Input Uncertainty Quantification in Stochastic Simulation

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Content

- A brief introduction.
- Motivation - who's interested in input uncertainty?
- Different solutions.
- Illustrate findings.

Introduction

Stochastic simulation is used for many real-world applications.
There are 2 sources of variance that arise from stochastic simulation:

- Stochastic uncertainty.
- Input uncertainty.

The sum of these 2 sources contribute to the total variance of the simulation.

What is input uncertainty?

- Input models are used to drive simulations. We use real-world data to estimate these input models.
- Input uncertainty describes the error from having estimated these input models from finite data.
- Ultimately, incorrect input models will lead to incorrect results.

Motivation

- Input uncertainty is usually ignored all together!
- Where data sets are small, input uncertainty can be much greater than stochastic uncertainty.
- Only stochastic uncertainty is usually reported. This will give a false sense of confidence when analysing the outputs from the simulation.

Methods

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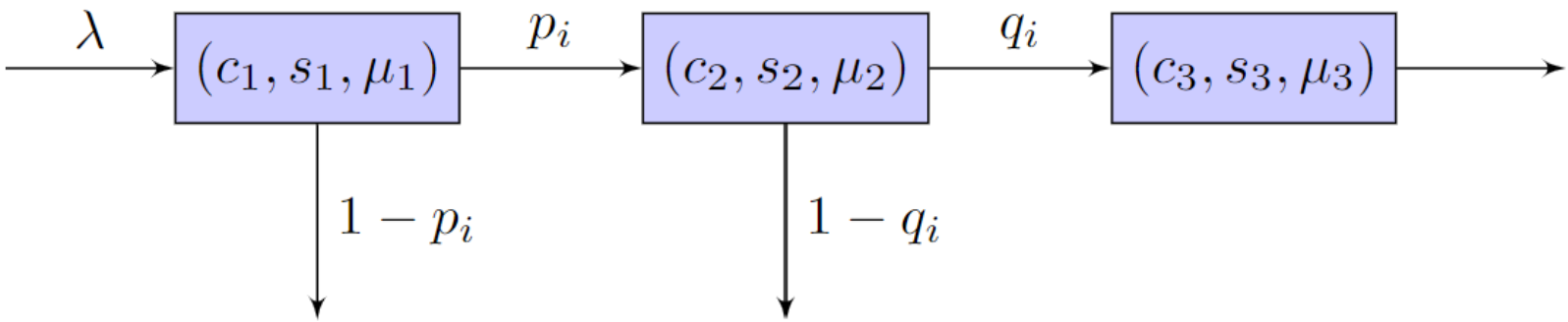
Assumption - we know the distribution family from which we are estimating the parameters.

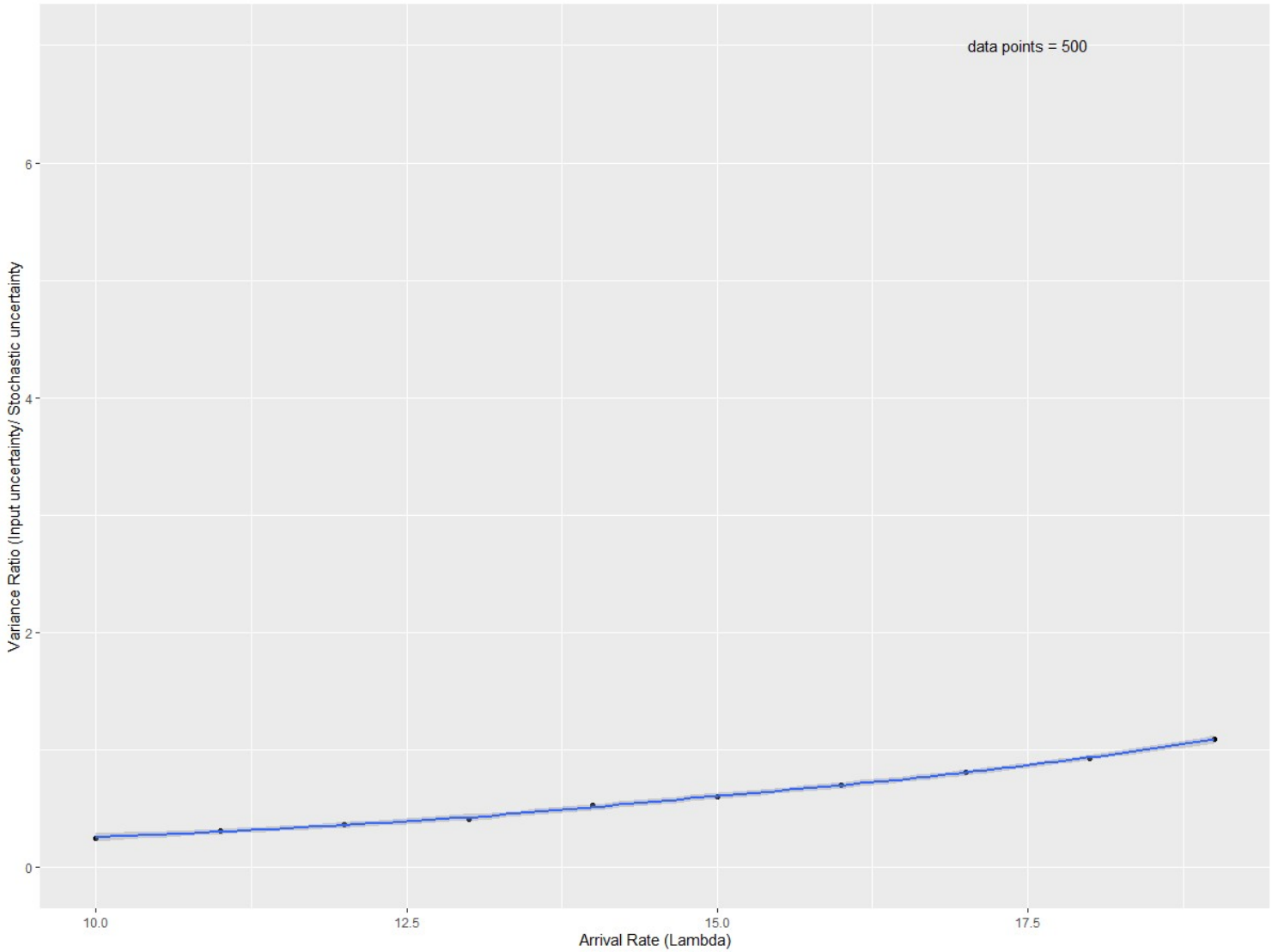
Taylor-series approximation

- Gives a more accurate estimation than Bootstrapping and Subsampling.
- Much faster to run! Only requires 1 simulation (Bootstrapping and Subsampling require BR simulations.)
- Shows contribution of individual parameters.
- Easy to extend to more realistic queuing models.

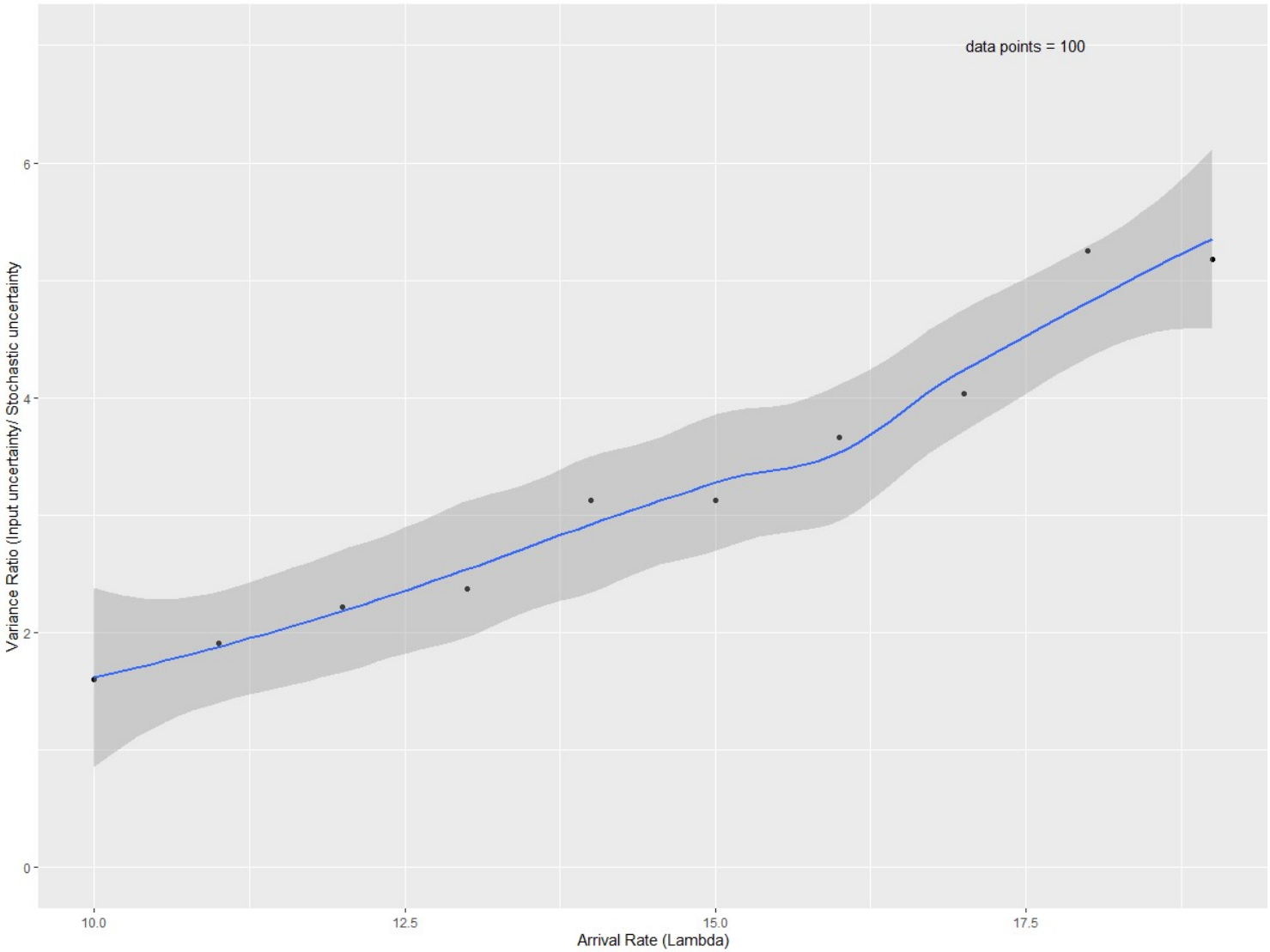
Queuing model



Findings


data points = 500
Variance Ratio (Input uncertainty/ Stochastic uncertainty
0
2
4
6
10.0
12.5
15.0
17.5
Arrival Rate (Lambda)

Findings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Thanks for listening!

- Any questions?