

A Different Perspective on Retirement Income Sustainability: Introducing the Ruin Contingent Life Annuity (RCLA)

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The *raison d'être* of the variable annuity (VA) industry – now with over \$1.4 trillion in assets and over \$160 billion in annual sales² -- has shifted from tax deferral and death benefits to income riders. The large majority of VA sales – a.k.a Segregated funds in Canada -- now include guaranteed living benefit riders, which anecdotally have become central to the sales pitch, allure and due diligence process. To many, they are viewed as an ideal private sector replacement for defined benefit (DB) pensions, in an increasingly defined contribution (DC) world.

Motivated by the popularity of these instruments – and the fundamental fear they appear to help address -- in this article we pose the question; why must retirees buy this type of insurance with their investments? Would it not be possible to purchase the same insurance for their investments and keep the insurance coverage distinct from the money management processes? This might sound confusing at first – and academic at worst -- but it truly gets to the heart of the retirement income dilemma. Currently, the VA “story” or bundle contains two distinct parts. The first component is the promise of a series of cash flows -- which is essentially a reverse dollar cost averaging strategy -- that continues until the day and time the investment account hits zero. The second component begins if-and-when the account is in fact ruined, at which point the true insurance matures. A second series of payments continue from a ruin date, and these cash flows in fact last for a single or dual life; which is why VAs are also positioned as providing longevity insurance for DB-starved retirees. This is true regardless of the exact mechanics of the rider, whether it is a GMIB or GMWB, etc.

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² Source: NAVA Quarterly Report, June 15, 2007

But why must these two services be bundled and offered in the same product and by the same provider?

A number of recent³ articles have explored the important role of pure longevity insurance, i.e. a deferred life annuity that initiates payments well into the retirement years, e.g. age 80 or 85, as opposed to at the start of retirement. A collection of related products now fall under the umbrella of advanced life delayed annuities (ALDA), a.k.a. longevity insurance with a deductible. Many U.S. companies such as New York Life, Hartford Life, MetLife and Prudential Financial are now offering variants on this concept.

Our main insight here is take the ALDA concept one (final) step further by fusing its desirable longevity insurance and inflation hedge concept with actual investment portfolio insurance. Stated differently, we propose an ALDA in which two risk valves must be triggered before the annuitant gets paid. First and obviously the individual (or their spouse) must be alive. But second, they must have the ill fortune to experience a bear market during the early critical years of your retirement. Stated more crudely, if you happen to get “lucky in life” then why bother with a life annuity? After all, Bill Gates doesn’t need longevity insurance.

To flush out this concept, in the next few pages we describe how such a product would work, a rudimentary pricing methodology, and then return to justifying the motivation and need for what we are calling a ruin-contingent life annuity (RCLA.)

Even if retirees are not necessarily interested in actually purchasing an RCLA to hedge their retirement risks, the mere existence of such products -- and hopefully their transparent prices -- would provide individuals with a mark-to-market value of their retirement spending and consumption strategies. And, akin to fickle consumers who change their plans to purchase an expensive car, yacht or jet once they realize the cost

³ See for example the paper by Milevsky (2005), Stephenson (1978), Webb Gong and Sun (2007)

of insuring the item, perhaps the pedagogical lesson from prices would be the greatest asset of such a product.

HOW DOES AN RCLA WORK?

The basic concept underlying the ruin-contingent life annuity (RCLA) is that it provides insurance against the joint occurrence of two separate and independent events; namely a bear market during the critical few years of retirement (a.k.a the retirement risk zone) and above average or unplanned survival rates.

Like any derivative product, the RCLA requires an underlying security or economic state variable upon which payments would be triggered and calculated. Thus, the first ingredient or main component of the RCLA would be a new and unique pseudo-equity index that would track the performance of the SP500 over time; but subjected to periodic withdrawals. We would label this number the SwP index to evoke the notion of a systematic withdrawal plan that is linked to the SP500 index, although any diversified equity index could be used.

Technically speaking, the SwP pseudo-index would start with a vintage year, e.g. 2007, would then be adjusted by the price and market value of its constituent stocks, but would also be reduced by a withdrawal factor. Over time the SwP pseudo-index would be expected to decline, quite similar to the anticipated behavior of a retirement nest egg or portfolio. This SwP pseudo-index would of course depend on a pre-specified withdrawal rate or factor, which would be fixed and determined at the launch of the pseudo-index.

Here is a detailed example to explain the pseudo-index. Imagine the SP500 index was hypothetically at a level of 1000 on January 1st, 2007. Under a pre-specified withdrawal factor rate of 7% -- assuming that during January 2007 the consumer price index increased by 0.5%, while the SP500 increased by a nominal 2% -- then the level of a vintage 2007 SwP pseudo-index on the first day of February 2007 would be \$100 x

$(1+0.02) - (7/12) \times (1+0.005) = \101.94 . The annual withdrawal rate of \$7 is divided by 12 to create the monthly withdrawal, which is adjusted for inflation. The same calculation algorithm would continue each month. The calculation would gross-up by total return, subtract monthly withdrawals adjusted for inflation and output the new level.

Now, if and when this vintage-2007 SwP 7% pseudo-index ever hit zero, the insurance company would then commence making payments to the annuitant who bought the product in early 2007, as long as they were still alive. The exact amount of the payment would be 7% of the original \$100 value of the index, which is \$7 per year, for life.

Naturally, the individual could scale up and purchase 1000, 2000 or 5000 such RCLA units to protect a \$100,000 or \$200,000 or \$500,000 nest egg. Likewise, the retiree could select from a range of withdrawal rates, for example 4%, 6% or 8%, assuming the insurance company was willing to offer a menu of spending rates (at different prices, of course.) In fact, the underlying index itself could be a combination of the SP500, the Russell 3000 or even the MSCI index. They are just variations on a theme.

FIGURE #1 PLACED HERE

Here is a graphical illustration of how the SwP pseudo-index has evolved over time. For example – as you can see from Figure #1 -- had you purchased a vintage 1970 SP500-based *RCLA struck at 7%*, then your lifetime income payments would have started in January of 1983. This is a mere 13 years after your so-called retirement date. The size of the payment would depend on the number of RCLA units you acquired.

In contrast to the 1970 vintage, had you purchased the same *RCLA struck at 7%* in January of 1976, which is 6 years later, you would actually still be waiting for payments to commence thirty years later in January 2006. This is because the vintage 1976 SwP pseudo-index has yet to hit zero. In fact, it is “trading” at a level of \$400 in early 2007, and so it is safe to say that vintage 1976 will never pay-off. Basically, the market returns during the first 30 years have been strong enough to overcome inflation-adjusted

withdrawals of 7%. But then again, the vintage 1973 RCLA struck at 7% would have kicked in (paid off) exactly 10 years later in January 1983. As most practitioners are well aware, the sustainability of a given spending rate is extremely sensitive to the initiation sequence of returns.

Of course, we remind the reader that in all these cases the retiree would have to be alive on the precise date of pseudo-index “ruin” for the RCLA annuitant to start receiving payments. Moreover, the retiree would have to stay alive to continue getting these payments. But, this is just like any other life contingent annuity.

<i>TABLE #1 PLACED HERE</i>

As one can see from Table #1 – which is a true historical analysis -- whether or not the RCLA ever pays out (or “matures in the money”, in the language of options) is quite sensitive to both the spending rate as well as the vintage year in which the pseudo-index is initiated. Notice that a hypothetical RCLA struck at 4% would have never paid out regardless of whether the vintage date was 1970, 1973, 1976 or 1979. In contrast, an RCLA struck at 9% would have resulted in a payout for three of the four starting dates.

In practice – to keep this process manageable and intuitive -- we envision an insurance company creating and updating a family of SwP pseudo-indices which are struck under a limited number of spending rates with ongoing issuance of annual vintages depending on demand. A variety of underlying equity indices would be available as well.

To start out, we recommend a 4%, 6% and 8% SwP pseudo-index that would launch January 2008 at a hypothetical value of \$1,000. Each month this value would be increased by the total return of the SP500 index, but then reduced by the relevant CPI-adjusted spending amount of \$40/12 or \$60/12 or \$80/12. These three pseudo-index levels would be calculated and published in early February 2008, etc.

Intuitively, the vintage 2008 SwP pseudo-index struck at 4% would always be slightly higher than the one struck at 6%, which would be slightly higher than the one struck at 8%, due to the lower withdrawals. Then, in January 2009 a new vintage of SwP pseudo-indices would be created for a hypothetical retiree starting withdrawals in January 2009, etc. Over time this might accumulate to (quite) a large matrix of indices, but this should be no more cumbersome than keeping track of a changing yield curve or swap curve over long maturities. In fact, the recent popularity of target-date or retirement-date lifecycle funds prove that it is possible to keep track of many different vintage-year fund classes that differ by just a few equity percentage points.

A retiree with a diversified portfolio of international stocks or perhaps high-yield bonds might buy various types of RCLA, each linked to different underlying indices so as to best hedge their particular next egg. Once again, these are implementation details. In fact, the point is not necessarily to create a perfect hedge to a fixed fictional spending rate, but rather a rough insurance policy against these broad risks.

WHY WOULD ANYBODY BUY THIS?

As we argued above, there seems to be a consensus⁴ amongst researchers in the field of retirement income planning that when individuals transition into their portfolio retirement years they face a number of unique risks. These risks are related to uncertain inflation, poor investment returns early-on in retirement and unexpected longevity. In fact, these three risks are often referenced as the main reason why retirees should consider purchasing a variable annuity (VA) with guaranteed living benefit (GLiBs). Recall that traditionally defined benefit pension plans hedged or protected against these risks, but many retirees are now left with a naked exposure in retirement; hence the variable annuity story.

But if this indeed is the case – and such protection is valuable -- then why not buy insurance against these risks without having to give up or cede control of your

⁴ See for example the book edited by Evensky and Katz (2006).

investment assets? Why does the insurance company have to take control of the assets in order to provide the insured with the desired protection? In theory the retiree could continue to manage his or her own portfolio -- maintaining liquidity and withdrawing more/less as needed over time -- knowing that if they do experience an adverse economic shock, they will continue to receive lifetime income. Recall that longevity risk is only costly to the retiree within the states of nature in which the investment portfolio has earned less than expected. After all, if a retiree with \$100,000 nest egg is withdrawing (an unsustainable) \$7,000 per year in inflation-adjusted terms and by sheer luck the SP500 earns 20% per year over the next 5 years, longevity risk is no longer an issue. *Ex post*, the retirement portfolio can now sustain much greater withdrawals. Clearly then, longevity risk is intertwined with portfolio risk and stand-alone ALDAs – or any fixed immediate annuities for that matter -- do not hedge the retiree's combined risks.

HOW MUCH WOULD IT COST?

It is obviously quite difficult to predict how much an insurance company would charge for an RCLA, since it depends on many factors that are difficult to quantify in advance. Intuitively though, it would depend on the age of the buyer since payments are due upon ruin only if the annuitant is still alive. Thus, the cost of an RCLA struck at $x\%$ would be lower, the higher the age of the buyer. Likewise, all else being equal, a 5% RCLA would be cheaper than a 7% RCLA which in turn would be cheaper than a 10% RCLA, etc. Intuitively, the higher the spending rate, the higher is the chance – and the sooner is the date -- the insurance will kick-in. Also, although we envision the RCLA as being linked to a widely quoted SP500 index, if such a product were linked to balanced bond/stock index, the cost might be different as well, depending on the unique volatility and growth projections.

That said we⁵ have developed a theoretical model for valuing an RCLA assuming a number of idealized assumptions. These are the same assumptions that are used to price and hedge widely available equity put options as well as generic life annuities, which is why we believe the model values provide a rough indication of what an RCLA would cost in reality.

<i>TABLE #2 PLACED HERE</i>

Table #2 provides some estimates of these values assuming a variety of purchase ages and withdrawal rate index values. Here is how to read the table. For example, a (unisex) 57 year old would have to pay a lump sum \$16,667 in exchange for a guarantee of \$6,000 annual inflation-adjusted lifetime income starting if-and-when the vintage 2008 SwP pseudo-index struck at 6%, ever hits zero. The same 57 year old would have to pay \$26,983 for \$7,000 of income upon ruin, and only \$8,983 for \$5,000 of annual income. Notice that the younger the retiree when they purchase the RCLA the more they must pay (naturally) and the greater the withdrawal rate the more you must pay as well.

Remember that a 7% RCLA is worth much more than a 5% RCLA for two reasons. First of all you are (possibly) getting more income, \$7,000 versus \$5,000 for example. Second, and more subtly, the underlying SwP index upon which the eventual payment is contingent is more likely to hit zero (sooner) since the withdrawals are greater as well.

In the same Table #2 we also display the value (which is the approximate cost) for an immediate annuity which pays an inflation-adjusted lifetime income of \$1,000 starting immediately. Thus, for example, at the same age of 57 the retiree would have to pay almost 18 times the amount of desired income. To put this number in perspective, the 7% RCLA would cost \$26,983 for \$7,000 of (eventual, possible) lifetime income. This is slightly more than 3.8 times the desired income. Compare this to the factor of 18 for the

⁵ Please see the technical working paper by H. Huang, M.A. Milevsky and T.S. Salisbury, IFID Centre, Fall 2007, for a detailed description of the rather subtle issues that arise in attempting to value an RCLA as well as a sensitivity analysis.

cost of an immediate annuity. The reason for the gap is due to the smaller chance of the RCLA paying out, and at some distant time in the future.

Now, there exist many variations on this basic theme. In theory, one could acquire an RCLA at retirement (i.e. when you start spending) but pay for the insurance protection in installments. For example, instead of paying \$26,983 up front at the age of 57 for a 7% RCLA – which is quite steep -- you would be required to pay half now and half if-and-when the SwP pseudo-index level hits zero and the annuity payments start. Alternatively, the buyer could amortize the cost of the RCLA over 5, 10 or 15 years. This would obviously open up the possibility of the buyer lapsing or discontinuing premium payments if the SP500 grew by more than average – which then reduced the chances of the SwP index hitting zero. All of these would obviously complicate the pricing and valuation since the optimal dynamic strategy for the retiree would be quite complex.

The bottom line is that we can only provide a rough estimate of what such a product would actually cost, especially in the early stage of the market when few insurance players would offer an RCLA, and likely at inflated prices. Over time of course, as new participants entered the market prices would reach some sort of competitive equilibrium which would resemble the hedging costs, which are closely linked to the model values we just described.

YES, A SIMILAR PRODUCT ALREADY EXISTS.

Astute readers – or at least those who are intimately familiar with the variable annuity industry in the U.S. -- will recognize that an RCLA is embedded within each and every guaranteed living benefit (GLiB). For example, a guaranteed withdrawal benefit for life (GMWB, sometime called a GLWB) assures the policyholder that if they withdraw no more than 5% of the initial premium deposit, for example, they will be entitled to receive payments for the rest of their life regardless of the performance of the sub-accounts. And so, if the account value ever hits zero, the guarantee kicks-in and the annuitant

receives lifetime payments. With a little bit of imagination one can visualize a GMWB as a combination of a systematic withdrawal plan together with an RCLA.

Table #2 can now be interpreted as more than just model values for a theoretical product, but an actual estimate of the discounted value of the embedded insurance. A 67 year old who buys a 5% GMWB is acquiring a guarantee that is worth approximately \$3,707 per \$100,000 premium deposit. A 57 year old, in contrast, is obtaining a benefit that is worth a much higher \$8,983 on a discounted value basis.

Once again, someone who purchased a guaranteed living income benefit (GLiB) is buying a garden variety investment account – which shouldn't cost anything beyond the money management fees -- together with an RCLA.

The comparative advantage of the insurance industry is protection and risk management, not necessarily investment management and portfolio selection. So, we end by asking why not sell the RCLA on its own?

IN SUM

The creation of a stand-alone ruin contingent life annuity (RCLA) would be a triumph of insurance and financial engineering. On the one hand it is a type of long-term equity put option, but it also provides true longevity insurance. Indeed, it is currently embedded within an assortment of GLiBs on variable annuities, but we believe they should be given a separate life of their own and sold on a stand alone basis.

Another use of such a concept product is that it provides us with a mark-to-market (or at least mark-to-model) value for one's retirement income plan. If a 7% spending rate is truly unsustainable, then the cost of 7% RCLA would tell us by how much – exactly.

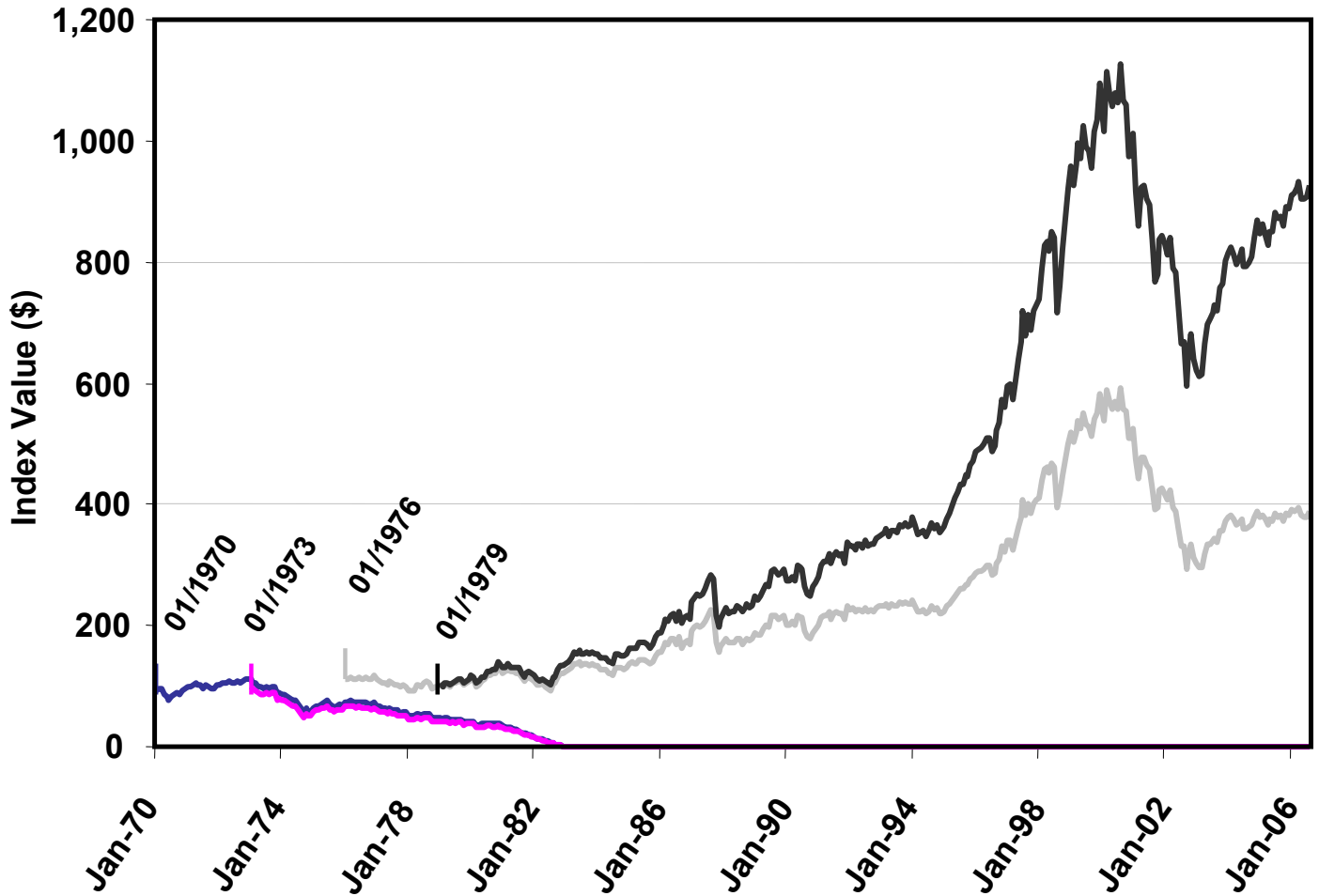
If mom and dad are spending too much, the relevant x% RCLA value would provide the beneficiaries with a rough (average) estimate of what it will cost them – in discounted

value terms – to cover their anticipated spending if and when they run out. The children might want to set this sum of money aside now, in a risk free saving account, to cover the cost of a life annuity if-and-when mom and dad ever run out of money.

At the very least, the creation of such products would enable retirees and their financial advisor to put a market price – as opposed to just simulation values -- on the risks they are running by spending too much, not investing appropriately or simply living too long. In this case, market prices would function as economic signals or even warning signs.

Figure #1

Evolution of the 7% SwP pseudo-index based on vintage year



Note: Somebody who retired in 1973, invested their \$100 nest egg in the SP500 index and then spent \$7 per year adjusted for inflation, would have been ruined in early 1982.

Table #1

**The ruin date of the x% SwP pseudo-index:
Depending on vintage starting year**

	Index initiation date			
RCLA Rate	Jan 1970	Jan 1973	Jan 1976	Jan 1979
4%	-	-	-	-
5%	Apr-94	Oct-90	-	-
6%	Jan-86	May-85	-	-
7%	Jan-83	Jan-83	-	-
8%	Jun-81	Oct-81	May-03	-
9%	Feb-80	Sep-80	Aug-93	-

Table #2

Model Value of a Ruin-Contingent Life Annuity (RCLA)

Pays inflation-adjusted \$100,000 x S% per-year for life

if-and-when SwP pseudo-index hits zero...

	Purchase Age				
Spending Rate	50	57	62	67	75
4.0%	\$6,326	\$3,945	\$2,545	\$1,467	\$440
5.0%	\$13,687	\$8,983	\$6,072	\$1,623	\$1,256
6.0%	\$24,410	\$16,667	\$11,680	\$3,582	\$2,779
7.0%	\$38,292	\$26,983	\$19,469	\$12,891	\$5,192

Value of \$1,000 Life Annuity:	\$21,838	\$18,810	\$16,493	\$14,102	\$10,304
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Note: A 62 year-old retiree (in 2007, for example) would pay \$6,072 up front in exchange for insurance that if the vintage 2007 SwP pseudo-index struck at 5% index ever hit zero, the annuitant would receive an inflation adjusted \$5,000 per year for life. Note that the same \$5,000 per life annuity starting immediately would cost the 62 year-old \$16,493 x 5 = \$82,465. The much higher cost of an immediate annuity – promising the same level of income – reflects the fact that the RCLA might never payoff.

Parameter Assumptions: Risk free rate = 2.5%, expected return (mu) = 7%, volatility of return (sigma) = 20%, both of which correspond with the historical behavior of the SP500 index after-inflation. Mortality – used to price the life annuity – is based on the Gompertz m=87.8, b=9.5 model

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