Economic Modelling xxx (2017) 1–13

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.journals.elsevier.com/economic-modelling

Convenience pricing in online retailing: Evidence from Amazon.com

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ARTICLE INFO

Code JEL:
D11
D22
D40
L11
L81
M21

Keywords:
Convenient prices
Price rigidity
Rational inattention
Amazon.com
Online retailing

ABSTRACT

To expedite payments, firms use convenience pricing strategies. A price is considered convenient if it can be paid with few coins. Convenient prices are well understood in offline retailing, but not online. This article fills the gap, examining an original panel dataset more than 2.5 million observations of book prices from Amazon.com. We provide empirical evidence supporting two claims. First in a static setup, more convenient prices are more likely to be set. Second in a dynamic setup, more convenient prices are more rigid. Emphasizing the role of convenience, this work sheds new light on price setting in online retailing.

1. Introduction

Psychological pricing has been widely discussed because of its managerial implications (Levy et al., 2004; El Sehity et al., 2005). Some research explains the role of round prices (Aalto-Setälä and Halonen, 2004; Manning and Sprott, 2009), other research insists on prices ending with the number nine (Schindler, 2006; Levy et al., 2011; Macé, 2012) or more broadly with odd numbers (Bambauer-Sachse and Grewal, 2011; Kleinsasser and Wagner, 2011; Lewis, 2015). Previous research has also pointed to the role of convenient prices (Aucremanne and Cornille, 2001; Folkertsma, 2002; Knotek, 2008, 2011; Bouhdaoui et al., 2014; Karoubi and Chenavaz, 2015). A price is more *convenient* if it can be paid with fewer tokens (coins or notes). All previous research on convenience pricing has considered offline retailing, where it originates, though, a major and growing part of transactions is realized in online retailing. This research fills the gap by analyzing convenience pricing in e-commerce.

This article examines if convenience pricing, a theory built in an offline context (Knotek, 2008, 2011), also applies in an online context, using the case of the book prices on Amazon.com. We expand convenience pricing theory from offline to online retailing by making a behavioral assumption linked to rational inattention theory (Sims, 2003; Maćkowiak and Wiederholt, 2009; Sims et al., 2010; Levy et al., 2011). We assume that customers internalize in their generic purchase behavior the effects of convenience pricing, for which the influence has been proved in the specificity of offline retailing (Aucremanne and Cornille, 2001; Folkertsma, 2002; Knotek, 2008, 2011; Bouhdaoui et al., 2014; Karoubi and Chenavaz, 2015). This assumption, tied to the limited consumer capacity of information-processing (Sims, 2003), implicates that convenience pricing also makes an impact in online shopping. To test this implication, we build an original panel dataset of more than 30,000 daily book prices from Amazon.com over a three-month period. The literature on convenient prices informs this research.

Convenient prices (also called fractional prices) make transactions simpler and faster, which reduces the physical cost of the transaction (Knotek, 2011). The minimum number of tokens useful to pay a price creates what is called an *efficient* payment (Cramer, 1983) and it is defined as the *objective inconvenience* of the price, *subjective inconvenience* measuring the monetary equivalent of objective inconvenience (Karoubi and Chenavaz, 2015). Objective inconvenience predicts cash

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https://doi.org/10.1016/j.econmod.2017.10.016
Received 10 March 2017; Received in revised form 20 September 2017; Accepted 27 October 2017
Available online XXX

payment behaviors, illustrating the *least effort principle* (Franses and Kippers, 2007). In offline retailing, there is evidence that sellers apply convenience pricing because more convenient prices are more likely to be set (Aucremanne and Cornille, 2001; Folkertsma, 2002; Knotek, 2008, 2011) and this strategy is successful because buyers are more likely to pay cash for a more convenient price (Bouhdaoui et al., 2014; Karoubi and Chenavaz, 2015). Karoubi and Chenavaz (2015) also propose an analytical framework providing a normative micro foundation to the behavior of sellers and buyers with respect to convenience pricing. Previous research on convenience pricing has been conducted with offline retailers. With online retailers though, no research has been done on convenience pricing.

In this article, we study the pricing scheme for books on Amazon.com, with an emphasis on the policy of convenience pricing. We contribute to existing literature by proving that convenience pricing, a theory built in an offline context, also exerts a role in an online context. We provide empirical evidence that Amazon.com is interested in setting and keeping convenient prices. At the static level, more convenient prices are set more often; at the dynamic level, more convenient prices are more rigid. Both relationships appear statistically very significant and non-linear; they are robust to several estimation techniques and to the inclusion of various controls. Our findings implicate that the (rational) role played by convenience pricing toward consumers in offline retailing also plays a (behavioral) role integrated by Amazon.com in its price setting. Focusing on convenience pricing, our article shapes a more comprehensive understanding of static and dynamic pricing policies in online retailing. More broadly, it highlights the practice of psychological pricing in e-commerce, which provides rich explanations founded at the micro level of price rigidity observed at the macro level.

2. Convenience pricing in online retailing

2.1. Convenience and inconvenience

Convenient prices necessitate few monetary units or little change to be paid (Knotek, 2008). A round price of USD 10 is convenient because it may be paid with a unique USD 10 bill. A price of USD 15 is less convenient because it has to be paid with a USD 10 bill and a USD 5 bill. Similarly, a price of USD 9 must also be paid with two tokens, the buyer giving a USD 10 bill and the seller returning a USD 1 coin. Note that we could think at other definitions of convenience pricing. The definition above is the most classical (Aucremanne and Cornille, 2001; Folkertsma, 2002; Knotek, 2008, 2011; Bouhdaoui et al., 2014; Karoubi and Chenavaz, 2015), allowing to build on more widely accepted prior findings.

Recall that objective inconvenience measures the minimum number of tokens required to pay that price (Knotek, 2008). On that basis, a price of USD 10, requiring one token, has an objective inconvenience of one; prices of USD 15 and USD 9, necessitating two tokens, have an objective inconvenience of two. The higher the convenience of a price is, the lower its objective inconvenience; there is a negative and bijective relationship between convenience and objective inconvenience. Plus, objective inconvenience is a natural integer other than zero, that is, objective inconvenience is a (strictly positive) qualitative ordered variable.

Remember that subjective inconvenience determines the monetary equivalent of the objective inconvenience of a price p. Similar to Karoubi and Chenavaz (2015), we define the subjective inconvenience function $SI(p)$ with $SI : \mathbb{R}^+ \to \mathbb{R}^+$. Reciprocally, the subjective convenience function $SC(p)$ is the opposite of the function of subjective inconvenience, that is $SC(p) = -SI(p)$. In other words, the fewer pieces of money required to pay a given price, the greater the subjective convenience of that price. Karoubi and Chenavaz (2015, pp. 4102–4105) detail the properties of the subjective convenience and inconvenience functions. The subjective inconvenience function will be useful in establishing the trigger pricing rule in Subsection 2.3. Before the establishment of that rule we need to elaborate on rational inattention.

2.2. Rational inattention

Our study benefits from the rational inattention theory (Sims, 2003; Maćkowiak and Wiederholt, 2009; Sims et al., 2010; Levy et al., 2011). In offline retailing, convenience pricing plays a rational role because of cash payments. Convenient prices help make easier change through fewer pieces of money (El Sehity et al., 2005), reducing the time of a transaction, which customers rationally infer. Conversely in online retailing, convenience pricing seems at first glance non-rational because it is not possible to pay cash. But at second glance, online shoppers may be rationally inattentive to small differences in price. Convenience pricing implies only a small variation in the price paid by the customer. Therefore, because attention is costly, the customer is rational when being inattentive to the real effect of convenience pricing in online transactions.

We expand the theoretical framework of convenience pricing from offline to online retailing: to repeat, consumers are known to pay cash offline, where convenient prices play a role (rational element) and are desired by themselves. Though, full rationality is a strong statement that unsystematically applies. Explaining this observation, Levy et al. (2011, p. 1428) write:

> The need for rational inattention by consumers arises for at least two reasons. First, consumers face huge amounts of information, which is costly to gather, absorb, and process. Second, they have time, resource, and cognitive information processing-capacity constraints.

Building on this idea, we assume 1) that consumers are rational in offline and online shopping, but 2) that they are attentive offline and inattentive online. The reason is that customers shop more often offline than online, developing their shopping habits offline. For instance, people buy their bread offline almost daily, where they may consciously pay attention to small changes, which define convenient prices. Consequently, convenient pricing, which comes from offline shops, exerts influence in online shops, even though there is no need to make changes. More precisely, they integrate the unconscious role of convenient prices when paying online shops (behavioral element). Convenient prices become desirable in online transactions. The unconscious role of convenience supports the behavioral element of the pricing rule presented below. Note that another story for the persistence of convenient pricing online is plausible. Indeed, online convenient pricing could be driven by coordination with prices in offline channel.[1] Therefore, our different models are also estimated using a subsample of Kindle books. This allows us to focus on a sample of exclusive online products. Results are qualitatively the same whether we consider the full sample or the sample of kindle books. In the main body of the paper we present only results estimated on the full sample, while restricted sample estimations are presented in Appendix B.

2.3. Pricing rule

For the sake of clarity, we posit now some formal notations about the pricing rule. Let the time be $t > 0$ and the duration since the last price change be $s > 0$ such that $s \leq t$. Note that t and s are variables (t is the time variable and the duration s depends on t) and $t - s \geq 0$ is a constant designing the time of the last price change. Let p_t be the price at t. Thus, p_{t-s} is the price since the last price change. Let p^* be the profit-maximizing price. These notations enable a more precise description of the pricing rule used by the e-retailer.

[1] Since Amazon sells books exclusively online, coordination with offline pricing would only transit through competition interaction with sellers in Amazon marketplace.