Economic Scenario Generator (ESG) Stylized Facts for Equities

Jason Kehrberg, MAAA, FSA
Chairperson, Economic Scenario Generator Work Group (ESGWG)

Link Richardson, MAAA, FSA, CERA
Chairperson, Field Test Subgroup of ESGWG (FTSG)

Henry Yim, MAAA, FSA, CFA
Member, Economic Scenario Generator Work Group (ESGWG)

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National Association of Insurance Commissioners (NAIC) Life Actuarial (A) Task Force (LATF)

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Agenda

1. Background, framework, and purpose

2. Overview of equity stylized facts

3. Detail on each equity stylized fact

4. Questions and next steps

1. Background, framework, and purpose

Our goal today is to present equity stylized facts and hear feedback so the ESGWG can begin work to develop equity acceptance criteria

- The charge for the Academy's Economic Scenario Generator Work Group (ESGWG) is to help ensure a smooth transition from the currently prescribed ESG (i.e., the Academy Interest Rate Generator or AIRG) to the NAIC's new ESG developed by Conning.

- LATF has requested the ESGWG assist with developing and proposing formal acceptance criteria for use in validating scenarios produced by the NAIC's new ESG.

- As discussed in our presentation on "A Framework for Developing, Evaluating, and Implementing an ESG":

  - A comprehensive set of *qualitative* stylized facts is a key prerequisite for model selection and the development of acceptance criteria.

  - A comprehensive set of *quantitative* acceptance criteria is key to making objective, timely, and actionable decisions on scenario sets produced by an ESG and helps ensure the ESG is performing in line with agreed upon stylized facts.
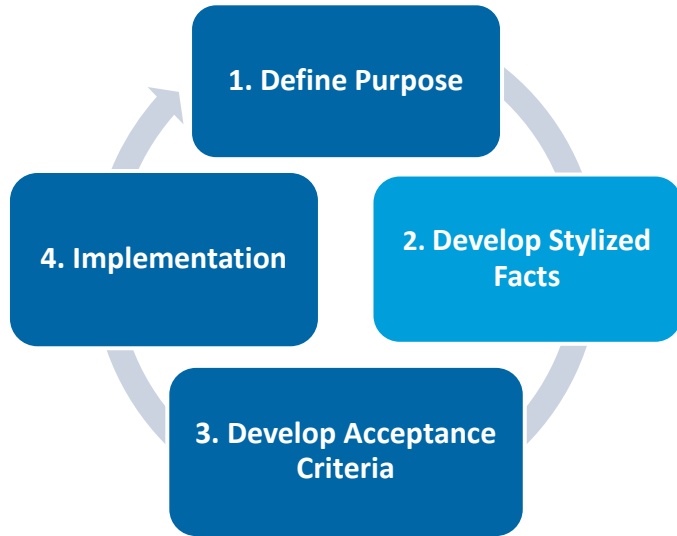
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Framework for developing, implementing, and evaluating ESGs and the scenario sets they produce

1. Define Purpose
2. Develop Stylized Facts
3. Develop Acceptance Criteria
4. Implementation

□ 1. Define Purpose: The intended purpose of the ESG informs the stylized facts and their relative importance.

➢ 2. Develop Stylized Facts: Equity stylized facts describe properties of equity returns observed in capital markets that should be reflected in sets of economic scenarios given the defined purpose. **The establishment of stylized facts is critical for selecting an ESG model and a key prerequisite for the development of acceptance criteria.**

□ 3. Develop Acceptance Criteria: A set of quantitative metrics or target values at different time horizons or in different economic conditions used to ensure the scenarios it produces are consistent with agreed upon stylized facts.

□ 4. Implementation: ESG models are selected based on their ability to reflect agreed upon stylized facts, then calibrated in accordance with acceptance criteria. **This is an iterative process**. Also, it is important to periodically review and recalibrate the ESG as market conditions change over time**.**

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"Suitability for Purpose" considerations help inform Stylized Facts

"ESGs are a critical component of a wide range of applications used by insurers in managing the economic risks of their operations. For a given application, it is critical that the ESG be suitable and properly maintained relative to the application's purposes."

"The objective and purpose of the analysis to be undertaken with an ESG should dictate the techniques and modeling formulas used."

- CAS Research Paper (https://www.casact.org/sites/default/files/2021-02/economic-scenario-generation-conning1020.pdf)

US Statutory Reserve & Capital **Reporting** for **Long-Duration Life & Annuity Products**

- Real world framework

- Importance of economic variables over the life of the business (not a 1-year or short-term distribution)

- Importance of tail events and "plausible extremes" in the conditional tail expectation (CTE) framework (vs. center of distribution or simple mean/standard deviation statistics)

- Importance of stability / responsiveness of scenarios from period to period as markets change – on an *absolute dollar* basis (vs. relative metrics or outcomes, e.g., strategic asset allocation, yes/no decisions)

- Importance of cumulative returns over multiple projection horizons (vs. single year or steady state)

- Importance of pathwise behavior for path-dependent guarantees

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2. Overview of equity stylized facts

Equity Stylized Facts are a key part of the framework for developing, implementing, and evaluating ESGs

- Equity stylized facts describe properties of equity returns observed in capital markets that should be reflected in sets of economic scenarios.

- There are several important considerations for equity stylized facts:

  - Long-term pathwise behaviors within single scenarios

  - Single-period distributions across all scenarios

  - How a set of scenarios transitions from initial market conditions to steady state equilibrium

  - Changes in the distribution from one valuation date to the next as initial market conditions change

  - The nature of the relationships between different economic variables simulated by the ESG

It is important to consider the relative importance of stylized facts

☐ ESG models differ in their ability to reflect stylized facts and no ESG model will be able to perfectly reflect all of them

☐ Stylized facts can be prioritized by looking to the ESG's intended purpose

- ◻ Stylized facts related to the **pathwise behavior of equity markets over long time horizons** should be prioritized given that long-duration life and annuity products tend to be sensitive to *cumulative* equity returns over the life of the product.

- ◻ Stylized facts related to how scenario sets should **change as initial conditions change** should be prioritized to avoid artificial volatility one valuation date to the next is a key consideration for statutory reserves and capital.

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Equity Stylized Facts

1. Equity indices (indeed, all asset classes) tend to exhibit **consistent risk/reward relationships** over long time horizons.

2. Cumulative equity returns tend to exceed the compounded risk-free rate (positive **equity risk premium**) over long time horizons, but over short time horizons the equity risk premium fluctuates due to several factors and can be negative.

3. Equities **fluctuate between bull and bear markets** (bubbles tend to burst) – Markets can experience significant losses but eventually tend to **move back into positive territory** (negative cumulative equity returns become less likely over longer time horizons).

4. Cumulative equity returns *over long time horizons* **are not materially impacted by initial market conditions**.

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Equity Stylized Facts (cont'd)

5. The **volatility of equity returns varies over time but quickly reverts to normative levels**. This allows for both extreme gains and extreme losses over short time periods (i.e., the distribution has fat tails, or *positive kurtosis*). Furthermore, the **volatility of equity returns is higher in bear markets**. This increases the probability of extreme losses relative to extreme gains (i.e., the distribution has a longer left tail, or *negative skewness*).

6. Equity markets contain **pathwise dynamics** over long time horizons that aren't present in the distribution of single-period returns. Future equity scenarios should have reasonable distributions of cumulative equity returns over long time horizons (e.g., 10, 20, 30 years), especially since these distributions are key to the performance of long-duration life and annuity products.

7. Future equity scenarios should include events that are **plausibly more extreme than history.**

8. Equity returns have both a **price and dividend component**, and they behave differently – Dividend returns tend to be more stable than price returns.

3. Additional detail on each equity stylized fact

1. Equity indices (indeed, all asset classes) tend to exhibit **consistent risk/reward relationships** over longtime horizons.

- The principle of consistent risk/reward relationships between equity indices is already a common theme in the valuation manual, often expressed in terms of the market price of risk (Sharpe ratio) or mean-variance efficiency.

- Excerpts from the 2022 valuation manual:

  - "It would generally be inappropriate to assume that a market or fund consistently outperforms (lower risk, higher expected return relative to the efficient frontier) over the long term."

  - "One approach to establish consistent scenarios would set the model parameters to maintain a *near*-constant market price of risk. A closely related method would assume some form of mean-variance efficiency to establish consistent model parameters."

  - "The Market Price of Risk implied in the projected fund returns when compared against the Market Price of Risk for all funds generated by the prescribed scenario generator should produce reasonable relationships."

  - "Guidance Note: While the model need not strictly adhere to "mean-variance efficiency," prudence dictates some form of consistent risk/return relationship between the proxy investment funds."

  - "Recognizing the uncertainty in the data, a "corridor" could be established for the frontier. Model parameters would then be adjusted to move the proxy market (fund) inside the corridor."

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1. Equity indices (indeed, all asset classes) tend to exhibit **consistent risk/reward relationships** over long time horizons. *(continued)*

- The NAIC's ESG Drafting Group has already provided some direction consistent with this stylized fact in their 3/31/21 update to the Life Actuarial (A) Task Force and the Life RBC (E) Working Group which contained the following recommendation for the field test:

  - "Apply a Sharpe-ratio approach with a 5% corridor [relative to the S&P 500 index] to set the expected returns for the [other equity indices, e.g., the] diversified international equity, aggressive international equity, and US aggressive equity indices."

- The S&P 500 index is generally used as the reference point for other indices due to its longstanding predominance in the U.S. market; it has the a much larger historical data set than the other equity indices.

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2. Cumulative equity returns tend to exceed the compounded risk-free rate (positive **equity risk premium**) over long time horizons, but over short time horizons the equity risk premium fluctuates due to several factors and can be negative.

- ☐ The Equity Risk Premium (ERP) is the *expected* return on stocks less the compounded (expected) risk-free rate. It is the compensation investors require to holding risky stocks over risk-free bonds.

- ☐ The ERP fluctuates (oscillates) over short time periods.

  - ◘ The fluctuation isn't completely random, but more of an oscillation due to several factors such as cyclical effects and systematic trends.

  - ◘ It fluctuates as the business cycle changes. It tends to contract in bull markets when stock prices rise and risk aversion falls, and tends to expand in bear markets when stock prices fall and risk aversion rises.

  - ◘ It fluctuates as bond yields change. It shrinks when the return on risk-free bonds increases and grows when the yield on risk-free bonds decreases.

    - ■ This inverse relationship (i.e., ERP contracting when rates increase and expanding when rates fall) is consistent with economic theory such as the dividend discount model, where a company's valuation (based on the present value of future dividends) falls as rates rise.

    - ■ It is also consistent with the Fed's use of monetary policy (i.e., short term rate management) as a key tool to achieve their dual mandate of maximum employment and price stability.

    - ■ Such relationships have also been observed in historical data.

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2. Cumulative equity returns tend to exceed the compounded risk-free rate (positive **equity risk premium**) over long time horizons, but over short time horizons the equity risk premium fluctuates due to several factors and can be negative. *(continued)*

*"Five **myths** about equity risk premiums*

3. The equity risk premium does not change much over time: Equity risk premiums reflect both economic fundamentals and investor risk aversion and they do change over time, sometimes over very short intervals, as evidenced by what happened in the last quarter of 2008. Shocks to the system – a collapse of a large company or sovereign entity or a terrorist attack – can cause premiums to shoot up overnight. A failure to recognize this reality will lead to analyses that lag reality."

- Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2021 Edition, Aswath Damodaran Stern School of Business (p. 130)

Excerpts from Academic Research

"What are the determinants of equity risk premiums?

- *investors' risk aversion and consumption preferences*
- *overall economic risk*
- *inflation and interest rates*
- *quality and availability of earnings information*
- *liquidity and fund flows into/out of equities*
- *potential for catastrophic risk / rare events*
- *government policies*
- *monetary policy*
- *irrational behavior"*

- Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2021 Edition, Aswath Damodaran (pp. 10-21)

"[The] DDM-based approach has been the only one with any real traction since the turn of the millennium…."

"[It] focuses on the expected rather than the realized ERP. This literature asserts that, like most DDM estimates, the ERP is time varying and countercyclical: The ERP is high when the market is low, and vice versa."

- The Equity Risk Premium: A Contextual Literature Review, CFA Institute (p. 9)
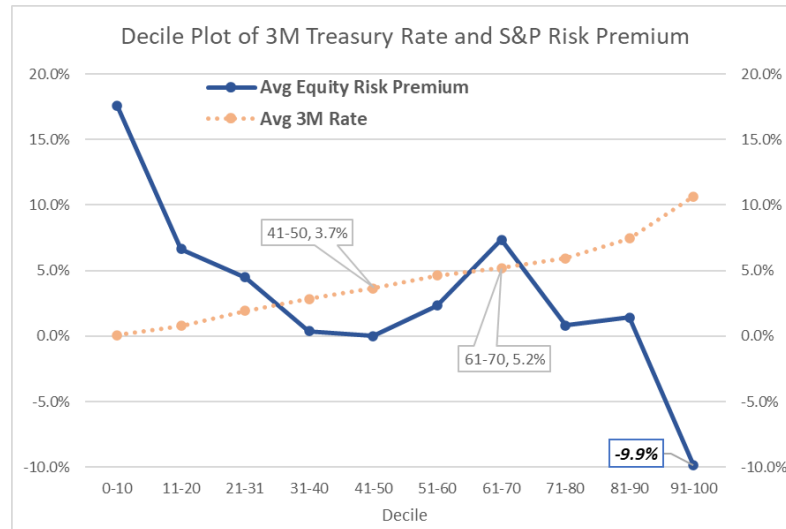
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2. Cumulative equity returns tend to exceed the compounded risk-free rate (positive **equity risk premium**) over long time horizons, but over short time horizons the equity risk premium fluctuates due to several factors and can be negative. *(continued)*

□ Historical data suggests an inverse (countercyclical) relationship, i.e., one that is better described by a constant mean return than a constant mean ERP.

Decile Plot of 3M Treasury Rate and S&P Risk Premium

- Avg Equity Risk Premium
- Avg 3M Rate

41-50, 3.7%

61-70, 5.2%

-9.9%

Decile

The methodology used by the ESGWG to create this chart was to calculate monthly ERP as the monthly return on S&P 500 less they monthly average 3-month Treasury rate. The monthly ERPs were then ranked ordered by the 3-month Treasury rate and bucketed into 10 equally sized groups. The average monthly ERP for each bucket is calculated and then translated to an annual ERP.

□ The chart to the left illustrates the range observed for the S&P 500's ERP over the 3-month Treasury rate from April 1953 to December 2020.

□ The graph shows positive ERPs in the three lowest buckets and near-zero or negative ERPs in the three highest buckets.

□ Note that the 3M Treasury Rate is indirectly impacted by Fed monetary policy, for example:

▫ The Fed increases/decreases short-term rates to slow/stimulate economic activity in the near term and maintain long-term stability.

▫ The '70s & '80s featured high rates with low ERP and equity returns while the last decade had low rates with high ERP and equity returns.

▫ The Fed is currently raising Fed Fund rates to fight inflation which has had a bearish impact on equity markets as companies deal with higher borrowing costs.

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2. Cumulative equity returns tend to exceed the compounded risk-free rate (positive **equity risk premium**) over long time horizons, but over short time horizons the equity risk premium fluctuates due to several factors and can be negative. *(continued)*

☐ This stylized fact is prioritized because the nature of the ERP relationship within the ESG directly affects the shape of the scenario distribution (particularly in the tails) and how scenario distributions respond changes in initial market conditions.

  ◘ The method an ESG uses to reflect the ERP has significant implications for the behavior of equity return paths in the tail scenarios that drive U.S. statutory reserve and capital requirements.

  ◘ The method an ESG uses to reflect the ERP also has significant implications for how scenario sets produced by the ESG change under different initial conditions, which could introduce artificial volatility into U.S. statutory reserve and capital requirements from one valuation date to the next.

Direction on this stylized fact is key for the subsequent development of equity acceptance criteria by the ESGWG.
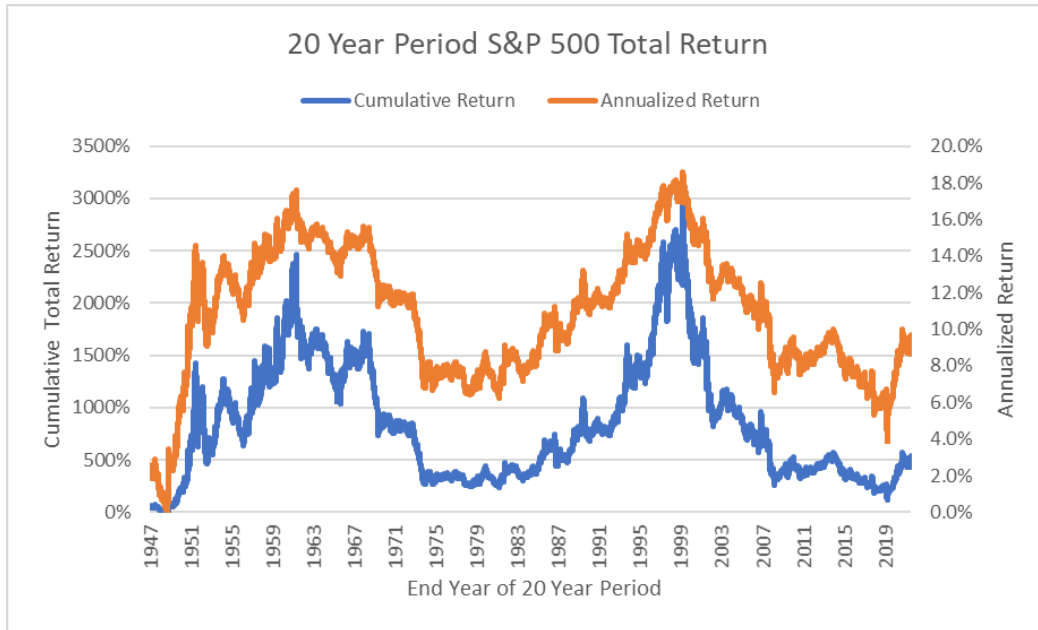
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3. Equities **fluctuate between bull and bear markets** (bubbles tend to burst) – Markets can experience significant losses but eventually tend to **move back into positive territory** (negative cumulative equity returns become less likely over longer time horizons).

20 Year Period S&P 500 Total Return

- Equity markets can and do crash, but looking at historical S&P 500 cumulative returns over 20 years suggests markets tend to move back into positive territory given enough time.
  - This chart only shows cumulative returns over a 20-year time horizon. Acceptance criteria should consider cumulative returns over multiple time horizons (e.g., 1, 5, 10, 20, 30 years).
- Future scenarios for the S&P 500 should include the possibility of negative cumulative returns over 20-year periods.
  - Even though this has not happened historically, there are relatively few non-overlapping periods to draw from.
  - Acceptance criteria will attempt to quantify the likelihood of this happening, which is informed by historical data and economic theory/models.

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3. Equities fluctuate between bull and bear markets (bubbles tend to burst) – Markets can experience significant losses but eventually tend to **move back into positive territory** (negative cumulative equity returns become less likely over longer time horizons). *(continued)*

- □ The NAIC's ESG Drafting Group has already provided direction consistent with this stylized fact
  - ◘ Per their 12/17/20 update to the Life Actuarial (A) Task Force and the Life RBC (E) Working Group:

> **Goal relating to the equity scenarios:**
>
> **5. Equity scenarios need to reflect the possibility of a very long recovery after a period of losses**
>
> Rationale and Background: During certain periods of time after periods of recession or depression, there have been extended periods of equity market recovery. This is important to reflect in the scenarios due to the long-term nature of some insurance liabilities.

  - ◘ Per their 3/31/22 update to the Life Actuarial (A) Task Force and the Life RBC (E) Working Group:

> "After a recession or depression, there have been some extended periods of equity market recovery. This is important to reflect in the scenarios due to the long-term nature of some insurance liabilities."

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4. Cumulative equity returns *over long time horizons* are not materially impacted by initial market conditions.

- Over short time horizons (within a business cycle), equity returns may be impacted by initial market conditions (observables) such recent interest rates and equity returns, current market sentiment, current point in the business cycle, and news on current dividend and cash flow yields.

- But over long time horizons (10, 20, 30+ years), changes in initial market conditions should not materially impact future expectations (cumulative equity returns).
  - Markets bouncing around during the quarter (trading fluctuations) shouldn't materially change future expectations.
  - Instead, cumulative equity returns over long time horizons are driven by fundamental factors such as future GDP and earnings growth
  - For example, equity market sell-offs often occur during periods of investor fear and uncertainty. This increases short-term market volatility but is not expected to have a significant impact on long-term GDP and earnings growth.

- If there isn't sufficiently compelling evidence to the contrary there should be not be any material procyclical or countercyclical equity return response to changes in initial market conditions.
  - Note, we are referring to changes in initial market conditions that are *not* indicative of a change in long-term trends or policies

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4. Cumulative equity returns *over long time horizons* are not materially impacted by initial market conditions. *(continued)*

Business cycle considerations

☐ The Fed uses monetary policy to maintain long-term stability, so more often than not, long-term equity expectations should not change as initial market conditions change.

  ◻ Fed actions to manage the business cycle are not likely to materially change cumulative equity return distributions beyond the current cycle.

    ▪ For example, if the Fed raises short term rates to 3.5% to slow a heated economy, there is little reason to suddenly expect cumulative equity returns over the next 30-50 years to be significantly higher.

    ▪ However, if the Fed changes its mandate or long-term targets (e.g., 3% instead of 2% inflation) then long-term equity expectations should change.

☐ The National Bureau of Economic Research (NBER) maintains data on the length of the U.S. business cycles. For the years 1945 through 2020:

  ◻ Contractions have averaged approximately 1 year

  ◻ Expansions have averaged approximately 5 years

  ◻ Taken together, the full business cycle has averaged approximately 6 years

  ◻ *Source: https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions*

4. Cumulative equity returns *over long time horizons* are not materially impacted by initial market conditions. *(continued)*

Do other regulatory or accounting frameworks have anything to say on this topic?

☐ US GAAP (countercyclical view): existing insurance accounting models (e.g., FAS 97 UL deferred acquisition costs, SOP 03-1 reserves for GMDBs and life secondary guarantees)

- ◘ A common practice is to assume that if recent equity returns (e.g., over the last 4-year period) were low, then future equity returns (e.g., over the next 4-year period) will be high (and vice versa); i.e., that the combined equity return over both periods will be consistent with long-term averages.

☐ Canada: excerpts from OSFI's 2012 policy paper, Evidence for Mean Reversion in Equity Prices

- ◘ "The claim that equity returns revert to the mean over the long term is not completely unfounded, and cannot be dismissed out of hand. However, there is at least as much evidence to refute this claim as there is to support it, and there is certainly no consensus answer within the economics profession. OSFI must therefore rely on its own judgement as to whether to accept mean reversion assumptions in modeling segregated funds."

- ◘ "Given the large reduction in segregated fund guarantee reserve and capital requirements that would result from assuming mean reversion in equity returns, it would not be prudent for OSFI to approve equity return models that are based on the assumption of mean reversion without strong evidence that mean reversion actually occurs in the market and is likely to continue in the future. The current state of research does not provide such evidence to a sufficiently high degree of certainty."

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5. The **volatility of equity returns varies over time but quickly reverts to normative levels**. This allows for both extreme gains and extreme losses from one period to the next (i.e., the distribution has fat tails, or ***positive kurtosis***). Furthermore, the **volatility of equity returns is higher in bear markets**. This increases the probability of extreme losses relative to extreme gains (i.e., the distribution has a longer left tail, or ***negative skewness***).
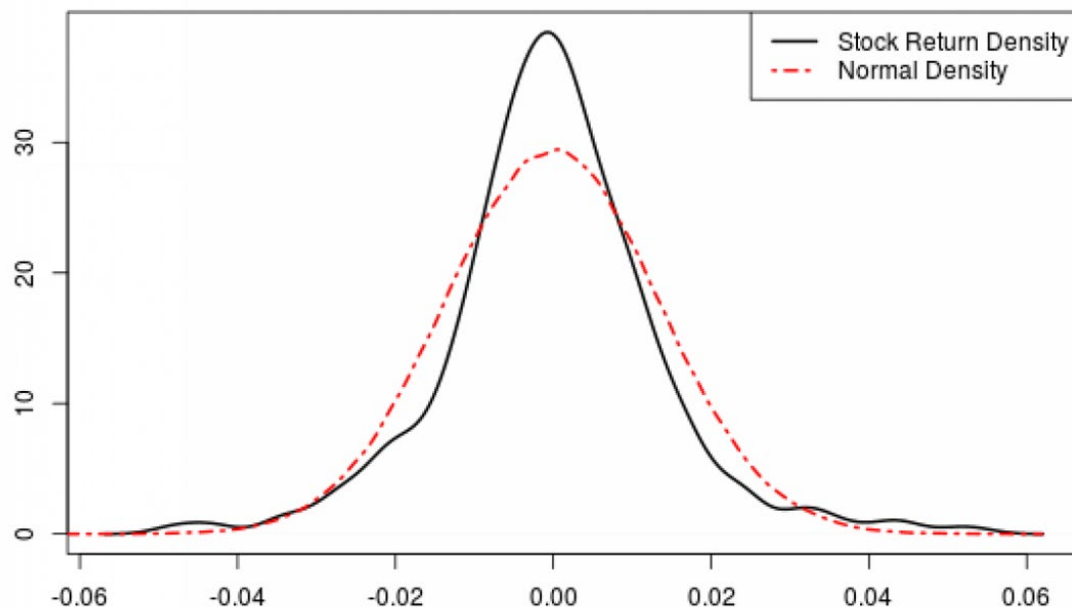
- Equity return volatility should be stochastic, time varying, with strong mean reversion.

  - Equity return volatility, especially over short time periods, is driven by market sentiment and the flow of new information to the market, and where the economy is in the business cycle (economic outlook), both of which are quite unpredictable.

  - As these things change, the level of equity return volatility fluctuates and clusters (exhibits regimes of high and low volatility) over time but tends to revert to normative levels rather quickly.

- Historically, the level of equity return volatility has tended to be higher in bear markets and lower in bull markets.

  - Recently, fears of recession and prolonged inflation have caused equity return volatility to increase.

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◘ Distributions of historical equity returns (see below for an illustrative example) generally exhibit positive kurtosis and negative skewness, consistent with the volatility characteristics presented on the last slide.

5. The **volatility of equity returns varies over time but quickly reverts to normative levels**. This allows for both extreme gains and extreme losses from one period to the next (i.e., the distribution has fat tails, or ***positive kurtosis***). Furthermore, the **volatility of equity returns is higher in bear markets**. This increases the probability of extreme losses relative to extreme gains (i.e., the distribution has a longer left tail, or ***negative skewness***). *(continued)*

□ Conning's "NAIC Scenario Set Technical Documentation – Equity and Dividend Model" contains the following chart associated observations:

Figure 1. Daily equity price returns for the S&P 500.
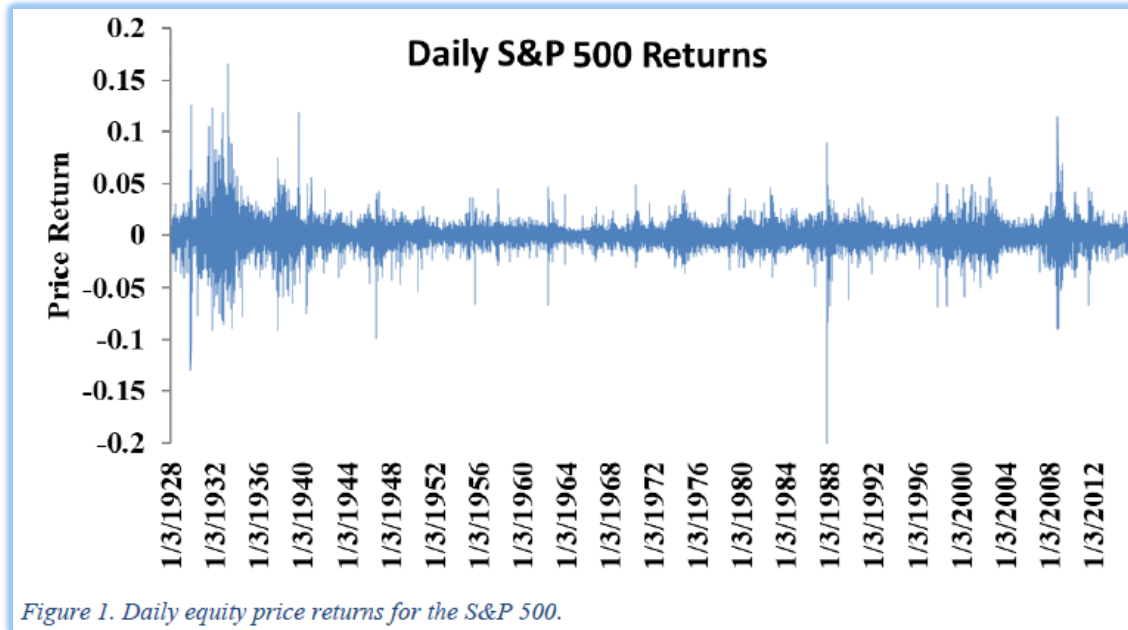
- A degree of randomness or stochasticity in the price returns.
- Periods of high and low volatility which have a tendency to cluster.
- Extreme events, with the price return suddenly spiking to high positive or negative values.
- A higher frequency and a larger magnitude of extreme events during periods of high volatility.
- A higher frequency of extreme negative returns as compared to extreme positive returns.

Source: NAIC Scenario Set Technical Documentation (Conning)

5. The **volatility of equity returns varies over time but quickly reverts to normative levels**. This allows for both extreme gains and extreme losses from one period to the next (i.e., the distribution has fat tails, or *positive kurtosis*). Furthermore, the **volatility of equity returns is higher in bear markets**. This increases the probability of extreme losses relative to extreme gains (i.e., the distribution has a longer left tail, or *negative skewness*). *(continued)*

- ☐ The NAIC's ESG Drafting Group has already provided direction consistent with this stylized fact
    - ◻ Per their 12/17/20 update to the Life Actuarial (A) Task Force and the Life RBC (E) Working Group:

Goal relating to the equity scenarios:

3. The equity model should have stochastic volatility and the initial volatility should be updated frequently

Rationale for this Goal: Most equity models have stochastic volatility because this allows for fatter tails in the scenario distribution. Without it, there would be little ability to produce big drops, such as the 2008 financial crisis or Black Monday.

- ☐ The NAIC's 3/31/22 update also provided data points on normative levels of volatility:

Historical United States Large Cap Stock Returns		
Historical Period	**Mean**	**Standard Deviation**
1900-2003	11.8%	21.1%
3/1957-2003	11.9%	16.5%
1900 -2021	11.8%	20.4%
3/1957-2021	12%	16.2%

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6. Equity markets contain pathwise dynamics over long time horizons that aren't present in the distribution of single-period returns. Future equity scenarios should have reasonable distributions of cumulative equity returns over long time horizons (e.g., 10, 20, 30 years), especially since these distributions are key to the performance of long-duration life and annuity products.

- "A path represents one possible future evolution of the economy and therefore represents one possible complete future "economic experience." The importance of pathwise model behavior is that it is the simulated path that represents the way an insurance company will experience the evolution of the economy. If the overall distribution of returns for an asset class is correct but the pathwise behavior does not correspond to the nature of the fluctuations that we see in the historical record, then the model has an issue."

  - *Source: "A User's Guide to Economic Scenario generation in Property/Casualty Insurance" (p.12), sponsored by the Casualty Actuarial Society and Conning (2020)*

- This stylized fact is critical for understanding and modeling long-term insurance liabilities

  - Long-term insurance liabilities have account values that accumulate over time, investment returns over time with cashflows, and guarantee amounts—all of which are path-dependent. At each individual point in time, it's not the cross-sectional distribution at that point in time that matters, but the specific path taken leading up to that point in time.

- The importance of pathwise behavior in interest rates to insurance products is evident by looking at the types of scenarios present in the ubiquitous "New York 7" scenarios

  - E.g., level, pop up, pop down, up/down, down/up, delayed pop up, delayed pop down

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6. Equity markets contain **pathwise dynamics** over long time horizons that aren't present in the distribution of single-period returns. Future equity scenarios should have reasonable distributions of cumulative equity returns over long time horizons (e.g., 10, 20, 30 years), especially since these distributions are key to the performance of long-duration life and annuity products. *(continued)*

☐ **An example—clearly, guaranteed amounts and resulting cash flows will differ under the three scenarios**

Three hypothetical 20-year market scenarios
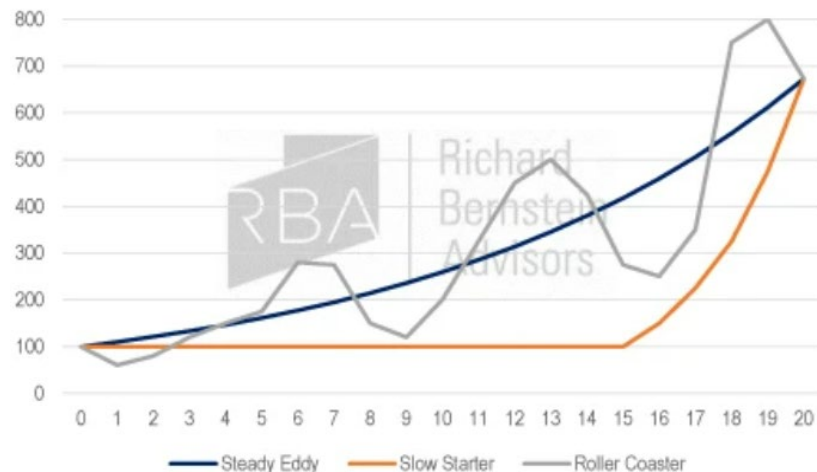
Initial $100 investments with different contribution rates

Market Scenarios	No additional contributions	With contributions	With contributions that keep pace with inflation
Steady Eddy	$673	$6,400	$7,628
Roller Coaster	$673	$7,488	$8,852
Slow Starter	$673	$11,640	$14,872

Source: Richard Bernstein Advisors LLC, Bloomberg, S&P https://www.rbadvisors.com/insights/the-good-side-to-a-bad-market/
Note: Each scenerio results in 10% compounded annual returns
Note: "With contributions" assumes constant $100 annual contributions.
"With contributions" that keep pace with inflation assumes the $100 initial contribution grows 2.5% per year.

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7. Future equity scenarios should include events that are *plausibly* more extreme than the historical record.

- "A good ESG produces some extreme but plausible outcomes, which encapsulate historical behavior but do not stray too far from market norms."

  - *Source: "A User's Guide to Economic Scenario generation in Property/Casualty Insurance" (p.12), sponsored by the Casualty Actuarial Society and Conning (2020)*

- It's important to distinguish between *plausible* events versus implausible but *theoretically possible* events.

  - The tails of scenario distributions should reflect plausibly severe stresses (including some more extreme than the historical record) that are appropriate for statutory reserves and capital.

  - While it's theoretically possible for an asteroid to hit the Earth someday, scenarios like that probably shouldn't be driving statutory reserve and capital levels.

  - Black swan events should occur with black swan probabilities.

7. Future equity scenarios should include events that are *plausibly* **more extreme than the historical record**. (continued)

☐ For example, since the historical record contains fewer non-overlapping 30-year equity returns than 1-month equity returns, there is a greater chance for future 30-year equity returns to be more extreme than the historical record than there is for 1-month equity returns.

☐ The plausibility range for such extreme events should be informed using judgment combined with economic theory/models.

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8. Equity returns have both a **price and dividend component**, and they behave differently—dividend returns tend to be more stable than price returns.

- This stylized fact is last because although long duration life and annuity products are often very sensitive to *total* returns, they tend not to be that sensitive to how those total returns are *split* between price and dividend

  - For liability cashflows on life and annuity products, it's usually the total returns that matter. However, price returns do potentially come into play on the asset side, particularly when it comes to derivatives and hedging.

  - When considering probabilities of cumulative losses or distributions in general, it's important know if those probabilities or distributions are for total returns or price returns—cumulative losses are less likely when considering total returns.

8. Equity returns have both a **price and dividend component**, and they behave differently—dividend returns tend to be more stable than price returns. (continued)

☐ Conning's "NAIC Scenario Set Technical Documentation – Equity and Dividend Model" contains the following language and chart, which are consistent with this stylized fact.
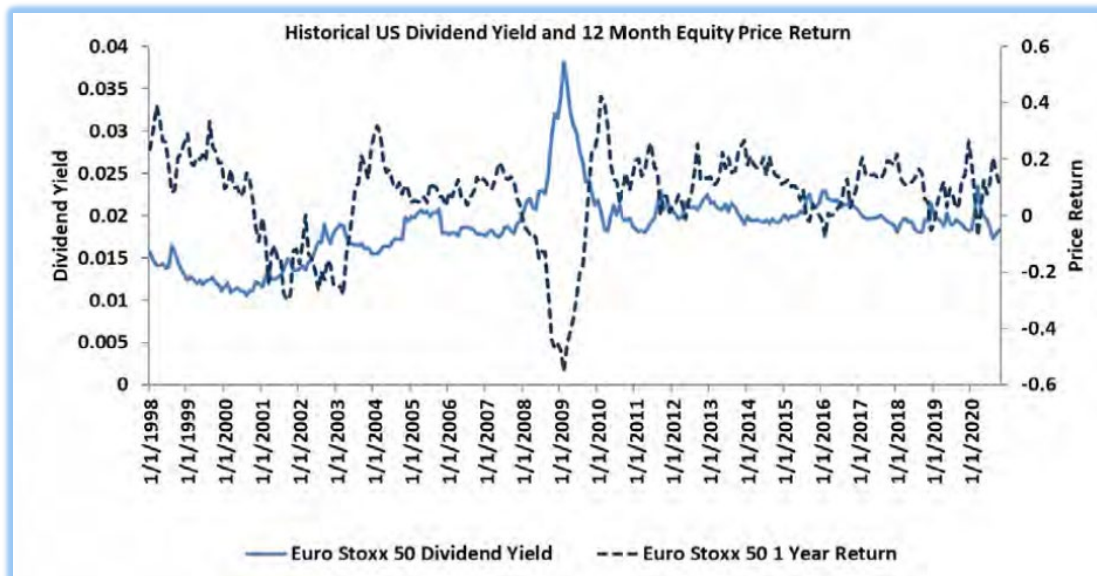

Figure 2 Historical releatiosnhip between large cap price returns in a rolling twelve month window and dividiend yields.

"Another important dynamic to capture in equity markets are the income cash flows received from dividends. In particular it is observed across multiple equity markets that dividend yields are negatively correlated with price returns, and that when jumps are observed in equity prices the dividend yield tends to jump in the oppositive direction. Figure 2 shows this behavior in the historical data. We observe that the rolling 12-month equity price returns and the 12-month dividend yield on United States Large Cap equity are negatively correlated and during the 2008 crisis moved rapidly apart."

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4. Next steps and questions

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The Academy's proposed schedule for developing acceptance criteria and other elements of a framework for working with ESGs

Session	Duration (hours)	Topic
1	1.5	Overview - A process for implementing and evaluating ESG scenario sets
2	2.0	Equity Model - Stylized facts
3	1.5	Corporate Credit Model - Stylized facts and acceptance criteria
4	1.5	Corporate Credit Model - ESGWG simplified corporate credit model
5	1.5	Equity Model - Acceptance criteria
6	1.5	Interest Rate Model - Stylized facts and acceptance criteria (1 of 2)
7	1.5	Interest Rate Model - Stylized facts and acceptance criteria (2 of 2)
8	1.0	Interest Rate Model - ACLI alternative interest rate model
9	1.0	Interest Rate Model - Other interest rate models

Questions?

- Contact: Amanda Barry-Moilanen,

  Life Policy Analyst: barrymoilanen@actuary.org

Appendix

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Reference Materials

- A User's Guide to Economic Scenario Generation in Property / Casualty Insurance sponsored by Casualty Actuarial Society and Conning.
  - https://www.casact.org/sites/default/files/2021-02/economic-scenario-generation-conning1020.pdf

- The Equity Risk Premium: A Contextual Literature Review, CFA Institute (p. 9)
  - https://www.cfainstitute.org/-/media/documents/book/rf-lit-review/2017/rflrv12n11.pdf

- Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2021 Edition, Aswath Damodaran Stern School of Business
  - https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3825823

- Duff & Phelps Client Alert May 2019
  - https://www.kroll.com/-/media/assets/pdfs/publications/valuation/us-equity-risk-premium-recommendation-increased.pdf

- The Equity Risk Premium: A Review of Models: FRBNY Economic Policy Review / December 2015 Fernando Duarte and Carlo Rosa
  - https://www.newyorkfed.org/medialibrary/media/research/epr/2015/2015_epr_equity-risk-premium.pdf