PRARI®

Product Allocation for Retirement Income

CANNEX

INTRODUCTION

Over the last five decades, financial advisors have been preaching the benefits and importance of a diversified portfolio using the principles of Modern Portfolio Theory. At its essence, the message has been that if you own a diversified portfolio then your financial future is secure.

However, as individuals retire and start withdrawing income from their nest egg, the famed role of asset allocation diminishes in importance and a new concept known as Product Allocation emerges. While a diversified portfolio of stocks and bonds is important, the actual products within which investors maintain their asset allocation will have a critical impact on sustainability of retirement income and the legacy for future generations.

With a decline in savings levels, reduction of Defined Benefit (DB) pensions, increasing longevity, and investment uncertainty, today's retirees face an enormous challenge that previous generations did not have to in maintaining a sustainable retirement. As more and more baby-boomers enter retirement they ask: How can we ensure that our retirement savings last a lifetime? The answer is non-trivial in the face of market uncertainty, inflation, and increasing longevity. When retirees turn for help from their financial advisors they are concerned with what they should do to sustain their current standard of living in retirement without imposing a burden on the next generation.

With a myriad of investment and insurance products available in the market to address retirement income concerns, the new challenge is answering the question: Which of these products are suitable and in what proportions?

This document examines the risks in retirement, explains the concept of product allocation, and shows how to apply this new approach to retirement income planning.

REVIEWING THE RISKS

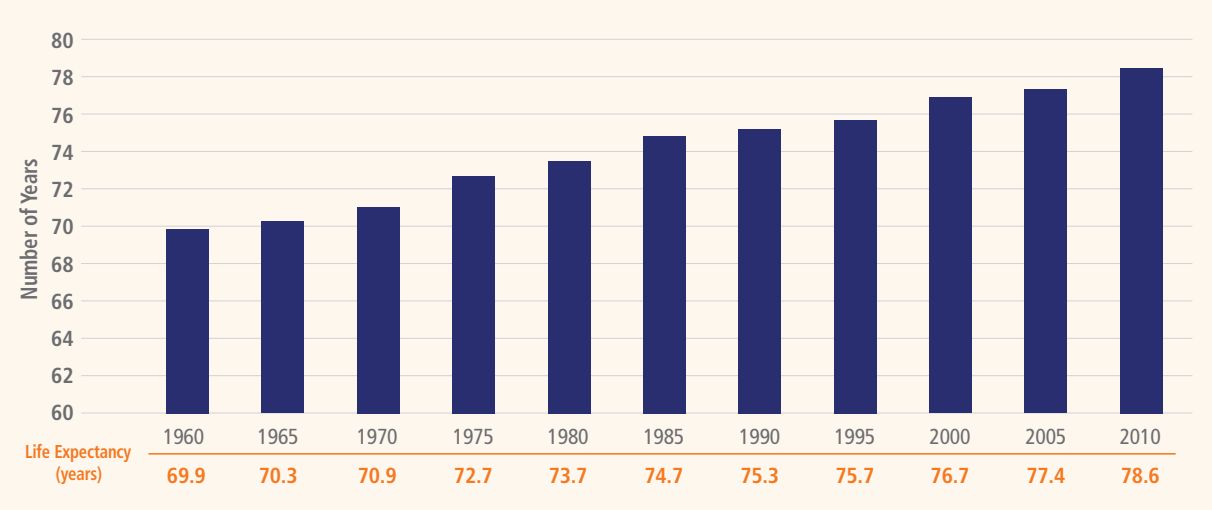
As individuals transition into retirement, they face unique and different risks that simply do not arise in an earlier accumulation stage. We briefly review the key risks before we introduce our main thesis regarding product allocation.

LONGEVITY RISK

Your Longevity Risk is the risk that you will outlive your retirement assets. Due to improvements in medical technology, nutrition, disease control, public health, and environment, human longevity has improved over the last 5 decades. **Figure 1** shows the life expectancies of Americans at birth. Notice the improvement in life expectancies from one decade to the next.

Figure 1: U.S. Life Expectancy at Birth Improvement (1960-2010)

Source: OECD Health Data



According to the National Center of Health Statistics, in 2010, life expectancy at birth in the United States of America was 76.2 years for males and 81.0 years for females. Averages alone do not tell the entire story since once we actually reach our retirement years, the chances of surviving for more than a decade are quite substantial. In fact, true across the entire life span, is the fact that as we survive each stage of life and the associated risks, we have increasing odds of surviving to higher ages.

Table 1 provides a sample of survival probabilities for 65-year old male and females:

Perhaps the most compelling of longevity statistics are the probabilities of survival for at least one member of a couple. For example, the chance that at least one member of a couple survives to age 85 is 82.5%; the probability that one spouse or even both are alive at age 90 is three in five.

Table 1: Probability of Survival at Age 65[1]

To Age	Female	Male	At Least One Member of Male-Female Couple
70	**95.4%**	**93.9%**	**99.7%**
75	**88.5%**	**84.9%**	**98.3%**
80	**77.8%**	**71.7%**	**93.7%**
85	**62.1%**	**53.7%**	**82.5%**
90	**41.8%**	**32.4%**	**60.7%**
95	**20.7%**	**13.3%**	**31.2%**
100	**5.8%**	**2.7%**	**8.4%**

1. Values are generated using the Gompertz-Makeham Law of Mortality calibrated to RP-2014 Mortality Table with MP-2014 Projection Scale applied.

While individual lifestyle factors, behavioral habits, and family history will obviously affect any individual survival estimates, it is also a fact that humans are living longer than they ever have. Moreover, the human lifespan is random and a retirement strategy must account for longevity risk. The implications of longevity are that after we retire, our accumulated assets may have to last much longer in time. Prior to retirement, longevity is not an immediate risk because the single most impactful thing that one can do to mitigate longevity risk is to work longer.

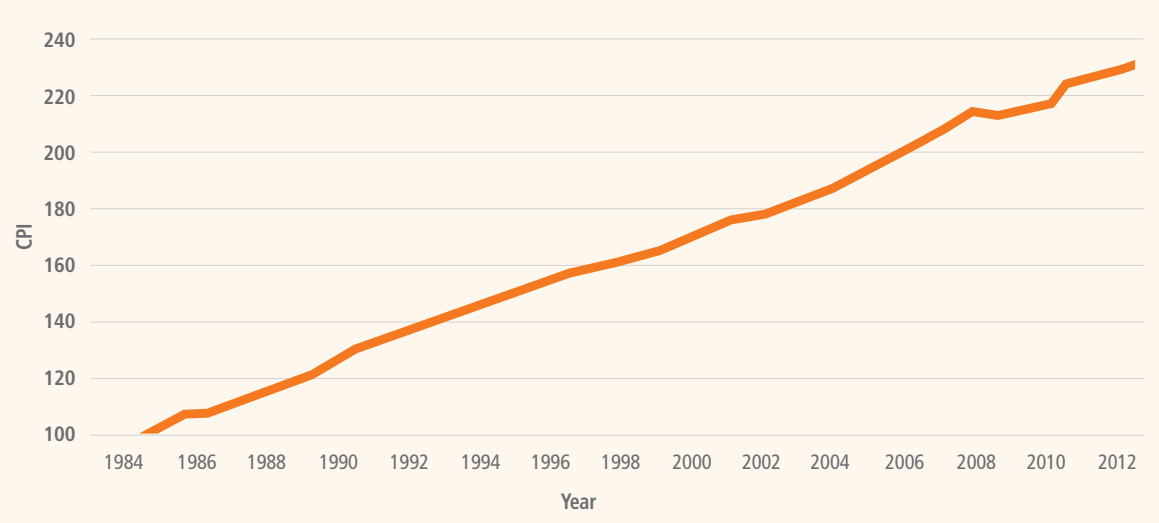
INFLATION RISK

Your Inflation Risk is the risk that the purchasing power of your retirement income will not be able to keep up with your standard of living. Central banks usually commit themselves to ensuring that inflation is kept at acceptable levels. They do this by fine tuning monetary policy so that the change in the Consumer Price Index (CPI) is kept within a certain range.

Inflation is the increase in the prices of goods and services over time. The inflation rate is calculated by observing the change in price of a basket of goods and services. CPI is an indicator of average inflation for a typical urban consumer. In the US, the Bureau of Labor Statistics (BLS) computes various consumer price indices nationally and for different geographical areas. **Figure 2** shows a graph of the average cumulative CPI-U from 1970 to 2014.

Figure 2: CPI-U

Source: U.S. Bureau of Labor Statistics (1982-84 = 100)

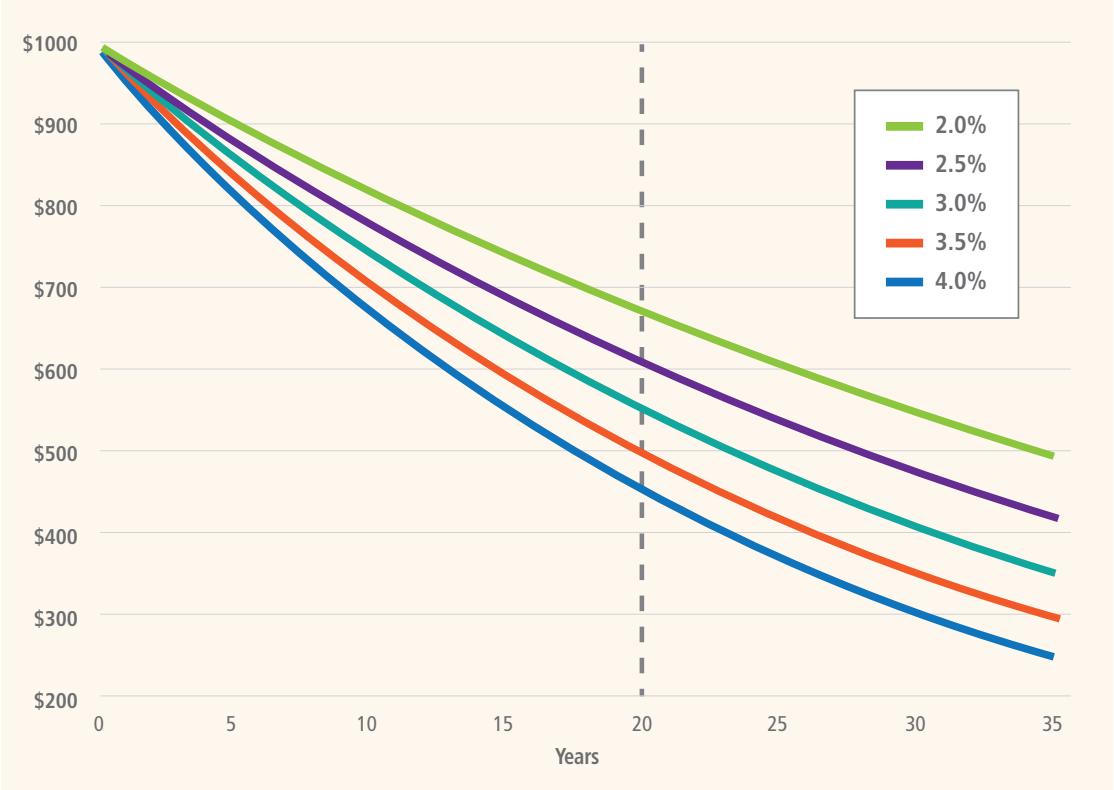


So why is inflation a concern? Inflation is a risk in retirement because it erodes the purchasing power of the consumer. It is less of a risk before retirement because most workers' salary increases are at least somewhat tied to inflation. In the figure above, in a span of 30 years, a basket of goods that cost $100 in 1984 costs $237 by the end of 2014. However, CPI-U understates inflation for retirees because health care costs, prescription drugs, medical appliances, and long-term care become a significant part of the expenditure. These items are not captured by the CPI-U in the proportions consumed by the elderly. The decline in purchasing power over the course of retirement is a risk that has to be managed.

For example, Figure 3 illustrates that even an inflation rate as low as 2% can reduce the purchasing power of $1,000 by more than a third after 20 years. Back in 1988, the BLS inaugurated a new experimental inflation

index called CPI-E which is designed to track the goods and services consumed by the elderly. The need for this new index arises because as we age, our spending habits change. Any inflation index, after all, is a reflection of a given basket of goods and this new index aims to capture retiree's spending patterns. According to the March 2010 CPI Detailed Report, CPI-E rose 36.1% compared to 33.9% for CPI-U over a 12-year period from December 1997 through December 2009. This translates into an average annual increase of 3.0% in CPI-E vs 2.8% for CPI-U. CPI-E helps quantify the higher inflation experienced by retirees and we should focus our attention on the upper inflation rate range in **Figure 3**. If we assume a rate of 4%, which is more realistic for retirees, then the real (after inflation) value of the initial $1000 would be reduced to a mere $456 after 20 years.

Figure 3: Inflation Effects on Purchasing Power



SEQUENCE-OF-RETURNS RISK

Your Sequence-of-Returns-Risk is the risk that you will experience poor portfolio performance early in retirement. When constant withdrawals are made from an account, there is a larger negative impact on the performance of the account in a down market than in an up market because a lower portion of each withdrawal payment is made up of interest or yield and therefore a higher portion of each withdrawal payment is made up of capital. In other words, the timing of the returns is important and is an additional risk that needs to be addressed.

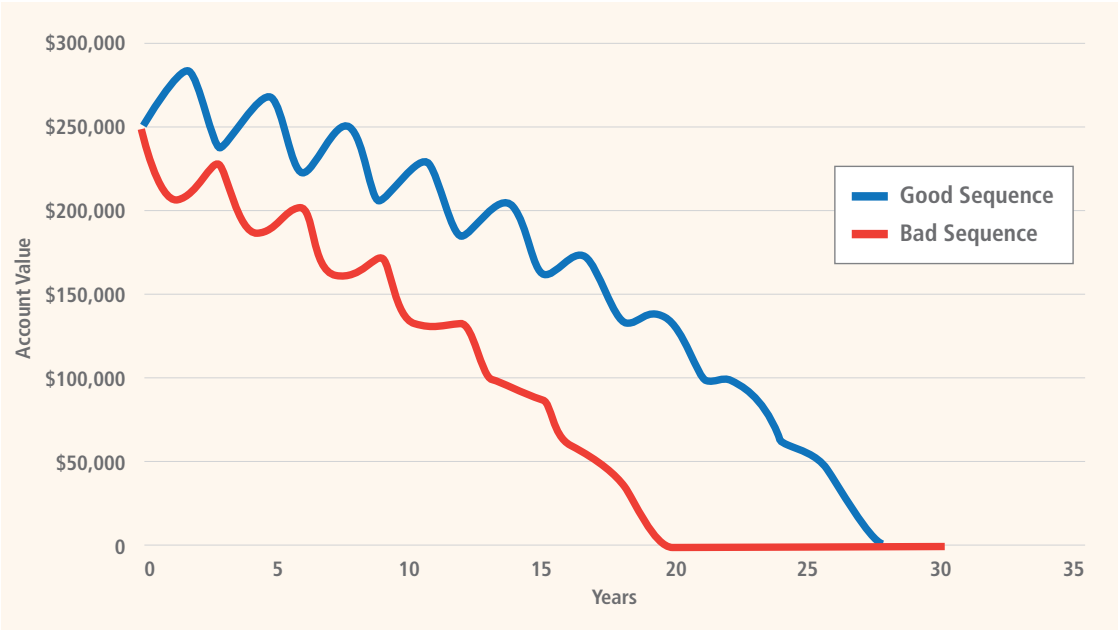
To illustrate the impact of Sequence-of-Returns risk, consider the following example: Assume you have $250,000 in assets and you earn 17% in year one, 10% in year two, and -8% in year three and then this sequence repeats itself indefinitely. On average, you are earning 6.3% and the volatility of the returns (as measured by the standard deviation of the returns) is 10.5% (which is typical of a balanced portfolio

invested in North American equities and fixed income assets). Further, assume that you will withdraw $1,650 monthly or $19,800 annually. How long is the money going to last?

As depicted in **Figure 4**, the funds will last around 28 years. Now, if we reverse the sequence, i.e. earn -8% in year one, 10% in year two, and 17% in year three (the average still being 6.3% and volatility still being 10.5%), then the funds will last around 21 years.

The difference of 7 years in the example above is attributable to nothing else but the sequence in which the returns are realized. As an individual, one does not get to choose the retirement date based on what sequence will materialize.

Figure 4: Sequence-of-Returns Risk Illustration



Any of these three risks can force the individual to adjust his/her standard of living and in extreme cases can cause a dependency on social programs, friends, and family, which clearly would not make for a dignified retirement. One cannot control the timing of the bear market just as we do not have control of our lifespan or the rate of inflation throughout our retirement. However, rather than trying to predict the outcomes of any of these random events, one could insure against adverse outcomes using a product allocation strategy.

HOW DOES PRODUCT ALLOCATION HELP?

The financial services industry has responded by offering an expanded repertoire of insurance and investment products to help mitigate these retirement risk. These products are certainly beneficial to some (and possibly most) individual clients. The challenge is determining which of these products should be recommended for allocating an individual client's wealth and in what proportions.

Product Allocation is a technique that allows an individual to hedge against the risks identified in the previous section by allocating funds across three broad categories:

- Income Annuities (immediate or deferred)
- Managed Accounts (stocks, bonds, mutual funds, commodities, etc.), and
- Hybrid Accounts (VAs and FIAs) with Guaranteed Lifetime Income Benefits (GLB).

Income Annuities such as Single Premium Immediate Annuities (SPIA) or Deferred Income Annuities (DIA) are used to capture the benefit and value of longevity protection within a retirement strategy. Financially speaking, the embedded longevity insurance protects the annuitant (the individual on whose life the policy is based upon) living past their life expectancy. While most of us would like to live to a ripe old age, proper planning requires that the financial cost of living much longer than expected be mitigated. Annuities insure us against longevity.

Managed accounts provide a Systematic Withdrawal Plan (SWP) or a method by which the account is periodically liquidated to generate income. With exposure to capital markets, a managed account, if markets perform well, provides protection from the effects of inflation.

Hybrid Accounts composed of Variable Annuities (or Fixed Indexed Annuities) or Segregated Funds (Canada) with a Guaranteed Lifetime Income Benefit (GLB) may grow with the market while providing a hedge against a bad sequence of returns and some longevity protection, however because their fees are typically higher than managed account fees, hybrids will not provide the same level of growth and they generally do not contain as much longevity insurance as income annuities (SPIA/DIA).

Each product varies in its effectiveness at addressing the risks and retirement goals of a retiree, which may include maintaining liquidity, maximizing estate value, or increasing sustainability. There is no 'free-lunch' — valuable benefit offered by a product is typically offered at the expense of another risk management attribute. For example, a SPIA offers a good hedge against longevity risk but at the expense of liquidity, bequest, and flexibility. On the other hand, a managed account provides full flexibility but fails to address longevity or Sequence-of-Returns risk. Our goal with product allocation is to try to find the best trade-off between income sustainability and financial legacy for the particular client.

Figure 5: Retirement Product Attributes
Source: The QWeMA Group

	Risk Management Attributes			Goal Achievement Attributes			
	Longevity	Inflation	Sequence of Returns	Liquidity	Behavioral	Legacy	Fees & Expenses
SPIA/DIA	●	—	●	x	●	x	**LOW**
VA with GLB	●	—	●	x	—	—	**HIGH**
SWP	x	•	x	●	x	●	**MEDIUM**

SPIA and DIA offer the most efficient forms of longevity insurance and can be viewed as the best substitute for traditional pension which many individuals no longer own. Conversely, unless one purchases an income annuity with increasing payments (Cost of Living Adjustment (COLA) or CPI-U indexing options), the SPIA/DIA scores the lowest on its ability tackle inflation. It should be noted that SPIAs with an option for increasing payments are the only products that provide longevity protection and explicit inflation protection, this option is not considered here as it tends to be expensive and rarely used in practice. Given the fixed nature of payments, SPIA/DIA offers a good hedge against Sequence-of-Returns risk and the product typically provides the least expensive way to establish a guaranteed income floor in any retirement plan.

On the other hand, a SWP's risk management attributes are opposite to that of a SPIA/DIA. The investment choices with the SWP are virtually endless and the underlying asset allocation is under complete control of the

investor. When managed well, the asset allocation offers indirect protection against rising inflation because in most years the market outperforms inflation.

Hybrid accounts such as Variable Annuities (VA) or Fixed Income Annuities (FIA) with GLB riders offer a good hedge against the sequence-of-returns risk. Guarantees and promises are the core of GLBs. Many promise at least the return of the initial investment, despite the performance of the market. GLBs are analogous to (albeit complex) long-term equity put options that can be purchased in the open market to provide downside protection on a portfolio. Thus, their embedded guarantees, earn GLBs the high score for hedging sequence of return risk. However, not all GLBs are created equal. While some variations guarantee an income for life, thus providing some longevity protection, they are typically more costly than the pure form of longevity insurance offered by SPIA/DIA. Finally, like managed accounts, GLBs do not typically provide explicit inflation protection; however, many offer systematic payment step-ups or minimum percentage increases that could potentially offset the impact of inflation. These inflation protection attributes can be thought of as more costly than those of a managed account because the fees for these hybrid accounts are typically higher than those of managed accounts.

From a financial engineering perspective, while a SWP and a GLB behave similarly in the first few years, the GLB contains a long dated put option that kicks in if and when the underlying account hits zero. Thus, while a SWP would terminate and cease providing income if the underlying account hits zero, a GLB on the other hand would continue to provide with a lifetime of guaranteed income. Stated differently, this means that a client who relies exclusively on a SWP to fund retirement is essentially 'short' this long-dated put option, which exposes him/her to both longevity and sequence of returns risk and may therefore reduce the probability of providing a bequest or estate transfer.

After all, the reason SPIA/DIA is able to offer such effective longevity insurance is the irreversibility of the initial lump sum payment.

As seen in **Figure 5** (previous page), the risk management attributes of the three retirement income products are only half of the story. The allocation among the products should also be selected in the context of at least three goal-achievement objectives: liquidity, behavioral "self-discipline", and legacy (or estate value).

For instance, a total allocation to a SPIA/DIA would be inappropriate if the retiree's primary future goal was to leave a large sum to his or her estate. Likewise, if the client spends their full monthly benefit payment, the client may have difficulty budgeting for a fluctuating spending rate or large lump sum withdrawals for unexpected cash needs. After all, the reason SPIA/DIA is able to offer such effective longevity insurance is the irreversibility of the initial lump sum payment. Thus, while some SPIA/DIA contracts do address liquidity, other products address these needs better.

On the other hand, the SPIA/DIA is highly effective at overcoming potential behavioral mistakes that investors are prone to making – such as spending beyond their means. Further, many of us are susceptible to making irrational decisions and errors with our investments in the absence of restrictions or a guiding system in place and that can decrease the chances of meeting our spending goals in retirement. When the initial irreversible payment is made to the insurance company issuing the SPIA/DIA, the control over the investment management decisions is also transferred away from the investor and the insurance company guarantees the monthly benefit payment for life. This leaves little room for the client's behavioral biases and blunders.

With a SWP, a disciplined and well-informed investor can meet liquidity needs and estate goals because he or she retains the control over asset allocation and withdrawal rate; but without discipline of, for example taking a

cut in income when necessary, and the financial acumen of, for example knowing when a cut is necessary, the SWP ranks low in effectiveness in helping the investor to avert behavioral mistakes.

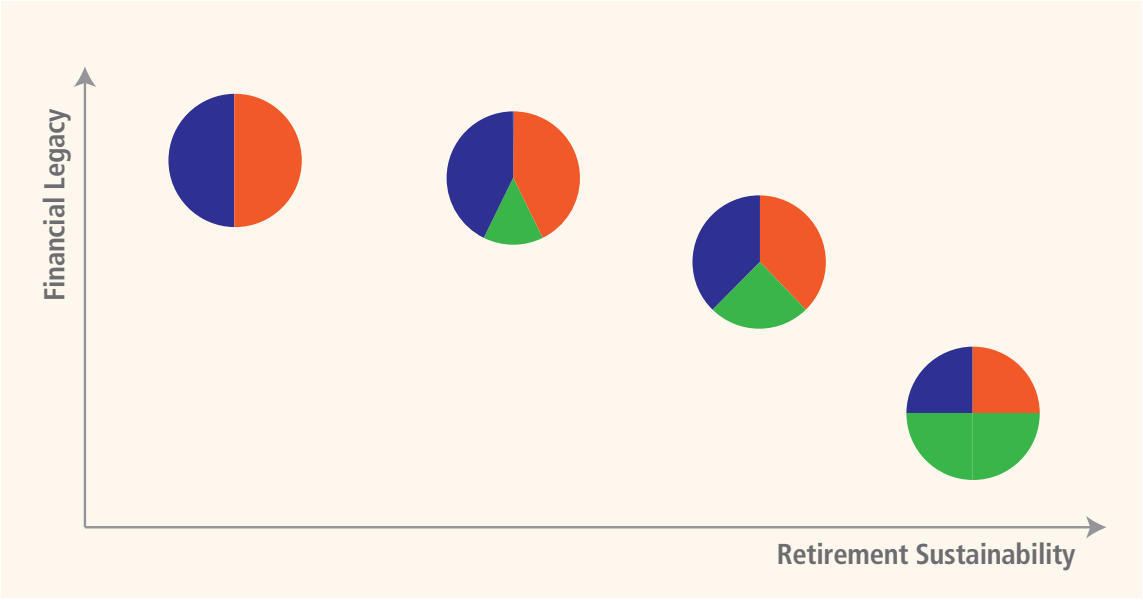
The GLB's liquidity is restricted by withdrawal limits imposed by the rider. Moreover, GLBs restrict withdrawals beyond a certain limit by charging surrender fees as well as reducing the benefits. The policyholder does have liquidity with a GLB, even if it may come at a hefty price and it is therefore superior to a SPIA on this trait. A GLB rider can also be effective in addressing some behavioral weaknesses because the surrender charge acts as a deterrent to making excessive withdrawals. When purchasing a GLB, the investor effectively purchases protection against poor market performance in that if the account value goes to zero, the product will continue to provide guaranteed payments for life. On the other hand, if the variable annuity is annuitized or if the underlying investments perform poorly, and the GLB is irreversibly converted into a retirement income stream then no death benefit will be paid. This attribute makes the GLB good for purposes where the estate is of secondary concern after the client's requirements for guaranteed lifetime income.

Finally, when it comes to evaluating fees, the basic SPIA/DIA tends to be the cheapest product option while the GLB is the highest because of the fees that must be charged for the embedded options, guarantees and the management of the underlying investments. The fees charged for a SWP typically fall between that of the other two income products because it is simpler than a GLB but its management is typically more involved than a SPIA/DIA.

PUTTING IT ALL TOGETHER: HOW DOES PRARI® WORK?

At its core, product allocation is a risk management strategy. The objective of a product allocation strategy is to hedge retirement risks in the context of one's retirement goals. Product Allocation for Retirement Income – PrARI® – was developed based on the research work of Dr. Moshe Milevsky. The methodology is based on the idea that any combination of products – such as a SPIA, DIA, SWP or GLB – in conjunction with a desired spending rate and other input variables will result in a set of metrics called the Retirement Sustainability Quotient (RSQ) and the Expected Financial Legacy (EFL). Moreover, varying the product allocations will change the value of the RSQ (captured by the horizontal X-axis) and EFL (captured by the vertical Y-axis), which then traces a frontier that is analogous to the Markowitz Efficient Frontier, as displayed in **Figure 6**.

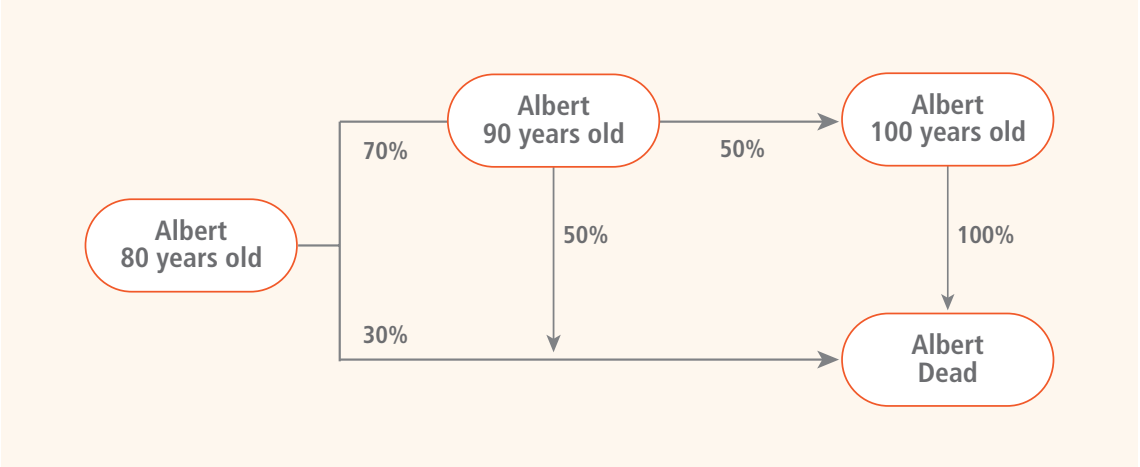
Figure 6: RSQ & EFL Trade-off



These two computed quantities (RSQ and EFL) capture the most fundamental trade-off at the core of retirement income planning, namely security for oneself versus legacy for one's heirs. The product portfolios on the frontier illustrate the variability in product allocation: a retiree who prefers higher sustainability (lower right-hand side) might have higher allocation to guaranteed income while the retiree who wants to maximize legacy (top left-hand side) might have a greater allocation to traditional investments.

To illustrate how the RSQ and EFL are calculated, imagine that Albert retires at the age of 80 with exactly $100 of savings in his nest egg. To simplify, we will assume no fees and all of Albert's consumption is at the very end of each decade of retirement, i.e. at the age of 90 and the age of 100. Further, assume that the probability of an 80-year old surviving to the age of 90 is 70% and the probability of a 90-year old surviving to the age 100 is 50%. Nobody makes it to age 101 in our simple world, in other words, beyond age 100, death is certain. Finally, imagine that the interest rate in our simple world is exactly 3.74% over a ten-year period. In other words, if Albert or anyone else invests $100 today, it grows to $103.74 in ten years. See **Figure 7** for a graphical illustration of this two-period model and the relevant probabilities of survival.

Figure 7: Albert's Survival Probablities



The reason we are making all these assumptions – and the rationale for the exact numbers we used – is that under these probabilities and rates, the 80-year-old retiree would be able to purchase a life annuity that pays $100 at the end of each decade, for exactly $100. Yes, you pay $100 now and you get $100 as long as you are still alive, as shown in the calculation below:

$$\text{Value of Albert's Annuity} = \frac{100 \times 0.7}{1.034} + \frac{100 \times 0.7 \times 0.5}{1.034^2} = 100$$

What this means is that if Albert desires or wants to spend exactly $100 per end-of-decade, he could, in theory, annuitize his entire nest egg today and guarantee a 100% RSQ. After all, if he survives to age 90 or even age 100, the insurance company would guarantee a payment of $100, which is exactly what he desires. In this simple case, full annuitization guarantees 100% sustainability.

Now the other side of this retirement security is that if he transfers or allocates his entire $100 nest egg to the insurance company – in exchange for this promise of lifetime income – he will effectively be broke and will have nothing left to bequeath to his family. Using our language, his EFL would be zero in order to "pay for" 100% sustainability.

On the other hand, if Albert decides to completely avoid the life annuity product, and take his chances, investing his $100 nest egg on his own, the future of his retirement security is random. This is the essence of the 100% SWP strategy. Things might work out – as morbid as it sounds, if Albert dies early – or things may not.

Think about this carefully, if Albert invests the $100 at the same 3.74% interest rate used by the insurance company to price life annuities, his money will grow to $103.74, which is enough to finance his needs (plus some change) at the age of 90. Nevertheless, if he then makes it to age 100, the $3.74 left over from age 90 will only grow to $3.88, which is definitely not enough to finance his needs. If he makes it to 100, his retirement needs will not be sustainable. Finally, since there is a 35% chance Albert will survive to age 100 (0.70 x 0.50 = 0.35), there is a 65% chance that this strategy – zero annuitization – is sustainable.

The zero annuitization strategy is worse than the 100% sustainability that comes from annuitization, but at least Albert might leave a bequest. Remember, if Albert dies prior to his 90th or 100th birthday, his estate will get the remainder of his nest egg – because he did not annuitize. In some cases, the estate will inherit as much as $100, and in some scenarios, the estate value will be negative (and his heirs will need to pay for Albert's consumption).

Finally, the same exact process and tradeoff applies to any combination of SWP and SPIA strategy. For example, a 60% SWP and 40% SPIA allocation would ensure that at least $40 was guaranteed for life, but there would still be a 65% chance that the other $60 need would be met. In this simple case, RSQ can be calculated by computing the quotient of the probability-weighted income from each of the products and the desired income in retirement:

$$\text{RSQ} = \frac{p_{SPIA} \times Income_{SPIA} + p_{SWP} \times Income_{SWP}}{Income_{DESIRED}}$$

$$= 1.0 \times \frac{40}{100} + 0.65 \times \frac{60}{100} = 0.40 + 0.39 = 79\%$$

Likewise, the EFL can be calculated by aggregating the present value of the probability-weighted account balances at death. Since Albert has annuitized 40% of his nest egg his immediate SWP balance is $60. If he survives to age 90, the SWP balance will grow to $62.04. However, he will consume $60 from the account (with the remainder $40 coming from the SPIA) and if he were to die immediately, his estate would receive only $2.04. If Albert survives to age 100, his SWP would grow to $2.11 and he will clearly fall short since he requires $60 but only has $2.11 in his account. The following is the EFL calculation:

$$\text{EFL} = q_{80} \times SWP_{80} + \frac{p_{80} \times q_{90} \times SWP_{90}}{(1+r)} + \frac{p_{80} \times p_{90} \times q_{100} \times SWP_{100}}{(1+r)^2}$$

$$= 0.30 \times \$60 + \frac{0.70 \times 0.50 \times \$2.04}{1.0374} + \frac{0.70 \times 0.50 \times 1.0 \times -\$57.89}{1.0374^2} = -\$0.14$$

In sum, a 60% SWP and 40% annuity strategy produces a 79% RSQ and -$0.14 EFL in this scenario.

The PrARI® algorithm is more complex, but the underlying idea is the same. Depending on the instruments available in the market as well as individual characteristics or input variables, the allocation to the products you choose will produce a particular RSQ that measures the sustainability of your retirement income and generates an expected financial legacy (EFL). These two metrics – RSQ and EFL – encapsulate your post-retirement finances. By measuring RSQ and EFL, you can find a more optimal allocation to products that meet your retirement goals.

CONCLUSION

There is general agreement today among financial professionals about the existence and relevance of specific risks (such as longevity, inflation and sequence of return) that await clients in their retirement, which were not present in the accumulation stage. Rather than trying to predict the outcomes of inflation, longevity, and sequence-of-returns variables, using a product allocation algorithm such as PrARI® allows the client to insure or hedge against adverse outcomes.

Relying upon traditional asset allocation alone will often not be enough. Rather, all three product categories — income annuities (SPIA/DIA), managed funds (e.g. mutual funds) within a systematic withdrawal plan, and variable annuities (which are called segregated funds in Canada) with embedded guaranteed living benefits — should be mixed and matched in various combinations to maximize one's retirement sustainability quotient (RSQ) or expected financial legacy (EFL).

PrARI® brings the concept of product allocation directly into the hands of retirement specialists offering them a fast and reliable analytic methodology to provide guidance on building sustainable retirement income plans. It allows advisors to rapidly test and validate proposed changes to client portfolios that provide a basis for discussion between advisors and clients. While the hypothetical examples that follow should not be taken as actual investment and insurance recommendations, they do illustrate the use of PrARI® as an analytic tool for thinking about the variables that affect the economic tradeoffs in retirement. This provides a framework for the beginning of a discussion between the advisor and the client.

PRODUCT ALLOCATION CASE STUDIES

For an illustration of PrARI®, consider the following hypothetical case studies. Meet three hypothetical clients named Denise Cook, Albert Smith, and Jose & Maria Campos; all of whom are seeking retirement product allocation advice. Let us examine their retirement priorities and economic tradeoffs.

DENISE COOK

Denise, who is in excellent health, is about to turn 63 years old. She plans to retire at 67. She has been self-employed throughout her working years and has accumulated $1.25 million in retirement savings. She anticipates that her annual Social Security benefits, starting at age 67, will be $30,000. In planning her retirement product allocation strategy, she identifies her main goal to be achieving a spending of $90,000 per year at her personal inflation rate of 4%. She is not concerned with leaving a large sum to her estate and hopes to leave only a portion of her nest egg to cover any remaining expenses. Given Denise's good health and the fact that she does not have a pension (aside from Social Security) that will last for the remainder of her life, she is most concerned with maintaining a substantial spending rate and hedging against longevity risk. Her criteria, therefore, is to maximize her RSQ while achieving a minimum EFL of $250,000.

Figure 9: Analyze Results for Denise Cook's Current Portfolio (before optimization)

Analyze Portfolio — Denise Cook

Product Portfolio	Income Start Age	Current Value	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	65	$1,250,000	90%	60%	35%	5%

Other Income & Expenses	Start Age	Annual Amount	COLA
SWP from Investments	72	$16,800	2%

Results

RSQ 75%

EFL $135,000

Figure 9 displays the results of the analytical calculations performed by PrARI® on Ms. Cook's current portfolio. At 75%, Denise's RSQ is very low! She has some tough choices to make. She can delay her retirement and work longer to increase her savings. She can also reduce her spending in retirement to improve her situation. After consulting with her advisor, she decides to adjust her spending down to $80,000. However, she still wants to allocate an additional $10,000 for travel related expense but only during the first five years of her retirement. Her improved RSQ is 82% and EFL is $292,000. Her advisor now performs an optimization within PrARI® and the results are shown in Figure 10.

PrARI® finds five possible product allocations for Denise. The results are presented in decreasing RSQ and increasing EFL. Note that the underlying tradeoff that is apparent in the optimized solutions and the resulting RSQ and EFL values. High overall income sustainability may come at the expense of an estate goal or vice versa.

All of these portfolios are optimal and it is now up to Denise to choose an appropriate one. In consultation with her advisor, Denise determines that she prefers to retain control over her investments and is only willing to consider allocating no more than 25% to guaranteed products. She decides to choose solution 3, which brings her RSQ to 90% and her EFL to $323,000.

Figure 10: Optimized Results for Denise Cook

Solution 1

Results	
RSQ	92%
EFL	$280,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	60%	80%	15%	5%
Variable Annuity with GMWB	10%	65%	35%	—
Income Annuity (SPIA)	30%	—	100%	—

Solution 2

Results	
RSQ	91%
EFL	$308,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	70%	80%	15%	5%
Variable Annuity with GMWB	5%	65%	35%	—
Income Annuity (SPIA)	25%	—	100%	—

Solution 3

Results	
RSQ	90%
EFL	$323,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	75%	80%	15%	5%
Variable Annuity with GMWB	5%	65%	35%	—
Income Annuity (SPIA)	20%	—	100%	—

Solution 4

Results	
RSQ	89%
EFL	$351,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	85%	80%	15%	5%
Variable Annuity with GMWB	0%	65%	35%	—
Income Annuity (SPIA)	15%	—	100%	—

Solution 5

Results	
RSQ	87%
EFL	$367,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	90%	80%	15%	5%
Variable Annuity with GMWB	5%	65%	35%	—
Income Annuity (SPIA)	5%	—	100%	—

ALBERT SMITH

Albert is 62 years old. He has spent most of his life working for the same company. He is thinking of taking an early retirement, since, as a result of his many years of service, he is entitled to a generous Defined Benefit (DB) pension that will provide him with approximately $45,000 per year, and an annual cost-of-living adjustment (COLA) estimated to be around 2%. In addition to his pension, he has also accumulated approximately $200,000 in a savings plan, which is currently invested in a money market account (100% cash). He is entitled to Social Security benefits of $2,800 per month which he plans to delay until age 72 so as to maximize his benefits. With the help of his professional financial advisor, Albert estimates that to finance the lifestyle he desires in retirement, he requires an additional inflation-adjusted income of $9,600 per year in addition to his COLA-adjusted $45,000 pension. Therefore, his total desired income in retirement is $54,600 per year at his personal inflation rate of 4%.

When Albert's advisor analyzes his client's current plan in PrARI®, Albert's RSQ is 91% however with a negative EFL of $57,100! Albert's RSQ is high because he has a fabulous pension however, his additional income requirement as well as a high personal inflation rate puts a huge burden on his investments. What this means is that Albert will be going in debt while in retirement to the tune of $57,100 in today's dollars, which his heirs would be expected to repay.

PrARI® also provides optimal allocation recommendations, shown in Figure 11. If Albert were to take 10% of his portfolio and divide it equally amongst an income annuity and a variable annuity (with GLB), while reallocating the remainder 90% across equities and bonds then he is able to increase his RSQ to 97% but also be able to leave a bequest (approximately $23,800 in today's dollars). His next best solution is to simply reallocate the investment portfolio and that too is an improvement from his current situation.

Figure 11: Optimized Results for Albert Smith

Solution 1

Results	
RSQ	97%
EFL	$23,800

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	90%	80%	15%	5%
Variable Annuity with GMWB	5%	65%	35%	—
Income Annuity (SPIA)	5%	—	100%	—

Solution 2

Results	
RSQ	96%
EFL	$27,800

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	100%	80%	15%	5%
Variable Annuity with GMWB	0%	65%	35%	—
Income Annuity (SPIA)	0%	—	100%	—

However, Albert does not like the two optimal recommendations from PrARI®. He is very uneasy with a risky investment portfolio. While his advisor explains to Albert that his large pensions are very much 'bond like' and that his global asset allocation is still very conservative, Albert's preference is to have a balanced asset allocation along with the 20% allocation to income annuity and variable annuity, combined.

Now his advisor performs a second 'Analyze' analysis within PrARI® but this time adjusts the investment portfolio to reflect a balanced asset allocation. The portfolio amount is adjusted to $180,000 since $10,000 is going toward an income annuity and another $10,000 is going toward a variable annuity. The Analyze results depicting the new RSQ and EFL are shown in **Figure 12**.

Figure 12: Albert Smith's Modified RSQ & EFL

Analyze Portfolio — Albert Smith

Product Portfolio	Income Start Age	Current Value	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	65	$180,000	90%	60%	35%	5%
Variable Annuity with GMWB	62	$10,000	5%	65%	35%	—
Income Annuity (SPIA)	62	$10,000	5%	—	100%	—

Other Income & Expenses	Start Age	Annual Amount	COLA
Social Security	72	$16,800	2%
Employer Pension	62	$9,600	2%

Results

RSQ 96%

EFL $18,300

With the same product allocation as the one proposed in solution 1 of the optimized results but having a balanced asset allocation within the investments portfolio, Albert now has an RSQ of 96% and an EFL of $18,300. While he realizes that his product allocation is less than optimal, he has made an informed decision regarding his personal investments and feels at ease knowing his investments will not have an adverse impact should the market suffer a financial crisis.

JOSE & MARIA CAMPOS

Jose is 62 and his wife Maria is 57. They both plan to retire in three years. Jose and Maria operated a successful small business that they have recently sold for $1.25 Million, which they immediately invested. Jose is entitled to $1,400 monthly Social Security payments while Maria will receive $800 monthly when she reaches 65. In close consultation with their advisor, Jose was insistent on receiving Social Security payments immediately and the couple determined that they need $61,540 of annual income. They estimate their personal inflation rate to be 3.0%. Jose and Maria want a plan whereby they can sustain their lifestyle in retirement and also be able to leave behind a legacy for their kids.

When the advisor analyzes Jose and Maria's current financial plan, PrARI® reports a RSQ of 88% and an EFL of $390,000. What this tells the advisor is that while Jose and Maria's retirement plan is good there is a decent possibility that their lifestyle may need adjustments. The advisor performs an optimization within PrARI® and the results are reported below:

Figure 13: Jose & Maria Campos Product Allocation Choices

Solution 1

Results	
RSQ	95%
EFL	$282,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	50%	80%	15%	5%
Variable Annuity with GMWB	30%	65%	35%	—
Income Annuity (SPIA)	20%	—	100%	—

Solution 2

Results	
RSQ	94%
EFL	$318,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	60%	80%	15%	5%
Variable Annuity with GMWB	30%	65%	35%	—
Income Annuity (SPIA)	10%	—	100%	—

Solution 3

Results	
RSQ	93%
EFL	$354,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	70%	80%	15%	5%
Variable Annuity with GMWB	30%	65%	35%	—
Income Annuity (SPIA)	0%	—	100%	—

Solution 4

Results	
RSQ	92%
EFL	$365,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	75%	80%	15%	5%
Variable Annuity with GMWB	25%	65%	35%	—
Income Annuity (SPIA)	0%	—	100%	—

Solution 5

Results	
RSQ	91%
EFL	$375,000

Product Portfolio	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	80%	80%	15%	5%
Variable Annuity with GMWB	20%	65%	35%	—
Income Annuity (SPIA)	0%	—	100%	—

Each one of the five solutions is an optimal solution given the product parameters and capital market assumptions. While Solution 1 will provide the maximum highest sustainability to Jose and Maria, the two settle for Solution 2. They base their decision on amount of legacy – they like the fact that 25% of their nest egg will form a bequest for their kids.

There is one last assessment that Jose is interested in knowing. Over the next decade, Jose and Maria plan to travel the world – a discretionary expense of $10,000 annual. He would like to know the impact that this discretionary expense would have on their new plan. The advisor enters the $10,000 as an unexpected cash-flow expense and runs the PrARI® analyzer. Jose & Maria's RSQ drops to 91% and the new EFL is $253,000; i.e. 20% of their portfolio will still finance their bequest.

Figure 14: Jose & Maria Campos "What-if" Analysis

Analyze Portfolio — Jose & Maria

Product Portfolio	Income Start Age	Current Value	Product Allocation	Asset Allocation Equity	Fixed	Cash
SWP from Investments	65	$750,000	60%	80%	15%	5%
Variable Annuity with GMWB	65	$375,000	30%	65%	35%	—
Income Annuity (SPIA)	65	$125,000	10%	—	100%	—

Other Income & Expenses	Start Age	Annual Amount	COLA
Social Security — Primary	65	$16,800	2%
Social Security — Secondary	65	$9,600	2%
Expense – World Travel[1]	65	($10,000)	n/a

1 – Ending at Age 75

Results
RSQ 91%
EFL $253,000

Performing 'what-if' type of analysis for your clients can provide important insights and educate clients how increased spending may affect their retirement lifestyle. Armed with this kind of analysis, the advisor is able to inform Jose & Maria that they are in good shape and can enjoy travelling the world in the first decade of their retirement.

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