

## 两级供应链产品质量控制契约模型分析

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## Product Quality Control Contract Model in a Two-Echelon Supply Chain

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**摘要** 基于博弈论和委托代理理论,研究在两级供应链中如何进行质量控制契约设计的问题。建立生产商和购买商的期望收益函数模型,生产商对其生产过程投资水平进行决策并确定其产品质量预防水平;购买商进行质量评价决策并确定其产品质量检验水平。生产商存在降低其生产过程投资水平的道德风险问题,在生产过程中将“削减投资”,购买商为激励生产商提高其生产过程投资水平将支付“信息租金”的成本。购买商在进行产品质量检验决策时,存在夸大产品质量缺陷率的道德风险问题,在产品质量检验过程中将“过度检验”。运用最优化原理,求解生产商的最优生产过程投资水平、产品质量预防水平和价格折扣额与购买商的最优质量检验水平和外部损失分摊比例,并进行了算例分析,结果表明:当生产商提高其生产过程投资水平时,其质量预防水平将显著增加,购买商的质量检验水平将显著下降;随着购买商质量检验水平的提高,生产商所提供的价格折扣额先增大后减少,生产商所承担的外部损失分摊比例将会下降,其期望收益增加,购买商的期望收益将会减少,供应链联合期望收益将呈现“倒U”型,求解了期望收益的最大值及各契约参数的值,结果证明所提出的质量控制契约模型是可行的。

**关键词:** 供应链 质量控制 契约设计 委托代理关系

**Abstract:** Based on game theory and principal-agent theory, how to design quality control contract in the two-echelon supply chain is studied. The producer's and buyer's expected profits function model is set up, in which the producer makes investment level decision in production process and decides the product quality prevention level, and the buyer makes quality evaluation decision and decides the product quality inspection level. If the producer has the moral hazard of reducing product quality investment level and it reduces the investment, the buyer will pay for the information rents in order to incentive producer improve investment level. The buyer may have the moral hazard of exaggerating product quality defects. The optimization theory is used to solve the producer's optimal investment level, product quality prevention level, price rebates and the buyer's optimal quality inspection level and apportionment ratio of external failure cost. Results of a numerical example show that when producer improve the investment level, the product quality prevention level will increase and the buyer's quality inspection level will decrease. With the improvement of the buyer's product quality inspection level, the producer's price rebates will firstly increase and then decrease, the external failure cost undertook by the producer will decrease, and expected profits will increase, the buyer's expected profits will decrease, and the supply chain's joint expected profits are inverse U-shaped. The maximum expected profits and contract parameters are solved and the results, demonstrate that the quality control contract model is effective.

收稿日期: 2010-04-20;

基金资助:教育部人文社会科学研究资助项目(12YJC630327,10YJA630194);山东省自然科学基金资助项目(ZR2012GQ001)

引用本文:

朱立龙, 于涛, 夏同水. 两级供应链产品质量控制契约模型分析[J] 中国管理科学, 2013, V(1): 71-79

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