

## Summary

### **Integrated Operational and Financial Decision Making**

This dissertation explores the role of financing in characterizing the optimal decision making in operations management. The joint treatment of financial and operational elements sheds light on the possible applications of the supply chain and finance in practice. Each chapter in this thesis is devoted to the operational and financial flow analyses of a capital-constrained manufacturing firm, who (partially) finances his business with external financing; i.e., a loan from a bank. Elaborating on different operational problems, and bringing in the financial aspects, we characterize the optimal operational policies.

The first application is for a supply chain and finance arrangement. The recent credit crisis emphasized the need for and the value of close financial and operational collaboration among the supply chain members. In this model, we explore a particular form of intra-chain collaboration, reverse factoring, which many businesses see not only as an important element in their strategy for recovery from the recent credit crisis, but also as a means for generating more value during usual economic conditions. Reverse factoring entails that supply chain partners collaborate on financing arrangements, in order to improve the efficiency of their transactions, reduce costs, and obviate operational roadblocks. We show how application of reverse factoring influences the operational and financial decisions of the firms. While some empirical work on reverse factoring exists within the academic literature, our model constitutes the first analytic treatment of the problem, using the value framework of financial theory. We show where the value of reverse factoring results from, and how it is conditioned by: (1) the spread in external financing costs, (2) the operating characteristics of the supplier, including the implied working capital policy, and (3) the risk-free interest rate. Thus, in addition to providing managerial insights that integrate operational and financial perspectives, our findings disclose an important relation of these elements to the broader macro-economic context.

The second application is regarding the managerial contracting within the manufacturing firms. Eliminating the single decision maker argument in a newsvendor framework, we study the effect of conflicting interests of different stakeholders governing the operational and financial processes. Building up on a financial framework, we develop a modified agency problem resulting from the divergent interests between the shareholders, the bondholders and the firm's management. The model demonstrates the agency costs attached to risky debt when the shareholders try to solely align managerial incentives with their own. In order to alleviate the deadweight costs, executive compensation contracts, aside having the role of aligning the interests between the shareholders and the manager, can be employed as a commitment tool for the bondholders. We contribute to the operations management literature by addressing agency costs in an operations model and providing the optimal executive compensation design, as well as to the finance literature by extending managerial compensation problem into a detailed operations model, by which we can characterize and

quantify the severity of the agency problem. The findings reveal that for the firms with risky debt, simple contract schemes such as pure-equity, employed as a rule of thumb for the complete alignment of the manager's benefits to the shareholders', or cash-based incentives like performance bonuses are suboptimal in eliminating the agency costs, resulting in an aggressive or a conservative operations policy respectively that directly translates into value loss. Efficient compensation structures, which are designed to maximize shareholder wealth, suggest the use of these two counteracting motives. In the optimal compensation package, we acknowledge that the portion of equity incentive should increase in the profit margin of the newsvendor, yet decrease in the bankruptcy costs and the leverage ratio.

The last application is for a well-studied operations problem: production postponement. We examine how flexible production technology investment, changing the amount and composition of inventory, affects the financial and operational processes, namely the production policy and the riskiness of the firm by means of expected bankruptcy costs. This study examines how the presence of costly bankruptcy affects the decision to invest in operational flexibility in the presence of a salvage market. Specifically, we compare the investment strategy of delayed product differentiation (postponement) to early product differentiation in a two-period, two-product model. We focus on how production postponement alters the composition of finished goods and work-in-process inventory affecting the financial risk of the firm and the operating and investment plans. Our analyses show under what conditions the decision to invest in postponement may be reversed when financial considerations are taken into account. We derive optimal postponement and operating policies, and show how this optimal policy is oriented by sector specific factors, such as salvage market and customization process of the firm, in the presence of capital market frictions. Depending on the characteristics of the product market, namely the product tradability and specificity, our findings reveal that the investment decision can alternate and the optimal production and financial policy alters as a result of costly bankruptcy. For the product markets, where the products require high (low) customization costs with high (low) salvage value for the common item, the findings reveal that delayed product differentiation (early product differentiation) dominates as bankruptcy costs increases. However, for the markets with high (low) customization costs and low (high) salvage value for the common item, early product differentiation (delayed product differentiation) dominates irrespective of the level of bankruptcy costs. This research reveals the importance of the existence and the magnitude of the market imperfections, in terms of bankruptcy costs, in investing in production postponement.

Finally, we summarize the main findings and practical implications of the studies described in previous chapters of this dissertation. Mathematical modeling is supported with numerical and sensitivity analyses to emphasize the importance of the results. The managerial insights are applicable to various manufacturing, process and service sectors. We also describe the main limitations of the models developed in this dissertation and provide directions for future research.