Contents

List of figures **V**

List of tables **VII**

List of abbreviations **IX**

1 Introduction **1**

1.1 Motivation 1

1.2 Outline 2

1.3 Contribution 5

2 Controlling the transition to optimized spare parts inventory policies **7**

2.1 Introduction 8

2.2 Literature review 11

2.3 Problem formulation and mathematical model 14

2.3.1 The inventory system in steady-state 15

2.3.2 The inventory transition 17

2.4 Solution approaches 22

2.4.1 Column generation approach 22

2.4.2 Marginal analysis approach 24

2.5 Numerical study 27

2.5.1 Performance evaluation of the solution approaches 28

2.5.2 The value of controlling the transition 33

2.6 Conclusion 45
Appendix 47
2.A Characteristics of (P^S) 47
2.B Column generation 49
2.B.1 Computing an upper bound 49
2.B.2 Generating new sequences by solving the subproblem . . . 50
2.C Marginal analysis algorithm for the inventory transition 53
2.D Distribution selection for sensitivity analysis 55
2.E Sensitivity analysis – Maximum periodic cost savings and maximum periodic system fill rate differences 57

3 The effects of algorithm transparency on the use of advice 59
3.1 Introduction 60
3.2 Literature review 62
3.3 Hypotheses development 65
3.4 Effects of algorithm transparency on the use of advice 67
3.4.1 Experimental design 67
3.4.2 Experimental protocol 69
3.4.3 Results 70
3.5 Discussion and future work 73

4 How algorithm complexity drives the use of advice 75
4.1 Introduction 76
4.2 Literature review 78
4.2.1 The use of algorithmic advice 79
4.2.2 Advice-taking in demand forecasting 81
4.3 Development of hypotheses 83
4.4 Experimental study 85
4.4.1 Experimental design 85

4.4.2 Experimental protocol 88
4.5 Results 89
4.5.1 Validation of treatment manipulation 89
4.5.2 Effects of transparency of simple and complex algorithms on weight on advice 91
4.5.3 Perceived appropriateness of complexity as a moderator of the effects of algorithm transparency on weight on advice . 93
4.6 Conclusion 96
Appendix 99
4.A Preliminary study 99
4.A.1 Experimental design 99
4.A.2 Experimental protocol 100
4.A.3 Results 101
4.B Preregistered hypotheses 103
4.C Laboratory experiment 107
4.C.1 Task description 107
4.C.2 Initial forecast 108
4.C.3 Algorithm explanation 109
4.D Regressions with controls 113

5 Increasing accuracy of lead time master data with machine learning 115

5.1 Introduction 116
5.2 Lead time prediction with machine learning 118
5.3 Problem setting 119
5.4 Methodology 121
5.4.1 Lead time types 121
5.4.2 Lead time prediction framework 122
5.4.3 Alternative planned lead times 124

5.4.4 Models . . . 124
5.4.5 Train/Test split . . . 126
5.4.6 Evaluation metrics . . . 128
5.5 Empirical study . . . 129
5.5.1 Dataset . . . 129
5.5.2 Features . . . 133
5.5.3 Spare parts order distribution . . . 133
5.5.4 Model training . . . 135
5.6 Results . . . 136
5.6.1 Performance of different regressors . . . 136
5.6.2 Feature importance and partial dependence . . . 136
5.6.3 Predicting order lead times . . . 140
5.6.4 Predicting planned lead times . . . 140
5.6.5 Predicting planned lead times for new parts . . . 141
5.7 Impact on inventory performance . . . 142
5.7.1 Inventory policy . . . 143
5.7.2 Influence of lead time accuracy on inventory performance . 144
5.8 Conclusion . . . 145
Appendix . . . 147
5.A Data analysis – Segmentation . . . 147

6 Conclusion **149**
6.1 Summary of key results . . . 149
6.2 Critical review and future research . . . 152

Bibliography **155**