

DISSERTATION PROPOSAL

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Essays in Modern Operations Management

This thesis explores three problems in modern operations management that have arisen in response to recent technological advances that have changed management practice. Our first chapter discusses the regulation of electricity markets with rooftop solar, whose adoption has recently seen a dramatic increase. The second and third chapters study problems arising from the increased availability of information to customers and firms.

Our first chapter is motivated by the observation that electricity markets in the U.S.A. are in significant flux, with utility regulators grappling to find an appropriate way of compensating customers with rooftop solar systems who sell electricity back to the grid. Regulators must safeguard utility company viability, ensure a healthy market for solar systems *and* equitably distribute costs among customers. This is a difficult balance to achieve: regulatory changes introduced in Nevada induced SolarCity, the market leader in solar systems, to suspend operations in the state. Similar regulatory changes in other states like Indiana threaten to annihilate the local solar industry there. In this chapter, we demonstrate that choosing the right tariff *structure* is crucial to fair regulation: We show that a non-tiered linear tariff structure that generalizes the existing and proposed structures in Nevada and Indiana has only a limited ability to allocate the financial losses (or gains) from solar adoption among the three parties in the market. In contrast, we then show that a two-part tiered tariff structure, with fixed charges that vary with demand tier, offers *full flexibility* to the regulator. We illustrate our findings numerically for the states of Nevada and Indiana, and find that our tiered tariff structure, in addition to being more flexible, produces more favorable outcomes in terms of customer equity.

Our second chapter is motivated by the recent practice of service providers broadcasting delay information to their customers. We address the question of whether a service provider *should* broadcast delay information when her competitor does not. We analyze a queueing model of two comparable service providers competing for market share. The service providers employ different delay announcement strategies. The announcer (A) voluntarily provides real-time delay information, for example on a website. For the non-announcer (N), customers are only aware of the periodically updated long-term average delay information. Customers make patronage decisions based on the available delay information. We investigate how A , as the first-mover in announcing real-time information, influences market shares and customer delays. We find that when A is not the higher-capacity (i.e. faster) service provider, real-time announcements improve her performance with respect to increasing market share and decreasing customers' delays. However, when A is the higher-capacity service provider, the effects are mixed, possibly resulting in A losing market share, or her customers experiencing longer delays. We propose to extend our work to consider N 's possible strategic response to A announcing delay information.

Our third chapter discusses the impact of publicly available competitor fare information on equilibrium pricing strategies for airline revenue management. Prior studies suggest that failing to explicitly account for competitors' decisions in a dynamic pricing exercise could result in revenue losses. We study equilibrium pricing strategies if these decisions *are* explicitly accounted for in a duopoly setting. We model customers as being either loyal to one of the two airlines, or flexible, buying from the airline offering the lowest fare. We establish the non-existence of pure strategy Nash equilibria (under some mild conditions on the demand function) when some strictly positive proportion of the customers is loyal. However, when all customers are flexible, we construct a pure strategy Nash equilibrium. Using these results, we comment on whether it is strategically advisable for a firm to explicitly consider competitor fare information. We propose to illustrate that the firms are caught in a Prisoner's Dilemma: the equilibrium action is for both firms to account for competitor information, although doing so makes them both strictly worse off than using the monopolistic pricing decision. However, if the firms repeatedly interact, we propose that they can sustain an equilibrium where neither firm uses competitor fare information.