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Modeling the demand and supply in a new B2B-upstream market using a knowledge updating process

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Abstract

Business-to-Business (B2B) services companies invest heavily in acquiring very expensive assets that they hire out to serve their clients (e.g. UPS buys huge warehouses and hires them out to companies), and hence they engage in careful long-term planning and forecasting, especially when it concerns a new market. It is interesting to note that the client-firms, on the other hand, decide to hire those assets based mostly on the prevailing short-term market forces. Hence, it is important for the companies which provide the assets for hire to also build the prevailing short-term market trends into their long-term forecasting and planning. In this paper, we develop a model for tracking these two simultaneously evolving and interacting patterns, namely the asset-availability (i.e. supply) and utilization (i.e. demand) patterns, in order to better understand the underlying processes, and thereby provide a basis for better forecasting. We test our models using three sets of data collected from the oil drilling industry, and find the proposed model to provide a good fit and forecasting efficiency.

Keywords: Marketing; B2B service; Knowledge updating; Demand and supply; Oil drilling

1. Introduction

Trying to understand the dynamics that underlie the demand process of a new product has always been of a primary interest for marketing researchers. However, this is actually of much more practical interest to the firms that supply the new product to the market, because they need to plan well in advance their production capacity, etc. Hence, forecasting becomes a critical factor for firms that seek to supply a new product. For established product categories, firms use techniques such as time series analysis to derive the long term market demand for the products. However, with new products such information is not available. Furthermore, new product sales cycles typically exhibit a diffusion pattern, starting off with very

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low numbers during the introduction stage, gaining momentum rapidly to far greater numbers during the growth stage, and reducing to a different range of sales numbers again when the cycle slows down. The great variation in the sales numbers during this cycle presents a big challenge to the suppliers. Fortunately, marketing researchers have shown that the demand for new products does have a systematic pattern of growth. Starting from Rogers (1962) and Bass (1969), many marketing researchers have advanced models which have explained the growth of new product demand rather successfully, and these models can be used by suppliers as forecasting tools.

However, the impact of those sales growth models on the supply side dynamics has not been paid sufficient attention in the marketing research area. In fact, it did not get any attention until 1991, when Jain, Mahajan, and Muller (1991) extended the Bass model to explain the new product sales growth that is constrained by supply restrictions. Since then, the difference between "demand" and "sales" has become increasingly significant; the former denotes the expressed need for the product in the market, while the latter term denotes what is actually sold to the market. Jain et al. (1991) modeled the demand and sales growth of new telephone installations in Israel, which faced restricted supply. In their model, the supply was assumed to be such that only a certain constant fraction of the demand was able to be met by the supply at any one time. This in turn assumed a supply growth process that mimicked the demand growth, of course lagged by a few periods. The authors' objective was to explain the observed demand pattern and estimate the supply-to-demand restriction constant. In a more recent paper, Ho, Savin, and Terwiesch (2002) used a similar framework normatively to analyze the way in which a supplier can devise an optimal production capacity in order to meet the demand growth of a new product that is expected to experience a typical diffusion pattern. Assuming a fixed production capacity, the authors set out to find out the optimal fixed capacity and the optimal product launch time, which is made possible through building up enough stock before launching the product. The authors point out that high-tech firms use this process of a pre-launch production build-up.

Both of these models rely critically on modeling the demand under the condition of a restricted supply.

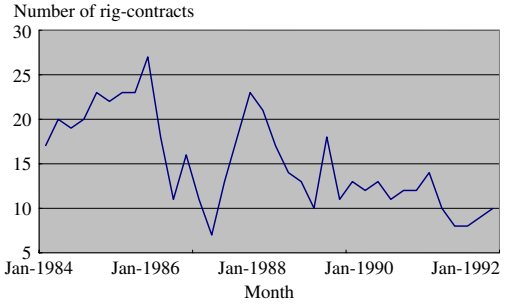

Fig. 1. Demand for drilling rigs (number of rig-contracts in GOM region).

While Jain et al. (1991) studied the demand pattern facing a constant supply-to-demand restriction, Ho et al. (2002) derived the optimal fixed production capacity, taking into account the fact that such a fixed capacity will introduce supply restrictions which will affect the demand pattern. The underlying assumption in these studies is that without such supply restrictions, the demand will follow a typical Bass-type diffusion pattern.

Consider now a different product category which we explain briefly. In Figs. 1 and 2, we show the demand and the corresponding supply of this product over a period of time. There are three aspects of this case that differentiate the focal product's supply and demand patterns from those captured by Jain et al. (1991) and Ho et al. (2002). During the period of observation, the demand never faced any supply restrictions; except perhaps for a brief time around January 1986, there was always ample supply in the market place to meet the demand. Secondly, the demand does not have a smooth diffusion-like pattern, even though it was *not* constrained by the supply. Thirdly, the supply curve has a smooth pattern that seems to capture the demand dynamics with some lag effect. For this product, it is difficult to apply the models developed in the extant literature, and hence, we need a new model to capture the supply and demand patterns observed in this product category.

We will now explain the product category shown in Figs. 1 and 2 in more detail. It is a service product in the upstream oil drilling market. Typically, oil companies such as Shell and Exxon-Mobil license-in a vast tract of land (whether onshore or off-shore) from governments, do exploration drilling in order to discover whether there is a sufficient amount of oil