decisions over what can be a 60-year process

in typical DC plan product designs. Furthermore, the complex decisions around managing uncertain human capital, individual saving, consumption, investment, and decumulation (Bodie *et al.*, 1992, 2008) as presented in typical DC offerings often require specialized knowledge and effort well beyond the knowledge and capabilities of even the most financially sophisticated.

On the other hand, it is reasonable to assume that even though individuals are moved from DB to DC schemes, their goals are unchanged. But, “[F]inding and executing a dynamic portfolio strategy to achieve such a goal is an extremely complex problem to solve, even for the best financial minds. Yet, through the use of defined-contribution plans, the financial services industry is, in effect, asking employees of all sorts—from brain surgeons, to teachers, to assembly line workers—to solve just such a problem.”¹⁷ In sharp contrast, the average consumer does not need extra training and instructions when he or she rents a car or buys a new cell phone (because they are designed to be used based on what the customer already knows); the same design principle can be incorporated for members of a DC plan as well as for any new financial instrument to be purchased directly by uncovered consumers of retirement benefits. In short, do not ask the consumer to become educated to use your product; instead design your product so the consumer already has the knowledge needed to use it.

Merton (2007, 2010a, 2010b, 2012a, 2012b, 2013) applies “finance science” to design an effective default option that can serve most members during most of their work years without their being at all engaged, but which takes into account important changes in the members’ circumstances. And when they eventually become engaged, it offers products and frames individual choices that require only what they already know. This permits members to focus on meaningful

decisions they are competent to make (e.g., desired retirement income, date of retirement, level of contributions) instead of what they are currently asked to choose (optimal mix of stocks and bonds; choice of annuity) which they are almost surely not prepared to make.

Merton (2007) raises another serious challenge about DC investment practice that persists today—the nearly exclusive focus on wealth goals and return—risk measures—value of assets in retirement accounts instead of the level of retirement income those assets can buy—the relevant measure of retirement welfare. Merton (2010a, 2010b, 2012a, 2012b, 2013, 2014, 2017) and Muralidhar (2011) warn that the wealth-volatility-minimizing “risk-free” asset, US T-bills in most DC plans, is quite risky in terms of volatility of retirement income generated. Bond funds or long-duration Treasury Inflation Protected Securities (TIPS) with considerable price volatility will reduce retirement income volatility (especially relative to US T-bills). The degree of reduction depends on how well the bonds can match the duration of the desired cash flows in retirement. Especially for those far from retirement, the cash flows from these bonds and the desired retirement cash flows are considerably different and the resulting mismatch of duration creates material income volatility. Figure 1 plots the likely real retirement cash flow of a 25-year old that wants inflation-protected \$50,000/year in retirement. It shows that the goal requires no cash flows for 40 years (through 2060) and then a steady stream of real income for 20 years (assuming life expectancy post the retirement date is 20 years). The duration of these cash flows vastly exceeds the longest durations of traditional bonds.¹⁸

First, these bonds pay coupons when individuals do not need them (i.e., in their working years); second, they pay a stub principal at maturity

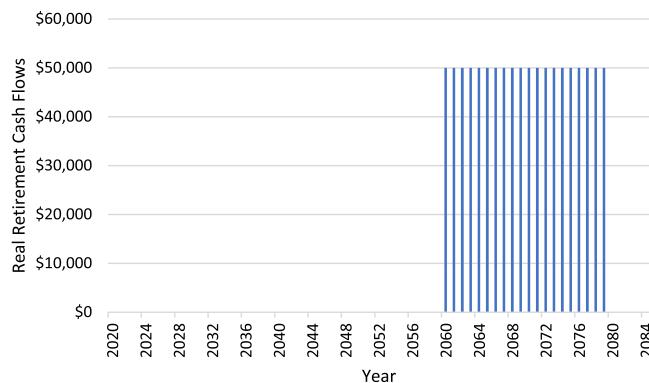


Figure 1 Projected real retirement cash flows of a 25-year old in 2020—work 40 years; live for 20 years.

which is also not needed as one typically wants a smooth stream of real income in retirement as shown in Figure 1; and finally, current bonds are linked to inflation and not standard-of-living. In other words, there is both enormous reinvestment and retirement income risk when one holds traditional bonds or bonds funds in a DC account. For example, if our 25-year old buys a sufficient number of 30-year Treasury securities for their retirement, it could take (at least) 61 non-trivial transactions to convert the cash flows from a traditional bond portfolio into a retirement cash flow stream shown in Figure 1. Hence, current standard financial instruments and fund strategies fail the “cell phone” test.

To date, the Merton’s (2007) warning remains largely unheeded globally. There is a fledgling industry interest in developing retirement income-oriented products for DC but progress is slow. Kobor and Muralidhar (2018, 2020) demonstrate how both static 60% Equity/40% Bond portfolios or Target Date Funds (TDFs) can lead to highly variable retirement income levels for consecutive retirement cohorts, even with identical savings and investment behavior, because the investment strategy is independent of goal progress and achievement, and the bond allocation is risky relative to the retirement income goal. Such highly different retirement outcomes across

cohorts with similar savings and investing behavior are problematic signs for a claimed universal strategy.

In summary, current DC plans around the world, in addition to dealing with a largely financially unsophisticated population, suffer from at least three additional major challenges that, left uncorrected, will most likely lead to highly uncertain retirement outcomes: (i) the focus on wealth at retirement (further underscored by the regulatory-required reports sent to participants that highlight the value of assets in the account instead of the amount of income in retirement they can buy); (ii) wrong risk-free asset that leads to highly variable retirement income; and (iii) ignoring standard-of-living risk completely in pension design (especially since assets to hedge this risk do not exist). After all, if one sets the wrong goal for retirement, invests in assets that they mistakenly believe are risk-free, and does not hedge against standard-of-living risk during accumulation, they risk not being able to maintain their pre-retirement lifestyle. This does not bode well for retirement security.

4.2 Potential solutions—Better investment products

Merton (2007, 2010a, 2010b, 2012a, 2012b, 2013) and Levitan and Merton (2015) describe a materially improved retirement product design for DC investors (over current offerings in DC plans) that is goal-based and tied to preferences of participants. They impose the design rule that requires only information that can be gotten either without asking the investor or that does not require the investor to have any financial knowledge to provide. They propose that asset managers use a dynamic investment strategy that takes into account changes in both personal and market conditions in allocating between the “risk-free” asset and a risky portfolio to optimize the

chance of achieving the individual’s retirement income goal, subject to risk constraints.

Levitan and Merton (2015) show that an effective pension system can be created that requires only information that the individual already has. For the default (DB-like) version, they require no information directly from the individual and determine from other sources the retirement date, current income and contribution rate. From these, they derive a retirement-income goal, either as a replacement income to sustain their pre-retirement standard of living or one specified as the replacement income objective for the plan by its sponsor. Including other standard retirement-dedicated assets such as social security, any employer-DB benefits, and projected future-contributions based on current contribution rate and salary, an integrated optimizing portfolio strategy is executed to maximize the chances for success subject to risk constraints. The goal is updated and the strategy adjusted as income level or retirement date change and the funded-ratio for the goal changes. The individual provides no information and makes no decisions in the default version.

If and when individuals become engaged and want to implement their specific preferences and circumstances, they are asked to make choices only about changing contribution rate, retirement date, retirement-income goal, and express their risk tolerance in an intuitive fashion, all information that individuals already have. The portfolio optimization takes place based on that information. The feedback information the individuals receive expresses the chances for success in achieving the goal as a consequence of their selections. Like a medical check-up, this shows them whether they are on-track or not doing well, and in the latter case, shows them how they can improve their prospects by changing contribution rate, retirement date, or risk-tolerance, and allow

them to see those goals which are achievable with sufficient high probability, given their current settings. All these choices are meaningful for the individual to understand, and no other choices are offered or needed. These cover the three ways to improve chances to achieve the goal in the second reality check. There is no need to discuss asset allocation choices, rates of return and risk–return frontiers, which, while important to outcomes, are not meaningful information or choices for the individual.

If the retirement-income goal can be achieved by investing only in the risk-free asset, the individual is contacted with “congratulations” you have achieved your goal, and asked whether they want to change it. If not, then as much risk as possible is taken out of the portfolio, since there is no longer any purpose for taking risk. If they change the goal, then the strategy for the new goal is implemented.

Levitian and Merton (2015) make two key arguments that will be critical for effective pension design proposals, including SeLFIES: (a) that the goal for DC plans should be retirement income; and (b) that the “risk-free” or “safe” asset in a DC plan, using currently available instruments, is a deferred inflation-linked annuity. Since there are currently no widely available deferred inflation-linked annuities, the recommendation to create the risk-free asset is to use financial engineering to create a portfolio of traditional assets (nominal bonds, TIPs, swaps, etc.) to duration-match the annuity payouts for each individual’s desired retirement income profile. However, this solution requires skilled asset managers and incurs transactions costs as this “risk-free” portfolio will need to be dynamically traded to implement. Moreover, the degree of precision in the creation of this “risk-free” portfolio is impacted by the maturity of traditional bonds. For example, if the longest maturity TIPS is 30 years, then one can only start

to hedge precisely using a *static* portfolio strategy for an individual at age 55 (assuming they retire at 65 and live for 20 years).¹⁹ This creates a potential challenge for younger individuals who cannot purchase the “safe” asset earlier in their life cycle leading to them having to bear more risk than they may be comfortable with (Muralidhar *et al.*, 2016; Muralidhar, 2015).

A somewhat offsetting factor to the inability to hedge is that young members have a small fraction of their retirement-dedicated assets in the DC plan, with social security and future contributions, both relative safe assets measured against a consumption-smoothing income goal, making up the vast bulk of their retirement-dedicated assets. So even if they were to put 100% of their DC assets in risky assets, it may only be 10% of the whole at risk.

Levitian and Merton (2015) do not address hedging standard-of-living risk as current instruments do not facilitate such hedging. Their systematic updating of personal information including income changes however leads to dynamic revisions of the retirement income goal for the individual as their standard of living changes. Levitan and Merton (2015) propose that asset managers use a dynamic investment strategy that takes into account changes in both personal and market conditions in allocating between the “risk-free” asset and a risky portfolio to optimize the chance of achieving the individual’s retirement income goal, subject to risk constraints.

Kobor and Muralidhar (2020) extend Levitan and Merton’s (2015) study and provide a simple logistical function that explicitly articulates a view-neutral dynamic strategy and rebalancing rule between the safe and risky assets. They call their strategy Goals-based, Lifetime-Income focused Dynamic Strategy or GLIDeS and demonstrate how this approach improves the likelihood of

meeting a retirement income goal relative to current static or dynamic approaches, because it is goal-focused. While the Levitan and Merton (2015) solution addresses the challenge of financial illiteracy and transfers the burden of innovation and interest-rate hedging strategies to asset managers, the absence of the ideal “risk-free” asset impacts the implementation of their solution.

4.3 Recommendation for component 2

We recommend that the second component be an income-goal-based DC plan that takes into account changing personal and market information for each member including a well-designed default DC option that corrects for the challenges of current DC plans, but can be sustainable, universal, portable, efficient, and easily regulated. This would require the creation of a goal-based default that is as easy to use and more tailored to personal needs than a DB plan and also vastly simplified for those who want to make choice and only give them meaningful information and meaningful choices. Such a design is entirely feasible today but has not yet been adopted widely. If designed and implemented properly, the Next Generation DC plan can provide the second tier of guaranteed real retirement income, over and above the guaranteed real income provided by the DB social security scheme.

5 Component 3: More benefits from existing assets

The second reality check notes that one option to maintain pre-retirement standard of living in retirement was to extract more benefits from existing assets. The two most important ways to improve benefits for a given set of assets, that can really impact achievement of a good retirement, are annuities and equity-extraction from one’s home.²⁰ Unlike other approaches to

increase benefits, they do not require changing savings behavior or retirement date or risk-taking (the three other options in the second reality check). Extracting more benefits from existing assets should not be considered as appropriate only for those in “tough” situations, but indeed as an integral part of the retirement solution to be considered for all working- and middle-class retirees.²¹ This section will offer a simple demonstration of how annuities and reverse mortgages could potentially improve retirement income goal achievement.

5.1 Annuities

“An annuity is a contract aimed at generating steady income during retirement, where a lump sum payment is made by an individual to obtain certain amounts immediately or at some point of future.”²² The annuity can take various forms and usually is provided through an insurance company. Warshawsky (1999) describes a life annuity as, “the financial vehicle that provides periodic benefits over an indeterminate lifetime. The key aspect of the life annuity, the continual payment over the lifetime of the participant, is possible through accumulations pooled into an annuity fund, which can be accomplished either through an insurance company that sells the annuity or through a pension plan.”

Consider an individual with assets accumulated in a DC plan that wants income from these assets. At retirement, they could potentially use the DC plan balance to buy a bond that pays annual interest (with the principal paid back at maturity). Alternatively, these balances can be used to purchase an annuity which is likely to generate a higher level of retirement income than interest from a bond or bond fund. As we demonstrate below, the annuity purchase provides valuable retirement income to help achieve one’s retirement income goal.

5.2 Use of one's home

One's home may provide the largest source of wealth to finance retirement. Many, especially working- and middle-income retirees, have a substantial portion of their wealth stored in their home, and they have typically been unable to safely and effectively extract value from this asset to fund retirement. In the United States, "At \$20.7 trillion, the primary residence accounted for almost one-third, 30%, of all assets held by households in 2010. . . . The primary residence represented 62% of the median homeowner's total assets and 42% of the median homeowner's wealth. . . . The primary residence is also a widely held asset. A greater share of households (67%) owned a primary residence than held a retirement account (50%) or stocks and bonds (16%). . . . Equity in residential property tends to be a particularly important component of wealth for lower income, older households. . . . The median residential equity share of net worth for households age 75 or older with total income between \$35,000 and \$60,000 was 47% and 36% for older households with income between \$60,000 and \$100,000. The median residential equity share of net worth for the highest-income, older households was 30%."²³ This is not just a US phenomenon; even in the developing world, individuals are more likely to own a residence than even own a bank account. ELCA (2016) reports that, in Colombia, 33.11% of households interviewed owned a bank account (with just 1% not responding), whereas with respect to homes: 55.04% owned their homes (fully paid), and 4.96% owned the house but were paying a mortgage (with the balance renting or some other form of occupancy). Interestingly, the percentage of heads of household that fully own their home and have a bank account is 18%. Warszawsky and Zohrabayan (2016) report that in Korea, "according to the survey of 20,000 households conducted in December 2012, houses and

residential real estate accounted for 70% of the average South Korean's assets, and for people at 60 years of age and older, the average value of houses and residential real estate accounted for even higher—81% of all assets."

Given insufficient access to traditional retirement accounts, especially in many parts of the world where employer-based pensions are not common, and many citizens are either self-employed or work in the informal sector, equity-extraction from the house can serve as a key asset to finance retirement. The most effective instrument for extracting that equity is a "transaction" on the house specially designed for this purpose, with names such as reverse-mortgage (US), home-pension (Korea),²⁴ and equity-release (UK). For simplicity, we will just focus on reverse mortgages (RM) and the other two contracts are similar. The two common features of an RM are that no payment of either interest or principal is made as long as the retiree lives in the home, and the mortgage is non-recourse. In contrast to standard mortgages and other types of loans, these features make the reverse mortgage borrowing very low risk to the retiree.

Merton (2015) describes the rationale behind the reverse mortgage, "The house which the owner-retiree will live in during retirement can be decomposed into two components as an asset:

- *An annuity-like asset* which provides the retiree with a stream of housing-services for life
- *A fungible financial asset*, which is the house value at the retiree's death when the housing-services are no longer needed: The residual value of the house is available for either funding part of the non-housing expenditures during retirement or for making gifts/bequests.

It is this second component which causes the house to be explicitly integrated into an effective

planning and investment strategy for the overall funding of retirement.”

In the United States, almost all reverse mortgages issued are HECM, US government guaranteed.

However, RMs are not widely used, can be complex, and involve multiple parties.

5.3 Example of using annuities and reverse mortgages to boost retirement income

We provide a simple example of how the annuity and RM can help individuals achieve a good retirement. We assume a 65-year-old individual who is in the 50th percentile income bucket. Assume he or she earned \$50,000/year pre-retirement, and has a retirement goal equal to a 72% replacement rate (or \$36,000/year)—typically considered a reasonable replacement rate (MetLife, 2009). In addition to receiving Social Security, he or she has \$165,000 in a DC plan and owns a house worth \$300,000. We

assume that the inflation-protected bond interest rate = 1.50% and the life annuity inflation-protected rate = 5.40%. Note that (typically) a house worth \$300,000 would generate an “annuitizable” value of 54% of the house value (or \$162,000) from an RM, based on current US government HECM rules.

In addition to receiving Social Security payments annually (column 1 in Table 2), we consider three options: (A) Bond Approach—This individual invests the DC portfolio in a bond fund that earns the bond interest noted above (column 2 in Table 2); (B) Annuity Approach—This individual uses his or her DC balance to purchase an annuity that earns the annuity rate noted above (column 2 in Table 2); (C) Annuity and RM—in addition to B, they take out an RM on their house. Using the equity release of \$162,000, they purchase an annuity for that amount that earns the annuity rate noted above (column 3 in Table 2). Table 2 demonstrates the income implications of the three

Table 2 Retirement income sources: Boosting through annuities and reverse mortgages.

Option	Annual Social Security (1)	\$165,000 in DC Plan (2)	\$300,000 House (of which 54% can be used as RM Principal) (3)	Total (4) = (1) + (2) + (3)
A. Bond Approach	\$18,978/year	Annual Interest from Bond Purchase = \$2,475/year ^a	N/A	\$21,453 benefit (60% of goal)
B. Annuity Approach	\$18,978/year	Annuity Pays \$8,910/year ^b	N/A	\$27,888 benefit (77% of goal)
C. Annuity and House RM Approach	\$18,978/year	Annuity Pays \$8,910/year	Annuity from RM Proceed Pays \$8,748/year ^c	\$36,636 benefit
	52% of Goal	Annuity DC 24% of Goal	Annuity from Reverse Mortgage 24% of Goal	100% of Goal

^a\$165,000 x 0.015 = \$2,475. However, recall that the investor will receive a lump-sum principal repayment, assuming no default, of \$162,000.

^b\$162,000 x 0.054 = \$8,910.

^c\$162,000 x 0.054 = \$8,748.

options and total retirement income earned from all sources (column 4 in Table 2). It shows how Option C helps this individual achieve his or her target retirement income goal, whereas Options A (60% of retirement goal) and B (77% of retirement goal) fall short of the target because of inefficient use of existing assets to generate risk-free retirement income for life. Approximately 50% of the target retirement goal is derived from Social Security, and 25% each from the conversion of the DC plan into an annuity and the extraction of equity from the house to purchase an additional annuity.

5.4 Recommendation for component 3

We recommend that effective pension design should facilitate the purchase of annuities and extraction of equity from homes to boost retirement income and close the retirement funding gap. This adds a third tier of guarantee retirement income to supplement the social security payments and guaranteed retirement income generated from the next generation DC plan.

6 Component 4: SeLFIES—A new retirement bond/currency for retirement

Muralidhar (2015) and Muralidhar *et al.* (2016) argue that there is a key instrument that is missing in financial markets as it relates to improving retirement outcomes—and define a new bond: Bonds for Financial Security (BFFS).²⁵ In some ways, BFFS have some of the elements of the consumption bond noted in Merton (1983) and Section 3, but with greater specificity around the bond's characteristics. Very simply, the BFFSs will be a series of real bonds issued by governments, with fixed real annual coupon payments only (e.g., \$5/year for US markets; R\$ 0.04/month for Brazil), but with different forward starting dates (e.g., 2020, 2021, 2022), each with a term of 20–25 years. The term of the bond will be linked

to the life expectancy in retirement (as this has implications for hedging longevity risk), and is updated periodically.

Merton and Muralidhar (2017a, 2017b, 2018, 2019) extend BFFS by requiring that the SeLFIES bonds be indexed to per-capita consumption as in Merton (1983). There are multiple advantages to using this nominal adjustment. For individuals, instead of current bonds that index solely to inflation, SeLFIES cover both the risk of inflation and standard-of-living improvements, specifically because standard-of-living risks are critical when one is making decisions over a 60+ year horizon. Even if these payments were adjusted for inflation, they would not be sufficient—for savings invested long before retirement, standard-of-living risk is really significant (especially when individuals measure their welfare relative to their peers/neighbors). The amount needed to maintain one's evolving life style while working is likely to increase over this long horizon, potentially leaving retirees with inadequate savings to cover that higher lifestyle.

Two simple innovations using finance science create the “perfect” retirement instrument: (i) “How/When one is paid”—BFFS/SeLFIES are forward-starting, income-only bonds, and thereby embed compounding. These bonds would start paying investors upon retirement, a fixed \$5/year real income for a period equal to the average life expectancy at retirement (e.g., US bonds would pay for 20 years) as shown in Figure 2. They incorporate the retiree’s desired annuity-like cash flow profile in the payout phase, thereby blending accumulation and decumulation in one instrument, in turn reducing decision risk; and (ii) “What” is paid—indexing SeLFIES to standard-of-living, thereby covering the key retirement risk and ensuring that financially unsophisticated individuals, who do not understand the effects of inflation are protected. These two innovations ensure

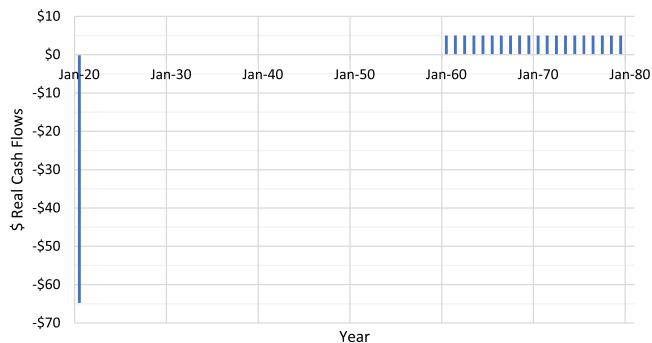


Figure 2 Real cash flows of 2060 SeLFIES: Pay \$5 real from retirement date (2060) for 20 years (2080).

that even the most financially illiterate individual can be self-reliant with respect to retirement planning as shown in Muralidhar (2016b, 2019a, 2019b). Figure 2 shows a very simple cash flow chart of SeLFIES that start paying in 2060 for 20 years and one can easily see the synergies with Figure 1. The sharp negative bar in 2020 is purely illustrative to indicate the potential payment made today to acquire the desired retirement cash flow stream (i.e., the price of SeLFIES).

In short, SeLFIES, like a cell phone can be used “out of the box” and require the most basic inputs for individuals of all levels of financial sophistication: their date of retirement and desired level of retirement standard of living. SeLFIES can be used by uncovered workers, gig workers, workers in a plan but seeking supplemental “safe” income, and institutional investors, including pension funds, asset managers, and insurance companies (to design better products as noted in Sections 4 and 5). In essence, if SeLFIES are created, one’s retirement planning can be disconnected from his or her employer, addressing a key challenge noted earlier. An individual who desires \$50,000 real (for say 20 years) in retirement as in Figure 1 has a simple goal—to purchase 10,000 bonds during his or her working life (\$50,000 annual income/\$5 annual bond payment). Complex decisions of how much to save, how to invest, and how to draw down, ignoring any potential

changes in goals, are simply meshed in an easy calculation of how many bonds to buy. Indeed, to make decisions about how much to buy and how much retirement income has been accumulated, individuals do not have to know anything about interest rates or rates of return or compounding. They only need to know the income in retirement paid by each SeLFIES bond and its price to figure how much income is being added to his retirement by purchasing the bond.

As Muralidhar *et al.* (2016) note, these bonds are low-cost (and eliminate the need for different entities for accumulation and decumulation), simple, liquid, and portable (allowing for changing goals), allow for bequests, have the highest credit rating (as it would be government issued), and allow for customization of retirement outcomes. More importantly, it completes markets and would allow insurance companies and DB pension funds to better hedge liabilities and thereby reduce the cost of deferred life annuities and pensions.

6.1 Benefit to governments as a bonus

Prior to the coronavirus crisis in 2020, a major challenge for many governments was to find ways to fund infrastructure and SDGs. The coronavirus has led to expansive fiscal policy that has to be funded in an efficient manner so as to not compromise long-term financial stability. For example, the United States has re-opened issuance of a 20-year bond to stagger repayment of this new debt over a long horizon, thereby sharing coronavirus burdens over multiple generations. Prior to the coronavirus crisis, Merton *et al.* (2020a, 2020b) note that governments might find it advantageous to issue SeLFIES as it lowers the risk of citizens retiring poor and also helps finance infrastructure (and SDGs), as the cash flows of these bonds are synergistic with infrastructure funding and long-term projects with positive development impact. The introduction of SeLFIES could be

made with no violation of fiscal balance rules or without necessarily adding new debt. Moreover, for governments with Value-Added-Taxes (VAT) as in the EU or Brazil, SeLFIES provide governments a hedge as revenues and bond payments are linked as first noted in Merton (1983). Additionally, in regions like the EU, a bond issued by Portugal can be purchased by investors in other EU countries, thereby allowing countries like Portugal to extend the maturity of their debt. Issuing SeLFIES could also address a key challenge faced in Europe during the coronavirus; namely debt mutualization. While the higher-income countries like Germany and Netherlands rejected debt mutualization, Euro SeLFIES allow for a broader European investor base, potentially benefitting lower-income European countries as an alternative permanent funding source to explicit debt mutualization. Furthermore, as Merton *et al.* (2020a, 2020b) argue, that in the case of developing countries like Brazil, SeLFIES can help de-dollarize government debt, help extend maturity and create a robust, long-term domestic investor base for government debt. In the wake of the coronavirus crisis, where foreign currency debt ratings are being lowered at a record pace,²⁶ issuing local currency denominated debt, with long maturities/repayment periods, and tied to receipts (e.g., VATs), may greatly improve the management of government finances.

The key issue to note is that SeLFIES will not be subsidized, but will be a pure market-based instrument; traded and issued like any other government bond in any country. Many countries like the United States, Japan, and even Brazil also have “Treasury Direct” facilities which allow individuals to purchase government debt directly from Treasury, thereby reducing transactions costs. SeLFIES will be issued through the traditional auction process, and traded in the aftermarket. The primary participants in these

auction and secondary markets are large institutions like insurance companies, pension funds, and asset managers, and this current market-based process ensures effective price discovery. Thereafter, the market-based prices can be used as the basis for Treasury Direct, which is a low-cost, small-size channel for individuals. This transparent price discovery process ensures that the prices at which SeLFIES are sold to individuals directly are not subsidized and so do not have to be rationed, as for example with I-bonds. Adopting current bond issuance processes for SeLFIES ensures efficiency.

6.2 SeLFIES as the currency for retirement

Merton and Muralidhar (2020) argue that SeLFIES can serve a useful purpose as a “currency for retirement”. The price of SeLFIES will reflect the cost of purchasing a guaranteed retirement income stream and could allow individuals to assess the impact of changes in economic policy on their retirement prospects. Section 5 highlighted that if individuals do not have sufficient savings in retirement accounts, and no provision is made to allow for supplemental retirement savings, then other assets will need to be included in retirement planning to supplement the retirement pot. SeLFIES will allow individuals to clearly understand how much potential retirement income (and protection of pre-retirement standard of living), their current assets are likely to generate (Muralidhar, 2018b). SeLFIES will make the calculations in Table 2 trivial for all individuals, regardless of financial sophistication. This is an additional benefit to having a “currency for retirement”.

6.3 Recommendations for component 4

SeLFIES help create “individual DB” plans and help overcome the four key challenges of DC plans. They are easily used by a financially

unsophisticated (and even minimum-educated) population, they are focused entirely on ensuring a guaranteed real retirement income stream, they serve as the safe asset in DC plans and can be used to create better investment products, and they hedge standard-of-living risk in retirement. They help with the achievement of Components 1, 2, 3, and 6. We recommend that all governments consider the immediate launch of SeLFIES to address the multiple challenges they face.

7 Component 5: Work longer

Typically, retirement has been perceived as a sharp break from working in a lifetime job (at a pre-determined age like 65) to complete retirement, with no work and income. Implicit in the classic lifecycle model (Modigliani, 1986) is an assumption that the value of human capital goes to zero on the date of retirement. This is clearly not true. Given the feasibility constraint and the funding challenge, effective pension system design and economic policy could facilitate a more gradual transition to “full retirement” to capture residual human capital post retirement. There is a need to create systematic opportunities for working less than full days, doing activities which match the comparative advantage of seniors. These comparative advantages include experience (e.g., child raising; beautification such as planting flowers; an engineer, teaching, and working with public school students), relative calmness, or reliability, and no pressure to build a career. The income earned from such activities could supplement their retirement income, at least through a transition period, and give them a better mental transition from work to fully retired.

7.1 COVID-19 and working in retirement

Rappaport and Seigel (2020) review the challenges raised by COVID-19 and also those faced by retirees, or those close to retirement.²⁷ They

find that many individuals may have involuntarily been moved into retirement before their planned retirement date. “This is consistent with findings from other SOA research done in 2013 that observed that many retirees had been ‘pushed’ into retirement, and few had voluntarily retired to meet their dreams. . . . These surveys have shown a persistent large difference between the ages that pre-retirees expected to retire and when retirees said they actually did retire. In 2019, pre-retirees planned to retire at a median age of 65, while retirees had retired at a median age of 60. These results were similar to the 2013, 2015 and 2017 results.”²⁸

This unexpected and unanticipated move into retirement has severe consequences to the level of funding available for retirement as well as the standard of living they can achieve in retirement. “Of those who missed work, 65% of pre-retirees and 49% of retirees said it had an impact on their ability to save for retirement. Respondents were asked what adjustments they made. Of the pre-retirees, 49% said they spent less, 35% said they planned to work longer, 31% plan to retire at a later age and 27% said they plan to spend less in retirement. Of the retirees, 69% said they spent less, 13% said they had worked longer than they planned and 12% said they retired at a later age.”²⁹

Finally, as Rappaport and Seigel (2020) note, the dislocation caused by COVID-19 may require a re-think about working in retirement: “The survey also shows a difference in expectations about working in retirement and actual experiences of working in retirement. In 2019, 45% of pre-retirees said that they expected to retire all at once, but 82% of the retirees said they had retired all at once. However, 36% of retirees said they had worked since retirement.”³⁰

Engagement in well-designed jobs for seniors will also help them in a non-pecuniary way as it will

have a positive impact on their mental health by giving them a sense of purpose and a smooth transition to full retirement. In turn, knowing that this demand will be reliably there under robust conditions means seniors can plan their retirement with this as one of their retirement “assets”.

7.2 *Recommendations for component 5*

We recommend that governments³¹ and the private sector consider creating jobs that are tailored to the comparative advantage of seniors and require very little additional training or investment in the retiree by the employer. With the given demographic trend and increasing numbers of retirees, there is a steady supply of such talent that can accommodate flexible hours, and thereby eliminate the typical reasons that might prevent them from staying in or finding a new job in a traditional job search. By the formal restructuring and institutionalization of this process (on both supply and demand) we can have a true win-win improvement for society. This proposal also allows a systematic means to address the issue of “forced retirement”, and without the stigma of being unemployable as well, since it becomes a common-place phase between one’s work-life type employment and non-working retirement. In addition to the other four components, Component 5 seeks to tap a potentially untapped asset to enhance retirement income.

8 Component 6: Lifetime consumption smoothing

However, all these efforts to design new pension systems or improve pension systems have been interrupted by the coronavirus crisis in 2020; many individuals have lost their jobs (and income) and have tapped into retirement accounts, where feasible, to sustain current consumption. A survey found that 3 in 10 Americans withdrew money from their retirement income

in March and April 2020, and 50% of the withdrawals were for necessary expenses like grocery bills and utilities.³² The evidence is much the same in Australia with record-setting borrowing from retirement accounts.³³ Countries in Latin America that switched to DC plans in the 1990s have also permitted borrowing against these balances.^{34,35} This raises a critical design issue that must be addressed; namely, can an effective pension system facilitate lifetime consumption smoothing and potentially serve as a “rainy day” fund? This is not to suggest that the pension fund serves as a savings account, but that there should be flexibility in the design to accommodate unanticipated crises that one might experience during the non-retirement part of the lifecycle.

Typical pension models focus on lifetime income smoothing and help individuals transfer labor income in excess of consumption during working years into retirement income, where labor income has ceased. As noted in Section 2 and Merton (1983), an effective pension plan should ideally ensure lifetime consumption smoothing (and not just income smoothing). Most current pension plans have been designed with the assumption that individuals can experience temporary shocks to income or experience unanticipated expenses (e.g., a medical expense). However, the coronavirus has raised an issue that has now found importance with the potential of a permanent shock to income and consumption.

If, as has happened with COVID-19, significant wealth is lost, it is rational for lifecycle consumption-smoothing, to reduce consumption both in the present but also in their plans for the future. Hence, drawing-down on retirement funds to help finance current consumption needs can be a prudent action to execute a rebalance of consumption over the full lifecycle.

Permitting some form of smoothing is critical to getting individuals to participate in pension plans, where participation is voluntary, and these plans are targeted to lower income individuals. As Modigliani (1997) noted: “The absence of a borrowing option in many retirement plans (e.g., Social Security and non 401(K) plans) seriously discourages the accumulation of retirement funds through voluntary employee contributions.” Muralidhar (2018a), in reviewing surveys of uncovered workers in California, confirmed Modigliani’s (1997) study and noted that, “these participants were also very specific that lack of access to funds pre-retirement potentially would lead them to opt out of the system.” Earning less than 1% in a government bond in a 401k, while paying double-digit interest charges on credit cards and payday loans, is surely not a rational economic strategy. Good design allows individuals some flexibility to finance such volatile patterns without necessarily curtailing accustomed standards of living or cannibalizing retirement consumption, and it is invaluable for providing a hedge against one’s own consumption and investment needs. Fellowes and Willemin (2013) note that “over 25 percent of households that use a DC plan for retirement have withdrawn, or breached their DC balances for non-retirement spending needs, amounting to over \$70bn of annual withdrawals.” Moreover, the evidence suggests that those most likely to breach their retirement savings are those with no emergency savings—typically individuals who are lower income, minorities, and in their forties. Fellowes and Willemin (2013) go so far as to suggest that many participants are using retirement accounts as an inefficient way to save for basic consumption needs. This follows because of the tax penalty incurred for early withdrawals. Lu *et al.* (2014) note that, “though close to 40% of participants appeared to borrow from retirement accounts over a five-year data period in their study, ‘fully 90% of loans

are repaid in a timely way, according to our estimates.’”³⁶

8.1 Current and prospective methods of consumption smoothing

What are the methods through which such smoothing is achieved? Home loans against Provident Fund balances are common, and some public pension plans in the United States offer home equity loans against DB balances. Fellowes and Willemin (2013) highlight three avenues available to participants in US. DC plans: (a) Loans—employers may allow participants to borrow up to 50% of vested balances or \$50,000, whichever is lower; (b) Cash outs—terminated employees can withdraw all or a portion of their DC balances, though these can incur a penalty; and (c) Withdrawals—which are permitted for financial hardships or other crises, subject to the employer’s discretion. Garcia-Huitron and Ponds (2016) and García-Huitrón (2014) identify four operative models for lifetime consumption smoothing along with many international examples.³⁷

Another alternative suggested by Modigliani (1995, 1997), which has yet to be implemented, is to issue a credit or debit card, using a third-party vendor, against one’s accumulated 401(k) balance. Modigliani (1997) notes that, “the ability of limited borrowing for short periods of time makes 401(K) assets more liquid and therefore more desirable and valuable, especially to lower employees.” This has the advantage of avoiding paternalism on the part of employers (in deciding whether to grant loans or whether financial hardship has been incurred), and it ensures portability if employees change jobs. With appropriate repayment and default-prevention provisions, this alternative could have significant value for individuals. Modigliani and Muralidhar (2004) propose a Social Security DB model discussed in Section 3 and propose further that, “[B]orrowing

against these retirement savings will be at the guaranteed rate, and thus individuals will be no worse off when they repay these borrowings to themselves.”³⁸ Similar principles can be applied to corporate and public DB pension plans.³⁹ As noted earlier, if SeLFIES serve as a currency for retirement, this facet could be invaluable in establishing the retirement income value of any borrowing and subsequent repayment of such savings. Clearly, if individuals are too far behind on retirement accumulation, there should be limits on their ability to withdraw for non-essential consumption.

8.2 Recommendation for component 6

In all previous proposals, the anticipation has been that full repayment of the borrowing will be made prior to retirement. However, the coronavirus shock has led, in some cases, to a permanent reduction in lifetime income and therefore to lifetime consumption. In such cases, some consideration should be given to codifying the accessing of retirement assets, including DB as well as DC, to less than full repayment (without penalties) because some individuals may be able to sustain a lower retirement lifestyle with the permanently lower balance and should not be penalized for having to make such unanticipated lifestyle changes. This has already been done impromptu with 401k and IRA accounts in the current crisis in the United States⁴⁰ and from DC balances in Latin American countries and Australia. Obviously, limits will need to be instituted as to how much of the retirement account can be accessed for drawing down in order to serve the public policy issue of retirement plans, which justify tax breaks that are offered on contributions.⁴¹

9 Conclusions

To create a sustainable solution to fund retirement will require using all the channels of resources

available efficiently. This paper has examined the global retirement crisis and noted that countries as diverse as Australia, Brazil, the Netherlands, Portugal, South Africa, South Korea, and the United States are grappling with some or all of the six components articulated, but not in a comprehensive and integrated fashion. On the assumption that the retirement goal can be expressed as guaranteeing real retirement income so retirees can continue to maintain their pre-retirement standard of living, this paper described how each of the six components can be designed or improved: from improving funding for and management of social security systems (and tying benefits to standard-of-living indices) to effective design of a next generation DC pension plan (that accommodates individual preferences and the flexibility to work with just what individuals are capable of expressing), to boosting retirement income through annuities and home-equity release programs (without requiring additional savings or risk taking), to facilitating working in retirement and lifetime consumption smoothing. One key component of this six-component approach was the recommendation that governments begin to issue SeLFIES as they address four of the six components, and can help governments fund long-term needs for infrastructure, SDGs or even COVID-19-related spending with long-term domestic debt.

This paper synthesizes all six components into an integrated approach, but presents it in a transparent, detailed modular fashion, so that any one module can be replaced with a different version and the rest of the system still works. This also means that all six components need not be implemented simultaneously, but can be done in a secular fashion. However, while they may be implemented piecemeal, a SUPER (sustainable, universal, portable, efficient and well regulated) pension system will not be feasible without all six components.

Table A.1 Different sources of retirement savings and risks hedged (United States).

Type of plan	Example	Typical contribution	Real vs. Nominal pension (hedging inflation risk)	Guaranteed vs. Volatile outcome	Life vs. Fixed term payments (hedging longevity risk)
Level 1	Nationally sponsored DB	Social Security	Set by government (split between employer and employee)	Real	Guaranteed
Level 2A	Employer-sponsored DB	Corporate/ state/ county DB	Varies by funded status (either paid by sponsor or split)	Nominal (if indexed, conditional on funded status)	Guaranteed (but some credit risk to guarantee)
Level 2B	Employer-sponsored DC	401(k)	Limited by dollar caps (e.g., \$18,000 per annum); paid by employee or split	Nominal	Volatile
Level 3	Private savings	Investment accounts	Individual contributes	Up to individual (more likely nominal, given current instruments)	Neither—lump sum, or manual decumulation (employee buys desired annuity)

Appendix I Different sources of retirement savings and risks hedged

Table A.1 examines the typical three-pillar approach to retirement system design with a focus on the different sources of retirement funding, and the risks that each pillar or pension fund hedges. It shows typical contributions for each type, whether it provides a hedge against inflation or longevity risks (two key risks), and whether the outcomes are guaranteed or volatile. Table A.1 contains generic information based on the US experience, but even in nations such as the Netherlands, inflation indexation of pensions within the employer segment is optional or conditional and is provided only if the pension fund is sufficiently funded.

Notes

¹ See Merton (2007, 2010a, 2010b, 2012a, 2012b).

² Defined as workers who do not have a permanent job but work on individual projects or “gigs” as a contractor.

³ <https://www.magnifymoney.com/blog/news/early-withdrawal-coronavirus/>.

⁴ Modigliani and Muralidhar (2004), Merton and Muralidhar (2017a), and Muralidhar (2018a).

⁵ See also Merton (2010a, 2010b, 2012a, 2012b, 2014).

⁶ This target return was a very specific value (and not constructed arbitrarily based on forecasts of expected returns as is usual practice). It was the unique return, that for current benefits and contribution rates, would ensure that the social security system would be sustainable for the foreseeable future. It was also calibrated on the basis of what is feasible in markets. In the two case studies provided on the United States and Spain, they demonstrated that given market realities, additional contributions would be needed, so as to highlight the fact that social security systems could not just invest their way out of the problem.

⁷ The MM Model would index the retirement age to longevity, thereby require more working years to fund potentially longer retirement.

⁸ Had the United States adopted the MM model or even invested the Trust Fund in financial assets, a simple 60%

stock/40% bond portfolio would have earned a nominal rate of return per annum from January 2004 to June 2020 in excess of the then proposed target/guaranteed rate.

⁹ <https://www.ssa.gov/history/reports/gspan.html>

¹⁰ Merton (1983, p. 261). The size of the annuity would be linked to the amount contributed and what happens to per capita consumption, but not the investment experience in the equities and other assets invested in the pension fund.

¹¹ Merton (1983, p. 262).

¹² One can argue that life insurance for dependents is better handled outside the pension system or as an option paid for incrementally within the system. A mandatory combined benefit forces all participants to pay for these benefits that single or no-child members do not want/need.

¹³ Merton (1983, p. 272).

¹⁴ Bodie and Merton (1993).

¹⁵ For an early discussion of the benefit-challenge trade-off between DB and DC plans, see Bodie *et al.* (1988).

¹⁶ <https://www.ipe.com/news/parliament-agrees-to-dutch-pensions-reform-but-questions-remain/10046855>. article.

¹⁷ Merton (2007).

¹⁸ For example, a new bond ETF has been proposed that offers cash flows that would mimic those in Figure 1, but given the maturity restrictions noted earlier, this product can only be used by investors 55 and older. Palacios *et al.* (2019).

¹⁹ In the case of South Africa or the United Kingdom, the maturity of TIPS or Inflation-Linked Gilts extends further to 50 years but this still is insufficient for a 25-year old.

²⁰ For brevity, we do not address tontines.

²¹ These options could also work effectively for upper middle class and affluent retirees, especially for funding gifts and bequests, but these groups can afford and need advisors for tax and legal advice, and are not really part of the “crisis” in funding retirement.

²² See <https://www.hdfclife.com/insurance-knowledge-centre/about-life-insurance/meaning-and-definition-of-annuity>.

²³ https://www.nahbclassic.org/fileUpload_details.aspx?contentTypeID=3&contentID=215073&subContentID=533787&channelID=311.

²⁴ https://www.hf.go.kr/ehf/sub03/sub01_01.do#jwxe_main_content.

- ²⁵ Brown (2014) provides a less specific idea for the same concept.
- ²⁶ Fitch made 18 EM sovereign rating downgrades from January 1 to April 21, 2020, which is the highest ever annual total in less than four months. <https://www.fitchratings.com/research/sovereigns/coronavirus-pandemic-strikes-devastating-blow-to-em-sovereign-prospects-21-04-2020>.
- ²⁷ https://www.plansponsor.com/pandemic-causing-older-workers-leave-workforce-earlier-planned/?utm_source=newsletter&utm_medium=email&utm_campaign=Newsdash.
- ²⁸ Rappaport and Seigel (2020, p. 12).
- ²⁹ Rappaport and Seigel (2020, p. 12).
- ³⁰ Rappaport and Seigel (2020, p. 12).
- ³¹ Many of the public-sector jobs will be local government activities where the retirees currently live and so need to move or travel long commutes. There should be jobs which require a minimum of new-skill training to do well, because neither employee nor employer wants to have a large investment of time in otherwise non-productive training.
- ³² <https://www.magnifymoney.com/blog/news/early-withdrawal-coronavirus/>.
- ³³ <https://www.reuters.com/article/us-health-coronavirus-australia-pensions/faced-with-covid-19-highest-number-of-australians-tap-retirement-funds-since-april-idUSKCN24F0VK>.
- ³⁴ <https://santiagotimes.cl/2020/07/08/chilean-house-of-representatives-approves-withdrawal-of-10-from-retirement-funds/>.
- ³⁵ <https://pensionpolicyinternational.com/withdrawals-from-mexican-pension-funds-soar-amid-weak-labor-market/>.
- ³⁶ Page 106.
- ³⁷ These include permanent withdrawal, loan and repay, feeder-fund, and pledge.
- ³⁸ Page 38.
- ³⁹ In the interest of brevity, the borrowing rate will be addressed in future research as there are various considerations, including whether the plan is DB or DC and whether the plan is fully or partially funded or Pay-As-You-Go.
- ⁴⁰ <https://money.usnews.com/money/retirement/401ks/articles/using-a-401-k-loan-to-cope-with-coronavirus-costs>.
- ⁴¹ As Bosch *et al.* (2020) note, design of these programs matters a lot.

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