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# HOW MODEL RISK *DEVASTATED* AN ORGANIZATION

To have a successful ERM program, companies must use a primary ERM model that is practical, transparent, flexible and realistic. A primary ERM model lacking these qualities can increase an organization's exposure to model risk ... sometimes to a devastating level. **BY SIM SEGAL**





Most large financial services organizations have some form of enterprise risk management (ERM) program. Having an ERM program gives their executives, boards of directors, and external stakeholders increased confidence in the organization's shock resistance. However, the way in which some of these ERM programs are designed and implemented can unwittingly weaken the organization. In this article, you will hear a story about a large insurance company that appeared to have a highly-sophisticated ERM program, yet, according to our source, harbored model risk whose exposure was so large that it caused massive destruction in shareholder value. The purpose of this article is to increase awareness of the dangers of model risk and to help prevent others from suffering a similar fate.

This article is divided into three sections:

- A. Four Characteristics Causing Model Risk
- B. Interview: Model Risk Case Study
- C. Concluding Remarks

### A. FOUR CHARACTERISTICS CAUSING MODEL RISK

Several years ago, I was having a discussion with someone—we'll call him George—about which is the better approach to ERM modeling. He believed that a Solvency-II-type<sup>1</sup> ERM model was the only one needed for an ERM program. Though I believed that many different types of models can play supporting roles, I advocated using a value-based<sup>2</sup> ERM model as the central focal point of an ERM program: the primary model most directly connected to decision making. A Solvency II ERM model infers a baseline company value by creating a market-value balance sheet, where liabilities are replaced by replicating asset portfolios that attempt to mimic liability cash flow behaviors. A

value-based ERM model directly calculates baseline company value by projecting, and then discounting, distributable cash flows consistent with the strategic plan. In each approach, risk is measured by the level of change in baseline company value. These are extreme simplifications of the two methodologies. However, rather than describe them in detail, we examine four characteristics that can generate model risk when using a Solvency II approach for a company's *primary* ERM model:

#### COMPLEXITY

A Solvency II approach requires a large number of mathematical inputs and has highly-complex calculations. This increases model risk, including errors in the model

1. Management invests all trust with, defers to, and over-relies upon, the few technical experts; or
2. Management refuses to base key decisions upon calculations they do not fully understand.

In contrast, a value-based approach is accessible to everyone. It is constructed of basic building blocks, such as deterministic risk scenarios and projected distributable cash flows. All of the elements are tangible and relatable, which contributes to the high level of buy-in it tends to generate with decision makers.

#### INPUTS

A Solvency II approach predominantly uses

CHARACTERISTIC	SOLVENCY II MODELING	VALUE-BASED MODELING
Complexity	Highly complex	Practical
Transparency	Understood by only a few	Understood by all
Inputs	External and formulaic	Internal and expert-based
Basis	Risk-neutral, market-consistent	Real-world

itself; errors in processes connected to the model;<sup>3</sup> misinterpretations of model results; and negative impacts on risk culture.

In contrast, a value-based approach has a manageable number of inputs and straightforward calculations. This lowers model risk, increasing model reliability. Reliability is one of the most important drivers of a model becoming trusted by management for decision making.

#### TRANSPARENCY

The Solvency II approach to modeling is typically only understood by a handful of technical personnel who must explain the outputs to management. This lack of transparency tends to produce one of two outcomes, neither of which is desirable:

an external and formulaic approach to quantifying risk. Risk information is largely inferred from examining market values and the company's balance sheet. This information is used to develop formulae that represent the risk distributions. The formulae are then used to generate stochastic (random) risk scenarios. This results in models that run on automatic pilot, where internal subject matter experts do not have much opportunity to provide their insights.

In contrast, a value-based approach uses an internal and expert-based approach to quantifying risk. Risk information is primarily obtained from internal subject matter experts. The subject matter experts have the opportunity to review and consider all available information, including market



information, stochastic model outputs, etc., and then choose the deterministic risk scenarios that they believe fairly represent the risk distribution. In addition, the risk scenarios can be updated dynamically when subject matter experts and management feel it is warranted.

Implicit in a Solvency II approach is a belief that the market knows more about the risks of a company than the company itself. A value-based approach has the opposite belief: that a company's own internal subject matter experts—those closest to the business—are in the best position to provide more accurate insights into the various risk scenarios that could occur and how each risk scenario would actually work its way through the organization.<sup>4</sup>

## BASIS

Solvency II models are based on an artificial construct: a risk-neutral, market-consistent view of the world. This is a construct—used purely to facilitate the mathematics of the calculations—in which some unrealistic assumptions must be made, such as:

- a) You cannot earn more than the risk-free rate.
- b) The market value of any business is equal to the market value of its individual component parts.

A value-based approach operates under the firm belief that since management has to live in the real world, so should ERM models, which are only useful to the extent they use realistic risk scenarios and project their realistic impacts on cash flows. The fact that assumption (a) above is unrealistic is self-evident. But I will share an example I use to illustrate the danger inherent in assumption (b). Imagine that I buy a new car for \$30,000, drive it off

the dealer's lot, and park it in my garage. In the real world, a reasonable valuation of the car on my personal balance sheet would be somewhat less than \$30,000, because it is now a used car. However, in a Solvency II world, the car is valued at \$90,000, because if you broke the car down into its component parts and sold them, it would bring about three times

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the car's value on the market.<sup>5</sup> And there's the problem: I'm not doing that with the car. I'm driving it. This is analogous to an insurance company operation. To value the

whole as the sum of what the individual pieces would bring in the market were the insurance company to sell them is unrealistic: They are not doing that with the pieces of their business. They are running the business as a going concern and using these assets in the process of producing distributable cash flows for owners, which is how they should be valued.

Let's return to my discussion with George. I recall that at the end of our discussion, he identified a large insurance company—we'll call it CastleCloud—as a poster child

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**THE JOINT RISK MANAGEMENT SECTION (JRMS)** of the Society of Actuaries (SOA), the Casualty Actuarial Society (CAS), and the Canadian Institute of Actuaries (CIA), in collaboration with the International Network of Actuaries in Risk Management ("IN-ARM"), will soon publish a fourth series of essays (13 total) that address "Incentive Compensation—the Critical Blind Spot in ERM Today." Congratulations to the authors of the top three papers. The papers will be available on the JRMS Web page in the coming weeks. Visit <http://www.soa.org/jrm-landing.aspx>.

- David Ingram (1st place, \$1,000)
- Towers Watson Essay (2nd place, \$500)
- Charles A. Bryan (Tied for 3rd place, \$200)
- Alfred O. Weller (Tied for 3rd place, \$200)

A webcast is being planned for the end of July. The prize-winning authors are invited to present their papers. Visit the SOA professional development calendar at <http://www.soa.org/PDCalendar.aspx> to check date and time.

for his approach. George had helped CastleCloud build what he claimed was one of the strongest ERM programs in the industry. Not long after our discussion, the financial crisis ensued. One might expect that if CastleCloud indeed had a superior ERM program, that it would have fared better, perhaps even far better, than its competitors, through the crisis. However, this was not the case. In fact, CastleCloud fared far worse than its peer group, suffering massive losses in shareholder value, layoffs of employees, and requiring a dramatic change in its strategy. I have always suspected that the weaknesses outlined earlier contributed to CastleCloud's losses.

It wasn't until a few months ago that I believe my suspicions were confirmed. I was having a discussion with someone—we'll call him Kirk—who was telling me a story about a company that in his view had suffered massive losses as a result of weaknesses in its ERM program. The company was CastleCloud. After hearing Kirk's story, I thought it would be helpful to share his views on how model risk contributed to CastleCloud's difficulties. What follows is an interview with Kirk, in which you will hear the cautionary tale, as well as echoes of the concerns outlined earlier.

## B. INTERVIEW: MODEL RISK CASE STUDY

**Sim:** Let's start with a high-level overview. Can you summarize what actually happened at CastleCloud?

**Kirk:** It began with sudden growth. This should always be a warning sign. If a business grows dramatically out of nowhere,

the red lights and the sirens need to be going off. I can't think of a single case where a company exploded onto the scene from nowhere, grew massively, and did not end up blowing up. As a risk manager or a regulator, when you see unusual growth, that's a huge warning signal. Internally, the thinking often is, "We've figured stuff out that nobody else has ever figured out. We're smarter." Maybe you are; maybe you aren't. At CastleCloud, there was incredible revenue growth across a number of business units. Yet I don't recall that anyone ever stopped to ask, "Why are we one of the sales leaders in these businesses? Are we better/smarter or are we mispricing or are we just taking on large amounts of risk?"

The financial crisis hit and many of CastleCloud's key businesses went wrong at the same time. In my view, the businesses were more interconnected than the models reflected. It was of course no surprise that the variable annuity (VA) business suffered in that economic environment. But the crisis also exposed the fact that the asset side of the balance sheet was also loaded with risk. And then as things deteriorated on the balance sheet, rating agencies, salespeople and customers began to be concerned, and their actions increased the pressure on the company. The result was a liquidity and capital crunch at CastleCloud.

As I see it, the company had to pull back on growth in general, due to the strain on capital. Some businesses were virtually shut down. This strained distribution relationships and resulted in layoffs, which further impeded the ability to grow. It was a vicious cycle, a potential death spiral. A massive amount of energy was appropriately spent trying to stabilize the situation, but this distraction

further inhibited growth. Shareholder value quickly plummeted at that point.

**Sim:** How do you think the ERM modeling approach played a part in CastleCloud's losses?

**Kirk:** In my opinion, CastleCloud had an economic capital (EC) model that was magnificently complex. I think it was this complexity that resulted in it being largely ignored by management at a front-line decision-making level. In my view, management was unable to connect the model results to what was going on in the day-to-day running of the business. I do not believe that the model produced either the statutory or GAAP numbers management was used to relying upon, and as a result, it wasn't actionable information.

I also think that the information just didn't make much sense a lot of the time. One business unit would get emails periodically from corporate saying that due to something happening in an unrelated business unit, changes to the model covariance factors needed to be made. This changed the model results, but I think that the business unit did not have a good understanding of what was driving the change and couldn't do much about it. In order for this information to be actionable, I think there should be communication with the business unit to properly evaluate whether, and to what extent, key ERM model inputs should change; but I don't know if such communication ever took place.

**Sim:** It sounds to me like they weren't including internal subject matter experts in the determination of key inputs into the model.



**Kirk:** I think that's correct. In my view, the ERM modeling team believed they had the perfect risk management model, and so felt no need to get input from people, no need to improve these models, no need to improve the process, because it was all so wonderful. I feel that the opinions of internal risk personnel with decades of experience were routinely ignored. It seemed to me that the ERM modeling team trusted in their model as an all-knowing oracle, didn't listen to management instincts about the business, or sometimes even their own instincts, and missed some obvious leading indicators of trouble.

It was not just the model itself, but also what I feel was the rigid structure and poor risk culture that surrounded it. As I saw it, there was an inflexible structure ... all these rules in place to manage the risk: "You need to follow the rules." It felt to me like rules-based risk management, where basically they created a bureaucracy that effectively insulated them from actually having to, and even allowing people to, stop and think, "Gee, are we missing something here?" And so I think they applied rules and structures to every business whether it applied to that business logically or not.

**Sim:** A key weakness of Solvency II is its belief that a balance sheet can tell you what your risks are. I believe that risks cannot be properly understood without projecting their impact on future cash flows, which is particularly true for very long-term businesses like insurance. Do you agree?

**Kirk:** Yes, and I saw this as part of the problem at CastleCloud. Market-consistent

approaches originated in the banking sector, where, even though they don't work particularly well there either—as the financial crisis has shown—they're even more inappropriate for insurance companies to use as a primary approach, because the liabilities are much longer in duration. And I think CastleCloud was influenced by the banking perspective when they developed their ERM modeling approach. But when bankers look at an insurance company, they see all the risks as an asset-based or investment risk. They think that the way you should manage risk is to use models. I'm not anti-model. Models are extremely

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important, but they are just a tool for management; models just don't manage risk on autopilot.

As an example, the VA business, which contributed mightily to the pain in the insurance sector, is a very long-term liability that is very difficult to understand. Bankers come in and say, "We know how to price derivatives and options," but they are talking about instruments with duration of one or two years at most and have no policyholder behavior risk element to them at all. And so being able to say what VA risk is, it is hubris to think you know what that number is at any point in time, particularly in the tail. That's where I think one of the biggest issues is: tail

risk. The notion of insurance companies, "if you hold enough capital, then you are safe" doesn't work for public companies, because shareholders won't let you hold enough capital for this. If there had been a double dip in 2008 to 2009, I think you would have seen some insurers fail. The worst thing you can do is to create a very rigid hard-and-fast structure around risk management, because the nature of the risks you're facing is going to evolve over time.

I think the model was also unrealistic. They used a market-consistent approach where everything is marked to market. But that's not the world we live in and not how things

work. So, one of the huge things that I think the model misses is that we live in a statutory and GAAP accounting world, and from a risk standpoint, statutory capital is the minimum needed to stay in business and that is not a mark-to-market world. In my view, there were many examples at CastleCloud—which include some of what were huge-growth businesses—where the market-consistent model results look fine, when in reality your statutory capital is imploding. A number of companies have figured that out now, some the hard way.

Market-consistent models have their uses. I'm not totally against them. But when used as the primary approach to ERM modeling, without proper focus on real-world things such as cash flows, GAAP earnings, etc.,

they can be disastrous. For most insurance businesses, if you mark to market, you get a very different view of the risk than if you look at it on a statutory or GAAP basis, due to their complexity ... insurance is far more complex than banking. For example, let's mark our fixed annuity business to market, both assets and liabilities. How do you do that? Too often we think the answer is easy: Apply a stochastic pricing model and run it through the market-consistent risk-neutral scenarios and get a market value for the liability. But is that the risk? I don't know. Because the market-consistent idea is that supposedly it represents the value for which a willing buyer and seller will exchange it. But, interestingly, such an exchange never occurs, so how realistic is it? The danger here is ignoring real-world perspectives while enshrining a market-consistent approach as being the absolute truth.

A good friend of mine, an actuary who worked on Wall Street for quite a while, commented to me that risk-neutral or market-consistent approaches can work when you are interpolating between two known observable market values. But the problem is that it is a terrible extrapolation formula. This is a really good insight. For example, what is the market-consistent price for an option that matures 30 years from now? I don't know. Nobody knows. Companies today that are marking their VA business to market and have their market-consistent value ... do you think any of them can or would sell it for that price? Do you think there would be any buyers at that price? So how is that market-consistent? It's not. It's fantasy.

**Sim:** It's informative that advocates of a market-consistent approach favor "risk-neutral" assumptions over "real-world" assumptions,

yet it is precisely because the modeling is not based in real-world terms that it can be misleading, even directionally incorrect.

**Kirk:** Exactly. In general, models that are not well thought out in the context of the real risks to the business and how they play out in the real world end up ignored when it comes to making business decisions.

**Sim:** Integrating ERM into decision making is one of my 10 key ERM criteria that define a robust ERM approach. But it sounds to me like ERM was not integrated into decision making at CastleCloud?

**Kirk:** I don't believe that it was. In my view, much of the time, the information provided by risk management staff was ignored. So when risk management staff would say, "Gee, maybe you shouldn't be doing this to your product," I felt that the reaction of the business leaders was something to the effect, "Well, we have these growth targets and everybody else is doing it and we don't understand your models anyway, so we are just going to ignore what your models say." There's always a tension between risk and growth. You have to take some risks to grow and thrive as a business. But when the tension becomes us vs. them rather than a collective business decision ... when you disconnect those things, I believe it becomes a huge problem because you end up with a winner and a loser instead of a company that's run in a cohesive way.

To senior management or someone from the outside, it might have looked like CastleCloud had a lot going on in ERM. They had sophisticated, super-complex risk models with all the latest bells and whistles and they had all these risk governance

structures with a high level of bureaucracy and numerous signoffs. But in my opinion, there were too many perfunctory and meaningless activities and not enough thoughtful consideration and discussion, which led to some really bad decisions. If you talked to the heads of the businesses, I believe that they would tell you they had almost no interest in ERM. I think they didn't understand it and didn't pay attention to it, so, effectively, in my opinion, they didn't have ERM.

**Sim:** In closing, do you have any parting advice about model risk?

**Kirk:** The insurance business has grown extremely complex over the years. It is very unlikely that it will become less complex. The complexity has led to some models with ever-increasing complexity. These models can be useful tools. But a more complex model does not a better tool necessarily make, because they will always fail to fully capture all of the complexity of the real world. In order to really manage risk, there needs to be an integration of modeling with expert analysis and decision making. And this all needs to be fully built into a company's culture.

**Sim:** Thank you for taking the time to share this. I think it should be very helpful to many in our industry.

**Kirk:** My pleasure.

### C. CONCLUDING REMARKS

As this case study illustrates, the approach to ERM modeling matters. Many different types of models can play useful and supporting roles in an ERM program. However, to be successful, companies

should use as their primary ERM model—the one most directly connected to decision making—one that is:

- Practical enough to keep complexity manageable and to maintain reliability
- Transparent enough to gain buy-in from decision makers
- Flexible enough to incorporate input from internal experts to properly reflect the risks
- Realistic enough to represent the real-world impacts of the risks.

A primary ERM model lacking these qualities can increase an organization's exposure to model risk ... sometimes to a devastating level. **A**

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#### END NOTES

- <sup>1</sup> The approach referred to herein is a risk-neutral market-consistent Solvency II approach used at that time; Solvency II has since evolved somewhat in response to industry pushback.
- <sup>2</sup> The value-based ERM approach was developed by the author and is further described in his book *Corporate Value of Enterprise Risk Management: The Next Step in Business Management* (published by Wiley in 2011).
- <sup>3</sup> A common example is "update fatigue" where the large number of inputs required to update a model results in a poorer quality of updates over time, as individuals making the updates become less careful.
- <sup>4</sup> These comments relate to the appropriateness of internal company ERM models and are not to

be mistaken for commentary on external factor-based ERM models, such as those used by rating agencies or regulators.

- <sup>5</sup> <http://www.gminsidenews.com/forums/f19/parts-worth-more-than-car-48624/>

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