Tailored capacity: Speculative and reactive fabrication of fashion goods

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Abstract

Consider a fashion goods retailer choosing a strategy for contracting production of its products. It can (1) speculate by contracting for a certain quantity to be produced well ahead of uncertain demand at relatively low unit cost, (2) react by waiting until demand is known, and only then contracting for just the right quantity at a higher unit cost, or (3) hedge its bets by speculating on a *portion* of the total quantity, and reacting to demand for the rest. Using a two-product two-stage model, we identify the conditions under which each strategy is preferred, and determine capacity requirements. We find that fashion retailing often benefits from the dual strategy due to relatively higher obsolescence costs. But the use of the dual strategy is sensitive to the cost premium for reactive capacity and to the makeup of reactive production costs as either largely variable or fixed.
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1. Introduction

Consider SportTee, a hypothetical fashion goods retailer that sells three different lines of college and professional team logo shirts: (1) TeamTees: official team jerseys with soccer, football, baseball, or basketball insignias; (2) ChampionTees: "event" shirts sold immediately after team victories in the World Cup, NCAA championship, SuperBowl, or World Series; and (3) PlayerTees: featuring specific player names and their numbers, such as soccer jerseys for Los Angeles Galaxy David Beckham and

for the Salt Lake Real's Freddie Adu. How should SportTee tailor production contract strategies to best fit the unique characteristics of each business?

Fisher and Raman (1996) proposed the strategy of *accurate response* as a means of better matching supply with demand in the fashion goods industry. Early in the production season, prior to realization of demand, capacity is dedicated to products based on a forecast, and production is referred to as *speculative*. Later in the season, demand is essentially known and production is *reactive*, in that it responds to demand volume that is known with more certainty. Fisher and Raman determine the production sequence for a set of known products given a fixed amount of speculative and reactive capacity (i.e., they establish which products should

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be manufactured at each of the two stages of the season given that capacities cannot be changed). We focus on the capacity decision in a setting similar to that of Fisher and Raman. In particular, we seek insight into how much speculative volume to produce prior to realizing demand and how much reactive capacity to have available for production in response to realized demand. Speculative production typically is more efficient because, for example, the firm may have the opportunity to mass-produce the items in a low-cost environment. A mix of speculative and reactive capacity (as in Fisher and Raman) is one strategy, but what is the right mix of speculative and reactive capacity under this strategy, and are there times when a firm might use a pure speculative strategy, or a pure reactive strategy?

We develop a simple two-stage, single-period model that determines the optimal speculative and reactive capacity levels, first for the case of one product, and then for the case of two products with independent and identically distributed demands. In the first stage, the firm commits to its speculative and reactive capacity levels, incurring fixed costs for each, and produces to the speculative capacity level. In the second stage, we assume that uncertainty is fully resolved—a slightly stronger assumption than Fisher and Raman make—and the firm uses its reactive capacity to fill this demand realization. If the sum of speculative and reactive capacity is insufficient, the firm experiences lost sales, representing an underage cost. It experiences an obsolescence (overage) cost if demand falls short of speculative production. If demand falls between the speculative capacity and total capacity levels, then some of the (relatively costly) reactive capacity goes unused. In the two-product case, reactive capacity can be used to fill demand for either product.

Returning to the SportTee example, a season's demand for a TeamTee (e.g., a Dallas Cowboys shirt), might be largely predictable based on historic patterns over prior seasons, and thus it might be optimal to make all units of this product using capacity that is speculative. In contrast, demand for ChampionTees with insignias such as "Colts: 2007 AFC Champions" and "Bears: 2007 NFC Champions" can only be determined after the outcome of the championship match is observed, such that it might be optimal to make all units using reactive capacity. And since the 2007 seasonal demand for the Beckham #23 Los Angeles Galaxy shirt or the Freddie Adu shirt may be associated with a high variance, it may be optimal for this product to use a mix of speculative and reactive capacities.

Our framework applies to a scenario where the retailer has the opportunity to contract for the production of some units of a specific product prior to its release into the market and then has a chance to supplement this initial run (of speculative production) with one additional run (that uses reactive capacity) after getting the actual orders for the product. While the primary focus of this paper is on the fashion clothing industry (see our examples from Sport Obermeyer later in the paper), other retailers and manufacturers face similar types of capacity decisions (that is, products other than clothing can also be considered to be "fashion goods"). For example, product life cycles in the personal computer (PC) industry have become sufficiently short that PC manufacturers may initiate a very limited number of production runs of any specific model before moving on to the next model. Initial runs might use speculative capacity followed by later runs using reactive capacity.

Consider also a semiconductor manufacturer who would like to take advantage of low-cost, long lead-time, offshore production. To the extent that long lead-times force the firm to set the offshore production quantity before observing any demand, that capacity is speculative. The manufacturer might benefit by reserving additional domestic reactive capacity (presumably at a higher cost than the speculative capacity) so that it could respond to the additional demand information after getting an early demand signal. We model the case where the product life cycle permits only one chance for recourse after demand becomes known.

Finally, consider the automobile industry, which is also facing shorter model lifetimes. Prior to the introduction of a new model, the firm might have to commit to a production schedule that is difficult to change significantly over the product's lifetime. Physical constraints may limit increases in capacity while labor agreements and supplier contracts may restrict decreases. As a result, the auto manufacturer may need to pre-commit to a production rate that effectively represents speculative capacity. Simultaneously, the firm could develop a contingency plan for producing additional units in case strong demand materializes, using some form of reactive capacity. For example, the firm might reserve some production slots in a second plant that is more flexible. Our model lends insight into