Episode 4: The Equity Model

In episode 4 of the Everything GOES podcast, Daniel Finn and Dr. Andrea Barresi discuss the GOES equity model and how it differentiates from the AIRG equity model.

SEGMENT 1—OPENING

[Joe Golaszewski] Hi, and welcome back to the Everything GOES podcast, where we discuss the NAIC's upcoming transition from the Academy Interest Rate Generator scenarios to the new GOES scenarios. I'm your host, Joe Golaszewski. In this episode, we'll examine the equity model. I'm joined once again by Daniel Finn and Dr. Andrea Barresi. Dan is a Managing Director at Conning, where he is head of the group responsible for generating these new scenarios. Andrea is also a Managing Director at Conning, and he heads our Quantitative Finance team. This team develops and maintains all of the GEMS models, which includes the continuous-time stochastic models, derivative pricing algorithms, calibration, and software development.

SEGMENT 2—EQUITY MODEL BASICS (0:50)

[JG] Andrea, can you please describe the GOES equity model for us?

[Andrea Barresi] Sure. Let me start by giving an overview of the GEMS equity model, and then we'll talk about some things that are unique to GOES. Our equity model is an affine stochastic volatility model with a jump process, and it is based on a paper of Bates. [It] can produce all the stylized facts that we observe in the market, like fat tails in the return distribution, rare but severe drawdowns, periods of high and low volatility which tend to cluster, more extreme events of larger magnitude during periods of high volatility, and a high frequency of high extreme-negative returns with respect to positive returns. Moreover, the model can produce a rich instantaneous correlation structure between price returns, volatility, and dividend yields, which allows for realistic interactions among multiple stock indices within and across economies.

This model allows also accurate semi-closed-option pricing formulas and well-defined estimation and calibration parameters. The nominal short rate is part of the drift term of the equity return. It gives a realistic distribution, and we can use the same model in risk neutral and real world modes. Moreover, we have linked the model to a global jump process to enhance the tail correlation with other asset classes.

[JG] I understand from the GOES valuation perspective, this created some challenges. The NAIC ultimately asked us to disconnect the equity movements from the Treasury movements. Dan, what was the reason for that decision?

[Dan Finn] Yeah, so, this is a discussion that's been going on since the first field test. What we found as part of that when we started testing different start dates—if you remember back four years ago when we were doing the test—we started seeing that there was a large swing in equity returns. So, under the normal GEMS calibration, when interest rates are low like they were in 2020, they revert relatively quickly, and the link to equity causes a small disruption in equity returns, but if you look out over the 30-year periods that we're typically looking at, there's not a huge difference. You might be looking at a 1 or 2% difference in cumulative returns starting at that low a level. But when we combine the very slow mean reversion needed to get the "low for long," which we talked about in the last episode for Treasury, with that link directly to equity returns, you started seeing much bigger gaps. When we started comparing a normative environment to, say, the 2020 where rates were essentially at 0, you started seeing cumulative differences of 15 or 20%. And there was a concern that if you had that large of a swing due to interest rate movements, you'd start seeing much bigger corresponding movements in the reserves, and so companies are very worried that while this might make sense in certain situations, if you started getting to the extremes, you might see very large swings in the reserves. And so the decision was ultimately to remove that direct link and switch it to a correlation. That'll still create a link between the returns and equity and Treasury, but it won't move the average, and thus we won't have as big a swing in the total return distributions that you would see with the standard link in the equity model that Andrea just described.

[AB] And in the software we have added the possibility to decide whether one wants the contribution of the short rate in the drift term or not. So, if, like in this case for the GOES scenarios, the user does not want the contribution of the nominal part in the drift, then there is a switch that can be set to 0 for the short rate and then the contribution of the nominal treasury will disappear.

[DF] Yeah. One final note about this is: all of this that we're describing is just for the four native indices. So, we're talking about the large cap, the mid cap, the small cap and the aggressive U.S. equity class. The two foreign investments—international diversified equity and aggressive foreign equity—they use a slightly different approach, and we'll discuss this later in this episode.

[JG] Just to clarify, what does that mean for insurers who currently license the GEMS Economic Scenario Generator software?

[AB] So, the default settings in the GEMS Expert View template will be such that the models will work as they always have worked.

[DF] Yeah, and those clients who want to use our software to run the GOES scenarios, they'll be able to leverage this new functionality that we're putting into the GOES templates, or they can work with us to ensure that their equity parameters for all of these indices are correctly set in order to replicate the valuation scenarios. And we should also mention that one of the things that Andrea and his team have worked on very hard is ensuring that everyone who runs it with the same parameters will get the exact same scenarios on a scenario-by-scenario basis, the same way you get with the AIRG. That's a key component that the NAIC wants to ensure consistency across different companies.

SEGMENT 2—KEY DIFFERENCES (6:32)

[JG] OK, so that gives us a nice basis for understanding the GOES model. What are some of the key differences between this and the AIRG model?

[DF] So one of the key reasons we did this, delinking the Treasury from the equity, was to move it closer to the AIRG. So, we felt that, in the AIRG, they're independent of one another—there's no direct link between the two—and so by making this shift and delinking the equity model from the Treasury, we're able to move it closer. But there's still some major differences. As Andrea mentioned, the jump process is one of the key components of the GOES scenarios that's not present in the AIRG. So, if you look at very short runs, you're capable of generating a Black Monday-type movement where the market can drop 15, 20% in a single month. The AIRG, because it doesn't have that—it does have stochastic volatility but doesn't have that same component—won't allow you to generate that kind of movement with the sort of frequency that GEMS does.

The other couple of components that you'll see, the AIRG is purely a real-world model, so if companies want to evaluate any of their hedging, they have to make their own assumptions, they have to do their own calculations. The GOES model will have the ability, for those companies who license the software, to directly do the calculations for derivatives, so you actually have a link between what's happening in the real world scenarios and the risk neutral.

And lastly, because we've got multiple drivers between the different equity models, as Andrea was mentioning, we've got a lot more ability to create correlation and control the relationship across the entire distribution. This is something we talked about in our second white paper on the transition here, where having the ability to correlate the jumps differently than the core distribution allows us to create more correlation in the tails than you would with the sort of AIRG normal copula-type approach. And that's particularly important for this application because we're doing reserves and capital calculation, both of which are heavily dependent on the tails of the distributions.

[JG] OK. Can you give us some idea of how these differences will impact companies' results?

[DF] So, the difference is sort of … depends on the the nature of your business. So, one of the things we have seen in this process is trying to make sure that there aren't wild unexplained swings when we move away from the AIRG. So, we've calibrated to similar targets for all of the equities, they have similar relationships, but you will still see some differences. In particular, the ability to have derivatives directly priced in is likely to create some big differences for companies that actively hedge their business versus those that don't. We're also likely to see companies potentially have more variability throughout their simulation. So, if they start thinking about projecting things forward or something like VM22, because the model has more drivers and has more variability in a lot of senses, you may start seeing more variability than you would with the AIRG. But, over all … unlike [what] we see in the Treasury model, we think the equity differences, to some extent by design, are likely to be more muted. There will be some, there will be, you know, some that have pretty big differences, but, by and large, compared to the movements we're seeing in the Treasury, likely much more muted for companies on their on their valuation results.

[JG] And how stable will the results be from one run to the next?

[AB] So, from month to month, we will update only the equity price and dividend yield to the market data. Since the nominal short rate is not directly included in the equity model like we have instead in the GEMS equity model, we will serve, for the GOES model, very small variability in the equity returns.

[DF] Yeah. And as a result, we're expecting to see fairly stable month-to-month results for the direct reserve and capital calculation. Again, you may see some differences with respect to hedging, but most of those will be in line with the differences you're seeing in the AIRG, and the field test really bore that out. A lot of the work that Oliver Wyman did on their results showed pretty similar differences with these scenarios as opposed to having the the bigger links between Treasury and equity.

SEGMENT 3—FOREIGN EQUITIES (11:41)

[JG] OK, Thanks. Dan, you mentioned this model only applies to the domestic equities. Can you give us some information about how the foreign equities are going to be modeled?

[DF] Sure. So, one of the reasons we decided to split the two into the four domestic and the two internationals, there's obviously some differences, but there was also some constraints within the GOES framework, where we only had five slots. We're using four of those for the domestic—for the model that Andrea was talking about with the jumps and the correlations—so, it would have been a pretty dramatic rebuild for us to to extend that to the full six. Instead, what we're going to do is we're going to treat those similar to what we do for some of the other classes on the bond side where we build in combinations of existing asset classes. So for instance, the international diversified equity is going to have a beta to the S&P 500 plus a residual. That's going to allow us to ensure that the returns make sense—they're correlated, they've got a similar nature of the distribution, and that if you put it into a portfolio, it'll still have a reasonable range. And then with the aggressive foreign equity, we've taken that and leveraged it again, so it's going to have a key link to the S&P 500 as well—again, to make sure it fits into the overall structure—but it's also going to try and capture some of those international differences that we see by having a link to the international equity. So we did, in that case, a two-part regression, one against the S&P and one against the international diversified equity that we created and then still has a residual, and by creating these building blocks, which is pretty similar to how we would do it with the Cholesky factorization that's used in the AIRG. It allows us to maintain this relationship so that when we start putting portfolios together, they make sense. And that's one of the things that's documented on our our website. If you want to go out, you can see a presentation specific to how we're building those out and ensuring for instance that the risk and reward for those new asset classes align with the other equity asset classes in the in the new model.

SEGMENT 4—CLOSING (14:05)

[JG] OK, thanks. Well, that's a lot of information. If our listeners want to learn even a little bit more, where can they go?

[AB] The best thing to do is go to the public NAIC Scenario Files website and download the equity model documentation. The website is naic.conning.com/scenariofiles, the documentation is in the first folder near the top of the page, and the document you are looking for is named "NAIC GOES Technical Documentation – Equity and Dividend Model."

[DF] Yeah, and we should point out that this is the first document that we've updated for the final GOES, so it's not a draft, this is the actual documentation. But after reading that, if listeners have specific questions, they can send those to us at naicscenarios@conning.com.

[JG] Thanks, Dan, and thanks to you both for talking about the equity model with us today. I think we've given our listeners a lot of information to absorb. In the next episode of Everything GOES, we're going to have another model deep dive, and this time it'll be on the corporate model. Until then, thanks for listening, and keep on modeling!

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