* Retention uncertainty
* Product competitiveness over time (new technologies, new competitors, change in prices)
* Customer might go to a competitor 20
* Discount rate uncertainty
* Data inaccuracies or bias
* Unconsidered factors of historical campaigns of competitors 16
* Assumptions made when modeling
* Model choice
* Model misspecification

1. “incorrect assumptions on the forecast error distribution;
2. incorrect assumptions on the functional form of the point forecasting model, leading to a biased point forecast;” 14 PI

* Economic uncertainty (general) might affect overall customer behavior but also individual customer behavior 14, 16
* Regular noise 5PI
* Many papers focus on data uncertainty, this is rather not the case for tracks of consumer behavior 9, 10, 11, 18
* Data, model, parameter uncertainty 9, 14PI
* Epistemic, aleatory uncertainty 12
* Data, model uncertainty 12
* Often too narrow 5PI, 10PI
* “The ex ante distribution provides a better guide to uncertainty than does the distribution of errors based on the fit to historical data” 10PI 234
* Uncertainty is maximum in non-contractual setting for a firm 15
* Challenge: “Sometimes the cost of increased errors can outweigh the benefits of long-term predictions.” 16
* Dealing with uncertainty: 16
  + Possible to model joint error structure 16
  + Average over different futures and retrieve values 16
  + Obtain a distribution of future profitability for each customer 16
  + CLV distribution highlight the uncertainty of future profitability 16

Comparing customer portfolios with financial portfolios 17

* Cost of acquiring should match the expected cash-flow 17
* Difference: … and uncertainty 17
* **“the deviation of customer cash flow and profit from their expected values provides a measure of risk“** 17
* “Unlike financial assets, which can be retained as long as the investor desires, customers can take independent actions and defect or shift a share of their total purchases to a competitor. Therefore, customer cash flow stability provides a narrow measure of the strength of a customer relationship” 17
* “Assume that the relationships and correlations of the past are sufficiently stable and that past variability is a good proxy for future variability” 17
* Risk: Have a variance formula for variance/standard deviation and coefficient of variance 17
* Have a customer β which contains an individual customer’s contribution to the risk of the entire portfolio 17
* Reward: Provide a formula 17
* Risk/Reward ratio: Identify the most attractive customer 17
* Construct a customer portfolio at the end 17