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99 Cent: Price points in e-commerce ☆

Franz Hackl [a,*], Michael E. Kummer [b], Rudolf Winter-Ebmer [c]

[a] University of Linz, Austria
[b] ZEW Mannheim, Germany
[c] University of Linz & IHS, Vienna, Austria

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ABSTRACT

Setting prices ending in nines is a common feature of many markets for consumer products. This prevalence has been explained either by a specific image of such price points or by the exploitation of rational inattention on the part of the consumers who want to economize on the cost of information processing. We use data from an Austrian price comparison site and find a remarkable prevalence of such price setting. Prices ending with nine are also sticky: price-setters change them with a significantly lower probability; rivals underbid these prices more seldom if they represent the cheapest price on the market, and we observe higher price jumps by price leaders for these price points. Finally, we explore the impact of these price points on the consumers' demand.

1. Introduction

This paper analyzes the role of price points or focal prices (used synonymously) in the sellers' price setting behavior of e-commerce markets and the consumers' purchasing decisions. Price points are defined as values with special price endings that are frequently used, i.e., ending in zero (also referred to as "even prices") and 9-ending prices ("just-below prices" or "odd prices"). Early explanations for this phenomenon rely on the customers' perceptions of these price points, i.e., particular price endings may convey a particular image of a product (image effect). Examples for these prices are €1100.00 or €6.00. With these even prices firms might signal that the high quality of their products does not make it necessary for the selling firm to engage in a Bertrand competition with declining prices. In a more recent study, Basu, 2006 explains the price-setting of odd prices as a rational strategy of oligopolists in a retail market. In his model, consumers disregard the right-most digits of the price, due to the cost of processing very detailed information. Hence, in equilibrium, it might be rational for firms to set 9-ending prices. By doing so, the firms can increase their prices somewhat and escape the zero-profit forecast of the Bertrand equilibrium in a retail market (level effect). Examples for these prices are €9.99 or also €1,999.00.

From a managerial perspective price setting is an important entrepreneurial task. This is especially true for the area of e-commerce in which the success of retailing depends on the firms' behavior in Bertrand competition. Taking the right decisions when it comes to setting prices is a crucial factor for a retailer's economic success. But what are the right prices for maximizing a firm's profits? Do customers react fully rational on the lowest price or do we observe some kind of bounded rationality (such as left-to-right price-processing in which the cents get irrelevant). Do some price endings (price points) have more impact in the consumers' demand than others? In a setting of Betrand competition it is equally important to know how other firms (re)act and how other firms set their prices:

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* Corresponding author. Address: Johannes Kepler University of Linz, Department of Economics, Altenbergerstr. 69, 4040 Linz, Austria. Tel.: +43 70 2468 8333.
E-mail address: franz.hackl@jku.at (F. Hackl).

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can we observe that certain price points are undercut more often than other ones? This paper sheds light on the role that price points play for the behavior of firms and customers and thereby provides important managerial implications.

Whereas previous research analyzes these price points in offline markets (scanner data from supermarkets and real estate markets), we focus on online markets. The lack of studies in emerging e-commerce markets is surprising given that the digital revolution might change our understanding of the pricing process of firms. One might argue that the lack of comprehensive studies in online markets can be explained by the less pronounced problems of price comparison: less cognitive difficulties to memorize and compare products of different retailers. In particular, at a price comparison site, all price offers for a specific product can be seen by one mouse-click. On the other hand, price dispersion in such markets is still high (Baye et al., 2006). We also observe service differentiation between e-tailers so that the idea of strictly ascending price listings loses importance. We will show that, although less than in brick-and-mortar stores, we do see a considerable proportion of odd as well as even prices in online shopping as well.

Most of the studies in offline markets analyze price points either on the demand side in the form of field or laboratory experiments or on the supply side in the form of price rigidity analysis. The focus and innovation of our paper lies in the consistent and comprehensive analysis of both sides of an online market. A careful analysis of the pricing strategies with price points has, on the one hand, to consider the price-setting decisions of firms, and, on the other hand, regularities in consumer demand. In order to draw correct conclusions, both market sides should be analyzed within a single set of data and it should be checked whether the reactions of both sides of the market are consistent. If the price points turn out to be equilibrium outcomes, they should prevail longer as comparable non-focal prices. The fact that we are the first to observe an entire market place enables us not only to look at the price stickiness for prices set by random firms but also to see the prices set by price leaders (i.e., the retailer that offers the good at the lowest price).

We use comprehensive data from Austria's largest price comparison site to explore theories on price points. While most previous studies consider only buying intentions, small samples, and a limited number of products, our data has the advantage in that we can observe the entire online market place with all competing shops. We use the price information on 23,317 products posted by 698 sellers together with the information about referral clicks and last-click-throughs, which are typically used as demand indicators in e-tailing. As many products are more expensive, we not only concentrate on 99 cent endings but also on prices ending in 9 euros, which will carry the same flavor of the argument.

In the beginning, the Internet was seen as the embodiment of perfect competition with instantaneous and comprehensive information of customers leading to fierce price competition, dwindling product differentiation, and vanishing brand loyalty (Brynjolfsson and Smith, 2000). In such an environment of perfect information, special price patterns like 99-cent endings are not expected to be important for the consumers' decisions. In contrast to this presumption, we show that price points are also prevalent in e-commerce markets. Our empirical results are generally supportive of Basu's theory: consumers are prone to disregard ordinary cent endings in their shopping behavior; price points are, therefore, more stable if they end with 9; and the best-prices ending in 9 or 99 are not changed by the price-setting firms and are less likely to be underbid by the rivals of the shop. Moreover, we observe higher price jumps for prices ending in 9. On the other hand, there is some role for image effects in the perception of consumers as well.

2. Literature

2.1. Theories for price points

Researchers have focused mainly on two consumer-oriented explanations for the phenomenon of price points[1] (Stiving and Winer, 1997):

(i) The first approach has been called the level effect, left digit effect, left to right processing (Thomas and Morwitz, 2009; Basu, 2006; Thomas and Morwitz, 2005). The basic idea is the assumption that the consumers use a heuristic to calculate, compare, and memorize prizes due to their limited brain-capacity to process prices exactly: they read prices from the left, and in particular, they disregard cent prices. As a result of this boundedly rational behavior, the consumers tend to overestimate the gap between prices differing only by a small amount, if the lower price has a smaller left digit (e.g., €3.00 vs. €2.99). This theory has only recently been formalized in a Bertrand-Equilibrium model (Basu, 2006). The paper assumes boundedly rational consumers, who do not bother to take into account what is after the comma. Instead, they "guess" that it is the average of all the last digits of the products in the market. This setting is used to analyze the market equilibria in a Bertrand setting where the firms can post prices but cannot affect quantities. The model is relevant for two reasons. First, the mechanism attacks the Bertrand paradox. Since the consumers ignore the cent ending, undercutting a 9-ending price by less than a full euro does not generate additional turnover; on the other hand, it reduces the profit margin. As a consequence, the firms who want to undercut will undercut by a full euro; undercutting with small amounts does not

[1] There is a wealth of operational or ad hoc explanations. The most famous example is the anecdotal account (Stiving and Winer, 1997) of shop owners, who posted prices that would force the clerks to give back some small change in order to force their staff to register the transactions rather than pocket the money. Among other ad hoc theories, Monroe (1973) mentions (and refutes) views that the number 9 might be considered a magical number with special properties. Clustering has also been considered as a tool to maintain tacit collusion as has been shown in Christie and Schultz (1994) and Christie et al. (1994).