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Bricks vs. clicks: Which is better for marketing remanufactured products?

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ABSTRACT

The economical and environmental benefits are the central issues for remanufacturing. Whereas extant remanufacturing research focuses primarily on such issues in remanufacturing technologies, production planning, inventory control and competitive strategies, we provide an alternative yet somewhat complementary approach to consider both issues related to different channels structures for marketing remanufactured products. Specifically, based on observations from current practice, we consider a manufacturer sells new units through an independent retailer but with two options for marketing remanufactured products: (1) marketing through its own e-channel (Model M) or (2) subcontracting the marketing activity to a third party (Model 3P). A central result we obtain is that although Model M is always greener than Model 3P, firms have less incentive to adopt it because both the manufacturer and retailer may be worse off when the manufacturer sells remanufactured products through its own e-channel rather than subcontracting to a third party. Extending both models to cases in which the manufacturer interacts with multiple retailers further reveals that the more retailers in the market, the greener Model M relative to Model 3P.

1. Introduction

It is profitable for a firm to engage in remanufacturing, because remanufacturing conserves not only the raw material content but also much of the value added during the processes required to manufacture new products (Giuntini & Gaudette, 2003). Overall, remanufacturing saves the company 40–65 percent in manufacturing costs (Ginsburg, 2001). As a result, more and more manufacturers, including Apple, Canon, HP, Lenovo, and Panasonic, have created business models in which remanufacturing is an integral part (Apple, 2014; Canon, 2014; HP, 2014; Lenovo, 2014; Panasonic, 2014). Moreover, remanufacturing can bring great environmental benefits, since it can eliminate the returned cores' disposal impact, and consumes fewer natural resources and less energy than manufacturing new products. On the whole, remanufacturing a product requires only about 15 percent of the energy used to make the product from scratch (Giuntini & Gaudette, 2003). Therefore, governments and environmental groups spare no effort to encourage firms to engage in remanufacturing. For example, The Waste Electrical and Electronic Equipment (WEEE) directive in the European Union promotes "extended producer responsibility" with which all original equipment manufacturers are required to take responsibility for treating and recycling their new products when the products are no longer wanted by their owner.

Although interest in the management of remanufacturing has increased noticeably in the past decade, extant remanufacturing research focuses primarily on remanufacturing technologies, production planning, inventory control and competitive strategies (Fleischmann et al., 1997; Ferguson & Toktay, 2006). To the best of our knowledge, there is little literature addressing the economical and environmental benefits related to different channels structures for marketing remanufactured products. Yet marketing remanufactured products poses a number of questions related to the distribution channel decision. For example, there are many obstacles for retailers to market remanufactured products together with new ones: firstly, remanufactured products are often offered at a reduced price, which raises concerns that they may cannibalize the sales of higher margin new products and discourages retailers from offering remanufactured products. Secondly, some legislation such as the Sales of Goods Act (SoGA) appears to discourage retailers from retailing remanufactured products (Gray & Charter, 2008). Thirdly, selling remanufactured products through the retailer channel may do harm to the manufacturer. For example, in 2010, HP was involved in a scandal of

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selling remanufactured computers[1] in China: Hong Hengchang, the biggest dealer of HP and Acer in Asia, makes false representations in selling remanufactured HP computers as new and does incalculable harm to HP's reputation (Lin, 2010). Similar case also appears between DELL and its reseller (i.e., TigerDirect).

As a result, the manufacturer usually sells the remanufactured products through a manufacturer-owned e-channel Web sites, as well as auction sites such as eBay, or the authorized distributors (Ferguson & Souza, 2010).[2] For example, all remanufactured Apple computers and notebooks, once collected from customers and given replacement parts for any defective modules identified in testing, are sold via Apple's online store (Apple, 2014). Canon has similar Web sites for a wide variety of Canon's remanufactured products, including EOS Digital SLR Cameras, PowerShot Digital Cameras, PIXMA Printers, and VIXIA Camcorders (Canon, 2014). In the second scheme, the manufacturer sells the remanufactured products via authorized third parties.[3] For example, Panasonic sells its remanufactured Toughbook computers through three authorized service center partners—Telrepco, Buy Tough, and Rugged Depot (Panasonic, 2014). This distribution choice is also common in automobile industry: in China, the Administrative Measures for Pilot Remanufacturing of Automobile Parts & Accessories, signed by China National Development and Reform Commission (China NDRC), requires all remanufactured automobile parts must be marked with labels for remanufactured automobile parts and only distributed by the authorized service center partners in after-sales service system, but not through the retail channels for new products (China NDRC, 2008).[4]

In this paper, based on observations from current practice, we develop two channel models for a manufacturer sells new units through an independent retailer but with two options for marketing remanufactured products: (1) marketing through its own e-channel (Model M) or (2) subcontracting the marketing activity to a third party (Model 3P). Using these two models, we address the following research questions.

(1) From the profit-maximization perspective, how do different channel structures for marketing remanufactured products affect all parties' profitability? Which is better for the manufacturer, retailer, and third-party?
(2) From the environmental impact angle, how do different channel structures for marketing remanufactured products affect the environmental performance? Which is better for our environment?

Our results show that although Model M is always greener than Model 3P, firms have less incentive to adopt it because both the manufacturer and retailer may actually be worse off under Model M than in Model 3P. Extending both our models to cases in which the manufacturer interacts with multiple retailers further reveals that the more retailers in the market, the greener Model M relative to Model 3P.

Our overall contribution is twofold. First, we address an aspect mostly ignored by extant research in the remanufacturing area: the fact that manufacturers have a potential flexibility to choose different distribution channels to market their remanufactured products. In other words, rather than focusing on remanufacturing technologies, production planning, inventory control and competitive strategies, we provide an alternative yet somewhat complementary approach to consider how different channel structures for marketing remanufactured products impact all players' profitability. Second, although the question of whether remanufacturing results in environmentally worse or improves the environmental performance has been well studied in remanufacturing literature; remanufacturing technologies, production planning, inventory control and competitive strategies concerns aside, little is known about how different channel structures for marketing remanufactured products can affect this issue. In this paper, we analyze the importance of such factor in impacting on the environmental performance.

The remainder of the paper is organized as follows. Section 2 reviews the related literature and explains our contributions in more detail. Section 3 describes the key elements of our basic model and introduces notations. Section 4 outlines our two models, Model M and Model 3P, and reports our main findings. Section 5 extends both models to the case in which a manufacturer interacts with multiple retailers. Section 6 concludes the paper.

2. Relevant literature

Although remanufacturing has been much studied, current research to this topic focuses primarily on technologies, production planning, inventory control, and competitive strategies. At first, the literature on remanufacturing technologies has been growing rapidly in the last decade. In an early study, Debo, Toktay, and Wassenhove (2005) and Debo, Toktay, and Wassenhove (2006) discuss the management of a portfolio of new and remanufactured products in a market. Robotis, Boyaci, and Verter (2009) then optimize a monopolist's expected discounted profits and determine the optimal level of investment in reusability as well as the market prices. Subsequently, Atasu and Souza (2013) show that quality recovery and costly recovery lead to increased quality and decreased environmental impact, while profitable material recovery leads to decreased quality and increased environmental impact. Recently, Orsdemir, Kemahlioglu-Ziya, and Parlakturk (2014) find that in the case where there is uncertainty in remanufacturing cost, the level of investment in reusability can increase with uncertainty.

There is also an increased interest in researching production planning of hybrid manufacturing/remanufacturing systems. For example, DePuy, Usher, Walker, and Taylor (2007) propose master production scheduling methods that take into account uncertainty in relation to the quality of the returned products. Denizel, Ferguson, and Souza (2010) then consider production planning for remanufacturing when inputs have different and uncertain quality levels, and there are capacity constraints. Recently, Ovchinnikov, Blass, and Raz (2013) provide a data-driven assessment of economic and environmental aspects of remanufacturing for product + service firms. Subsequently, Cai, Lai, Li, Li, and Wu (2014) study the acquisition and production planning problem for a hybrid manufacturing and remanufacturing system with core acquisition at high/low quality conditions. We refer the interested reader to Lage Junior and Godinho Filho (2012) for complete literature review for production planning and control in a remanufacturing environment.

Inventory management of hybrid manufacturing/remanufacturing systems is another major issue for firms. DeCroix (2006) analyze the problems into the multiechelon inventory system with used and returned products. Likewise, Gong and Chao (2013) explore a periodic-review hybrid system with inventory management for a production/remanufacturing firm. While, Georgiadis and Athanasiou (2013) deal with long-term demand-driven capacity planning policies in the reverse channel of closed-loop supply chains with remanufacturing. A review of related literature can be found in Guo, Aydin, and Souza (2014). In addition, numerous researchers, including Majumder and Groenevelt (2001), Ferrer and Swaminathan (2006, 2010), Savaskan and Van Wassenhove (2006), Ovchinnikov

[1] The definition of remanufactured products can be found in Williamson et al. (2012). And note that some firms may use different terms for remanufactured, such as "refurbished," "rebuilt," "recycled," etc. We thank an anonymous reviewer for pointing this out.

[2] We note that our analysis centers on how the channel decisions for remanufactured products affect all parties' profitability as well as environmental performance. As such, whether the e-channel/third party sells new products or not is not our primary concern. We thank an anonymous reviewer for pointing this out.

[3] To distinguish the authorized reseller partners from those unauthorized retailers, we call them third parties.

[4] We refer the interested reader to Hormozi (1997), and Ferrer and Whybark (2001) for more motivational examples in the automobile industry.