An Introduction to Bayesian Reasoning

Society of Northern Ireland Actuaries

Mick Cooney mcooney@describedata.com

6 October 2020

Bayesian Inference Engine

Prior Knowledge

$+$

Data

$=$

Posterior Knowledge

Discrete Variables

$$P(A \mid B) = \frac{P(B \mid A) P(A)}{P(B)}$$

Continuous Variables

Parameters, θ

Data, D

Prior: $p(\theta)$

Likelihood: $p(D|\theta)$
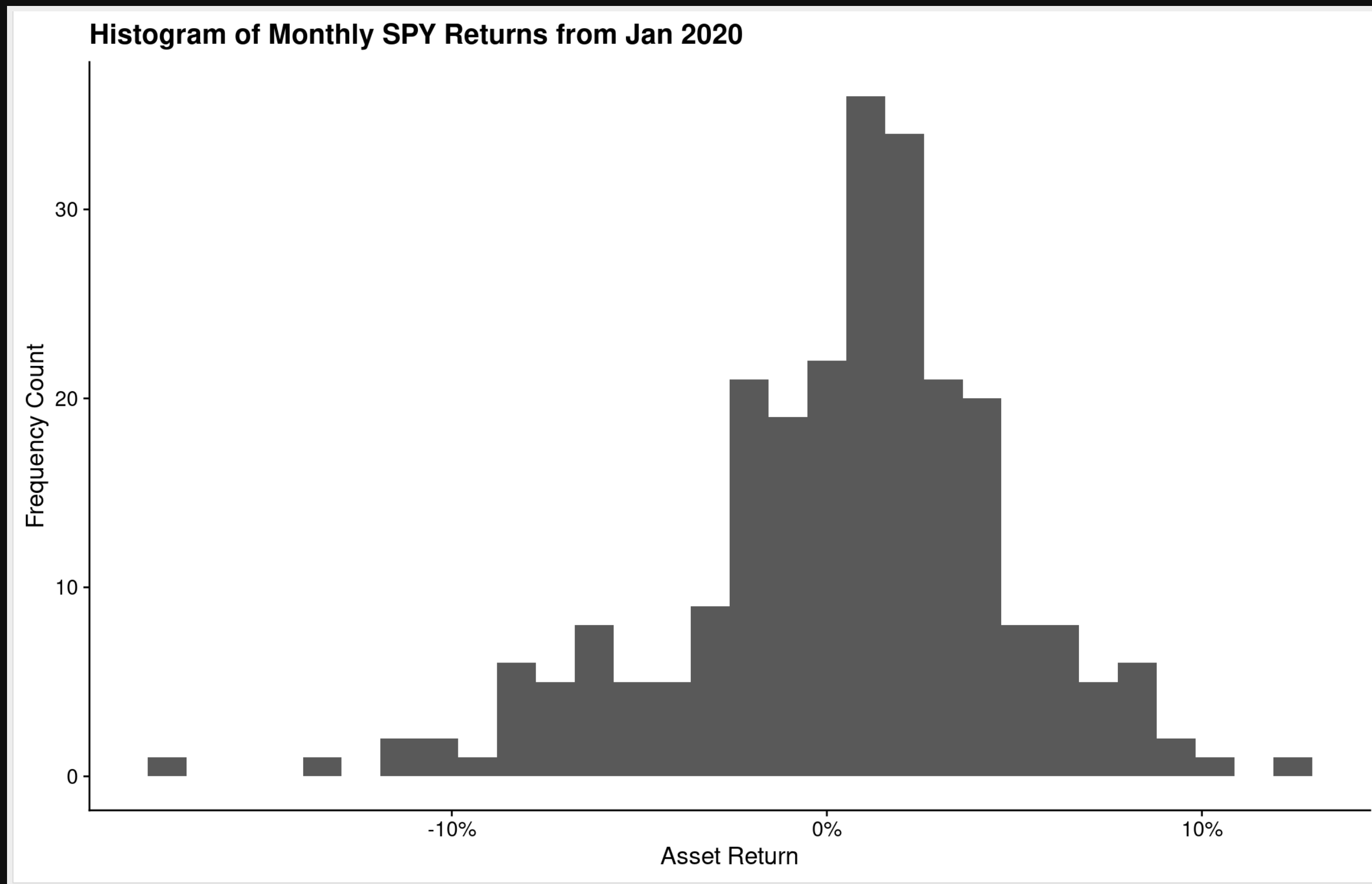
Posterior: $p(\theta|D)$

$$p(\theta \,|\, D) = \int p(\theta)\, p(D \,|\, \theta)$$

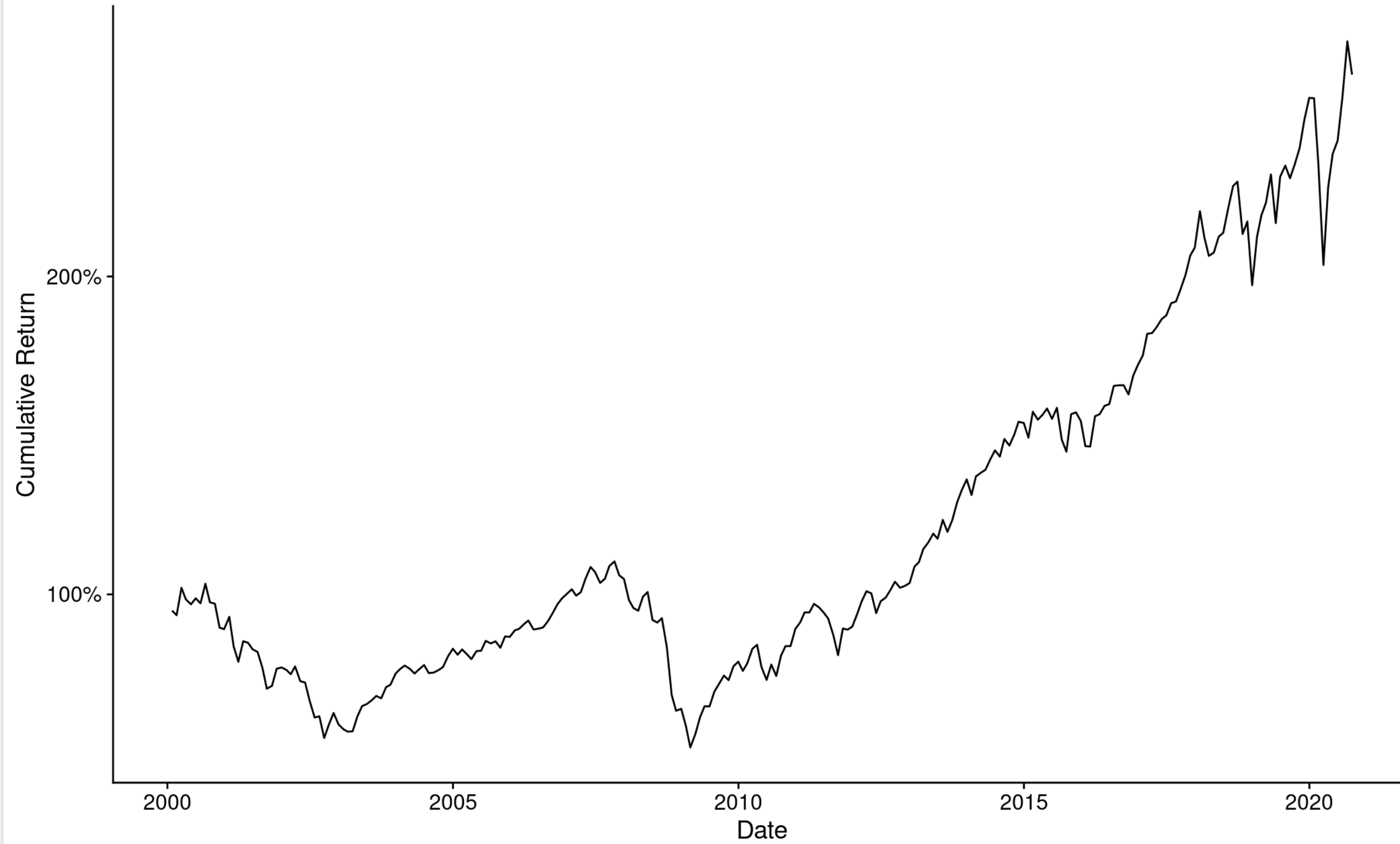Posterior calculation is high-dim integral

Use MCMC to sample posterior

Quick Example
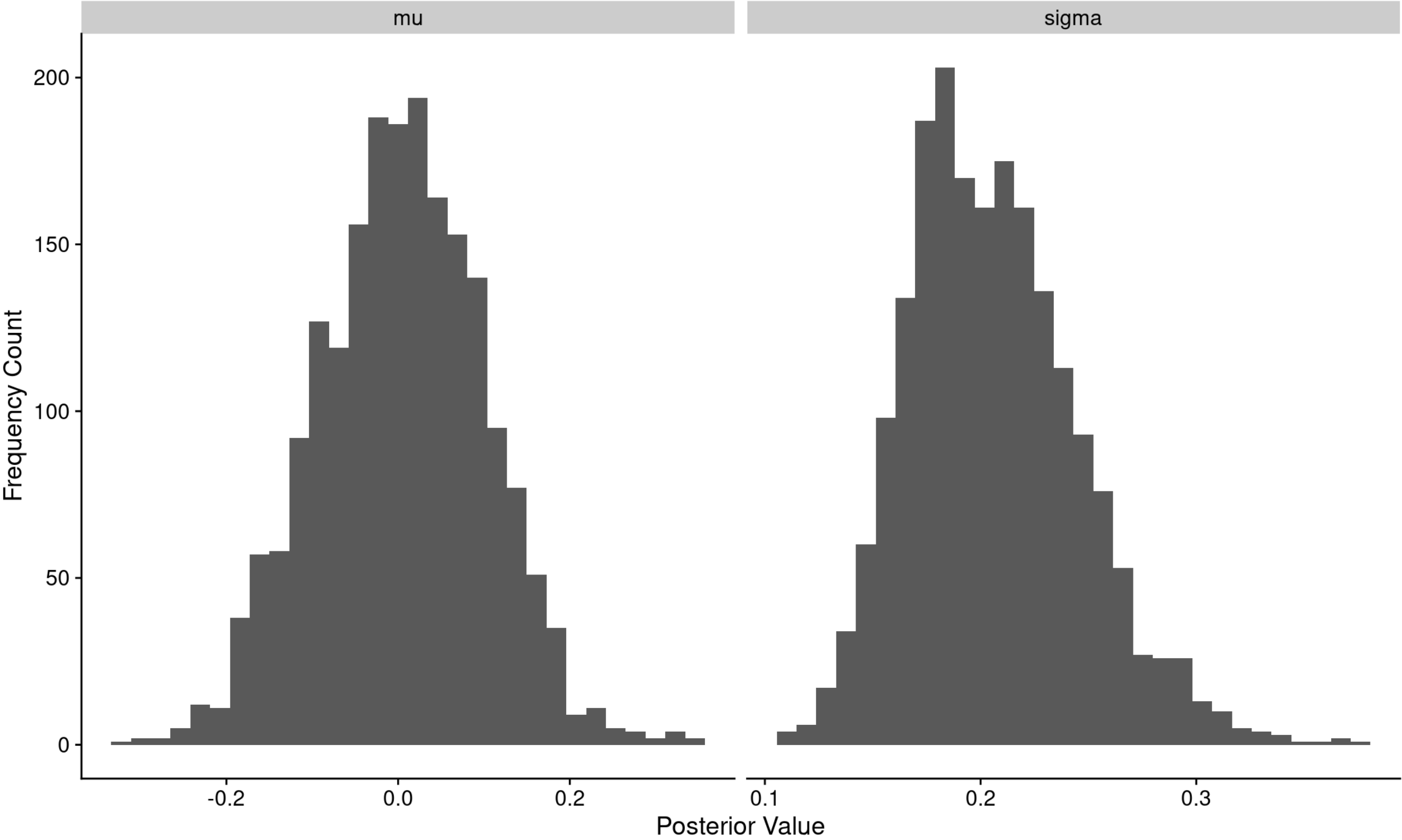
SPY Monthly Returns

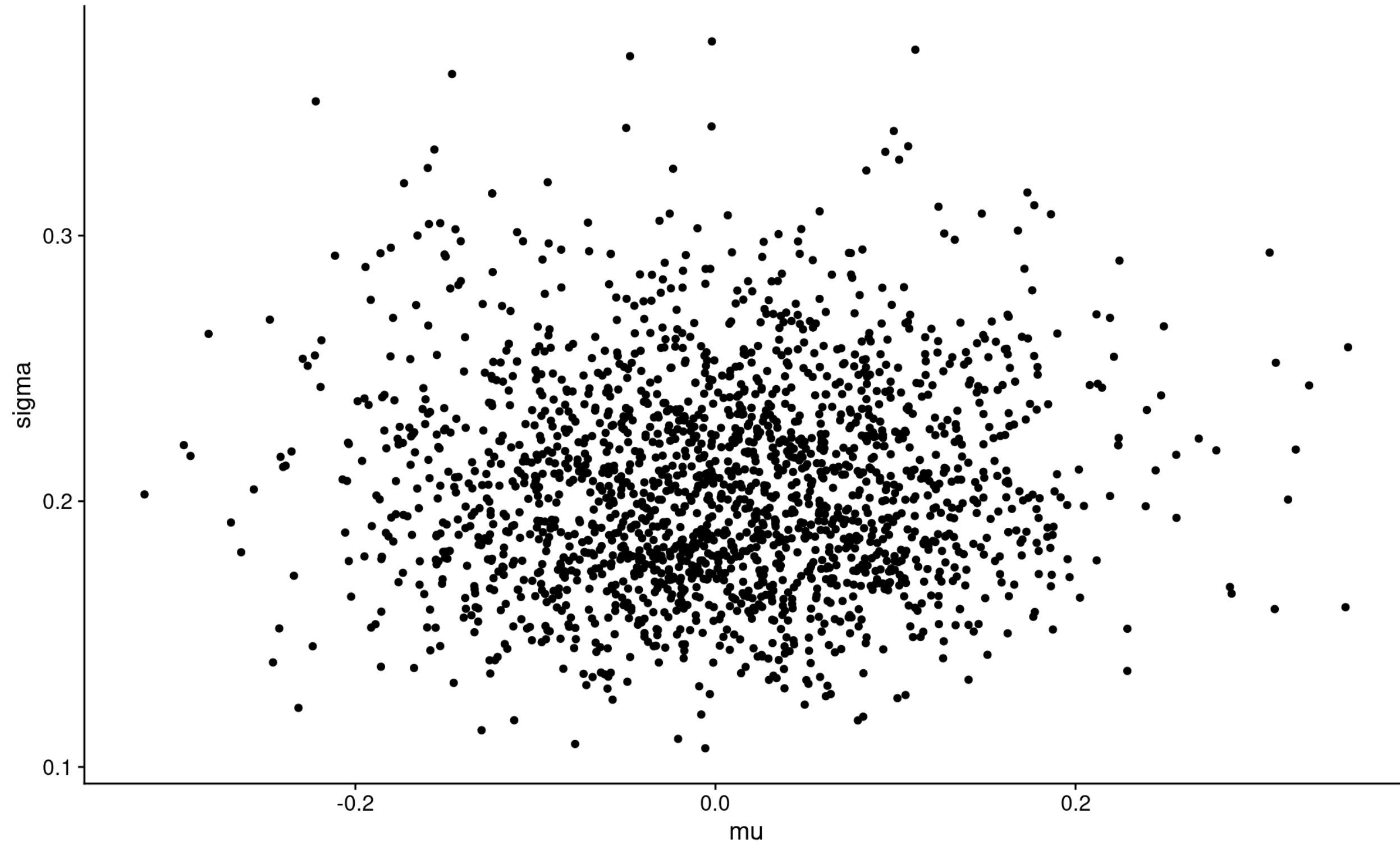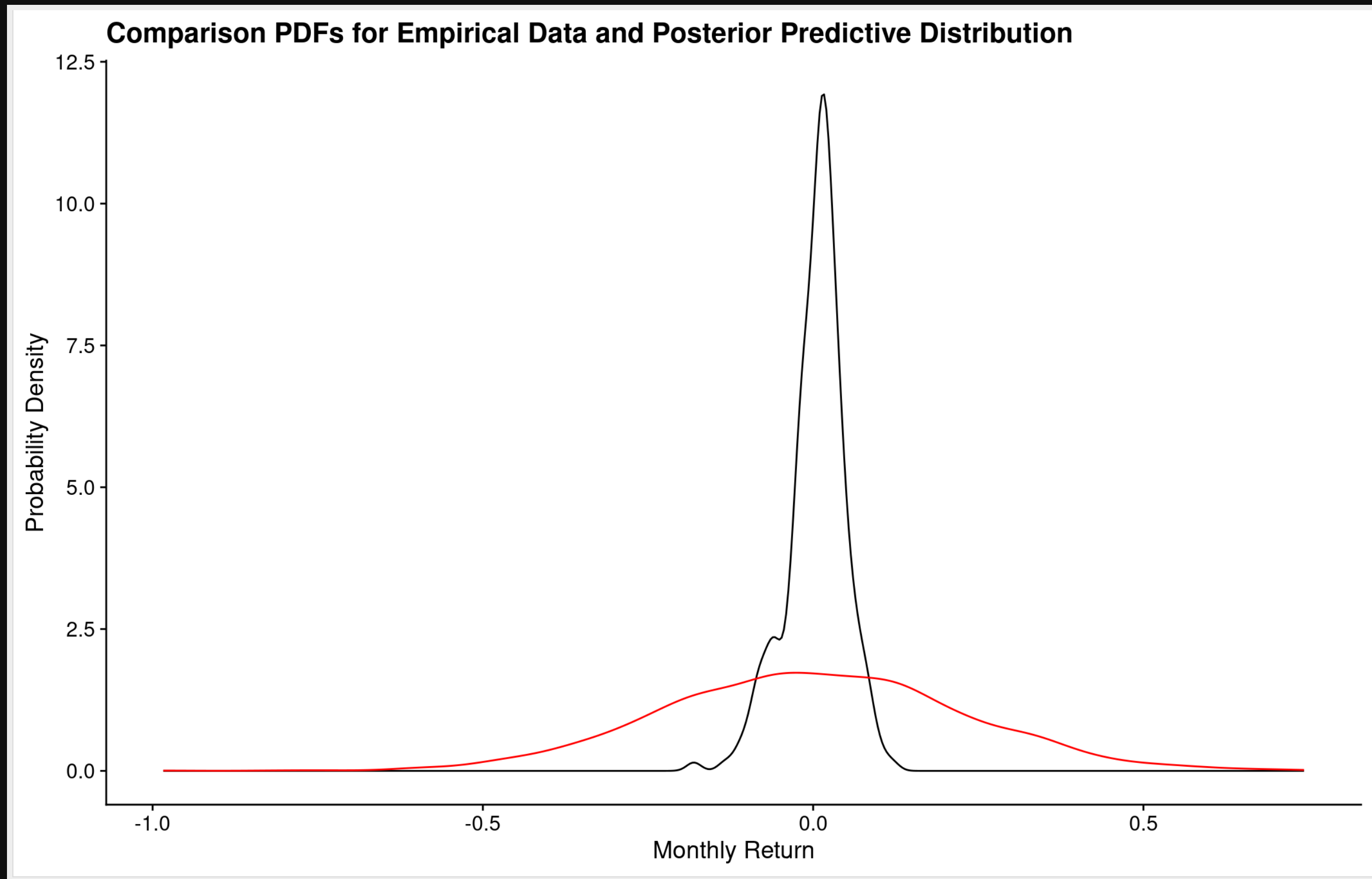Histogram of Monthly SPY Returns from Jan 2020

Lineplot of the SPY Cumulative Returns

Histogram of Parameter Posterior Distributions

Plot of Joint Posterior Distribution of mu and sigma

Model Checks

Comparison PDFs for Empirical Data and Posterior Predictive Distribution

Thank You!

Mick Cooney

mcooney@describedata.com

https://github.com/kaybenleroll/data_workshops