**Uncertainty in marketing**

Some general sentences about uncertainty in marketing

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**General applicability of the methods to other contexts than CLV** *(could also go into the general method comparison table)*

Bootstrap:

* How I use it here, it requires a model that is fitted to data (many times). When I have a model and can split the data often, it is applicable.
* No model and just data (without trend or anything): Bootstrap observations and calculate intervals

“Ensemble”:

* As I use it here, you need a model and a covariance matrix, then it is applicable
* No model and just data: Ensemble is doable, but you need a few other methods to average over them

Bayesian approach:

* You need a model with parameters which can be estimated bayesianic
* No model and just data: Not applicable

Conformal prediction:

* No model needed, just enough past data and exchangeability

Quantile regression:

* Model needed, otherwise not possible to estimate parameters that deliver borders
* With model and past data to “train” the parameters should be possible

**3 Examples from marketing**

1. **Price reduction by 10% without model:** Want to know the effect on sold quantity:

* Bootstrap possible (bootstrap the last n 10% reductions, calculate intervals)
* Bayesian not possible
* Ensemble: Averaging over other methods yes, via covariance matrix not
* Conformal prediction not possible because I don’t have predictions, hence not quantiles
* Quantile regression not possible because there are parameters to be estimated

1. **Price reduction by 10% with model, e.g. Qi​=α+βPi​+ϵi** and many observations i from past price reductions.

* Bootstrap: Split the data x times, estimate the model x times and get a distribution of parameters and possible reactions from the planned price reduction. Take the interval.
* Ensemble 1: If covariance matrix exists, applicable.
* Ensemble 2: You need to average over probably too many other methods.
* Bayesian: Estimate the parameters with the Bayesian approach and take the resulting intervals from the posterior distribution.
* Conformal prediction: Split the data, estimate the parameters on the training set and see how the model would have performed, take the quantiles and apply them to the current problem.
* Quantile regression: Estimate the parameters so that they would deliver the desired quantiles covered and apply them to get the interval.

1. **ETS model: Want to make sales forecasts for the next Monday**, having data for the last 5 years. I want to use an ETS model.

* Bootstrap: Following [[1]](#footnote-1), doable but not as I applied it in this work because of trend and seasonality
* Ensemble: No covariance matrix, not applicable.
* Bayesian approach: Parameters can be estimated with the Bayesian approach, too (13 RU). Take posterior predictive distribution and the interval from it.
* Conformal prediction: Take the quantile of the prediction errors and apply it.
* Quantile regression: Find the parameters so that in x% of the cases, the true value is above or below.

1. https://otexts.com/fpp2/prediction-intervals.html [↑](#footnote-ref-1)