**UNC-Charlotte Case Study**

Fall 2016

Monday

Deb, who heads risk management for the Annuities division, calls you just before 8:30am on Monday morning. You’re surprised to hear from her. “Deb, I thought you would already be on vacation! Did your flight get cancelled?”

“No, everything’s set for my trip to Morocco, and we’re in the airport terminal already. I’m sorry to do this to you, but I need you to drop your other projects and develop a recommendation for me this week while I’m gone. Mark, the chief risk officer, sent an e-mail late Friday which I’ll forward to you after this call, but it was better if I gave you a call first to give some context.”

“Oh. What is this about?” It wasn’t so common for the enterprise risk area to ask a business line for a recommendation on a risk measure.

“It’s about our Medicare Annuity product,” Deb continued. “We haven’t talked much about it since it is such a simple, quiet product compared to most of what we sell. Basically, we offer this through a retirement advocacy group as a benefit for their members. The pitch is really simple…when you turn 65, you can convert retirement savings into a life-only fixed annuity at a 6% rate. The retirement group allocates quotas from each insurance company that participates based on their benefit quotes, and our allocation has been steady at $60 million for several years. The average deposit has also been steady at $100 thousand, so, on average, each participant receives $6000 on their 65th birthday and continues to receive $6000 on subsequent birthdays as long as they live. Making sense so far?”

“Yeah, good so far—I remember hearing about this product. It’s been a steady profit-maker, hasn’t it?”

“Yes, it has, but Mark is suddenly concerned about this product. Compared to many of our deferred annuities with surrender benefits, this product has a high degree of mortality risk. Our internal capital requirements do not include any factors for mortality risk for Annuities as a whole, but Mark feels he can longer defend the decision to not hold capital for mortality risk on just this product. Since this is focused on a single product, he thought it best for us to recommend what this capital factor would look like.”

“OK, so it sounds like I need to…”

“Oh, I’m sorry,” Deb interrupted, “but they just called us for boarding. I have to go if I’m going to forward Mark’s e-mail. Thank you for handling this, I know you can this. OK, bye!” And with that, the phone call was over. It would have been nice to review the approach with Deb and clarify some details with her, but ambiguous projects are nothing new.

Mark’s e-mail soon arrived:

To: Deb

From: Mark

Re: Medicare Annuity mortality capital factors

Deb,

Risk Committee concerned about mortality risk and reviewed capital factors. Annuities stuck out by not having factors…made case for deferred annuities but could not make the case for Medicare Annuity. I know it’s a small part of Annuities, but I need to develop and apply a mortality capital factor for this within a week to show progress on this matter. I know almost nothing about this product except that it is an immediate annuity—please recommend something by Friday. Like our other internal factors, it should be based on 1-year Value at Risk at 99%. Don’t fuss too much about exact mortality assumption—expected mortality won’t affect factor that much. And please, keep the factor really simple—I don’t want to spend a lot of time and resources implementing this.

I’ll be swamped by rating agency meetings next week, so I look forward to your response.

Thanks for doing this,

Mark

This was unlucky timing, indeed—both Mark and Deb unavailable and a potentially impactful capital factor to be developed from nothing. Or did it have to be from nothing? The Life division already has mortality capital factors, so maybe it would make sense to follow Life’s lead on this, rather than reinvent the wheel.

You seek out Walker in the Life Risk Management department and explain your predicament, including concerns on how to apply 1-year VaR at 99%. As usual, Walker is casual and comforting. “Don’t worry, it’s pretty straightforward. To get the VaR for today, figure out the 99th percentile of deaths for a single year and assume this happens. Then, calculate the reserves in this stress scenario and compare it to expected reserves one year from now. Whatever capital factor you produce should be reasonably similar to this number.”

“Don’t I need to discount the result one year from now back to today?” you ask.

“Sure, you can do that if you want, but it probably falls into the rounding error once you come up with the factor, which should be a nice round number. Don’t create specious precision, you know! Oh, I should probably tell you how the factor is applied. It is applied to the total expected death benefits. For you, that will be the same as your reserves, since you don’t have to worry about future deposits, lucky you. Those premium persistency assumptions are such a headache!”

“Yeah, glad not to have to worry about those, but I do have to worry about mortality assumptions. Now, Max’s e-mail says it doesn’t matter that much, which surprised me, but probably a good thing since I don’t have time to do a separate mortality study on this business. Does this sound right, just to use whatever?”

Walker paused for a moment. “I hadn’t thought about it that way, but he may be right. If your risk comes from how much deviance from expected you might get in one year of deaths, the amount of deviance may not differ that much whether your mortality rate is 10 or 11 per 1000 lives.” He paused again, biting his knuckle as he continued to think. “Yeah, that feels all right. Listen, I’ll tell you a rule of thumb that works for quick analysis. Assume 10 lives per thousand mortality at age 65, um, age last birthday in this case, and assume that the mortality rate by 10% each year, doing the whole converting to a survival rate and taking that to a power to avoid the mortality rate going over 100%.”

“OK, that certainly would make it easier, but is that realistic? I mean, how much a bad assumption throw off my answer here?”

“Well, do some sensitivities on the initial rate and slope, and I think you’ll find the 99% VaR doesn’t move around that much. Besides, what would it mean to have a good assumption? Even if you did a detailed mortality study on this product, you’d probably have a bunch of uncertainty left over and even that might not give you a full picture of how quickly mortality anti-selection would wear off.” Walker glances at the clock. “Oh, I’m late for a meeting—trust me, I’d rather talk about this then attend my next three hours of meetings, but so it goes. Thanks for dropping by!”

You go back to your desk and get to work, curious to test out what Walker was saying. A quick lookup of documentation on the intranet confirms that 3.00% is the appropriate discount rate for reserve calculations. The mortality assumption is straightforward to enter, and by the end of the afternoon, you have done the following:

1. Determine the initial reserve for a typical $100,000 policy based on expected mortality.
2. Determine the per policy reserve after one year.
3. Determine the 1-year VaR at 99% of change in reserve for a year of typical sales, 600 policies.

Tuesday

The next morning, Duncan, a colleague from Annuity Pricing, drops by holding his typical cup of coffee. He is chatty and is describing the latest abrupt change in plans. Then, perhaps just wanting to be nice (or not yet quite settle in for the day), he asks, “Say, anything new going on in your world?”

You decide to tell him about your own abrupt project and then almost immediately regret it. His shoulder bag slips off his shoulder, jolting his elbow and almost causing his coffee to splatter everywhere. He sits down and invites you to do the same. “Hmmm…I don’t know about this. Doesn’t Max have a choice about this? The Medicare product is something we haven’t had to price in a long time—nice steady product, always helps to support our overall profitability, especially in this interest rate environment.”

You grab your laptop and show him what you’ve done so far. “This doesn’t seem to me like that much compared to the reserves you have to hold already. Wouldn’t this be fairly meaningless for profitability?”

“No…no, it’s quite impactful. Anytime the capital changes just a bit, it can swing our profitability. Think of it like this...we use the deposits to set up reserves and capital after paying expenses. Usually the initial strain, reserves and capital together less the initial deposit, is a tiny fraction of the deposit. A small percentage change in total initial assets can be a big percentage change in initial strain, the amount of money our company has to put into each sale up front, and our profitability is based on the return on that investment, the money we put in.”

“I see. So, um, can you try this in your pricing models and see what the impact is?” You give him a sheepish grin.

“Not this week, sorry. My whole team is swamped with the latest product change proposal. Listen, this is a simple product, so you can estimate it pretty easily.” He sips his coffee and then grabs a piece of paper to start sketching out the mechanics. “Do a lifetime projection of lives and reserves per policy for each year until they all die out by age 121, then repeat the capital calculation you’ve shown me for each of those years. That gives the additional capital needed. Next, get the cost of this capital. Let’s see…” His handwriting gets sloppier as he continues to sketch and talk. “The difference between our profitability hurdle rate and the earned rate we can earn on assets backing capital is about 6% right now. So, each year, 6% of the projected capital is the cost of capital. Now discount this back to today at the same 3% rate you used for reserves.”

You’re suddenly glad for all his scribbling—there’s a lot to take in. He continues, “That will give you the present value of the cost of capital, which you should then convert to a per policy basis. Now, here’s where you can save me some time. Let’s assume that for this new capital factor to work, the increase in the present value of the cost of capital is balanced by a decrease in the initial per policy reserves. This product only has one lever, the 6% payout rate, so determine how much lower that would have to be so that the per policy reduction in reserves equals the increased in present value of cost of capital.” His final stroke with his pencil carries a certain flair. “Make sense?”

You stare at it for a while, then wonder aloud, “Wait…why couldn’t I just balance the additional initial strain with a reduction in reserves, rather than do all these gymnastics? Even if I did them, they could be hard to explain to some people.”

“Yeah, I know,” Duncan confides. “This calculation tripped me up the first couple of times I did it. The reason is that just taking into account the impact on initial strain assumes that future capital is proportional to future reserves, I think. If that’s the case, go ahead, make your life easier. But I feel like once you project this out, the capital is going to move differently than reserves.” He sips his coffee again and grimaces. “Ugh, coffee’s gone cold. Hey, I better get going. If you run into any issues, just drop by and see if you can find my door open today.”

Duncan leaves his notes and leaves. You were feeling pretty good about having the capital calculated at issue, but now you need to do it for every year in an annual projection. You pull up a spreadsheet and get cranking, building out the various annuity factors and per policy reserves and expected and 99% VaR changes in lives. By the end of the day, you have done the following:

1. Determine the per policy and total reserves at each year after issue using expected mortality.
2. Determine the additional capital needed each year to cover a 1-year 99th percentile deviation in mortality.
3. Calculate the present value of cost of capital as described by Duncan.
4. Determine the reduced annuity benefit to offset the present value of cost of capital.

Wednesday

You are sorting through e-mail the next morning when Anna, head of Product for Annuities, marches in. “What are you doing to us? Duncan was over and casually mentioned that some new capital requirement is going to lower the benefits we can offer on our Medicare Annuity. Do you realize how commoditized and competitive this particular product space is? When we created our three-year sales plan, we expected to keep our allocation and possibility grow it via bundling it with another product from our Voluntary Benefits division. I can understand having to change benefits if the market moves abruptly, but this seems like a self-inflicted wound. Our competitors surely won’t be cutting benefits at the same time, we’ll look silly, and our relationship with the retirement advocacy group will be badly hurt. The product bundling would probably go nowhere if we suddenly cut rates this year. How could you possibly think this is a good idea?”

For a while, you sit in half shock and gather your thoughts. Probability distributions and capital calculations are not the answer she wants, but you’re not sure at all how to satisfy her concerns while acknowledging that there is real risk involved. Finally, you offer, “Anna, I’m so glad you came by. This is a product I have not given much thought too before this week, and you bring up some important points. I’d like to take some time to think about this and get back you this afternoon.” You tell her all this earnestly, looking her straight in the eye.

“OK, that’s…OK,” Anna responds. “I’m free between 3 and 4 today, so come by then. Just know this…I would guess that for every 5 basis points you lower the benefit, our allocation is reduced by 20% of current levels. A 25 bps reduction would put us completely out of this market, OK?” She walks off, calmer than when she entered.

If only Deb were around! You grab your laptop and try to visit Duncan, but his door is closed and his schedule for the day is jam packed. You’re not sure you want to share your preliminary, sensitive figures by e-mail at this point. Maybe Walker from Life can help. You walk by and he looks open for an interruption. “Walker! What’s up?”

“Hey! Nothing much…how’s it going? Did that capital calculation work out?”

“Yeah, thanks for the help on that. I think I got it. Do you mind looking over my numbers?” The two of you sit down and you walk him through both the initial calculation and the estimated impact on benefits that Duncan outlined. He squints while decoding your spreadsheet formulas but can’t find any meaningful errors. You then tell him about Anna’s visit this morning and ask for some advice.

“So…I’m guessing that saying you said so is not going work?” he quips.

“Are you kidding? Probably not even if Deb said so. Maybe if Mark did, but I don’t really want that to be the reason, you know?”

Walker nods his head. “Yeah, I know exactly what you mean. If Product thinks that our risk decisions are arbitrary and capricious, this will happen every time. We want them to partner with us, not battle us every step of the way. We have to keep trying to explain the risk story, where it comes from and how it could possibly affect outcomes. But it’s hard, you know? Part of our professional duty is to admit where our calculations may be wrong, and even our conclusions are often a range of possibilities, with no one distinct future. It is a lot easier for management to take comfort in solid proclamations about sales than to take in nuances about risk, but there’s nothing more important than to tell this story.”

“Thanks, Walker. OK, I need to think this through and come up with something to say to Anna this afternoon, something to help her see my concerns as much as I see her concerns. But I need to also make sure she knows that I see and agree with her concerns.” You wander back to your office and close the door for a while to think. Soon enough, 3pm rolls around, and it is time to sit down with Anna.

1. Write out your response to Anna.

Thursday

You didn’t sleep so well the night before. Anna listened to everything you had to say, but you still feel conflicted about what to do. During the night you suddenly have a realization: increased capital lowers profitability 🡪 restoring profitability lowers benefits 🡪 lower benefits decrease sales 🡪 decreased sales increases capital! It’s a vicious cycle! You wonder how that last point had escaped you until last night. Short on sleep, you hope to have a quiet morning to think through this additional complication.

Your e-mail has a different plan. There’s a meeting invitation from Denise, the head of Annuities. You, Duncan, and Anna are invited. The subject line simply says “Medicare Annuity”.

Denise is going to want a full update—surely Anna mentioned something, but was it before or after you responded to her yesterday afternoon? Or did Duncan voice a concern? It doesn’t matter really. You check calendars and see that Duncan and Anna are both traveling this morning for a leadership in-person conference with Denise at company headquarters. Normally Deb would be there and could speak in person, but it looks like you get the opportunity to present this possible new capital factor.

It’s a half-hour meeting, and you see about having Mark there as well. He could help provide cover for the need to include this new factor, including the pressure he is getting from the Risk Committee. You contact his admin but his schedule cannot be reconfigured. You have to get back to him tomorrow anyhow, and it would be better to have a unified message from Annuities. Maybe this meeting with Denise is ultimately a good thing.

You think about Walker’s advice from the day before, finding that balance between professional duties and business needs. It feels like these things shouldn’t be working in opposite directions. Maybe it doesn’t have to. You only just realized now the vicious cycle this calculation creates…is there something else you have forgotten. You spend the whole morning looking over your spreadsheet and thinking. What to do?

After lunch, it is time for practical matters. Denise will better understand the whole situation if she has something in front of her she can see. You decide to put together a short slide deck, just 2 – 3 slides of content that will take no more than 10 minutes to present. In the deck, you:

1. Recap the situation for Denise.
2. Present a simple formula for mortality capital that you want to recommend to Mark.
3. Justify your recommendation using an appropriate amount of technical language and addressing all the concerns brought up this week.