

May 17, 2022

Mr. Mike Boerner  
Chair, Life Actuarial (A) Task Force (LATF)  
Mr. Philip Barlow  
Chair, NAIC Life Risk-Based Capital (E) Working Group (Life RBC)  
National Association of Insurance Commissioners

Re: Economic Scenario Generators

Dear Mr. Mike Boerner and Mr. Philip Barlow,

Please accept this comment on the NAIC LATF Economic Scenario Generator field tests.

Sincerely yours,

Mark S. Tenney

Mr. William Carmello said the original parameterization of the vendor, Conning, should be part of at least the first field test. This was in the context of equities, but can apply to interest rates as well. I support this recommendation. The original set before any contact with the NAIC has value. The set or sets that were then revised based on interaction with LATF but before the shadow rate models are also of value.

Although heavily criticized, these scenarios are important to understand. Steeper negative interest rate scenarios and much lower equity return scenarios where the wealth ratios are substantially below one are important to study and include in risk management from a regulator point of view.

<https://voxeu.org/article/negative-interest-rate-policy-post-covid-19-world>

<https://voxeu.org/article/swedish-experience-negative-central-bank-rates#:~:text=The%20Swedish%20Riksbank%20was%20the,lowered%20it%20to%20%2Do.10%25.>

These scenarios can be used to make arrangements with banking and securities regulators so that insurance companies are able to borrow at negative interest rates if those occur. Even if rates are negative and an insurance company owns a bank, it is not automatic it can borrow at negative interest rates from the Federal Reserve. This is because of tiering.

The Narrow Bank applied for receiving interest on excess reserves but was turned down by the banking regulators. This was an application of tiering in the US already. Tiering is used already in negative interest rate countries. Some bank reserves are charged a negative rate but not all. Alternatively, some can borrow at negative rates but not all. Or they can borrow at a negative rate but not as negative a rate as others. Paul Kupiec of AEI has criticized the banking regulators for playing favorites and not having an equal access to tiering rates from the Federal Reserve.

A bad tier day for insurance companies could mean bank regulators saying no to borrowing at negative rates through banks they own or through other banks. Bank regulators and the SEC could also interpret existing to rules to make it hard or harder for insurance companies to use corporate bonds as collateral for negative interest rate loans from banks or in the repo market.

The NAIC ESG scenarios with negative rates and low equity returns can be used now to head off such bad regulatory rulings. They can be used now to get some favorable regulatory action in advance from banking regulators and possibly the SEC for insurance companies if negative rates happen. There is extensive interest in negative interest rate among economists and central banks. This includes developing mechanisms to prevent arbitrage by hoarding paper currency. They are going fast to get somewhere on this.

The equity premium puzzle is the name given to equity return premiums being too high for conventional economic theory to support. One possibility discussed widely is that equity premiums will drop to what traditional economic theory says they should be. In this case, downward scenarios can involve very substantial losses.

One formula for the equity risk premium based on standard economic theory is illustrated numerically. See Theory of Financial Decision Making, Jonathan Ingersoll. See formula 22 page 275 and formula 25 page 276.

Assume gamma is  $1/2$ , a measure of risk aversion. Assume the ratio of risky wealth is  $1/2$ . Assume a stock market annual log volatility of  $.2$ . In that case, the equity risk premium is  $1/2 * 1/2 * .2 * .2 = .01$ . A more typical annual volatility is  $.15$  or  $.16$ . This would result in a lower value.

What do we add the  $.01$  to? The inflation rate target plus  $r$ -star. The inflation target in the US has been 2

percent, but experience prior to the current episode is 1 percent. R-star is now considered to be likely negative, say -1 percent. If we take the 1 percent inflation and add minus one for rstar, we get a nominal short rate target of 0. Adding the equity risk premium of .01, gives us an expected nominal equity return of .01 i.e. 1 percent per year.

Using an annual standard deviation of .2, then over 25 years, we get a standard deviation of square root of 25 times .2 or 5 times .2. So 1. The mean over 25 years is .25. Two standard deviations down would be  $.25 - 2 = -1.75$ . This would be .17 or a wealth ratio of 17 percent of the starting value. This is including reinvesting dividends.

If we used .15 for the standard deviation, then over 25 years we still get .75 for the standard deviation. Suppose for that period we used an equity expected return of 4 percent per year. Then we get  $25 * .04$  or 1.0. If we now have 3 standard deviations down, we get  $.04 * 25 - 3 * .75$ . Taking the exponential of that we get .28. This is the wealth ratio including reinvested dividends.

<https://www.credit-suisse.com/about-us-news/en/articles/media-releases/credit-suisse-global-investment-returns-yearbook-2022-202202.html#:~:text=Over%20the%20last%2012%20years,bonds%20by%203.2%25%20per%20year.>

Projecting the US to continue to have its high realized equity returns is to take one of the best periods of the best countries and extend it into the future. The 21st century is unlikely to be as favorable to the US relative to the rest of the world as the 20th century was. So to continue to project the US in the 20th century as normal is not something a prudent regulator should do.

Credit Suisse is using a 3.5 percent equity risk premium. So .035 annually. If the nominal target is zero, then the .035 is the total equity expected return. Prudent regulators should be looking at a number close to this. If the inflation target was 2 percent and rstar was minus one, this would give a total return of .045 expected. Regulators should consider the real possibility that equity risk premiums move substantially in the direction of traditional economic theory, i.e. become substantially lower.

6 percent nominal expected return for equities from some reasonable perspectives could be the upper bound for regulators to count on for long horizons. The nominal target for the short term interest rate should have an upper bound of 2 percent is also sensible. Zero as the short term nominal target is a reasonable value. That would then give an equity expected return of no more than 4 percent. That includes dividends. The total expected equity return could be as low as one percent. This is using a low equity risk premium based on standard utility functions and a zero percent nominal target yield. Although this number seems ridiculous to some, it does have a basis in economic theory.

<https://www.nbim.no/contentassets/2b92009ffa9440f98eec8f32a0996ca2/discussion-note-1-16---equity-risk-premium.pdf>

" The average World Equity Risk Premium (ERP) based on data from 1970 to 2015 is 6.4 percent. Adjusting the average for repricing over the period lowers the average to 3.9 percent. "

" The expected World ERP from the discount models may be closer to 4 percent if expectations of interest rate normalisation are taken into account. "

" Estimates from cross-sectional and time-series models also suggest an expected World ERP of 3 to 4 percent. "

<https://www.cfainstitute.org/-/media/documents/book/ef-lit-review/2017/rflrv12n11.pdf> <https://blogs.cfainstitute.org/investor/2022/04/08/equity-risk-premium-forum-dont-bet-against-a-bubble/>

<https://ourworldindata.org/grapher/world-gdp-over-the-last-two-millennia?yScale=log>

A 10 percent annual growth rate for 100 years gives a log return of  $.1 * 100 = 10$ . The exponential of this is 22026. We can check this number and make it more intuitive with the rule of 72. In 7 years at 10 percent, money doubles. So in 100 years there are  $7 * 14 = 98$  years, so 14 doublings. The doublings go 2, 4, 8, 16, 32 for the first 5. 32 squared is around 1000. That leaves 4 more doublings, 16 so we get to 16,000 which is roughly the 22,026.

Higher returns need large consumption out of wealth to justify them. Particularly with environmental exhaustion showing up everywhere.

<https://inequality.org/great-divide/updates-billionaire-pandemic/>

<https://fortune.com/2021/12/07/worlds-richest-inequality-richer-during-pandemic/#:~:text=World's%20richest%20people%20now%20own%2011%25%20of%20global%20wealth%2C%20marking,biggest%20leap%20in%20recent%20history&text=Subscribe%20to%20Fortune%20Daily%20to,during%20the%20COVID%2D19%20crisis.>

<https://wir2022.wid.world/>

[https://wir2022.wid.world/www-site/uploads/2022/03/0098-21\\_WIL\\_RIM\\_RAPPORT\\_A4.pdf](https://wir2022.wid.world/www-site/uploads/2022/03/0098-21_WIL_RIM_RAPPORT_A4.pdf)

(Watch out a4 at that link won't print well on US sized paper.)

If a single billionaire leaves his money in the market and avoids taxes, then in 100 years it is worth 22 trillion dollars. Billionaire wealth of 1 trillion that accumulated at 10 percent for 100 years would then reach 22000 times 1 trillion or 22 quadrillion.

The last 100 years or 500 years is not the normal growth pattern for humans or for the environment. It isn't possible to sustain such growth. At some point, the laws of physics, chemistry, and biology rule out such growth.

A corporation doesn't have to pay death taxes and is not required to pay out any dividends. So a C corp that invests in stocks on buy and hold can earn at least 2/3 of the equity return and more likely close to it. So 1 billion in a C corp that just invests would grow at close to these ratios. A total of 1 trillion in corporations growing on such terms would then explode to enormous levels. Levels impossible to achieve in practice. Ten percent annual return on the wealth of the wealthiest people or corporations is not sustainable.

Monarchs of countries like Saudi Arabia don't have to pay inheritance tax presumably. There are rich people around the world who don't have to pay inheritance tax in their country. So if they put away some billions in the US stock market just grow it accumulates to absurd levels.

<https://taxsummaries.pwc.com/saudi-arabia/individual/other-taxes#:~:text=There%20are%20no%20inheritance%2C%20estate,gift%20taxes%20in%20Saudi%20Arabia.>

"There are no inheritance, estate, or gift taxes in Saudi Arabia."

So a single billionaire in Saudi Arabia who puts a billion in the US market to accumulate at 10 percent, would see his money worth 20 trillion dollars or so in a century. Presumably, they would pay some US dividend tax.

<https://fiscaldata.treasury.gov/datasets/debt-to-the-penny/debt-to-the-penny>

Debt of the US government currently held by the public is about 24 trillion. So in a century, a single Saudi billionaire would have that much money in the US stock market.

The World Bank has figures on the growth rate of US GDP per capita in real terms.

<https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?locations=US>

This fluctuates and is currently negative. But even at 1 percent per year it is far below a 10 percent stock market return. With inflation averaging 1 percent before the recent spike these numbers would suggest a divergence of GDP per capita and stock market value from a century of 10 percent stock market growth. Currently, total factor productivity in the US has a zero growth rate.

If we look at the last 2000 years or 10,000 years, human societies that build up huge wealth then collapse. So the growth of the last 100 years might imply that negative returns are more likely. The higher the unsustainable peak, the greater the probability of negative returns from that high peak. It may be that this negative scenario is already showing up in interest rates. These may be a better canary in the coal mine than are equity returns.

If the US stock market is doing well because it is a refuge for investors in a world that is doing badly, then how far can that go? The American Economics Association had a panel of several former chief economists of the World Bank a few years ago. They painted a stark picture of crisis for the developing world. If the US is a giant Switzerland for a world swimming in a sea of problems, then how long can that giant Switzerland's stock market keep going up at 10 percent a year?

If humans are at a bubble stage of growth, it is plausible that short term relatively safer country government interest rates would turn negative first. If we think of the bubble as worst in the developing world and spreading, then negative short term government rates in the safest countries turning negative first is a plausible early stage of the bubble bursting. In a rising storm at sea, the last boat still afloat might project itself to rise at 10 feet a year for the next century. But it might also be prudent to make sure everyone on board has their life preserver on. Which translates into using low expected equity returns for regulated insurance.