A Stochastic Programming for Aggregate Production Planning Model with Demand Uncertainty

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ABSTRACT

The better production plans have the international enterprises or manufacturers, the more competiveness on the market. There are three kinds of production plans, called short term, median term, and long term plans. Aggregate production planning is belonging to median term plans. Its horizon covers from two months to 12 months. It plays an important role in the decision-making system of an enterprise or manufacturer because it influences the variations of production, inventory and human labors during production horizon. According aggregate production planning, real demands and inventory, the master production, capacity plan and material requirements planning can be scheduled. In practice, aggregate production planning includes uncertainties, such as cost, price, capacity, labor and demands. In this study, the demand is considered as a random variable in an aggregate production planning. A stochastic programming model is applied to maximize profit with limited capacity. For the proposed aggregate production planning problem, expected-value, wait-and-see model and here-and-now model are compared and sensitivity analysis is performed. The results show that here-and-now solution is superior to expected-value model and approaching wait-and-see model. The forward means the proposed stochastic model is more real and profitable for practice; the latter means its optimality approaches the solution with perfect information.

Keywords : Aggregate Production Planning、Stochastic Programming、Uncertainty

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REFERENCES

一、 中文文獻 [1] 李綺容 (2004)。航空貨運網路於需求不確定下之規劃。國立嘉義大學運輸與物流工程研究所碩士論文。

[2] 余強生 (2006)。可協調儲運供應與銷售努力的單一產品多時期之穩健供應鏈模式。台灣管理學刊，6(1)，1-34。

[3] 林毓舜、張毓恆、周雍強 (2005)。隨機規劃法在半導體機台組態之應用。管理與系統，12(4)，1-15。

[4] 周國端、吳志遠 (2005)。最低收益保證對於國民年金基金之資產配置的影響:隨機線性規劃方法之應用。臺大管理論叢，16(1)，67-92。

[5] 徐惠伶 (2007)。模糊目標規劃法於多偏好資訊下群體決策問題之研究。國立成功大學工業與資訊管理學系碩士論文。

[6] 張百棧 (2006)。生產與作業管理。三民書局。

[7] 張益菁 (2005)。考量需求不確定之單階多廠產能規劃問題— TFT LCD產業為例。國立清華大學工業工程與工程管理學系碩士論文。

[8] 陳惠國、薛哲夫、張美香 (2011)。含時窗限制暨機率型旅行時間車輛途程問題之真正解演算法探討。運輸學刊，23(4)，28-67。

[9] 博和彥 (2005)。生產與作業管理。前程文化。

[10] 楊大輝、李綺容 (2007)。需求變動下之航空貨運網路規劃。運輸學刊，19(2)，169-189。

[11] 簡聰海 (2007)。生產與作業管理。新文京。

[12] 蘇恩德 (2011)。考慮價格跳躍不對稱與波動狀態轉換之動態資產配置考慮價格跳躍不對稱與波動狀態轉換之動態資產配置。管理與系統，18(1)，1-33。 二、 英文文獻 [13] Atthawit, T., and Pisal, Y. (2002). Aggregate production planning using spreadsheet solver: model and case study. ScienceAsia, 28, 291-300.

[14] Bowman, E. H. (1956). Production scheduling by the transportation method of linear programming. Operations Research, 4,100-103.

[15] Bowman, E. H. (1963). Consistency and optimality in managerial decision making. Management Science, 9, 310-321.

[16] Car?業, C. C., and Tind, J. (1998). L-shaped decomposition of two-stage stochastic programs with integer recourse. Mathematical Programming, 83, 451-464.
[17] Car?業, C. C., and Schultz, R. (1999). Dual decomposition in stochastic integer programming. Operations Research Letters, 24, 37-45.
[18] Charnes, A., and Cooper, W. W. (1977). Goal programming and multiple objective optimization. part I. European Journal of Operational Research, 1(1), 39-54.
[19] Dupacova, J. (2002). Applications of stochastic programming:achievements and questions. European Journal of Operational Research, 140, 281-290.
[20] Fung, R. Y. K., Tang, J., and Wang, D. (2003). Multiproduct aggregate production planning with fuzzy demands and fuzzy capacities. IEEE, 33, 302-313.
[21] Holt, C. C., Modigliani, F., and Simon, H. A. (1955). A linear decision role for production and employment scheduling. Management Science, 2, 1-30.
[22] Hood, S. J., Bermon, S., and Barahona, F. (2003). Capacity planning under demand uncertainty for semiconductor manufacturing, IEEE Transactions on Semiconductor Manufacturing, 16(2), 273-280.
[23] Jones, C. H. (1967). Parametric production planning. Management Science, 13, 843-866.
[24] Mula, J., Poler, R., Garc? ′ a-Sabater, J. P., and Lario, F. C. (2006). Models for production planning under uncertainty: a review. International Journal of Production Economics, 103, 271-285.
[25] Pr?翳opa, A. (1995). Stochastic Programming. Kluwer, Dordrecht, The Netherlands.
[26] Powell, W. B. (1996). A stochastic formulation of the dynamic assignment problem, with an application to truckload motor carriers. Transportation Science, 30(3), 195-219.
[27] Rakes, T. R., Franz, L. S., and Wyane, A. J. (1984). Aggregate production planning using chance-constrained goal programming. International Journal of Production Research, 22, 673 - 684.
[28] Saad, G. (1982). An overview of production planning model: structure classification and empirical assessment. International Journal of Production Research, 20, 105-114.
[29] Singhal, K., and Adlakha, V. (1989). Cost and shortage trade-offs in aggregate production planning. Decision Sciences, 20, 158-165.
[30] Sen, S. (1999). An introductory tutorial on stochastic linear programming models. Interfaces, 29, 33-61.
[31] Stephen, C. H. L., Wu, Y., and Lai, K.K. (2003). Multi-site aggregate production planning with multiple objectives: a goal programming approach. Production Planning and Control, 14(5), 425-436.
[32] Thompson, S. D., and Davis, W. J. (1990). An integrated approach for modeling uncertainty in aggregate production planning. IEEE Transactions on Systems, Man, and Cybernetics, 20, 1000- 1012.
[33] Taubert, W.H. (1968). A search decision rule for the aggregate scheduling problem. Management Science, l4, 343-359.
[34] Valente, P., Mitra, G., Poojari, C., and Kyriakis, K. (2001). Software tools of stochastic programming: a stochastic programming integrated environment. Department of Mathematical Sciences, Brunel University, Uxbridge, UB8 3PH.
[35] Vladimirou, H., and Zenios, S. A. (1997). Stochastic linear programs with restricted recourse. European Journal of Operational Research, 101, 177-192.
[36] Wang, R. C., and Liang, T. F. (2004). Application of fuzzy multi-objective linear programming to aggregate production planning. Computers and Industrial Engineering, 46, 17-41.
[37] Whybark, D. C., and Williams, J. G. (1976). Material requirements planning under uncertainty. Decision Science, 7, 565 -701.
[38] Wets, R. J-B (1996). Challenges in stochastic programming. Mathematical Programming, 75, 115-135.
[39] Wets, R. J-B (2000). Stochastic programming models: wait-and-see versus here-and-now. National Science Foundation, Document 90C15.
[40] Zhao, Y. Q., Lu, L. B., and Fang, S. F. (2006). Stochastic linear optimization for modeling uncertainty in aggregate production planning. International Conference on Autonomic and Autonomous Systems, 31-31.