Using the Coefficient of Variation for Not-Ad Hoc Evaluation of Risk Transfer

Presented at 2022 CAS Spring Meeting

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What's This About-Risk Transfer Testing

- Requirement for treating contracts, reinsurance mostly, and otherwise, as re/insurance, not bondlike
- Tax, accounting, and potentially solvency implications
- Current approaches, with varying actuarial complexity, are ultimately based on ad-hoc assumptions
  - Want to provide something that is a natural consequence of the transaction and does not require any quasi-arbitrary thresholds be met.

Key Components of This Approach

- Focus on reducing the coefficient of variation (CV) of the “net line” due to the reinsurance being included
- “Financial Appropriateness” (Is it a fair deal) has been part of the scope that “Risk Transfer” has been asked to address from the beginning.
  - Will address this by comparing the net cost of the re/insurance contract to the cost of maintaining enough surplus to make the reinsurance unnecessary.

Hurdles to be Met: NAIC Guidelines for Risk Transfer

- Reinsurer must assume significant insurance risk
  - After all, it's reducing the CV
- Reasonably possible that reinsurer may suffer a significant loss from the transaction
  - Consider this in light of later requirement for prudence.

The Coefficient of Variation and Risk Transfer

Problems with Existing Methods for Evaluating Risk Transfer

- 10/10 rule (10% chance of at least a 10% loss)
  - Fails to pass high excess treaties with under 10% chance of hit
  - 10's were ultimately determined subjectively., ad hoc.
- Expected Reinsurer Deficit (expected % of losses over 100% of premium)
  - What deficit is okay? 1% to match 10/10?
  - Amount is ultimately subjective
- Both focus on NAIC's significant probability of significant loss, but don't deal directly with what reinsurance does for the cedant

Suggestion: Require that Most Contracts Reduce Coefficient of Variation of Net Loss

- Coefficient of Variation (CV) is measure of riskiness relative to size.
- Why? CV = standard deviation of (net) loss , or volatility, divided by the mean.
- Requiring that reinsurance contract reduce CV of the net loss, means that the reinsurance makes the net losses less risky. REAL Risk Transfer.

Other Benefits of Using the CV

- Not Ad-Hoc
- Wide Applicability, but other situations may have other issues.

Example

- Forgetting CV, ERD, 10/10, which of contracts appears to have risk transfer
- Base distribution: Pareto order 3, truncated and shifted by 20 (mean = 10)
- Options
  - Coverage all losses excess of $6
  - Underlying coverage then has all losses limited to $6

Which Covers Do You Think Contain Risk Transfer?-Tell Us on the Chat Feature

- Excess cover only
- Underlying cover only
- Both

Chat Feature Poll-Tell Us Which You Think Should Pass Risk Transfer and Why

Reason to Consider Requiring CV of Ceded Losses to be Larger than CV of Retained Losses

- Total Business: CV = 1.6 roughly
- Excess: CV = 2.75 roughly, obviously passes 10/10, ARG, CV
- Underlying : CV = .53 roughly , passes 10/10, Zero Expense ERD Ratio = 24%, fails base CV test because 2.75>1.73,

Poll Question: Does CV Test Appear to Tst Risk Transfer More Correctly than the Alternatives?

- Yes
- No

Poll Results

Is it a Prudent Purchase?

Why Consider Prudence of Purchasing a Reinsurance Contract

- CV approach does (speaker's opinion) a great job of assessing whether a contract makes the business less risky
- Historically, risk transfer was used to test whether contract in some way exploited a company by transfring more funds than necessary to a sister company, etc.)
- The CV approach alone does not address this, but requiring that the contract be prudent purchase does this…

Prudent Purchase Definition:

- Is the Net Cost of Reinsurance Less than the Cost of Any Additional Capital Needed to Cover the Losses Without Reinsurance?

Reasons to Consider the Prudency of a Re/Insurance Purchase?

- There are all kinds of treaties in reinsurance, a small part are viewed as passing income/profit more than transferring risk.
- Some actuaries I've spoken to are quite vocal that this must be addressed.
- Prudency of the purchase: Is the expense, profit and other markup of expected less than the cost of obtaining additional capital to cover the losses without reinsurance.

Computing Whether Contract is a Prudent Purchase- Key Factors

- Need type of criteria for needed capital-I like VaR-%likelihood that all claims will be covered (TVaR, etc., too)
- Need numerical criterion for capital-say 95% chance that all claims will be covered
  - Typically, would use current capital level after contract, maybe higher target amount for troubled companies
- Need cost of capital
  - Surplus note rate, cost of capital, increased if loan would lower credit rate/ stock sale overdilute capital.

Computing Whether Contract is a Prudent Purchase- Additional Capital

- Without treaty there is more volatility
- Could use loss ratio variance (in wheelhouse), etc. to estimate the 95% VaR, x%TVaR, x% VaR amount.
- That minus current capital funding is the additional capital needed
- Multiply that by cost of capital rate – for cost of foregoing reinsurance.
- Compare to net cost of reinsurance, as cedant estimates it.

CV Approach Appears to Comply with NAIC Risk Transfer Requirements

- Considering prudence requirement, losses transferred must be significant enough to require more capital, hence they are significant losses.
- Discussed earlier that reinsurance passing CV test, generate reasonable probability of those losses.
- CV approach appears to comply with NAIC requirements for risk transfer

A Couple of Caveats

- Consider that everything we don’t explicitly address would be unchanged from present practices
- In particular, all cash flows and values (except US loss reserves) are discounted.

Special Situations

Special “Fronted-Type” Programs

- Boiler and Machinery
- Cyber
- Umbrella (sometimes)
- Etc., all where reinsurer has special expertise and perhaps technology

- Consider cost of replicating risk selection and assessment (excluding any sales or marketing) along with cost of capital
- Allowing sales or marketing could open the door to transactions some regulators have concerns about.

Poll

- Which of the following could use the CV/prudent purchase approach? [yes /no]
  - A - Aggregate Excess
  - B – 50% cover on a new venture that “matches” a competitor’s profitable program with a substantial reinsurer’s profit
  - C – Loss Portfolio Transfers
  - D – Quota Share

Possible Poll Answers

- A-Aggregate Excess only
- B-New Ventures only
- C-Aggregate Excess and New Ventures
- D-Quota Share only
- E-Loss Portfolio Transfers only
- F-Quota Share and Loss Portfolio Transfers

Possible Poll Answers

- A-Aggregate Excess only
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- F-Quota Share and Loss Portfolio Transfers

Poll Results

Believe All but Quota Share and Loss Portfolio Transfers - Yes

- But for Quota Share and Loss Portfolio Transfers – Consider Financial Prudence- Why?

Quota Share and Loss Portfolio Transfers.

- Purpose of Quota Share is to reduce Absolute Risk (Absolute Surplus Need)
  - This is contained in prudence, consider just requiring prudence of the purchase.
  - Los Portfolio Transfers serve similar purpose---suggest similar treatment
  - May consider whether adding CV requirement would cause a problem with treaties that are actually appropriate.

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Credibility-Type Smoothing Using Ghost Trend

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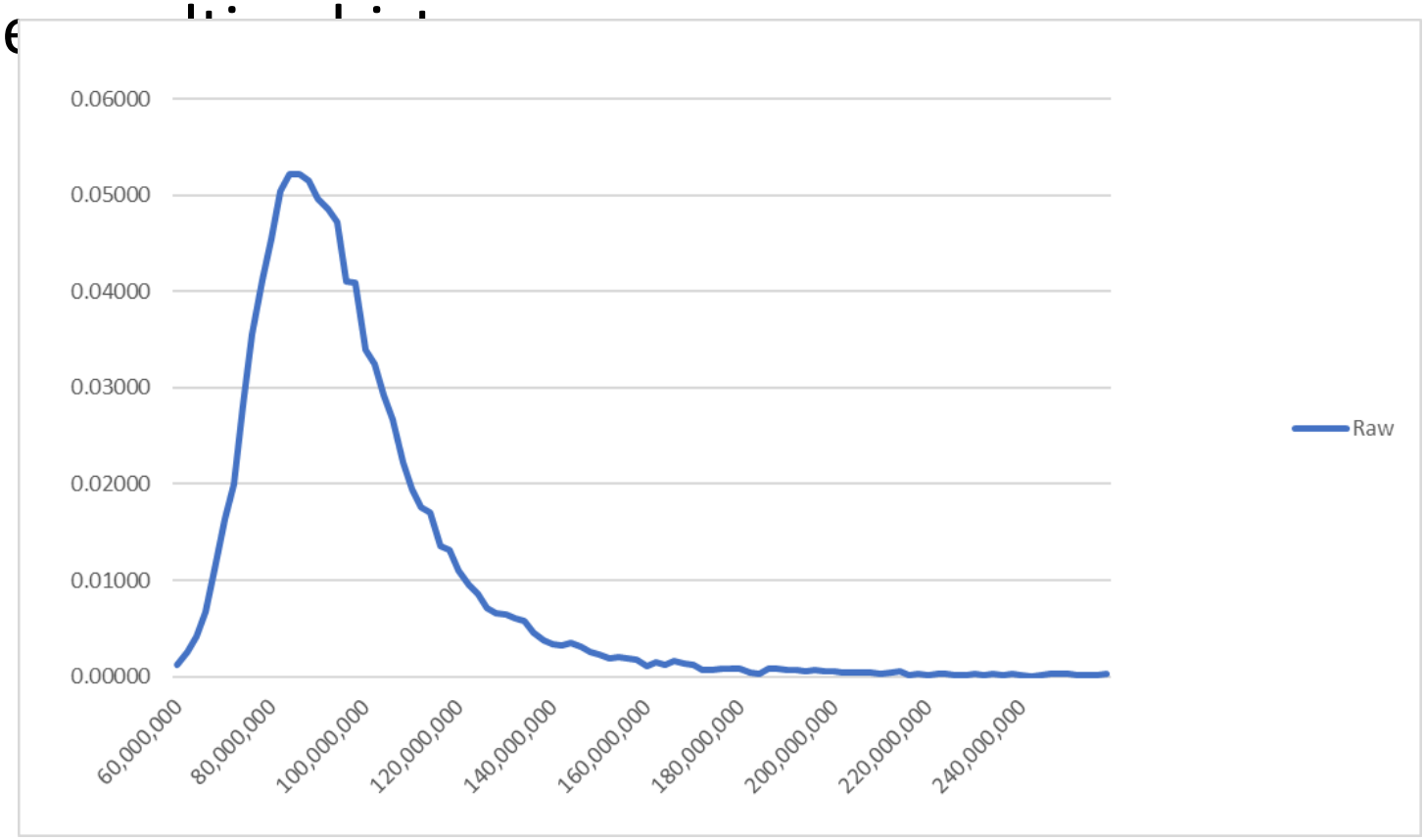
How This is Relevant

- In the paper that goes with the other half of this session, I needed to illustrate (graph) what an aggregate loss distribution representing the claims of a medical malpractice insurer looks like.
- For detail, it involves Poisson(500) claims that come from a truncated and shifted Pareto (α=1.5) distribution with a mean of $100,000.

Issue with Graphing the Distribution

- I ran 30,000 samples (using NTRAND) and got the following graph from the

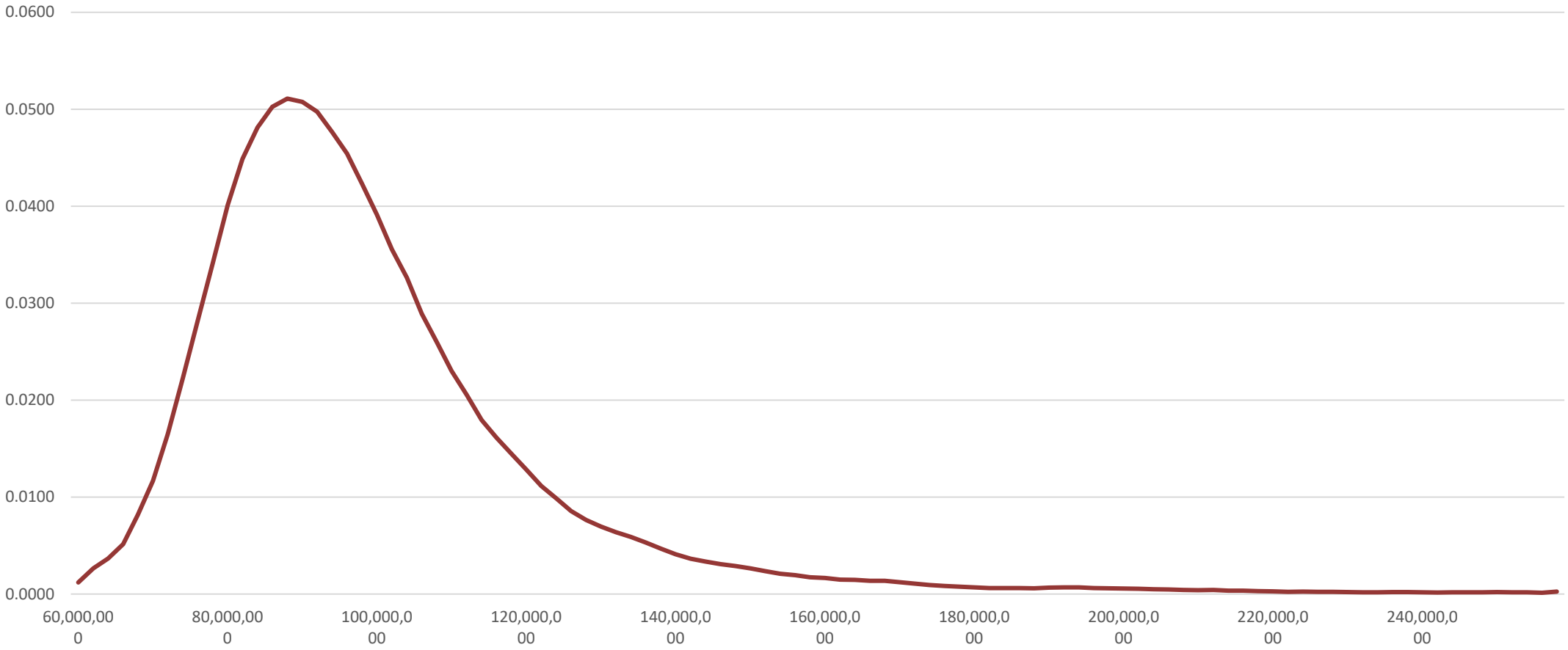


Removing the Bumps

- Certainly enough samples would remove the bumpiness, but my sample size was very, very, high already
- I chose to put the ghost trend approach I had to work.

- And I got ……

Curve After Ghost Trend Adjustment (and 5 Point Averaging)



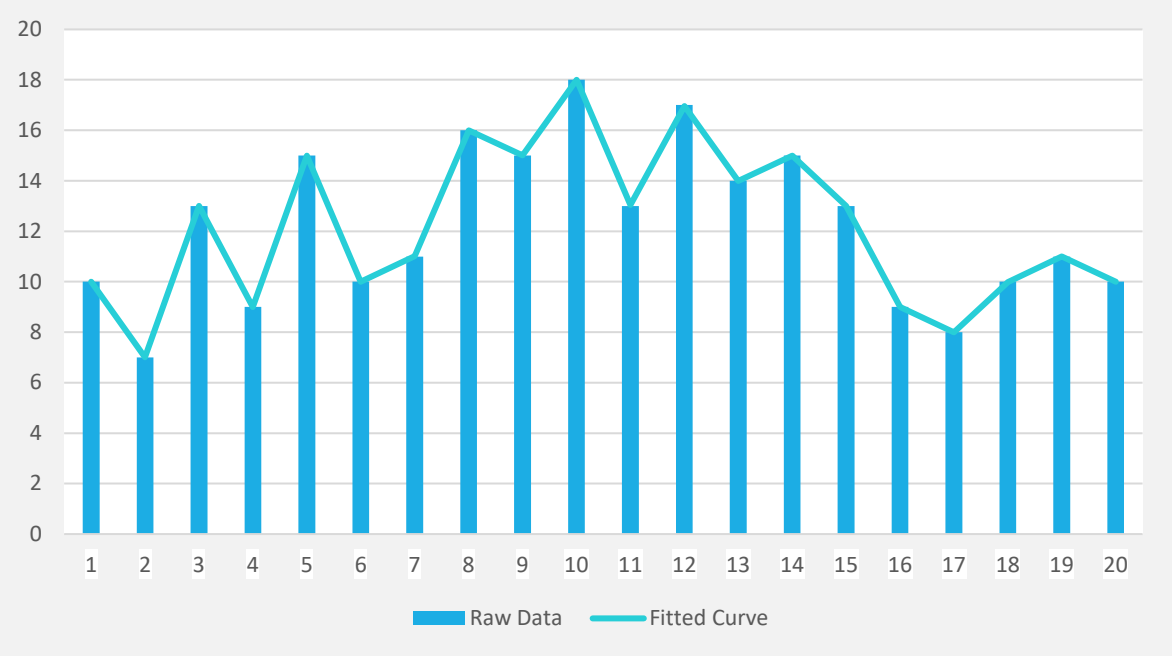
How the Process Works

Competing Concerns When Smoothing

- Want the curve to match the data points as closely as possible
- But also want the changes from point-to-point to be smooth and consistent
  - Even if the data is wildly bumpy and volatile
  - Need a smoothing mechanism that addresses both as well as possible…a smooth curve that is close to the points

Flow Thru the Steps that Produce the Method

- Start by solely requiring that curve match the points as closely as possible-straight match but very “bumpy”

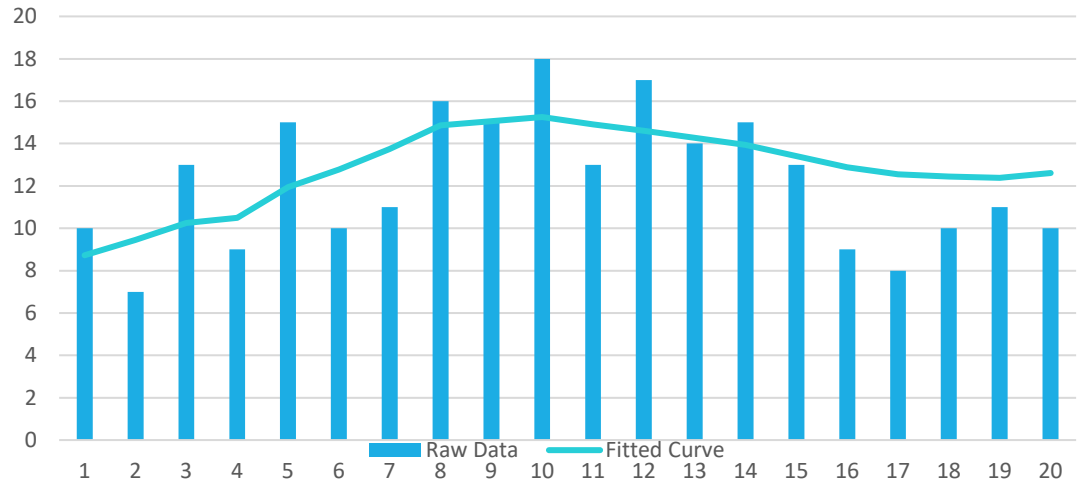


First Step in the Trade-Off
Accuracy vs. Smoothness

- Values on previous slide simply match the data
  - For the trade-off, use the sum of squared differences between the curve and the data points
- For smoothness use a constant “trend” rate, or linear, non-exponential increase from point-to-point.
  - In this case the value to manage is the sum of squared differences between in turn the differences between values at adjacent points
- The tradeoff is set by selecting weights for the two SOS quantities, then minimizing the weighted sum of squares.

First “Ghostlike” Trend Process

- Results are much smoother
- Process is credibility-like if data points are treated as raw data and the fixed trend values are viewed as benchmarks.



The “Hump” in the Last Slide Makes the Fit Challenging

- The data shows a positive trend going up the hump, but negative trend when going down the other side of the hump.
- Solution: Don’t require that the underlying “expected” or “benchmark” trend be constant. Just put a penalty on large changes from point.

Penalty for Large Changes in the Trend Benchmark

- Set actual “trend” between two adjacent points to be the difference between the value at the second point in the two minus the value at the point before it.
- There is a penalty for the squared differences between the actual trend values and the “ghost trend” values.
- The ghost trend is not constant, but the squared differences between the ghost trend in adjacent intervals are added up and get a “weight” multiplier

Add Up Three Penalties, Each for a Different Aspect of the Fit

- Weight 1 times sum of squared differences between the curve and the datapoints.
- Weight 2 times sum of squared differences between the actual point-to-point trends and the corresponding ghost trends
- Weight three times the sum of squared differences between the ghost end values at adjacent intervals.

What Do You Pick to Minimize the Total Weighted Sum?

- Curve values ad ghost trend values
  - Then I generally run “solver” to get the optimum curve
- The choice of weights is, to my knowledge, completely arbitrary- select what works
  - More weight on difference from data – more accuracy, less smoothness
  - More weight on differences from ghost trend- more stiffness, more smoothness.
  - More/less weight on ghost trend, more/less long term stiffness or flexibility

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Full Approach

- Minimizing the weighted set of sums to compute the curve can lead to a very substantial reduction in the “bumpiness”
- If you’re working with a large amount of data points and very variable values, using , say, 5 point averaging may be a useful final touch.

Summary

- Ghost trend process, minimizing weighted sum of sums of squares, can create a very practical smoothed version of volatile data values.
- Allows actuary to exercise a great deal of judgment in choosing weights for stiffness vs. accuracy, etc.
- Since it is an unknown (although estimated) benchmark to influence but not govern a trend that governs the curve, I feel that “ghost trend” is a fitting name

Ghost Trend

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