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SECTION**

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# Product Matters!

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# Product Matters!

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# Chairperson's Corner

By Brock Robbins

I can almost hear the steel guitar, banjo, fiddle and drums in the background as we prepare to attend the 2018 SOA Annual Meeting & Exhibit in Nashville on October 14–17. I look forward to seeing many of you during this year's meeting. I'd also like to remind you about the sock drive that the SOA is hosting during the meeting to benefit homeless people served by Nashville Rescue Mission. A warm pair of socks is the most sought-after item among the homeless population, and an extra pair or two of socks won't take up too much room in your luggage.

In this issue of *Product Matters!*, we announce the winners of our wearable technology essay contest. Congratulations to Al Klein, whose humorous article, "A Day in the Life of Adorable," illustrates what one day in the life of a wearable wearer might be like. Imagine a wearable named Adorable which talks to its owner as it monitors the wearer's daily living activities. This smart watch (some might even say smart aleck watch) announces the wearer's sleep disorders and medication compliance while also broadcasting his blood pressure and heart arrhythmia. Accessories for the wearable allow the wearer to scan an eye for macular degeneration, test saliva for infection and monitor alcohol consumption, tobacco usage, driving experience and physical activity levels. Don't miss this award-winning forecast into what might be a not-too-distant future.

I would also like to congratulate our second place winners of the essay contest, who are:

- Kyle Nobbe, Kristen Kenney and Kaitlyn Fleigle for "Knowledge is Power"
- June Quah for "The Future is Now: Wearables for Insurance Risk Assessment"



Other topics in this issue include:

- Section sponsored sessions at the annual meeting
- Risk-reward analysis for optimizing your CPPI investment strategy
- Annual survey insights into the Universal Life and Indexed UL market
- In-force management polling results
- Why IUL income streams need to be managed (Part 1 of 2)

Thank you to all our contributors for this final 2018 issue of *Product Matters!* I hope you have a wonderful holiday season and look forward to working with more of you as newsletter contributors, committee members and section leaders in 2019. ■



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# A Day in the Life of Adorable

By Al Klein

*Editor's Note: This article is the winning submission from the Product Development Section's 2018 Call for Essays on The Future of Wearable Technology in Life Insurance.*

“Good morning James. Congratulations, you only had one episode of sleep apnea last night. You are getting better.” James was groggy and had yet to get used to this kind of awakening from his new wearable. “Well, aren't you going to say good morning to me?”

“Good morning, Adorable,” James reluctantly said as he stretched and began to rise. James had named his wearable device Adorable because the instructions said to name it like a pet and because Adorable kind of sounded like wearable. James was now thinking his wearable might not quite be so adorable this early in the morning. James had always tried to be on the cutting edge of technology and had just purchased this wearable five days ago.

“Don't forget your medications, James.” James had not yet made it to the bathroom, where he kept his medications. After he finished brushing his teeth, “don't forget your medications, James” once again came from Adorable. While James was beginning to tire of Adorable, he felt even worse about his medications. He popped one of the pills into his mouth and swallowed it with a sip of water. As James began to leave the bathroom, he heard “James, you only took one of your pills. Please take the others.” James had forgotten that his pills had sensors that were activated by the acid in his stomach and information on the pills he took and when he took them was relayed almost immediately back to Adorable, who could then pass the information on to James' doctor. James retreated to the bathroom and took the rest of his medication. One minute later, “thank you, James for being compliant.” She could be adorable! “By the way, I did not notice any irregular heartbeats last night. You are really doing well. In fact, you have not had an irregular heartbeat in the last two days, two hours and twenty-three minutes.”

James went downstairs to have his breakfast. He had decided on the deluxe version of the wearable, with all of the extras. He

continued his reading from the prior day about the extra features that came with his version of the wearable. An eyepiece allowed for an eye scan. It was used to determine whether there were any early warning signs of macular degeneration. The lack of the need for a flash was ingenious as it made sure the eye stayed open for the picture. There was a small clear bowl to be used for the analysis of saliva to determine if James had any infections. He had to place the bowl on his smartphone, which was synched to his wearable. This would be used in conjunction with an app he had yet to download. This feature could also determine his epigenetics and biological age. It also allowed for tracking his biological age over time to determine if he was, hopefully, aging less rapidly than his true age. There was another clear plate in the deluxe package that had a sharp edge in one corner. The sharp corner was used to draw a blood sample for a complete blood profile; another app was required for this. James made a mental note to be careful when removing this plate from the box.

James had finished his breakfast and figured he would pick up tomorrow with the breathing onto the wearable to check glucose levels, cancer screening, identifying health issues before they occur, and online shopping for health care specifically offered to the owners of this type of wearable. James thought he would need to spend more time on the last item to compare the offerings to other online health markets generally available to the public. You never know when you might need treatment for something and sorting out the best sources ahead of time is wise.



After breakfast, James enjoyed a morning cigarette with his coffee. The sensors on Adorable picked this up immediately. “James, you know cigarette smoking is not good for you and it is going to go into your record.” “Yes, I know Adorable, but it is a bad habit of mine that I cannot . . . or maybe don’t want to break.”

James still had time this morning before he had to leave for work and he craved a mimosa, just a small glass. He opened a new bottle of champagne and mixed it with some orange juice. He thought the pop of the cork might scare Adorable, but she said nothing. However, as James sat back to enjoy his mimosa, he was interrupted by Adorable with “James, this is a workday. You should not be drinking and not this early in the morning. This is going to go on your record, too.” James had the urge to toss Adorable across the room, but he refrained, having promised himself that he would give this new technology two weeks before making a final decision. He had read just yesterday that the wearable picks up a change in the molecules of the skin when one drinks alcohol. James finished his drink and since it was just a small one and “watered down” with orange juice, he felt he was fine to drive.

This was confirmed a moment later by Adorable. As James entered his car, Adorable said “James you have been drinking. You cannot drive immediately after drinking . . . calculating . . . okay James, you are under the legal limits for drinking. You can drive.” That’s what James thought, and was relieved when Adorable confirmed it; driverless cars were not here yet. If he had been above the legal limit for his state, Adorable would not have let him start the car. James pushed start, backed out of his garage, and was on his way to work.

James got distracted by a family walking along the edge of the road and he nearly missed a stop sign. “James, your auto insurance rates may go up if you are not more careful. This may go on your record.” James wanted to swear at Adorable, but figured he would just be admonished again. “James, your blood pressure is rising. Please take several deep breaths and slowly exhale. You do not want your life insurance rates to go up, too, do you?” “No Adorable. Thank you for watching out for me.”

James was a pricing actuary at Slow and Steady Life Insurance Company and was actually looking forward to this day at work. James’ boss, who was hired three months ago from Ready Fire Aim Life Insurance Company, had scheduled a large meeting today to discuss how technology can be utilized to improve sales and profitability at the company. This was a big meeting with the marketing, underwriting, claims, IT, legal, and both corporate and product actuarial departments represented. James was representing the product team.

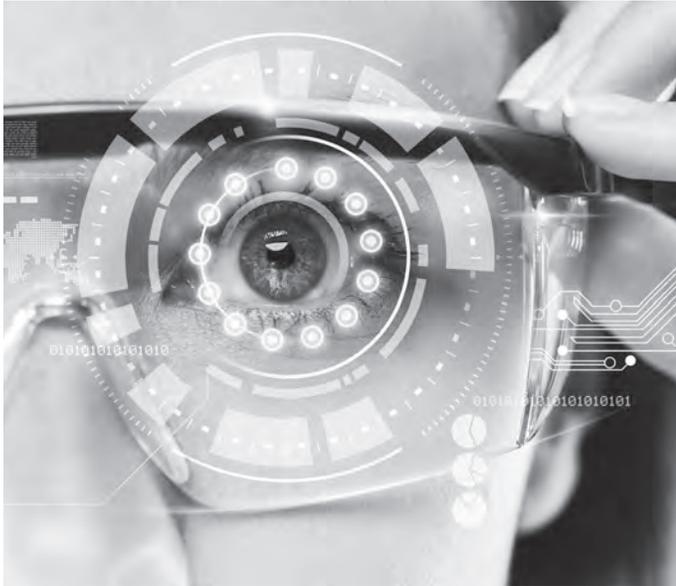
As James approached the parking lot, Adorable chimed in “James, you were heavy on the gas twice in this trip. Please try to be more careful. And don’t forget to park as far away as you can to get your steps in. The weather is fine today.” He could obviously see the weather too, but refrained from commenting. James learned from research that while active time was still valuable, the number of steps was the more important measure of health, maybe even offsetting his smoking habit. James otherwise tried to be healthy, going to the local gym three times a week and trying to park as far as he could from his destination to get more steps in. In fact, the first time he worked out with Adorable, he gloated at how complimentary she was; it reminded him that she was not all bad, and he smiled. He didn’t think Adorable was able to notice his smile and she didn’t say anything, but gloated herself. Adorable helped him change his workout routine, doing more interval-type training and he was already feeling more energetic after just two of these workouts.

“Talk to you later, Adorable,” James said aloud muting her before she had a chance to say anything back. He would probably hear about this later.

James parked as far away as he could. He locked the car and began to walk towards the building. James remembered two days ago when he forgot to lock it because he had too much to carry and was shocked that Adorable reminded him to do so. How did she know, he wondered. The wearable has so many unique sensors, it is incredible. Maybe Incredible was a better name; no, it was too late and James liked sound of Adorable!

James approached the building and reached for the door. “1,126 steps. Good job, James.” James was somewhat competitive, even with himself. His best was just over 1300 steps, but he didn’t get in early enough to get that furthest space, but the mimosa was worth it. James also didn’t have time to do more steps now as he had to get in to finish a few projects before the big meeting. James also remembered that he had to mute Adorable so she wouldn’t disturb others at work or worse, let everyone know some of his personal information or habits. Who knew if she would update him on his heart rate at work, but he wasn’t taking any chances. It seemed like PHI was ignored in the design of these wearables. “Talk to you later, Adorable,” James said aloud muting her before she had a chance to say anything back. He would probably hear about this later.

The meeting wasn’t until after lunch so James had time to get caught up on his emails and complete the projects he needed to



work on. Mission accomplished, it was time for lunch and James went to the cafeteria with a couple friends. They got their lunch and sat down to eat it. James accidentally hit the “on” button as he sat down and immediately heard Adorable “James, the ph in your stomach is.” James, embarrassed, quickly shut off Adorable. One friend thought the voice was coming from another table, but the other friend asked James what that was. James said it was a new wearable he recently purchased that talks to you. Fortunately, both friends were caught by surprise and didn’t hear the specific words Adorable said.

After lunch, it was time for the meeting and James was both anxious and excited. He wanted to contribute to the meeting and believed he could. Even more, he wanted to impress his new boss.

His boss led the meeting and began by saying at his previous company they moved very quickly and he wanted to instill that philosophy at Slow and Steady. His company was able to do this with the technology, which is why he called this meeting, Ready Fire provided Fitbits to their policyholders to motivate them to stay healthier. His boss indicated that they would go around the room and each person would have five minutes to present their ideas.

The claims person went first and indicated that she would be interested in a predictive model that could help detect which claims were more likely to be fraudulent. The underwriter was next and indicated that he would like to better monitor the quality of each underwriter and of the business brought in by each agent to know who it would be worthwhile to make exceptions for. The marketing person was about to object until she took in the positive message at the end of the sentence.

James was next. He knew his boss was also excited to hear what one of his new direct reports had to say. James knew that Adorable could improve the underwriting quality, allowing him to reduce premiums by about 10 percent, while also increasing profitability; he had already done the calculations. He also recognized that Adorable could improve the health of existing policyholders, which would improve the relationship with policyholders, leading to even more sales of his products. James was jarred from his thoughts, “James, it’s your turn.” James paused, took a deep breath, and began, “Five days ago . . .” ■



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# The Product Development Actuary's Annual Meeting Playlist

By Taylor Pickett

**N**ashville is known as Music City. While that nickname does not explicitly mention any particular style of music, Nashville is often further labeled The Country Music Capital of the World. While Nashville is undoubtedly home to several legendary country music venues and has played host to the launch of several successful country artists' careers, this second name undersells the diversity of genres represented in Nashville's vibrant music scene. For those who prefer their music to be sung with less of an accent (or to avoid the use of lyrics altogether), Nashville offers music ranging from rock and roll to classical and everything in between.

In a somewhat similar fashion to the city of Nashville and its remarkable musical culture, product development can sometimes bring to mind a very specific (and somewhat narrow) selection of topics. However, the Product Development Section

is sponsoring sessions covering a wide spectrum of subjects, including both more traditional topics such as assumption setting and very recent developments like wellness initiatives and the impact they can have on life insurance. More broadly, look for sessions sponsored by the Product Development Section in the following subject areas:

## ADVANCES IN UNDERWRITING

These sessions will provide attendees with information on leading edge developments in the underwriting space with a particular focus on how they will impact traditional actuarial areas of focus such as product design and assumption setting. Plan to attend one or more of these sessions if you want to learn more about Accelerated Underwriting, new types of evidence currently being introduced and being considered for use in the very near future and the effects that new sources of data and their associated tools may have on our industry.

- Session 83PD: Accelerated Underwriting Update—Tuesday at 8:30 a.m.
- Session 116PD: Diving Deeper into Accelerated Underwriting—Tuesday at 2:00 p.m.
- Session 156PD: Evolution of Traditional Underwriting—Wednesday at 8:30 a.m.
- Session 187PD: Impact of New Underwriting Data Sources and Tools—Wednesday at 12:00 p.m.



## ANNUITIES

These sessions will provide attendees with more focused information that is of particular relevance to the annuity market. Mark your calendar to attend these sessions if you'd like to hear about strategies to optimize the use of assets available at the end of the accumulation phase, product and market trends in the annuity space and emerging regulatory developments that are expected to impact this market segment.

- Session 97PD: Annuity-based Solutions: Securing the Golden Years—Tuesday at 10:15 a.m.
- Session 172PD: Annuity Hot Topics—Wednesday at 10:15 a.m.

## LIFE INSURANCE

These sessions will provide attendees with an update on the current state of the life insurance market and key considerations for successfully navigating that space. Make time for these sessions if you want to learn more about forces and trends that are currently affecting the term life insurance space and how new developments in wellness programs could help improve results for life insurance companies.

- Session 42PD: Using Wellness for Life Insurance—Monday at 1:45 p.m.
- Session 96PD: Term Insurance Update—Tuesday at 10:15 a.m.

## PRINCIPLES BASED RESERVES

These sessions will provide attendees with information on recent developments in Principles Based Reserves (PBR). Plan

Look for PD Section sponsored sessions in the following subject areas: Advances in Underwriting, Annuities, Life Insurance, Principle Based Reserves, In-force Management and Networking.



to attend these sessions if you're interested in new rules and constraints around assumption setting under PBR and the process modifications they may necessitate, identifying solutions to potential impasses in the product development process coinciding with the introduction of PBR and possible impacts of the new valuation mortality table.

- Session 59PD: VM-20: Assumption Setting—Theory and Practice—Monday at 3:30 p.m.
- Session 129WS: Pricing under VM-20: Lessons Learned—Tuesday at 3:45 p.m.
- Session 157PD: 2017 CSO Friend or Foe—Wednesday at 8:30 a.m.

## IN-FORCE MANAGEMENT

Although not all of the following sessions are offered by the Product Development Section, the desire to develop actuaries

involved in in-force management has been embraced by the Product Development Section through forming a subgroup focused on in-force management. A listserv has been created and activities are planned focusing on in-force management. Monday at the annual meeting provides a mini-inforce management symposium including:

- Session 24PD: Inforce Management—Monday at 10:30 a.m.
- Sessions 40OF: Managing Inforce Blocks from a Risk Manager's Perspective
- Session 62PD: May the Inforce Be With You: Transactions for Life and Annuity Business

## NETWORKING

These events are geared to inform and interact with peers encouraging discussion and engagement related to the specific topic.

- Session 9: Product Development Section Hot Breakfast (plan to discuss waiver of premium research and being on a Project Oversight Group) —Monday at 7:15 a.m.

- Session 32M: In-force Management Networking Lunch—Monday at 12:00 p.m.
  - *Note: this session requires an additional payment in order to attend*
- Session 140M: Investment, Joint Risk Management, International and Product Development Joint Section Networking Event—Tuesday at 6:00 p.m.
  - *Note: this session requires an additional payment in order to attend*

There is certainly no shortage of compelling topics on offer in the sessions sponsored by the Product Development Section at this year's SOA Annual Meeting. Please join us at these sessions for what is certain to be an insightful look into the current and future state of our industry. ■



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# Optimizing CPPI Investment Strategy for Life Insurance Companies: A Risk-Reward Analysis

By Aymeric Kalife and Saad Mouti

## ABSTRACT

*Individualized constant proportion portfolio insurance (iCPPI) products are attractive alternatives to traditional unit-linked products because the former offer a guaranteed minimum return, such as variable annuities. They also offer high potential returns whilst limiting the downside risk by implementing a dynamic allocation strategy between high-risk and risk-free assets tailored to the risk appetite of the beneficiary. But the performance evaluation of iCPPI products should not rely on the unrealistic assumptions of continuous market price variation and continuous rebalancing of asset allocations. We adopt a more general and realistic pricing jump model and examine several dynamic strategies and put options to mitigate the risk that the value of the product will fall below the guaranteed minimum (so-called “gap risk”).*

**W**ith rising life expectancies, current provisions for retirement may not be sufficient for people to secure an acceptable standard of living after retirement. To achieve sufficiently high investment returns together with low risks over the long term, customers' funds should remain invested in risky assets as well as in safer bonds over an extended period well into retirement. The design of long-term investment products should also reflect the requirements and risk appetites of individual investors.

From the point of view of the provider as well, iCPPI products provide an attractive alternative to many traditional retail long-term investment products and offer a guaranteed minimum return for several key reasons:



- They lower exposure to volatility and extreme market price movements along with slightly lower returns.
- They have lower costs.
- They require lower regulatory capital.

Besides their price transparency, open time horizon, and no early redemption penalty, CPPI products generally offer a wide range of alternative investments for the risky asset and the flexibility to add other guarantees such as ratchets.

The CPPI investment strategy provides a minimum guaranteed return, the *floor* (usually defined as the discounted value of the final capital guarantee), and aims to maintain a risk asset exposure equal to a constant multiple of the *cushion* (defined as the excess value of the fund above the floor) at all times. The capital guarantee at maturity and the multiplier are customized to the customer's risk appetite, usually between three and six (which may be constant or not, depending on the contract).

However, implementation comes with many concrete challenges, as raised in section 1. The rebalancing of the asset allocation can be made only at discrete times. There are transaction costs, and risky asset prices may jump. There is likely to be a difference between the realized return compared to the hypothetical value of a CPPI strategy computed under

traditional unrealistic theoretical conditions of continuous price movements, unfettered zero-cost trading, and continuous rebalancing. In particular, there is a non-zero probability for the value of the fund to fall below the guaranteed floor, called the “gap risk,” as illustrated by the impact of introducing discontinuous jump processes in the modeling within the risky asset dynamics.

Section 2 deals with concrete strategies that at least partially mitigate such gap risk through a dynamically risk-adjusted multiplier and the use of put options.

SECTION 1. CPPI MANAGEMENT: FROM THEORY TO PRACTICE

**CPPI Mechanism Basics**

Consider that at time  $t$  a risky asset (e.g., a share) with price  $S$  and a risk-free asset (e.g., a Treasury bond) with price  $B$  returns a constant rate  $r$ . The CPPI fund is invested in these two assets so that part of its value—the floor  $F_t$ —is guaranteed, whilst the excess value above the floor—the cushion  $C_t$ , which equals  $V_t - F_t$ —remains exposed to the risky asset price fluctuations. At any time, the exposure to the risky asset is kept at a constant multiple  $m$  of the cushion, that is,  $m \times C_t$  (where  $m$  is usually held in practice between 3 and 6, implying that the asset manager borrows dynamically to buy the risky asset or may in practice buy the non-risky part only close to the expiration of the contract).

The risky asset  $S$  is defined by the usual lognormal continuous-time diffusion equation with drift  $\mu$  and volatility  $\sigma$ ;

$$\frac{dS_t}{S_t} = \mu dt + \sigma dW_t \quad \frac{dB_t}{B_t} = r dt$$

$$dV_t = m(V_t - F_t) \frac{dS_t}{S_t} + (V_t - m(V_t - F_t)) r dt$$

$$V_t = F_t + (V_0 - F_0) \exp\left(\left(m(\mu - r) + r - \frac{m^2 \sigma^2}{2}\right)t + m\sigma W_t\right)$$

This makes the portfolio value  $V$  independent on the path followed by the underlying  $S$ , while the probability to touch the floor is zero.<sup>1</sup>

The cushion  $C_t$  is then also lognormally distributed:

$$\frac{dC_t}{C_t} = (m\mu + (1 - m)r) dt + m\sigma dW_t$$

$$C_t = C_0 \exp\left(\left(m(\mu - r) + r - \frac{m^2 \sigma^2}{2}\right)t + m\sigma W_t\right)$$

However, such statistical assumptions are unrealistic and not consistent with market practice. Two alternatives are studied to

remedy this: modeling in a discrete-time framework and using discontinuous jump processes (such as the Kou model)

**Discrete-Time CPPI**

A sequence of equidistant points in the interval  $[0, T]$  is defined, between which the portfolio asset allocation is updated. The first time the portfolio value touches the floor is defined by the following formula:

$$t_s = \min\{t_k \in \Theta | V_{t_k} - F_{t_k} \leq 0\}$$

The probability of touching the floor now becomes greater than zero, assuming the portfolio has not breached the floor up to time  $t_k$ . The probability of breaching the floor at time  $t_{k+1}$  is that of a downside jump in the risky asset of more than about  $1/m$ , as evidenced below:

$$V_{t_{k+1}} - F_{t_{k+1}} = \begin{cases} (V_{t_k} - F_{t_k}) \left( m \frac{S_{t_i}}{S_{t_{i-1}}} - (m-1)e^{r\frac{T}{N}} \right) & \text{if } V_{t_k} - F_{t_k} > 0 \\ (V_{t_k} - F_{t_k}) e^{r\frac{T}{N}} & \text{if } V_{t_k} - F_{t_k} \leq 0 \end{cases}$$

Assuming the breach of the floor did not occur until  $t_k$ ,

$$V_{t_{k+1}} > F_{t_{k+1}} \Leftrightarrow \left( m \frac{S_{t_i}}{S_{t_{i-1}}} - (m-1)e^{r\frac{T}{N}} \right) > 0 \\ \Leftrightarrow \frac{S_{t_{k+1}}}{S_{t_k}} > \frac{m-1}{m} e^{r\frac{T}{N}}$$

As the interest rate return is close to zero over one day, we get the following result:

$$\frac{S_{t_{k+1}}}{S_{t_k}} - 1 > -\frac{1}{m}$$

Backtesting on three rebalancing frequencies (daily, weekly and monthly), over Q1 2006 to Q3 2007 S&P 500 index in Figure 1, illustrates that the CPPI strategy under daily rebalancing performs better than the weekly and monthly ones within bearish markets. We tested 10,000 simulation paths using the Black & Scholes model with a three-month realized volatility, a constant asset return  $m = 8\%$ , a risk-free rate  $r = 4\%$ , a duration of five years and 10 basis points (bps) transaction costs. This result reflects how highly responsive daily rebalancing is to decreasing the risk exposure, which prevents the bond floor from being breached and thus ensures the capital guarantee at maturity (as illustrated by fatter left tails in Figure 2). On the other hand, the 5 percent and 0.5 percent quantiles in Figure 3 show that the CPPI with  $m = 6$  has a larger right tail. It performs better than the other two in a bullish market even though the mean return is similar to CPPI with  $m = 3$ .

Figure 1  
Performance Depending On Multiplier vs. Buy and Hold Strategy

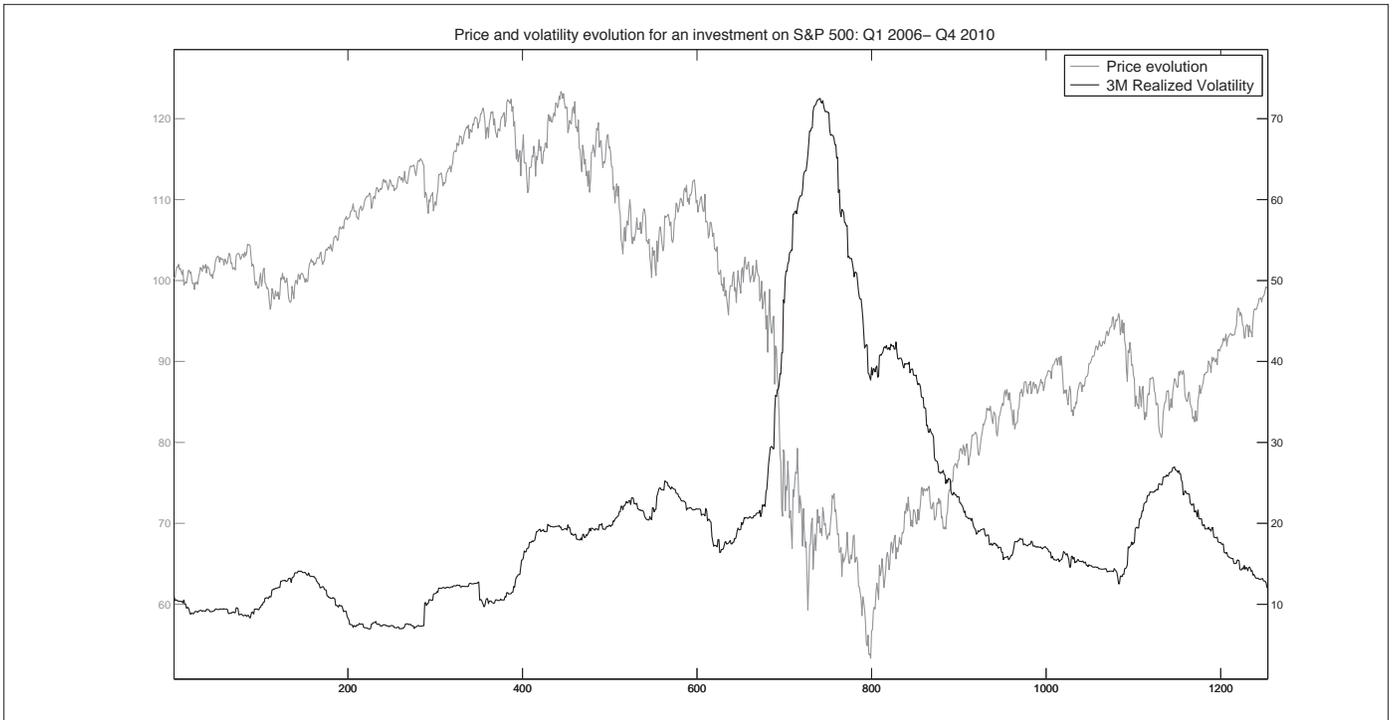


Figure 2  
Statistical Metrics Depending On Multiplier and Rebalancing Frequency

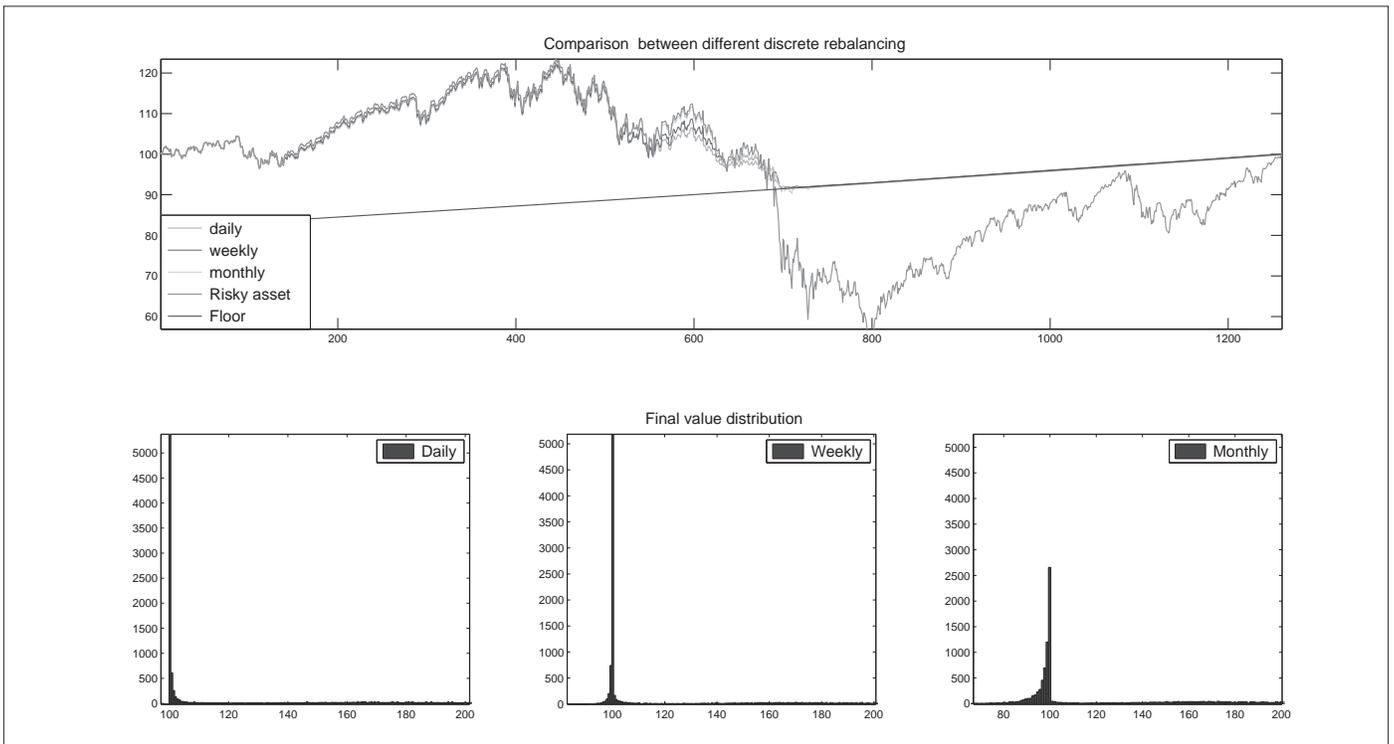


Figure 3  
Statistical Metrics Depending On Multiplier and Rebalancing Frequency

|                  | CPPI with $m = 3$ |        |         | CPPI with $m = 6$ |        |         |
|------------------|-------------------|--------|---------|-------------------|--------|---------|
|                  | Daily             | Weekly | Monthly | Daily             | Weekly | Monthly |
| Mean             | 123.31            | 122.39 | 119.75  | 124.10            | 124.87 | 125.01  |
| Std-dev          | 31.58             | 32.66  | 36.86   | 42.62             | 43.88  | 48.10   |
| 95% quantile     | 100.48            | 99.98  | 97.01   | 99.99             | 99.13  | 89.69   |
| 99.5% quantile   | 100.02            | 99.88  | 91.47   | 99.98             | 95.20  | 74.26   |
| 5% quantile      | 194.37            | 195.23 | 197.94  | 216.51            | 218.50 | 225.46  |
| 0.5% quantile    | 266.47            | 284.07 | 282.58  | 294.49            | 293.75 | 311.46  |
| Rebalancing cost | 0.91              | 0.44   | 0.26    | 0.78              | 0.46   | 0.31    |

However, using a constant volatility and lognormal distribution modeling is not consistent with empirically observed jumps during extreme market moves. They are likely to breach the bond floor. Jumps are thus added in the next section.

### Jump Modeling

For computational tractability, we chose the double exponential Kou model.<sup>2</sup> The Kou model introduces jumps into the stochastic process for stock returns as a set of random Poisson processes. The Kou model is defined as follows:

$$\frac{dS_t}{S_t} = \mu dt + \sigma dW + d\left(\sum_{i=1}^{N_t} Y_i - 1\right)$$

where  $W$  is a standard Brownian motion,  $N$  is the added (Poisson) jump process, where the jump sizes  $\{Y_1, Y_2, \dots\}$  are independent and identically distributed (iid) random variables with a common asymmetric double exponential density and

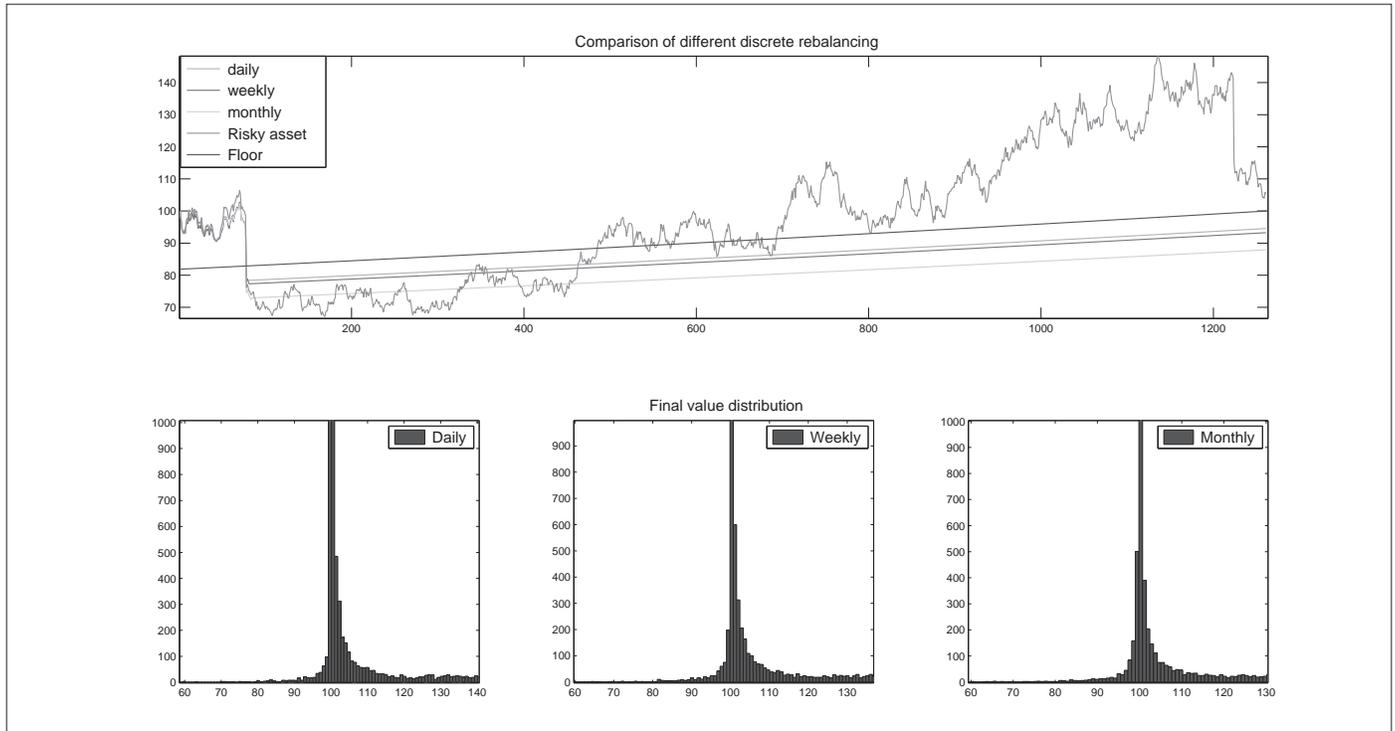
$$f(y) = (1-p)\gamma^+ e^{-\gamma^+ y} 1_{y \geq 0} + p\gamma^- e^{-\gamma^- y} 1_{y < 0}$$

$\gamma^+/\gamma^-$  are the intensity of positive/negative jumps, and  $(1-p)$  and  $p$  are the likelihood of positive and negative jumps, respectively. The calibration has been carried out by minimizing the quadratic error on options prices with a one-month maturity and strikes from 80 percent to 110 percent of the underlying. The strategy results are shown in Figures 4 and 5.

Figure 4  
Statistical Metrics Depending On Multiplier and Rebalancing Frequency

|                  | Kou model |        |         |
|------------------|-----------|--------|---------|
|                  | Daily     | Weekly | Monthly |
| Mean             | 146.28    | 147.10 | 147.57  |
| Std-dev          | 52.84     | 52.93  | 53.11   |
| 95% quantile     | 92.19     | 92.21  | 92.03   |
| 99.5% quantile   | 59.38     | 59.08  | 59.23   |
| 5% quantile      | 238.13    | 238.67 | 239.41  |
| 0.5% quantile    | 349.41    | 350.92 | 350.37  |
| Rebalancing cost | 0.92      | 0.45   | 0.26    |

Figure 5  
Simulation and Distribution of the Three Rebalancing Frequencies Under the Kou Model



The results in Figure 6 demonstrate that, whereas the probability of breaching the floor (the gap risk) significantly decreases to negligible under the traditional unrealistic assumption of continuous price movements (B&S in the figure) as the rebalancing frequency increases to daily, that is no longer the case under more realistic discontinuous modeling assumptions (here the Kou model), even with continuous rebalancing frequency.

Figure 6  
Probability Of Breaching The Floor Depending On Asset Dynamics Modeling And Rebalancing Frequency

| Model | Frequency  | Prob(Breach Floor)   |
|-------|------------|----------------------|
| B&S   | Monthly    | $9.07 \times 10^5$   |
|       | Weekly     | $1.2 \times 10^{10}$ |
|       | Daily      | ~                    |
| Kou   | Continuous | 0.00410              |

Section 2 deals with concrete strategies that at least partially mitigate gap risk through a dynamically risk-adjusted multiplier and the use of put options.

## SECTION 2: MITIGATING THE DOWNSIDE RISK (GAP RISK)

### Adjusting The Multiplier To Market Conditions

The manager usually sets the multiplier at the beginning of the period. Still, the probability of breaching the floor may surge in a market crash, or the manager might miss the subsequent market recovery. Thus, the multiplier needs to be adjusted according to current market conditions.

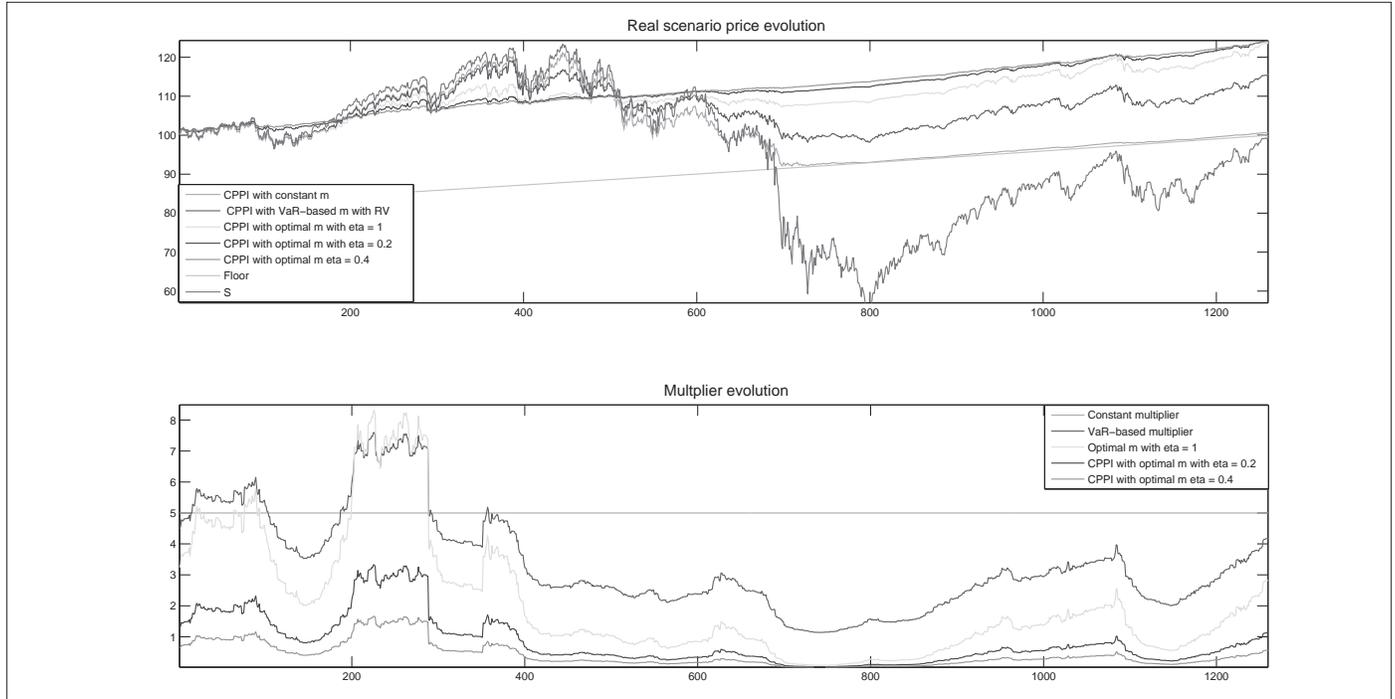
A first approach to defining a dynamic multiplier is the choice of an “optimal”  $m^*$  (for instance, using optimal certainty equivalent returns with hyperbolic absolute risk aversion utilities and log-normal distribution<sup>3</sup>).  $m^*$  is defined by the following formula:

$$m^* = \eta \frac{(\mu - r)}{\sigma^2}$$

where  $\eta$  is the sensitivity of the investor’s risk tolerance to the level of wealth.

An alternative is a value-at-risk (VaR)–based multiplier where investors choose the confidence level according to their tolerance for tail risks.<sup>4</sup>  $m_t$  is defined as follows:

Figure 7  
 Comparison of Different Multipliers (VaR-based with  $p = 99.5\%$  vs. the Optimal One with  $\gamma = 0.2, 0.4$  and Based On Realized Volatility)



$$m_t = \frac{1}{1 - \exp\left(\left(\mu - r - \frac{1}{2}\sigma^2\right)(T - t) - z_p\sigma\sqrt{T - t}\right)}$$

These two approaches offer an interesting alternative to the constant multiplier, which lacks flexibility depending on market conditions. Based on backtesting of data from 2006 to 2011 (Figure 7), the VaR-based multiplier performs better than the “optimal” one in bullish and recovery markets. In contrast, during bear markets, using the “optimal” multiplier (through  $m < 1$ ) helps keep a relatively higher cushion (but misses the recovery as it makes no provision for high leverage).

To allow for a higher level of participation in the market recovery, the multiplier is adjusted with a modified volatility estimator. This is done either through a short-term exponentially weighted moving average (EWMA) realized volatility ( $\lambda = 0.94$ ) or an estimator based on implied volatility of the strike consistent with the latest market returns. For example, if the underlying jumped 5 percent downward, the implied volatility with strike 95 percent would be chosen. This adjustment would enable the model to capture more of the upside return when markets rebound. For example, reinvesting in the risky asset in Q3 2009 in the

backtest results in higher returns, as illustrated with the stock’s rising ongoing performance shown in Figure 8.

Finally, the fixed frequency rebalancing may be switched to a trigger rebalancing when the multiplier is out of a specific range chosen by the portfolio manager, as illustrated by the stock’s higher performance in Figure 9. On average, the rebalancing frequency becomes every other day, which is consistent with the usual practice in CPPI asset management—while the cost of rebalancing is cut by half in comparison to a daily rebalancing (that is, as low as weekly or monthly).

Adjusting the multiplier dynamically allows it to be more reactive to market conditions and explicitly dependent on the investor’s risk aversion. However, it is still exposed to the downside risk in case of sudden jumps (a “black swan” event such as a market crash of 20 percent in one day) where options may be useful to hedge such gap risks.

### Hedging Gap Risk

A simple hedging strategy for the CPPI can be constructed using short maturity put options. Touching the bond floor is mathematically equivalent to the cushion becoming negative. Assuming the event has not occurred up to time  $t$ , the gap risk is defined by

Figure 8  
 Comparison Between Dynamic Multiplier Based on RV and on IV Through Backtesting

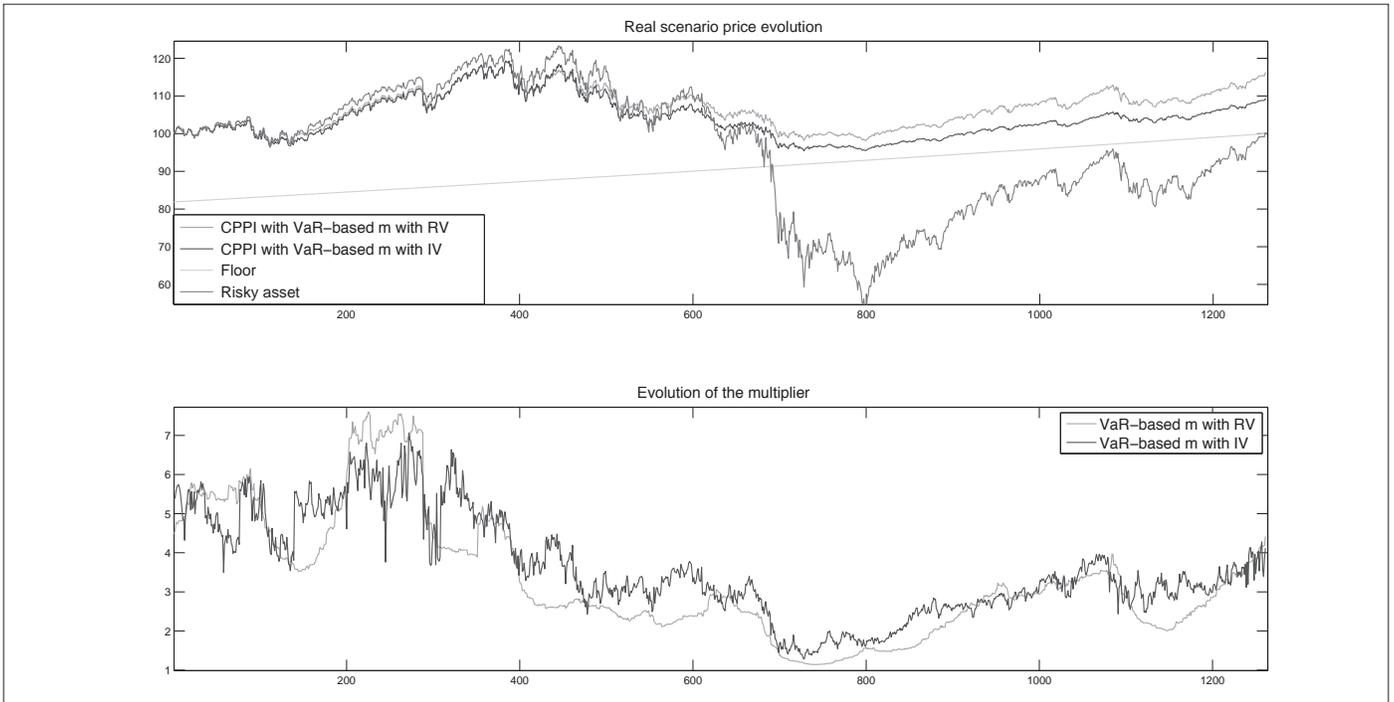


Figure 9  
 Comparison Between Trigger Rebalancing vs Fixed Frequency Rebalancing

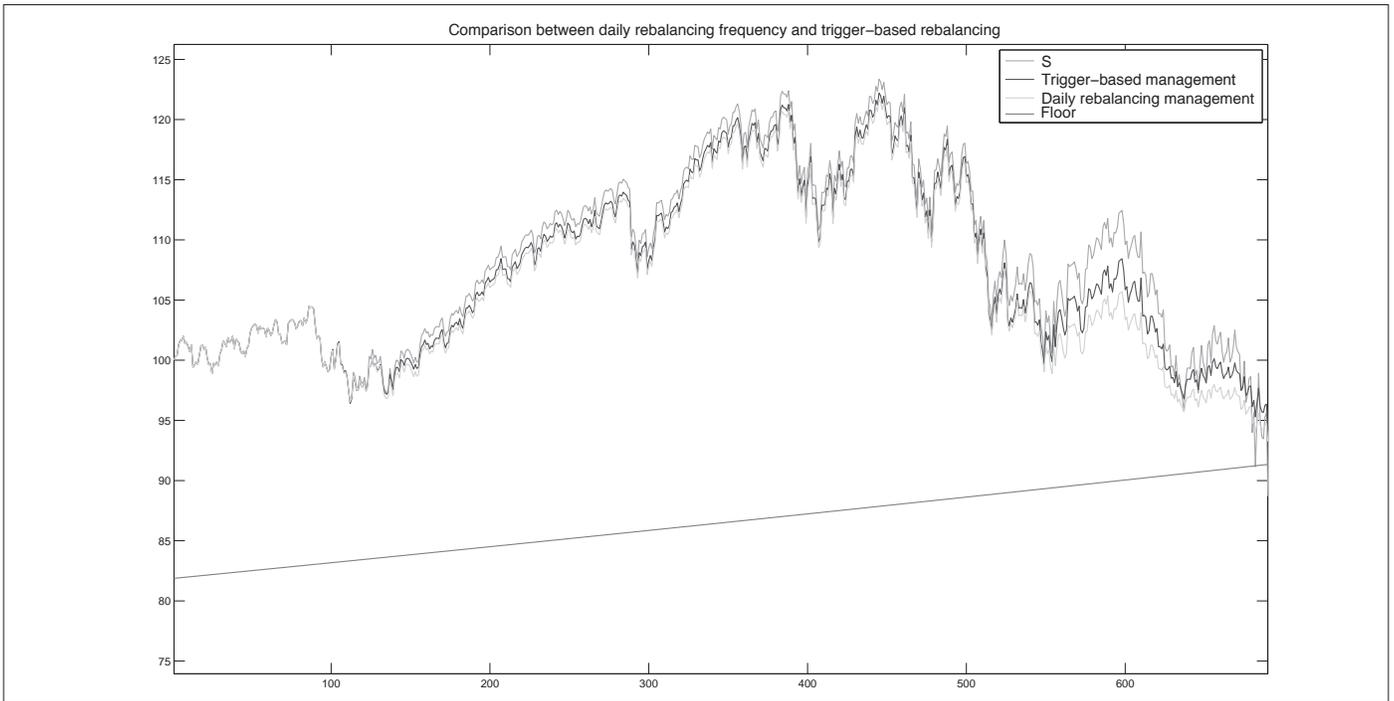
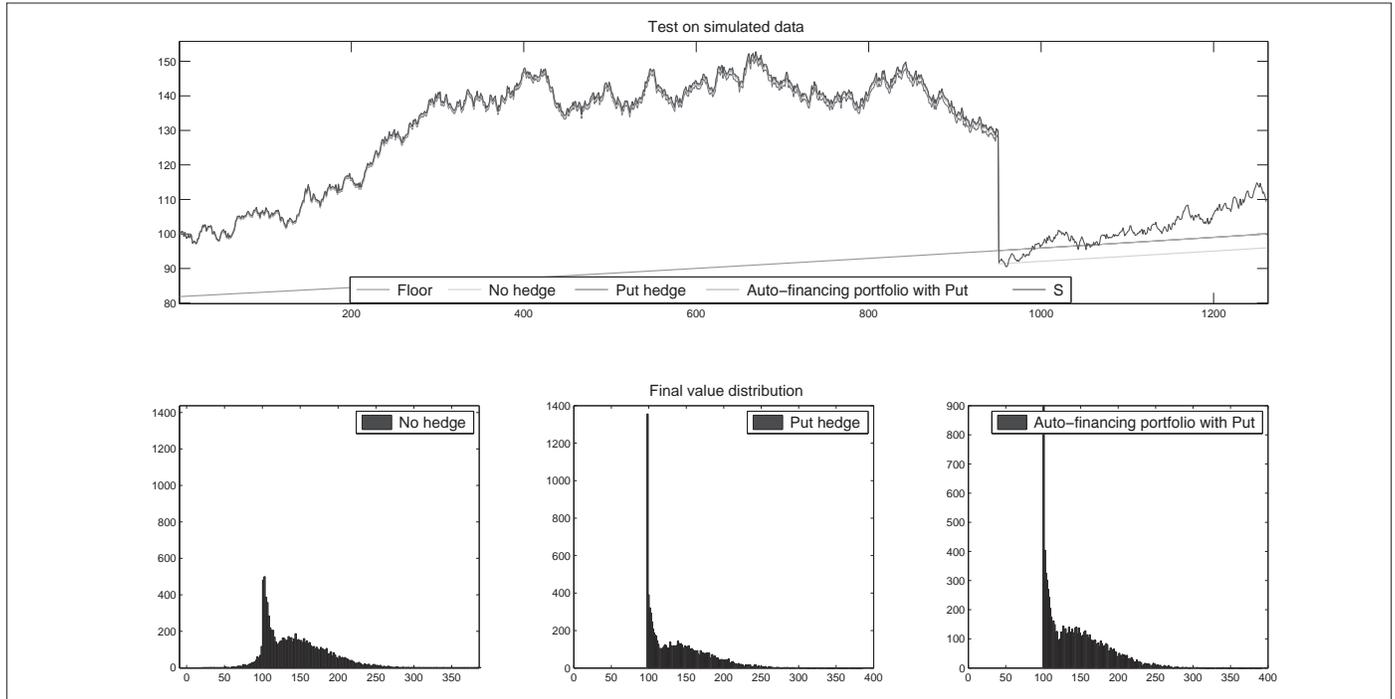


Figure 10  
Comparison Between No Hedging and Put Hedging



$$C_{t_{k+1}} < 0 \Leftrightarrow m \frac{S_{t_{k+1}}}{S_{t_k}} - (m-1)e^{r\frac{T}{N}} < 0$$

This risk can be hedged by buying put options at each rebalancing period with a strike price of

$$\left(1 - \frac{1}{m} e^{r\frac{T}{N}} S_{t_k}\right)$$

and with maturity equal to the CPPI rebalancing frequency. To hedge the whole portfolio, the manager needs a number of puts equal to

$$m \frac{C_{t_k}}{S_{t_k}}$$

which is the risky asset exposure. The discounted payoff in this case is then

$$e^{-r\frac{T}{N}} C_{t_k} \left( (m-1)e^{r\frac{T}{N}} - m \frac{S_{t_{k+1}}}{S_{t_k}} \right)^+$$

While the hedging cost is

$$\text{Cost}_{t_k} = m \frac{C_{t_k}}{S_{t_k}} \mathbb{E}^\varrho \left[ \left( \left(1 - \frac{1}{m}\right) e^{r\frac{T}{N}} S_{t_k} - S_{t_{k+1}} \right)^+ \right]$$

We observe the following impacts of hedging with puts:

- The guarantee is ensured, and the manager no longer holds the risk of breaching the floor. However, once the put is exercised and the floor recovered, the manager needs to monetize that option to keep the guarantee until maturity.
- In terms of profit and loss distributions, the CPPI distribution with put option hedging is a truncation of the classic CPPI where losses are cut (left tail limited by the guarantee).

### CONCLUSION

In this article we have presented a study of the CPPI as an insurance contract, a review of its theory and practice as well as its modeling and hedging issues for a risk/return/cost perspective. The main conclusions are as follows:

- Jump modeling is an essential element of CPPI modeling. It allows the model to measure the non-zero probability of breaching the floor.
- Correctly choosing and adjusting the multiplier dynamically significantly reduces the downside risk according to a VaR indicator. The multiplier decreases in periods of market turmoil, reducing the risk exposure, and increases during periods of market recovery.
- Hedging the gap risk is possible through normal put options. ■



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#### ENDNOTES

- 1 F. Black and R. Jones. 1987. "Simplifying portfolio insurance." *Journal of Portfolio Management* 14(1): 48–51.
- 2 S.G. Kou. 2002. "A jump-diffusion model for option pricing." *Management Science* 48(8): 1086–1101.
- 3 Jacques Pézier. 2011. "Rationalization of investment preference criteria." ICMA Centre Discussion Papers in Finance DP2011-12. University of Reading.
- 4 C. Jiang, Y. Ma and Y. An. 2009. "The effectiveness of the VaR-based portfolio insurance strategy: An empirical analysis." *International Review of Financial Analysis* 18(4): 185–197.
- 5 P. Tankov. 2010. "Pricing and hedging gap risk." *Journal of Computational Finance* 13(3): 33–59.

# Annual Survey Provides Insights into the Universal Life and Indexed UL Market

By Susan J. Saip

Since 2004, the market share of universal life (UL) products has been in the range of 35 percent to 40 percent<sup>1</sup> of total life sales measured by first-year premium, despite the recent challenges of low interest rates, reserving changes, and new illustration requirements. Industry insights relative to these challenges are included in the most recent UL and Indexed UL (IUL) survey conducted by Milliman. Survey results are based on responses from 29 carriers of UL/IUL products. The broad-based survey covers a range of product and actuarial issues such as sales, profit measures, target surplus, reserves, risk management, underwriting, product design, compensation, pricing, and illustrations.

Products included in the scope of the Milliman survey are: UL with secondary guarantees (ULSG), cash accumulation UL (AccumUL), current assumption UL (CAUL), and the indexed UL (IUL) counterparts of these products (i.e., IULSG, AccumIUL, and CAIUL). These product types are defined as follows:

- *UL/IUL with Secondary Guarantees:* A UL/IUL product designed specifically for the death benefit guarantee market that features long-term no-lapse guarantees (guaranteed to last until at least age 90) either through a rider or as a part of the base policy.
- *Cash Accumulation UL/IUL:* A UL/IUL product designed specifically for the accumulation-oriented market where efficient accumulation of cash values to be available for distribution is the primary concern of the buyer. Within this category are products that allow for high-early-cash value accumulation, typically through the election of an accelerated cash value rider.
- *Current Assumption UL/IUL:* A UL/IUL product designed to offer the lowest cost death benefit coverage without

death benefit guarantees. Within this category are products sometimes referred to as “dollar-solve” or “term alternative.”

The key findings of the survey are highlighted in this article.

## UL SALES

The mix of UL sales (excluding IUL sales) reported by survey participants from calendar years 2014–2016, and for 2017 as of Sept. 30, 2017 (YTD 9/30/17) is shown in Figure 1. Sales were defined as the sum of recurring premiums plus ten percent of single premiums for purposes of the survey. In the past couple of years fewer participants reported significant shifts in their UL product mix relative to prior years, when comparing the mix at the end of the survey period to that of the beginning of the survey period.

New in this year’s survey was the reporting of sales by underwriting approach. Underwriting approaches for the purpose of the survey were defined as follows:

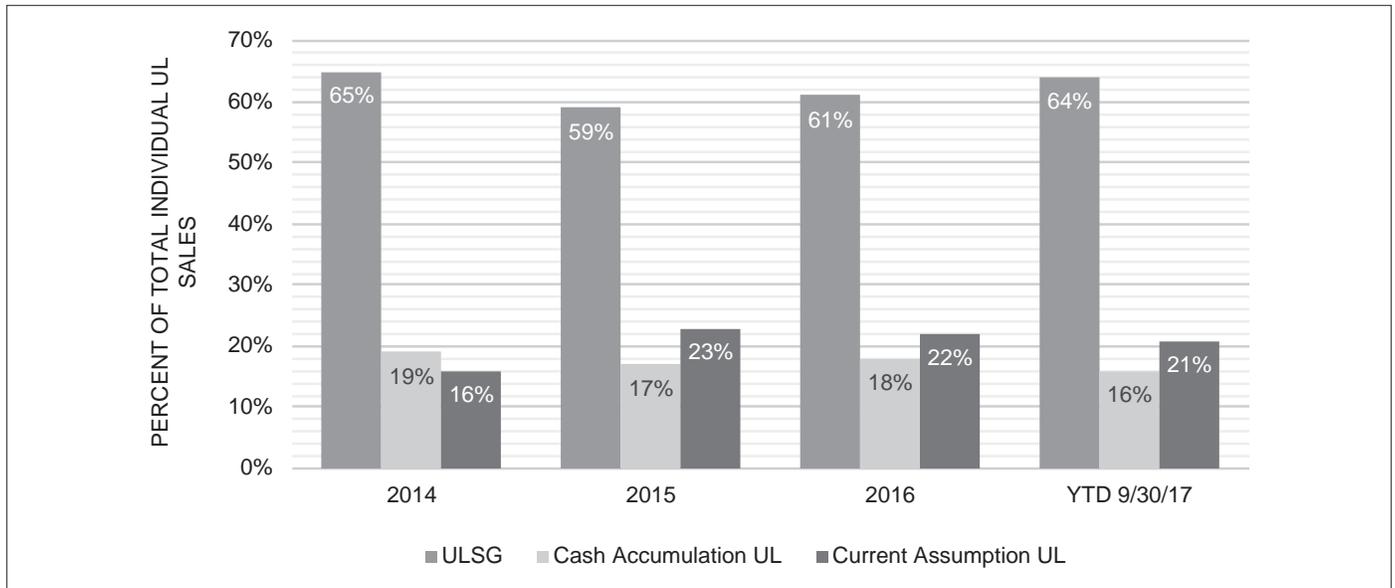
- *Simplified issue underwriting:* Less than a complete set of medical history questions and no medical or paramedical exam.
- *Accelerated underwriting:* The use of tools or predictive models to waive requirements such as fluids and a paramedical exam on a fully underwritten product for qualifying applicants without charging a higher premium than for fully underwritten business.
- *Fully underwritten:* Complete set of medical history questions and medical or paramedical exam, except where age and amount limits allow for nonmedical underwriting.

For accelerated underwriting sales, participants were instructed to include total sales for products under which accelerated underwriting is offered. The distribution of 2016 UL sales (on a premium basis) by underwriting approach was 27.6 percent simplified issue, 0.7 percent accelerated underwriting, and 71.7 percent fully underwritten. For YTD 9/30/17 UL sales, the distribution by underwriting approach was 29.8 percent simplified issue, 1.1 percent accelerated underwriting, and 69.2 percent fully underwritten. This demonstrates the gradual shifting from full underwriting to simplified issue and accelerated underwriting approaches for UL, in contrast to more significant shifting for IUL, as discussed below.

## INDEXED UL SALES

IUL sales reported by survey participants during YTD 9/30/17 accounted for 48 percent of total UL/IUL sales combined during YTD 9/30/17, flat relative to sales in 2014. The IUL

Figure 1  
UL Product Mix by Year



sales percent increased for AccumIUL sales from 2014 to YTD 9/30/17 from 81 percent to 84 percent of total cash accumulation UL/IUL sales. IULSG also increased from 8 percent to 9 percent of total combined ULSG/IULSG sales over the survey period. CAIUL sales, as a percent of total combined CAUL/CAIUL sales, decreased from 35 percent to 29 percent over this period. Overall survey statistics suggest that companies plan to focus more on IULSG and CAIUL products, rather than AccumIUL products, as reported in the past, with less focus on ULSG products.

The distribution of 2016 IUL sales (on a premium basis) by underwriting approach was 2.6 percent simplified issue, 0.5 percent accelerated underwriting, and 96.8 percent fully underwritten. For YTD 9/30/17 IUL sales, the distribution by underwriting approach was 2.6 percent simplified issue, 16.8 percent accelerated underwriting, and 80.6 percent fully underwritten.

#### LIVING BENEFIT RIDER SALES

Six of 12 participants that reported UL/IUL sales with chronic illness riders provide a discounted death benefit as an accelerated benefit. Fewer participants are using this approach than reported in the past. Perhaps this is because carriers are moving to other approaches that seem to be better solutions to chronic illness needs. Two participants reported their chronic illness rider uses a lien against the death benefit to provide the accelerated benefit. Another two use a dollar-for-dollar discounted death benefit reduction approach. One of the final two participants reported

using both the lien approach and dollar-for-dollar death benefit reduction approach. The final participant uses both the discounted death benefit approach and the dollar-for-dollar death benefit reduction approach. The various approaches are defined as follows:

- Under the discounted death benefit approach, the insurer pays the owner a discounted percentage of the face amount reduction, with the face amount reduction occurring at the same time as the accelerated benefit payment. This approach avoids the need for charges up front or other premium requirements for the rider, because the insurer covers its costs of early payment of the death benefit via a discount factor.
- Under the lien approach, the payment of accelerated death benefits is considered a lien or offset against the death benefit. Access to the cash value (CV) is restricted to any excess of the CV over the sum of the lien and any other outstanding policy loans. Future premiums/charges for the coverage are unaffected, and the gross policy values continue to grow as if the lien didn't exist. In most cases there are lien interest charges that are assessed under this design.
- Under the dollar-for-dollar approach, there is a dollar-for-dollar reduction in the specified amount or face amount and a pro rata reduction in the CV based on the percentage of the specified amount or face amount that was accelerated. This approach always requires an explicit charge.

Figure 2  
Chronic Illness Rider Sales as a Percent of Total Sales

| Calendar Year  | Total Individual UL | ULSG  | Cash Accumulation UL | Current Assumption UL |
|--|---------------------|-------|----------------------|-----------------------|
| <b>UL Sales with Chronic Illness riders as a percent of total UL sales</b> |                     |       |                      |                       |
| 2014   | 10.8%               | 13.0% | 7.3%                 | 5.7%                  |
| 2015   | 9.7%                | 12.0% | 10.5%                | 3.1%                  |
| 2016   | 10.8%               | 12.8% | 13.7%                | 2.8%                  |
| YTD 9/30/17  | 8.7%                | 7.5%  | 18.8%                | 4.7%                  |

| Calendar Year  | Total Individual IUL | IULSG | Cash Accumulation IUL | Current Assumption IUL |
|--|----------------------|-------|-----------------------|------------------------|
| <b>IUL Sales with Chronic Illness riders as a percent of total IUL sales</b> |                      |       |                       |                        |
| 2014   | 32.4%                | 26.0% | 33.6%                 | 25.1%                  |
| 2015   | 32.9%                | 29.6% | 34.3%                 | 22.2%                  |
| 2016   | 33.8%                | 41.0% | 35.6%                 | 11.1%                  |
| YTD 9/30/17  | 38.5%                | 43.7% | 40.1%                 | 19.5%                  |

Figure 3  
LTC Rider Sales as a Percent of Total Sales by Premium

| Calendar Year  | Total Individual UL | ULSG  | Cash Accumulation UL | Current Assumption UL |
|--|---------------------|-------|----------------------|-----------------------|
| <b>UL sales with LTC riders as a percent of total UL sales</b> |                     |       |                      |                       |
| 2014   | 19.8%               | 29.9% | 1.3%                 | 0.2%                  |
| 2015   | 22.3%               | 33.2% | 2.0%                 | 9.7%                  |
| 2016   | 27.0%               | 35.4% | 1.2%                 | 24.5%                 |
| YTD 9/30/17  | 33.2%               | 42.3% | 3.0%                 | 27.7%                 |

| Calendar Year  | Total Individual IUL | IULSG | Cash Accumulation IUL | Current Assumption IUL |
|--|----------------------|-------|-----------------------|------------------------|
| <b>IUL sales with LTC riders as a percent of total IUL sales</b> |                      |       |                       |                        |
| 2014   | 11.0%                | 20.5% | 10.4%                 | 10.0%                  |
| 2015   | 11.8%                | 13.5% | 11.9%                 | 9.7%                   |
| 2016   | 11.8%                | 8.2%  | 10.8%                 | 23.2%                  |
| YTD 9/30/17  | 10.9%                | 4.7%  | 9.8%                  | 25.9%                  |

The table in Figure 2 summarizes sales of chronic illness riders as a percent of total sales by premium (separately for UL and IUL products). During YTD 9/30/17, sales of chronic illness riders as a percent of total sales were 8.7 percent for UL products and 38.5 percent for IUL products.

A greater share of chronic illness riders is seen on an IUL chassis because more new IUL products have been developed recently. Sales of total individual IUL chronic illness riders increased year-over-year during the survey period.

Long-term care (LTC) riders attached to UL/IUL policies have been addressing LTC needs due to the high cost of long-term care, the aging population, and the exiting of some life insurers from the standalone LTC market. During YTD 9/30/17, sales of policies with LTC riders as a percent of total sales by premium were 33.2 percent for UL products and 10.9 percent for IUL products. Sales of LTC riders as a percent of total sales (measured by premiums, and weighting single-premium sales at 10 percent) for UL and IUL products separately by product type are shown in Figure 3. Sales of total individual

Figure 4  
Actual Results Relative to Profit Goals For 2016

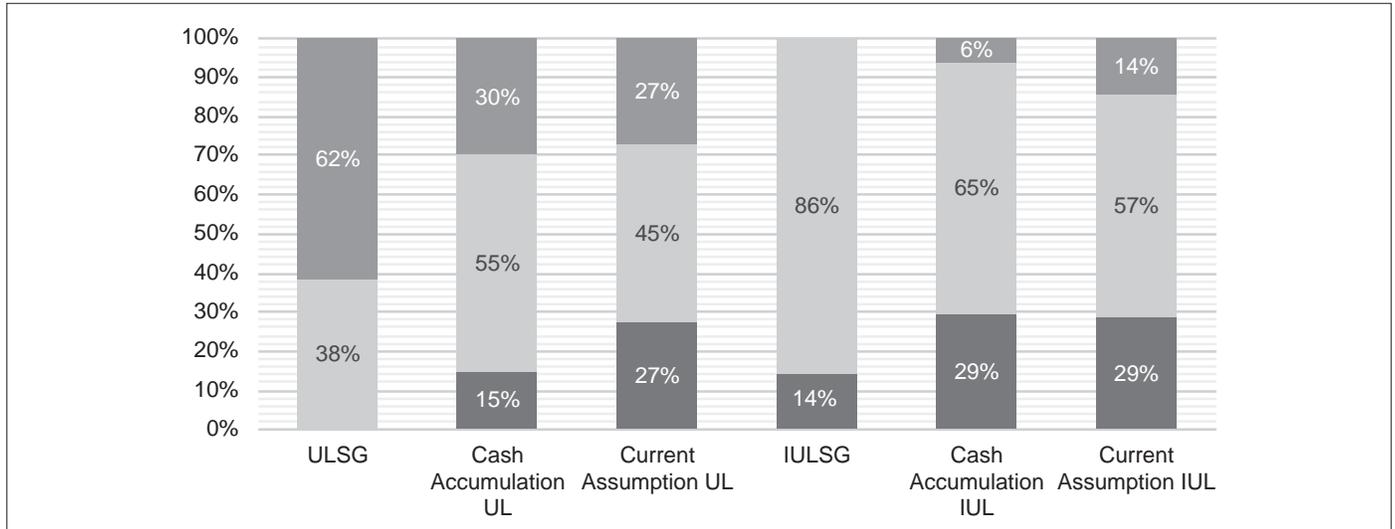
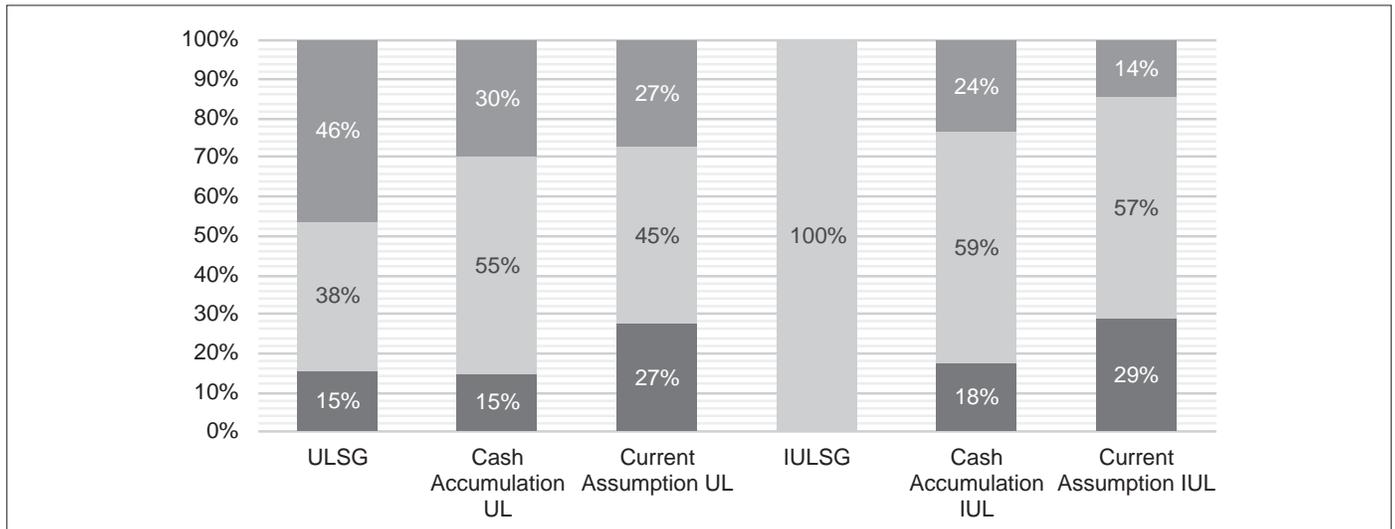


Figure 5  
Actual Results Relative to Profit Goals For Ytd 9/30/17



UL LTC riders increased year-over-year during the survey period.

Within 24 months, 83 percent of survey respondents possibly will market either an LTC or chronic illness rider.

PROFIT MEASURES

Consistent with prior surveys, the predominant profit measure reported by survey participants is an after-tax, after-capital statutory return on investment/internal rate of return (ROI/IRR).

The average ROI/IRR target reported by survey participants was 12.5 percent for AccumIUL and CAIUL, 12.3 percent for IULSG, 11.2 percent for AccumUL, 10.9 percent for CAUL, and 10.6 percent for ULSG.

The percentage of survey participants reporting that they fell short of, met, or exceeded their profit goals by UL product type for calendar year 2016 and YTD 9/30/17, is shown in the charts in Figures 4 and 5, respectively. Of note is the percentage of participants that fell short of their profit goals for ULSG products:

62 percent in 2016, and 46 percent during YTD 9/30/17. The primary reasons reported for not meeting profit goals were low interest earnings and expenses, consistent with prior survey responses.

#### PRINCIPLE-BASED RESERVES AND THE 2017 CSO

The earliest effective date for implementation of principle-based reserves (PBR), as well as for the use of the 2017 Commissioner's Standard Ordinary (CSO) mortality table was Jan. 1, 2017. The 2017 CSO is the new valuation mortality table to be used in the determination of CRVM (Commissioners Reserve Valuation Method) reserves, net premium reserves, tax reserves, minimum nonforfeiture requirements, etc. Twenty-three of the 29 survey participants reported they expect to implement PBR for all their UL/IUL products spread over the three-year phase-in period allowed. The average issue year reported by survey participants to implement the 2017 CSO mortality table is 2019 for all UL/IUL products, except CAIUL. For CAIUL, the average issue year is 2018 for the implementation of the 2017 CSO.

#### UNDERWRITING

The life insurance industry has been moving away from full underwriting of life products to simplified approaches with fewer or different requirements, and more timely responses while still considering the implications of mortality cost. Nineteen of the 29 respondents reported using more than one underwriting approach. Simplified issue underwriting is used by nine participants, accelerated underwriting by 12 participants, and full underwriting by 28 participants. For those survey participants that do not have an accelerated underwriting program, nine indicated they plan to implement one. Two additional participants are currently researching accelerated underwriting programs and may implement one. Nine of these participants may implement the program in the next 12 months. Eight survey participants use predictive analytics in their accelerated underwriting algorithm for UL/IUL products. Only two participants reported using predictive analytics in underwriting of UL/IUL products under other underwriting approaches (i.e., other than accelerated underwriting). Predictive modeling utilizes statistical models that relate outcomes/events to various risk factors/predictors.

Scoring models are an example of predictive modeling used relative to life underwriting. Scoring models are used by 12 survey participants to underwrite their UL/IUL policies. Six of the 12 use purely external scoring models and four participants use purely internal scoring models. The remaining two participants

reported the use of both internal and external scoring models. Eleven of the 12 participants reported the use of scoring models by underwriting approach. Ten participants reported using these models for fully underwritten policies, with one of the 10 also using them for accelerated underwritten policies, and another four of the 10 using them for simplified issue policies. One company uses scoring models exclusively for simplified issue underwriting. It is common for these companies to use more than one type of scoring model. In total, four participants use lab scoring models, six use consumer credit-related scoring models, six use scoring models relative to motor vehicle records, and seven use prescription drug scoring models.

#### ILLUSTRATIONS

Sixteen of the 20 IUL participants reported the credited rate used in IUL illustrations for participants' most popular strategies. Ten of the 16 reported the rate decreased relative to the illustrated rate of one year ago. One participant reported no change in the illustrated rate, and five reported increases in the illustrated rate. The median illustrated rate reported was 6.64 percent and the average was 6.49 percent.

#### CONCLUSION

The UL/IUL market has experienced many changes in recent years. Indexed UL has continued to be popular, low interest rates have persisted, and regulatory actions and new underwriting approaches have presented new opportunities and challenges. It is imperative for UL/IUL carriers to evaluate where they stand in relation to their peers in order to remain competitive in this market.

A complimentary copy of the executive summary of the June 2018 Universal Life and Indexed Universal Life Issues report may be found at: <http://www.milliman.com/insight/2018/Universal-life-and-indexed-universal-life-issues--2017/2018-survey/>. ■



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#### ENDNOTE

- 1 According to LIMRA's U.S. Retail Individual Life Insurance Sales reports



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# In-Force Management: An Informal Survey

By Jennie McGinnis

Over the last couple of years, sessions related to in-force management have been included at the Life & Annuity Symposium and SOA Annual Meeting.<sup>1</sup> A range of topics have been included in each, from fundamental considerations when establishing an in-force management function to some of the innovative uses of big data to support management activities.

At each of the sessions audience polling was utilized in order to

- encourage shared learnings,
- enhance the session's engagement, and
- help the SOA gauge interest in establishing a more dedicated support system for those practicing in-force management.

Across the sessions we have now gathered more than 100 responses (nearly 200 in some cases) to some of the questions asked (while the full set of questions has varied a bit each time, some have been considered standard). While there are caveats to be made regarding the aggregation of these responses (e.g., double counting of individuals who attended more than one session, multiple individuals from the same company attending, self-selection bias in attending the session in the first place) there are certain themes that have evolved over time. Unless noted, the responses have also remained consistent meeting-to-meeting.

## WHO PARTICIPATED IN THE POLLING?

The majority of attendees worked for direct companies (~60 percent) with just over 25 percent working for reinsurers and nearly 10 percent as consultants. The balance of attendees had roles with other types of organizations (e.g., government) or were retired. There has been a slight trend of less attendees from direct companies and more from reinsurers across meetings.

Perhaps unsurprisingly, given the meetings and session descriptions, the vast majority selected life insurance as their primary area of practice (~75 percent). Just over 15 percent focused on annuities, with the balance being involved in other lines of business.

## IN-FORCE MANAGEMENT PARTICIPATION

Nearly half of attendees reported that their organizations had stand-alone teams dedicated to in-force management activities. Another 25 percent noted that individuals are pulled together on an ad hoc basis as needed (though across meetings this has steadily trended downward). About 10 percent identified with the use of a cross-functional committee while another 10 percent recognized that their organization uses a combination of these different structures.

Although the question has not been used as often (having less than 100 total responses), the amount of time that individual attendees spend on in-force matters is also of interest. Just over half of attendees noted spending less than a quarter of their time on such activities—it is possible they attended the session in anticipation of this increasing, or due to a general interest in what others at their organization are working on. About 25 percent identified as spending more than three quarters of their time on such activities, with the balance in between (25–75 percent of time spent on in-force management).

## MANAGEMENT OF NON-GUARANTEED ELEMENTS

Sessions have consistently allocated some time to the discussion of non-guaranteed element (NGE) management, as this is a common in-force management activity across organizational types. This discussion has typically considered NGEs in three groups, the first relating to the management of post-level term (PLT) premiums (that is, utilizing a sloped increase rather than a “jump” design).



PLT premium design is not necessarily a topic attendees were aware of, with a third of participants not being sure whether their firms utilized sloped rates. About a quarter of attendees were aware of their firms having managed for both new business and in-force products. Ten percent indicated they utilized sloped premiums on new issues only and another 5 percent on in-force products only. The balance (another quarter) noted that they had not undertaken any such management activities.

Polling split management of other NGEs into two groups, with one focusing on dividends, interest credited rates, and index cap rates. For such NGEs, just over 75 percent indicated that they had modified these in the last five years. Five percent indicated they had not, and the balance were unsure.

The third grouping then questioned whether any *other* NGEs have been managed in the last five years. While not specific to cost of insurance rates, such changes would be included in this grouping. In this case, just over 40 percent were aware of their firms managing such features, another 40 percent indicated they had not, and the remainder were unsure.

#### IN-FORCE CUSTOMER ENGAGEMENT

In addition to product management, which incorporates activities related to NGEs, in-force management teams may also take part in assessing and implementing policyholder-related activities.

For instance, when asked whether their firms had approached in-force blocks to generate additional sales (for example, through cross-selling or up-selling) only 15 percent considered themselves as doing so regularly. The most popular response (40 percent) was that they did so rarely and a quarter of attendees said they never did. This however leaves a sizeable balance that was unsure as to whether their firms utilize such activities.

Further exploring why companies were not more active in this space shows the primary reason as being not wanting to disrupt the producer relationship (~40 percent). About 10 percent selected that they didn't think it would be worth the effort, and a similar amount indicated having a sense it would be too annoying or invasive. The balance of respondents were split between having some other (unspecified) reason for not doing so and now considering that perhaps they should.

#### SUPPORTING IN-FORCE MANAGERS

As noted, one reason for including the polling at each session was to gauge interest in establishing a more dedicated support system within the SOA for those practicing in force management. As such, the question was posed at each session as to whether and how attendees would be interested in networking with other in-force management professionals.

The consistent response was that half were interested in some form of formal networking (e.g., a subgroup to a section) and a quarter in informal networking (e.g., a listserv). While a promising result, this was an interesting finding given the amount of time attendees were currently spending on in-force related matters.

This evidence helped support the establishment of an In-Force Management Subgroup within the Product Development Section, which was introduced in the last issue of *Product Matters!*<sup>2</sup> The organization of the subgroup is such that there are both formal and informal components. If you are interested in participating yourself, please join via our listserv community!<sup>3</sup>

Through the subgroup, and in partnership with other sections and communities with shared interest in in-force management, the SOA will continue to support those with interest in this space. We look forward with interest to how responses to the questions posed will change over time as in-force management continues to become a more well-established area of practice. ■



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#### ENDNOTES

- 1 2017 Life & Annuity Symposium Session 60 "Benchmarking Life Insurance In-force Management"; 2017 Annual Meeting Session 188 "Inforce Management: Understanding and Increasing Its Value"; 2018 Life & Annuity Symposium Session 30 "Inforce Management: Getting More From What You Have"
- 2 McGinnis, Jennie. 2018. "Introducing the In-Force Management Subgroup." *Product Matters!* June 2018. <https://www.soa.org/Library/Newsletters/Product-Development-News/2018/june/pro-2018-iss110.pdf>
- 3 Go to <https://www.soa.org/News-and-Publications/Listservs/list-public-listservs.aspx>, find "In-Force Management Listserv" and JOIN.

# Why Indexed Universal Life (IUL) Income Streams Need To Be Managed: Part 1

By Ben H. Wolzenski and John S. McSwaney

## WHAT'S THIS ABOUT AND A QUICK BOTTOM LINE

*Wolzenski:* John, over the past decade working with producers, you've observed that most Indexed Universal Life (IUL) new premium comes from sales that illustrate policy loans or withdrawals, either for retirement income or to repay premium financing.

*McSwaney:* That's right.

*Wolzenski:* Illustrations show cash coming out of the contract at current assumptions, at mid-point assumptions, at an alternate scale, and at guarantees. There is a wide range of possible outcomes.

*McSwaney:* By far the most important illustrations in making the sale are those based on current assumptions, either at the maximum permissible interest rate or a slightly lower rate chosen by the agent. But the initial illustration does not predict what income can come out of the policy decades later; it only shows the income that could be taken under current assumptions.

*Wolzenski:* That's why we've been researching the issue for the past two years. How about a few sentences to sum up all the results for impatient readers. Details can follow.

*McSwaney:* 1. When loans or withdrawals are about to begin, it is prudent to set the initial income at less than the current assumption maximum. 2. To avoid potential tax consequences, the amount taken out of the policy needs to be adjusted, preferably annually, for as long as the income stream continues. 3. Making the right adjustments is not easy, and it is not realistic to expect policyholders and agents to do it well, especially if they are in their 80s or 90s. Carriers need to adopt systems to do it.



*Wolzenski:* Part 1 of this article will provide background and some data regarding why there is a problem. Part 2 will provide additional data and discuss approaches to solutions.

## WHY THERE'S A PROBLEM

*Wolzenski:* Suppose it's time to start taking income. What's wrong with just using a lower crediting rate than the maximum permitted and feeling that a safety margin has been provided?

*McSwaney:* It's called the "incidence of returns" risk. Even if the *average* credited rate over the life of the income stream is as good as illustrated, the policy can lapse and produce a large taxable income if the *order of returns* is unfavorable.

*Wolzenski:* Here's an example for a hypothetical but representative IUL policy with a 0 percent floor and a cap of 12.5 percent. This would be a "Benchmark Index Account" defined by Actuarial Guideline 49 (AG49). The policy would have been for \$1 million issued to a male super preferred age 45, with income to age 100 starting at age 65 based on the maximum permitted level interest crediting rate permitted by AG49.

The chart in Table 1 shows the result of converting the 20 one-year returns of the S&P (without dividends) that occurred on May 15 from 1997 through 2016 to IUL crediting rates, then applying the crediting rates to an income illustration. By using each of the twenty crediting rates as the first crediting rate in the year after income begins, twenty different outcomes are produced (see Table 1). (Twenty different sequences of returns are produced by using the same order of returns, but with different starting points, and reusing crediting rates from the beginning of the time period as needed out to age 100.)

Table 1  
Policy Results Using the Same Twenty Crediting Rates in Different Order

|  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Male super preferred issue age 45</li> <li>• \$1 million face amount, increasing death benefit at age 65, then level</li> <li>• Pay \$45,000 annual premium for 20 years</li> </ul> | <ul style="list-style-type: none"> <li>• Indexed UL policy with 1 year S&amp;P, 0% floor, 12.5% cap</li> <li>• Cash value at age 65 = \$1,769,278</li> <li>• Annual income to age 100 with participating loans = \$167,438</li> <li>• Results if income is unchanged and insured lives to age 100</li> </ul> |
|--|--|

| Date      | S&P index value |            | S&P     | 0% floor  | Results if Date was 1st anniversary after income started |
|-----------|-----------------|------------|---------|-----------|--|
|           | on Date         | 1 yr prior | Return  | 12.5% cap |  |
| 5/15/1997 | 841.88          | 665.42     | 26.52%  | 12.50%    | Policy cash value at age 100 = \$4,225,559               |
| 5/15/1998 | 1108.73         | 841.88     | 31.70%  | 12.50%    | Policy lapses at insured's age 91                        |
| 5/15/1999 | 1339.49         | 1108.73    | 20.81%  | 12.50%    | Policy lapses at insured's age 89                        |
| 5/15/2000 | 1452.36         | 1339.49    | 8.43%   | 8.43%     | Policy lapses at insured's age 82                        |
| 5/15/2001 | 1249.44         | 1452.36    | -13.97% | 0.00%     | Policy lapses at insured's age 87                        |
| 5/15/2002 | 1091.07         | 1249.44    | -12.68% | 0.00%     | Policy lapses at insured's age 87                        |
| 5/15/2003 | 946.67          | 1091.07    | -13.23% | 0.00%     | Policy lapses at insured's age 92                        |
| 5/15/2004 | 1084.1          | 946.67     | 14.52%  | 12.50%    | Policy cash value at age 100 = \$8,322,389               |
| 5/15/2005 | 1165.69         | 1084.1     | 7.53%   | 7.53%     | Policy cash value at age 100 = \$8,307,119               |
| 5/15/2006 | 1294.5          | 1165.69    | 11.05%  | 11.05%    | Policy cash value at age 100 = \$8,526,005               |
| 5/15/2007 | 1501.19         | 1294.5     | 15.97%  | 12.50%    | Policy lapses at insured's age 88                        |
| 5/15/2008 | 1423.57         | 1501.19    | -5.17%  | 0.00%     | Policy lapses at insured's age 87                        |
| 5/15/2009 | 882.88          | 1423.57    | -37.98% | 0.00%     | Policy cash value at age 100 = \$2,725,440               |
| 5/15/2010 | 1136.94         | 882.88     | 28.78%  | 12.50%    | Policy cash value at age 100 = \$5,683,908               |
| 5/15/2011 | 1329.47         | 1136.94    | 16.93%  | 12.50%    | Policy cash value at age 100 = \$4,535,306               |
| 5/15/2012 | 1330.66         | 1329.47    | 0.09%   | 0.09%     | Policy cash value at age 100 = \$4,193,332               |
| 5/15/2013 | 1658.78         | 1330.66    | 24.66%  | 12.50%    | Policy cash value at age 100 = \$7,308,984               |
| 5/15/2014 | 1870.85         | 1658.78    | 12.78%  | 12.50%    | Policy cash value at age 100 = \$4,221,188               |
| 5/15/2015 | 2122.73         | 1870.85    | 13.46%  | 12.50%    | Policy lapses at insured's age 94                        |
| 5/15/2016 | 2066.66         | 2122.73    | -2.64%  | 0.00%     | Policy lapses at insured's age 92                        |

The same twenty returns, but in different order, produce very different results.

#### THE SITUATION WHEN IT'S TIME FOR INCOME TO START

*McSwaney:* Consider the position of someone who is about to begin distributions for income. The accumulated cash value may be more or less than originally illustrated, but that does not really matter. The question is how much income can one safely draw from the policy given the cash value there? It also does not matter if the policyholder wants to start income earlier or later than originally planned. Whenever that is, the starting point is an in-force illustration showing an income stream.

*Wolzenski:* The in-force illustration will show more than one possible income stream, and the most attractive will be that based on current assumptions with the maximum permitted crediting rate. Let's consider what happens if the policyholder takes that income stream every year, as we did in Table 1.

Indexed IUL crediting rates do not remain constant from year to year, despite what illustrations show. Actual crediting rates will vary between the floor, the cap and rates in between. That means that the compliant illustrations available to policyholders and agents, which limit crediting rates to the maximum permitted by AG49, cannot model crediting rates realistically.

Table 2  
Distribution of Persistency Results Using Returns for Two Time Periods

- Male super preferred issue age 45
- \$1 million face amount
- \$45,000 annual premium to age 65
- 12.5% cap 0% floor
- S&P index - one year point-to-point

|                               | Withdrawals to Basis + Fixed Loans |           | Participating Loans to Age 90+ Fixed Loans |           | Participating Loans to Age 100+ Fixed Loans |           |
|-------------------------------|------------------------------------|-----------|--|-----------|---|-----------|
| Cash Value at Age 65          | 1,769,278                          |           | 1,769,278                                  |           | 1,769,278                                   |           |
| Annual Income                 | 131,148                            |           | 158,095                                    |           | 167,438                                     |           |
| S&P return years              | 1997–2016                          | 2000–2016 | 1997–2016                                  | 2000–2016 | 1997–2016                                   | 2000–2016 |
| Average annual crediting rate | 7.58%                              | 6.76%     | 7.58%                                      | 6.76%     | 7.58%                                       | 6.76%     |
| vs. 7.15% rate                | 0.43%                              | -0.39%    | 0.43%                                      | -0.39%    | 0.43%                                       | -0.39%    |

|                  | Policy persistency (unmanaged) with monthly historical S&P returns |     |     |     |     |     |
|------------------|--|-----|-----|-----|-----|-----|
| Persist to A100  | 67%  | 20% | 72% | 17% | 45% | 9%  |
| Lapse by Age 100 | 33%  | 80% | 28% | 83% | 55% | 91% |
| Lapse by Age 90  | 9%   | 29% | 19% | 76% | 38% | 89% |
| Lapse by Age 85  | 2%   | 6%  | 3%  | 56% | 11% | 78% |
| Lapse by Age 80  | 0%   | 0%  | 0%  | 12% | 6%  | 36% |

**BETTER TOOLS ARE NEEDED**

To assess the income streams realistically requires calculations not in AG49 compliant illustrations. Spreadsheet models of actual or representative IUL policies are needed so that interest crediting rates can be tested outside the limits of AG 49. Then realistic patterns of interest crediting rates need to be available for testing.

To these ends, I built two IUL policy models, both with annual crediting based on the S&P index with Benchmark Index Accounts, that is, a 0 floor and a cap. One model was for products with a relatively high cap and had values representative of those of several such products. That is, it was not an actual product, but the model produced accumulated values and income streams that were typical of a group of actual products. The second model used a lower cap and corresponding charges and other features.

To create realistic crediting rate sequences, I chose to use actual monthly S&P index values over the past 20 years to create patterns of indexed interest crediting rates. By starting at different dates, and re-using all monthly index values in the time frame, over 200 sequences are created, each based in historical values.

*McSwaney:* You used two different time periods, 1997–2016 and 2000–2016. Why was that?

*Wolzenski:* In the years after a policyholder starts an income stream, the index returns could be either more or less than the historical average that AG49 uses to set the current maximum illustrated rate. The period 1997–2016 produced index returns that averaged higher than the recent AG49 period, whereas the period 2000–2016 produced index returns that averaged lower than the AG49 period.

**TEST RESULTS—A FIRST LOOK**

*McSwaney:* So we have a range of returns—both better and worse, on average, than those that produced the AG49 maximum.

*Wolzenski:* Yes. Let’s start with the results that jumped out as a major problem. What happens when the policyholder takes out the current assumption income stream on the higher cap policy model without ongoing adjustments in the annual income? The illustration was for a male super preferred age 45 who takes income at age 65, expecting it to last to age 100.

*McSwaney:* The results are shown in Table 2. They depend on the return period (1997–2016 or 2000–2016) and the method

of taking income—withdrawals to basis then fixed loans, participating loans to age 90 then fixed loans, or participating loans all the way to age 100. Par loans to age 100 produce the greatest illustrated income, and so the temptation for the agent is to illustrate that method. It is also the method with the greatest risk, as can be seen in the far right columns in Table 2.

If S&P returns from 2000–2016 are used to calculate crediting rates, 89 percent of the policies will not last to age 90, and 78 percent will lapse by age 85. You calculated life expectancy for this risk class and it falls in that range. With the more conservative approach of taking participating loans only to age 90, the lapses are still 56–76 percent by those ages. Even with the better than average returns from 1997–2016, substantial numbers would be expected to lapse by life expectancy without active management of the income stream. Using withdrawals to basis and fixed loans helps too, but does not eliminate the problem.

*Wolzenski:* Part 2 of this article will continue with more results and a description of approaches to managing the income stream.

Readers can reach me using the contact information below. I am happy to provide documentation regarding the research results in this article without charge upon request.

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