

## Graphical Abstract

### Prescriptive Analytics for Two-Echelon Logistics, a Case Study in Large-Scale Retail

Integration of bootstrapped autoregressive models and scenario-based  
optimization in a real-world logistic case study

The case study is based on a 2-echelon supply chain with retail stores allocated to distribution centers (DCs).

The problem was to minimize the allocation cost and the corresponding aggregated demand to each DC when the retailer requests are forecast based on historical data.

This process allows us to determine the inventory required to be stocked in each DCs, and consequently the size needed to hold it.

We propose grounding the forecasting phase on bootstrapped autoregressive models, which demonstrated effectiveness compared to alternative methods.

The bootstrapped series are used to generate scenarios, which in turn are incorporated into a deterministic equivalent formulation.

The results demonstrate the effectiveness of the approach on the use case presented.

The approach has a validity that extends beyond the case study forming the basis of a more general framework for prescriptive analytics called Bootstrap Enhanced Scenario Optimization (BESO).

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## Highlights

- A new framework for integrating time series forecasting into stochastic programming.
- Maximum Entropy Bootstrap with bagging for forecasting short logistic time series.
- Bootstrap distributions for deterministic equivalent scenario generation.
- Predictive analytics for warehouse sizing.
- Real-world 2-echelon logistics case study.

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**Abstract**

Abstract text.

*Keywords:*

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**1. Example Section**

Section text. See Subsection 1.1.

*1.1. Example Subsection*

Subsection text.

*1.1.1. Mathematics*

This is an example for the symbol  $\alpha$  tagged as inline mathematics.

$$f(x) = (x + a)(x + b) \tag{1}$$

$$f(x) = (x + a)(x + b)$$

$$f(x) = (x + a)(x + b) \tag{2}$$

$$= x^2 + (a + b)x + ab \tag{3}$$

1	2	3
4	5	6
7	8	9

Table 1: Table Caption

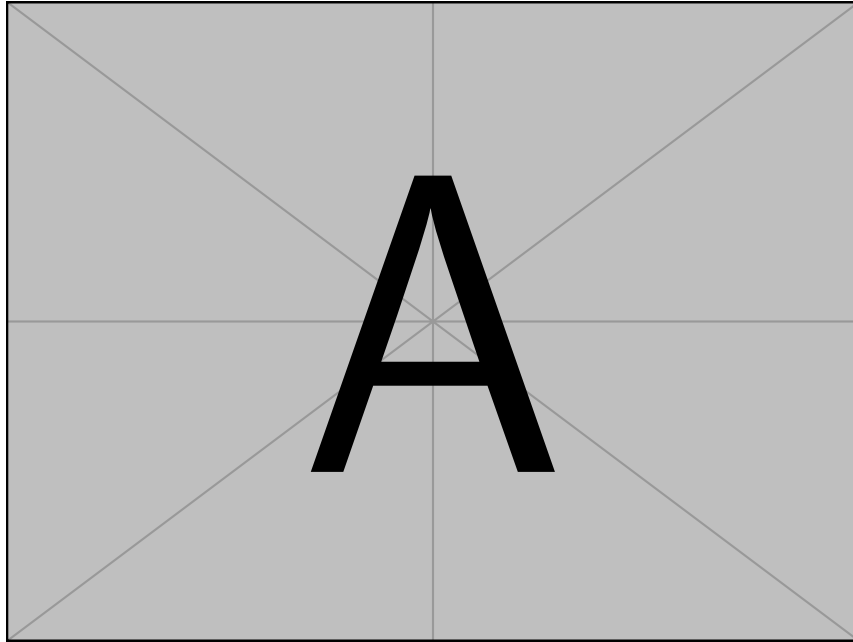


Figure 1: Figure Caption

$$\begin{aligned}
 f(x) &= (x + a)(x + b) \\
 &= x^2 + (a + b)x + ab
 \end{aligned}$$

## Appendix A. Example Appendix Section

Appendix text.

Example citation, See Andersson and Marklund (2000).

## References

Andersson, J., Marklund, J., 2000. Decentralized inventory control in a two-level distribution system. *European J. of Operational Research* 127, 483–506.