Contract Portfolio Optimization for a Gasoline Supply Chain

Abstract

Major oil companies sell gasoline through three channels of trade: branded (associated with long-term contracts), unbranded (associated with short-term contracts), and spot market. The branded channel provides them with a long-term secured and sustainable demand source, but requires an inflexible long-term commitment with demand and price risks. The unbranded channel provides a medium level of allocation flexibility. The spot market provides them with the greatest allocation flexibility to the changing market conditions, but the spot market's illiquidity mitigates this benefit. In order to sell the product in a profitable and sustainable way, they need a dynamic contract portfolio strategy that would enable them to adjust the supply contract portfolio over time in anticipation of the future market conditions in each individual channel while satisfying the contractual obligations. We propose two analytical models: a strategic model to capture the high-level economic tradeoffs among the components of the supply contract portfolio, and a tactical model to dynamically rebalance the contract portfolio according to changing market dynamics with the objective of maximizing total expected discounted profit. We characterize the structure of an optimal state-dependent base-share contract portfolio policy for both finite and infinite planning horizons. We also apply an efficient modified policy iteration method to compute optimal strategies and corresponding optimal profit values. We present computational results in order to obtain qualitative insights into the structure of optimal policies, capture the value of the dynamic contract portfolio policy by comparing it with static policies, and illustrate the sensitivity of the optimal contract portfolio and corresponding profit value in terms of the different parameters.