

DISSERTATION PROPOSAL

Essays in Service Operations Management

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The first two chapters of my thesis focus on the operation of rental businesses, which provides a novel and increasingly significant application of a supply chain and service operation. According to IBISWorld industry reports, at least fifteen different rental industries in the United States have annual revenues exceeding \$1 billion. Furthermore, the consumer trend of “access over ownership” has spurred the creation of new and disruptive business models such as Rent the Runway, which rents designer dresses by mail to over 2 million users. However, existing operations management literature offers little support to rental operations subject to complex demand characteristics and the loss of rental units due to customer damage or purchase.

In the first chapter I provide structural results for how the inventory procurement decision affects profit in a discrete-time, finite horizon rental operation. My work is the first to provide such results for a rental system with the random loss of rental units which is a crucial issue for many rental companies, and it also considers random customer rental duration and lost sales. Furthermore, I characterize the optimal rental unit recirculation policy. This policy dictates which rental unit should be chosen to meet each customer demand and is important, for example, when rental unit have an increasing failure rate. These results hold under very general settings, enabling the model to reflect complexities of fashion products and consumer behavior. A numerical study shows that accounting for rental unit loss can increase the expected profit by up to 7% for a single season and becomes even more important as the time horizon lengthens. We also show that choosing the optimal recirculation rule over another simple policy allows more rental units to be profitably added and the profit-maximizing service level increases by up to 6 percentage points.

For my second chapter I am currently extending my work on rental operations to focus on advance reservations. I have begun to study structural properties of a finite horizon model to gain insights about how different dynamic reservation policies compare to first-come first-served policies with and without reservations. In particular, I will examine how reservations affect the utilization of rental units and how the reservation policy interacts with the pre-season capacity planning problem for a model with usage-based loss. Other potential model elements include customer classes and an in-season decision to re-order or repair rental units.

Another project contributing to my thesis addresses both strategic and tactical policy questions for the operation of a statewide adoption network, which matches children in state custody with prospective adoptive families. Our policy recommendations were guided by child outcome data, case worker surveys and interviews, and economic insights from market design. Using a discrete-event simulation of the adoption network, we predict that a functioning statewide recommendation system with better information about family preferences generates a 22% increase in the successful adoption rate for children compared to the current system. To achieve this benefit, we worked closely with managers of the Pennsylvania Adoption Exchange to help improve the information collected from families and children, the matching algorithm, and the information incentives for family preferences.