

# Linear Programming Notes VII

## Sensitivity Analysis

### 1 Introduction

When you use a mathematical model to describe reality you must make approximations. The world is more complicated than the kinds of optimization problems that we are able to solve. Linearity assumptions usually are significant approximations. Another important approximation comes because you cannot be sure of the data that you put into the model. Your knowledge of the relevant technology may be imprecise, forcing you to approximate values in  $A$ ,  $b$ , or  $c$ . Moreover, information may change. **Sensitivity analysis** is a systematic study of how sensitive (duh) solutions are to (small) changes in the data. The basic idea is to be able to give answers to questions of the form:

1. If the objective function changes, how does the solution change?
2. If resources available change, how does the solution change?
3. If a constraint is added to the problem, how does the solution change?

One approach to these questions is to solve lots of linear programming problems. For example, if you think that the price of your primary output will be between \$100 and \$120 per unit, you can solve twenty different problems (one for each whole number between \$100 and \$120).<sup>1</sup> This method would work, but it is inelegant and (for large problems) would involve a large amount of computation time. (In fact, the computation time is cheap, and computing solutions to similar problems is a standard technique for studying sensitivity in practice.) The approach that I will describe in these notes takes full advantage of the structure of LP programming problems and their solution. It turns out that you can often figure out what happens in “nearby” linear programming problems just by thinking and by examining the information provided by the simplex algorithm. In this section, I will describe the sensitivity analysis information provided in Excel computations. I will also try to give an intuition for the results.

### 2 Intuition and Overview

Throughout these notes you should imagine that you must solve a linear programming problem, but then you want to see how the answer changes if the problem is changed. In every case, the results assume that **only one thing about the problem changes**. That is, in sensitivity analysis you evaluate what happens when only one parameter of the problem changes.

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<sup>1</sup>OK, there are really 21 problems, but who is counting?

# Linear Programming Notes Vii Sensitivity Analysis

**Barry Render,Ralph M. Stair,Michael E.  
Hanna**

## **Linear Programming Notes Vii Sensitivity Analysis:**

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**Quantitative Approaches to Distribution Logistics and Supply Chain Management** Andreas Klose,M. Gracia Speranza,Luk N. Van Wassenhove,2012-12-06 Increasing customer needs the globalization of markets and the evolution of e commerce add to the complexity of logistic processes In today s business it is well understood that an effective management of logistic processes is impossible without the use of computer based tools and quantitative methods This book presents in a systematic way quantitative approaches to distribution logistics and supply chain management The main orientation of the book is towards practical problem solving and numerous case studies and practical applications are presented The topics covered include supply chain management revers logistics e commerce facility location and network planning vehicle routing warehousing inventory control

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to review the latest developments in the field

**Sm Intro Management Science I/M and Tests** Pearson Higher Education & Professional Group,1993-04

**Optimality and Efficiency** D. J. White,1982-12-22 An organized overview of recent developments in the field of optimality and efficiency Presents the concepts of optimal solutions and efficient solutions their interrelationships basic theorems and classes of problems where these concepts can be applied Includes extensive references for further study

**The Measurement of Market Risk** Pierre-Yves Moix,2001-07-03 The objective of this book is to set up an economic quantitative model for the assessment of financial market risk The Measurement of Market Risk reviews the probabilistic modelling of so called risk factors which represent the uncertainty of financial markets and discusses the issue of risk as the perception of uncertainty by individuals when faced with a decision problem Further the book discusses the pricing of financial instruments as a function of risk factors Emphasis is put on options because they exhibit a non linear exposure to the risk factors The core of the text is the assessment of risk for financial portfolios by way of estimating the portfolio probability distribution A new approach the Barycentric Discretisation with Piecewise Quadratic Approximation BDPQA which poses no assumptions on the risk factor distribution and accounts for the non linearity of the price functions is introduced

**Management Science** David G. Dannenbring,Martin Kenneth Starr,1981

*An Introduction to Management Science* David Ray Anderson,Dennis J. Sweeney,Thomas Arthur Williams,1985 Provides graduate and undergraduate students with an introduction to management science procedure and the role it plays in the decision making process This edition contains expanded presentation of Microsoft Excel spreadsheet appendices new case problems to address current trends in management science and a new management science software 5 0 package available under a different ISBN Includes self test exercises with worked out solutions Annotation copyrighted by Book News Inc Portland OR

Multiple Criteria Optimization Ralph E. Steuer,1989

The American Mathematical Monthly ,1980

*Foundations of Control Engineering* ,1986

**journal of retailing spring 1967, vol. 43, no. 1** ,1967

**Quantitative Analysis for Management** Barry Render,Ralph M. Stair,Michael E. Hanna,2006 Fully integrated with the personal computer this easy to use book provides readers with the skills to necessary to apply the techniques of quantitative analysis in all kinds of organizational decision making situations It covers every major topic in the quantitative analysis management science field showing how each technique works discussing the assumptions and limitations of the models and illustrating the real world usefulness of each technique with many applications and case studies in both profit making and nonprofit organizations A FREE CD ROM readers can use to solve the examples presented in the book is conveniently packaged with the book providing Excel QM Crystal Ball TreePlan QM for Windows and data files for examples Probability Concepts and Applications Decision Theory Decision Trees with Utility Theory Forecasting Inventory Control Models Linear Programming Models Linear Programming The Simplex Method Transportation and Assignment Models Integer Programming Goal Programming Non Linear Programming and Branch and Bound Models Analytic Hierarchy Process Network Models Project

Management Waiting Lines and Queuing Theory Models Simulation Modeling Markov Analysis Using QM for Windows Using Excel OM Appropriate for business managers and analysts      **Parametric Optimization and Related Topics** Jürgen Guddat,1987      *Comptes Rendus* International Association for Hydraulic Research. Congress,1993      *Operations Research* Wayne L. Winston,1991 Since the publication of the first edition in 1987 Winston s text has become increasingly popular because of its easy to follow format its many examples and problems and its emphasis on model building and model formulation skills The text includes comprehensive coverage of all areas of operations research and management science

Progress in Operations Research ,1961      **Operations Research** William C. House,1972      *Bibliographie der Staats-und Wirtschaftswissenschaften* ,1996

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