



Online pricing dynamics in Internet retailing: The case of the DVD market

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ABSTRACT

The explosive growth of Internet retailing offers an excellent opportunity to collect online prices at a disaggregate (e.g., individual store and/or individual product) level over time and to investigate the evolution of Internet markets. In this paper, we generalize the results obtained in existing static analyses and develop two random coefficient regression models to capture the dynamics of prices in the US online DVD market. On the basis of the models, we test hypotheses to compare the rates of change in price levels and in price dispersion at both pure dotcoms and online branches of multichannel retailers in the DVD market. The results, based on the analysis of 6759 price quotes over a 12-month period, suggest that multichannel retailers effectively differentiated themselves from pure dotcoms on nonprice dimensions so that they charged higher prices and maintained the difference in price levels throughout the time period of the study. Head-to-head price competition within pure dotcoms tended to be more severe. Our results also suggest that there is a sign of maturity in the current US online DVD market.

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1. Introduction

Although in the early years of Internet retailing it was widely predicted that online marketing would lead to frictionless e-commerce (Alba et al. 1997, Bakos 1997), a considerable number of recent studies have overwhelmingly shown that this is not true (see e.g., Lal and Sarvary 1999, Brynjolfsson and Smith 2000, Pan et al. 2004). This study shifts the research focus and by investigating pricing behavior aims to gain a better understanding of how different types of retailer compete with each other in online markets.

The issue of online pricing is of particular importance in the online marketing research. This is because pure dotcoms tend to differentiate themselves from other types of retailer via flexibly pricing their products. In addition, the competition among dotcoms also tends to be on the price dimension. Such competition leads to substantial price dispersion in the Internet markets. It is thus crucial for researchers to understand the characteristics of online pricing behavior and how it evolves over time. The results on this research issue also have important managerial implications.

Most of the earlier empirical studies performed a static analysis where price competition was measured in terms of price levels and price dispersion. From the perspective of marketing research, both price levels and price dispersion are summaries of the price distribution in a market that reflects how retailers interact with each other. In these empirical studies price levels and price dispersion

were compared between bricks-and-mortar (traditional) and online retailers (Bailey 1998, Brynjolfsson and Smith 2000, Erevelles et al. 2001, Clay et al. 2002). Further studies focused on comparisons of various retailing channels. They compared pure Internet retailers (hereafter dotcoms) and online branches of multichannel (hereafter multichannel) retailers (Tang and Xing 2001); or traditional retailers, dotcoms, and multichannel retailers (Ancarani and Shankar 2004). These studies resulted in some interesting findings that suggest substantial differences in pricing behavior among different retailing channels.

It has also been recognized that the stage of development of Internet retailing has a substantial influence on the pricing behavior of retailers. In the early stage, for instance, online retailers priced products at a higher-level than traditional retailers (Bailey 1998, Erevelles et al. 2001). As Internet markets developed in the early years of this century, online retailers substantially lowered their prices. During the transition period there was a mixture of findings, some of which contradicted each other. For example, Clay et al. (2002) did not find any significant difference in prices between online retailers and traditional retailers, whereas Brynjolfsson and Smith (2000) compared prices of CDs and books and found that online retailers had a lower price level than traditional retailers. There were also conflicting results on price dispersion. See Pan et al. (2004) for a comprehensive review.

Internet markets are now more mature. It is thus of interest to investigate which of the earlier findings on Internet retailing can be generalized to the current online markets. In addition, since the majority of the existing researches were carried out at a fixed

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time-point, it is of interest to investigate which of the findings in these static analyses can be generalized to a longer time period so that the evolution of online prices over time can be investigated.

The emergence of Internet data sources offers an impetus to the development of dynamic models that capture price dynamics (Dekimpe and Hanssens 2000, Pauwels et al. 2004). Consequently, recent studies on online pricing have used more sophisticated dynamic approaches. As Pauwels et al. (2004) have pointed out, however, few existing studies in marketing research recognize that the neglect of heterogeneity across the entities over which the data are averaged is a serious issue in dynamic modeling. For instance, in the recent analysis in Xing et al. (2006), cross-sectional heterogeneity was absent and the correlation of the prices posted at different retailers for the same product (e.g., a particular DVD title) during the same time period was ignored. Statistically, when aggregation bias is not addressed properly, it may result in parameter estimates being inconsistent, inefficient, and/or biased (Pauwels et al. 2004).

This paper incorporates a sophisticated statistical technique to address these econometric issues. On the basis of our models, we focus on the pricing dynamics in online market evolution and investigate how different types of retailer compete with each other in an online market, the US DVD market.

The US DVD market is chosen for several reasons. First, it is generally considered that DVDs are relatively homogeneous goods and thus likely to experience strong price competition given the characteristics of Internet channels (see e.g., Bakos 1997, Lal and Sarvary 1999, Brynjolfsson and Smith 2000, Harrington 2001, Tang and Xing 2001, Iyer and Pazgal 2003, Xing et al. 2006). Secondly, there is a rich literature on the US online DVD market so it is easy to compare and contrast the findings of this study with other results, and in particular to compare the current price dynamics with those presented in Xing et al. (2006). In addition, it is more straightforward to compare DVDs because they are relatively homogeneous. For instance, prices of identical DVDs at different retailers can be compared directly. This is not the case for goods such as clothes, shoes, and electronics where there are many styles and/or models, and similar products may differ from each other to a considerable extent. Finally, the US online DVD market has a long history of Internet retailing and is likely to be more mature than other markets.

The existing static analyses have revealed some interesting results on online marketing. Tang and Xing (2001) found that prices at dotcoms were significantly lower than prices at multichannel retailers. In addition, the corresponding price dispersion was much lower among dotcoms than among multichannel retailers. Contrary to Tang and Xing (2001), Pan et al. (2003) found that multichannel retailers generally had smaller price dispersion than did dotcoms. Ancarani and Shankar (2004) argued that multichannel retailers can combine the benefits of online shopping with physical inspection, pickup, and return of merchandise via support from their offline stores. In their static analysis they suggested that multichannel retailers may effectively differentiate themselves from dotcoms on nonprice dimensions and charge higher prices. Recently Xing et al. (2006) have investigated the dynamics of online prices in the US DVD market. On the basis of the online price data in the US DVD market collected during years 2000–2001, they have found that multichannel retailers charge higher prices than dotcoms and prices go up with time for both multichannel and dotcoms retailers. In addition, prices of dotcoms go up faster than those of multichannel retailers.

In this paper we shall investigate which of these earlier findings can be generalized to the current online DVD market and can be generalized from a given time-point to a longer time period. More importantly, if there exists a difference in price levels between dif-

ferent types of retailer at a given time-point, we shall investigate whether the difference is maintained across the time period.

To reveal the competitive pricing behavior of retailers, two dynamic models will be built at an individual product level, one model for price levels and the other for price dispersion. The nature of the data collected in this study raises several challenging issues for dynamic modeling, including extremely high dimensionality, and cross-sectional heterogeneity and the associated random effects. As indicated in Dekimpe and Hanssens (2000) and Pauwels et al. (2004), it is difficult to address these issues in the framework of the widely used VARX approach. Hence, in this paper we shall consider an alternative approach, random coefficient regression models, to analyze pricing dynamics at an individual product level where the issues of time correlation and cross-sectional heterogeneity can be easily dealt with. We can also link marketing characteristics directly to the rate of change in price levels and in price dispersion so that the research issues of interest can be investigated.

The next section is devoted to data collection and summary statistics. We then develop our main research questions. Then we build econometric models and test the formulated hypotheses. Finally we summarize the main results and discuss the managerial implications.

2. Data collection and summary statistics

2.1. Data collection

In this study, we investigate the US online DVD market. Two types of online retailers are included in this study: dotcoms and multichannel retailers. All the included retailers sell a general selection of DVD titles and the prices are posted on their websites. Following Brynjolfsson and Smith (2000), Tang and Xing (2001), Ancarani and Shankar (2004), and Xing et al. (2006), the retailers in this study were chosen by their high ranks in the PowerRanking for Movies by Forrester Research and the DVD Talk Online store listings (<http://www.dvdtalk.com>). In total five dotcoms and five multichannel retailers were selected. Together, the market share of these online retailers is substantial, ensuring that their pricing behavior represents the US online DVD market. To minimize selection bias, we did not include more specialized retailers in specific entertainment niches.

With regard to DVD titles, we selected an even mix of bestsellers and non-bestsellers. The bestsellers (“popular titles”) were selected from the lists of bestsellers available when the study was initiated. Non-bestsellers were chosen by randomly selecting pages from an English dictionary and finding a title starting with a word on the page (“random titles”).

In the beginning of the study, two lists of DVD titles were considered, one for the popular titles and the other for the random titles, each included 26 DVD titles. During the study period some of the selected popular titles became non-bestsellers and some of the selected random titles were no longer posted by the retailers. Whenever this happened, another DVD title was selected from the corresponding categories (popular or random) to replace the one that had disappeared to ensure the total of 26 DVD titles for each list was retained. In the end, there were 32 different popular titles and 29 different random titles on the two lists across the whole time period, although the total number of the titles on each list was kept to be 26 at any time-point of the study period.

For the 61 selected titles, we collected online price quotes weekly at the selected dotcoms and multichannel retailers from April 3, 2004 to March 5, 2005. This resulted in a total of 29,796 price quotes (excluding missing values) over the time span of the year.

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