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Durable goods leasing in the presence of exporting used products to an international secondary market



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ABSTRACT

With the rapid growth of global trade, used durable goods from wealthy countries increasingly find their way into the secondary market of less wealthy countries. Exporting used products to a physically separate market not only removes cannibalization for new products at home, but also fetches additional revenue.

In this paper, we investigate the implications of exporting used products to international secondary markets in the durable goods industry. We find that such a practice may significantly stimulate new product lease on the home market, an effect in which the market attractiveness and product quality are mutually reinforcing. We discover that removing cannibalization pressure is more of a priority than generating additional revenue while exporting used products.

If the export is carried out by an agent, who exports used products bought from OEM (Original Equipment Manufacturer), we observe the disadvantage of double marginalization in a channel structure, which slows down export and causes quantity distortion, and also reduces the effectiveness of government stimulus. However, if the agent and OEM set export price based supply and demand equilibrium, this reduces the quantity distortion.

One special characteristic of used products trade across borders is the involvement of governments on both sides of the border. The government measures include penalties imposed on aging durable goods and trade barriers. We find that legislation of penalizing used products on the domestic market can stimulate export, but it does not have an intended effect of stimulating new products produced at home. The channel structure worsens the problem.

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1. Introduction

As one of the countries worst hit by recent financial crisis, Hungary saw new car sales plummet from 153,346 in 2008 to 60,189 in 2009 and further to 43,396 in 2010. For such a small country with only 10 million people, this sharp decline has immediate and visible consequences on the country's fleet: the average age of cars in Hungary has increased from 10.45 years in 2008 to 12.43 in 2012, and there is a sharp decline in number of used cars available for sale on the used car market since the new cars sold in 2008–2010 became used cars today. Simultaneously, the demand for used cars in Hungary has increased since fewer people can now afford to buy new cars as the economy slowly recovers. The simultaneous increase in demand and fall in domestic supply of used cars have given rise to an import of used cars from foreign countries into Hungary, which increased from 17,000 in 2010 to 70,000 in 2013.

Unsurprisingly, the majority of them are from Germany, a prosperous neighbor and also the leading automobile manufacturer and market in Europe. German Original Equipment Manufacturers (OEMs) have taken a very proactive role in this cross-border transaction of used cars. For example, BMW leases new cars to its employees and car rental companies in Germany; the leased cars with low mileage (less than 15,000 kilometers) and young age (less than one year) are then exported outside Germany to emerging markets of Eastern Europe, such as Hungary, through the BMW Premium Selection program (www.bmw.hu/premiumselection). Similar programs also exist for other German OEMs, such as the Weltauto program of Volkswagen group (Audi, VW, Skoda) and Jahreswagen program of Mercedes-Benz.

The cross-border trade of used cars can be seen in many parts of the world, although details vary from case-to-case due to different local conditions. Used cars from Japan can be found in almost all parts of the world, and the Toyota Hilux pick-up truck with a machine gun on top is commonly seen in military conflicts in the Middle East. Many used Japanese cars enter the neighboring Far Eastern part of Russia, where 60 percent of cars on the street of Vladivostok are

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right-handed and the car import business provides employment for tens of thousands of locals. The used car trade between Japan and Russia is very different from the one between Germany and Hungary in two important aspects. First, related legislation of both governments play an important role in the trade. In Japan, drivers are required by law to submit three-year-old cars to strict road tests costing at least \$1250 – with subsequent tests every two years. It is equally expensive to dispose of them too. This makes aging cars worth very little, and owners normally relinquish ownership before it gets too expensive. This essentially pushes used cars out of Japan. The Russian government also introduced an ever-increasing tariff to curb the inflow of used Japanese car imports, largely to protect local automobile manufacturers, such as Lada. Second, unlike their German counterparts, OEMs in Japan are not directly involved in the exporting business. Instead, there are thousands of agents specialized in the cross-border trade of used cars, such as JAA, JU Group, TAA, USS, and ZIP, who would collect used cars from OEMs mostly through the method of auctions and then export the cars to foreign countries.

The cross-border trade of used cars has rather important implications for management. First, removing used products from the home market makes cannibalization between new and used products less of a concern, which has been a central theme in the durable goods literature. Second, since new products are needed as the source of used products, the additional demand from the foreign market for used cars provide a new stimulus for new product production. Third, there are multiple actors involved in the cross-border trade, such as the governments on both sides of the border and import/export agents as middlemen; their presence makes the story much more interesting.

In this paper, we seek to answer 3 questions:

1. With an active international secondary market to export used products returned after lease, how should the firm adjust its production and pricing?
2. With additional players, such as export agents, how would the additional complexity of channel structure change the problem?
3. If legislators wish to achieve a certain social goal, such as to simulate production or protect local industry in the presence of this cross-border trade, what are the most effective and efficient tools?

The remainder of the paper is organized as follows. [Section 2](#) reviews related literature. [Section 3](#) introduces the model set-up. [Section 4](#) analyzes the monopoly case. [Section 5](#) studies impact of third party collectors. [Section 6](#) concludes the paper.

2. Related literature

Durable goods have received ongoing attention in marketing, economics and operations management literature. [Mantena, Tilson, and Zheng \(2012\)](#) provide a comprehensive review of the vast durable goods literature. Therefore, we focus only on those papers most relevant to our research in this section. Our paper employs a model of vertical differentiation over infinite time horizon, which borrows from the literature. Among the most influential papers, [Desai and Purohit \(1998\)](#) first develop a model of vertical differentiation over two periods to study the concurrent leasing and selling of durable goods. An important contribution is that in this particular model setting leasing and selling become identical when they both lead to identical depreciation rates, a result we use to help justify why we focus on pure leasing. The work has been extended to investigate the impact of competition ([Desai & Purohit, 1999](#)). [Desai, Koenigsberg, and Purohit \(2004\)](#) extend the model setup to a channel case in which distribution of used durables is carried out by an agent. The most important finding is that despite the presence of double marginalization the channel structure can actually increase a manufacturer's profits. Remanufacturing literature has thematic parallels to the durable goods

literature because the remanufactured products are also used products with lower quality than new products. Several important papers in this area use a model of vertical differentiation over infinite time horizon ([Agrawal, Ferguson, Toktay, & Thomas, 2012](#); [Debo, Toktay, & Van Wassenhove, 2005](#)). The remanufacturing papers with infinite time horizon model most focus on stable equilibrium with constant product quantities to derive insights, a practice which we also follow in our paper. We develop our model similar to the setup of vertical differentiation in the literature but add an element of international secondary market which was separated from the home market by a transportation cost.

The international secondary market plays an essential role in our model. How to deal with used products has always been a central theme in durable goods industry, and many important papers have focused on the role of secondary market and associated transaction cost. One ongoing debate is about whether secondary market is harmful or should be eliminated altogether under various setting ([Chen, Esteban, & Shum, 2013](#); [Rust, 1986](#)). [Anderson and Ginsburgh \(1994\)](#) investigate the impact of transaction cost and product quality in the context of secondary market. They show that contrary to common belief a low transaction cost of secondary market is not always helpful and that if quality of used products can be manipulated it should be either zero or identical to new products, both scenarios essentially eliminating cannibalization threat posed by a lower quality product. [Hendel and Lizzeri \(1999\)](#) analyze durability issue in the context of secondary market. While in a different context, this paper is similar to ours in that it shows the benefits of a well-functioning secondary market, especially if the monopolist actively interferes to make it in line with other choices made regarding durables such as manipulating the transaction cost of secondary market. Later work allows product upgrade and obsolescence across generations of durables. [Purohit \(1992\)](#) investigates secondary market with potential for product obsolescence. The results suggest that contrary to common belief introducing a new product version can make used products of old version worth more if the upgrade is not well perceived by the market. [Levinthal and Purohit \(1989\)](#) explicitly discuss the problem of decreasing willingness to pay for old version due to introduction of new version, and propose different mechanisms such as limiting sales volume, buying back used products of older versions or announcing forthcoming new version. [Yin, Ray, Gurnani, and Animesh \(2010\)](#) investigate the impact of multiple used goods markets, retail and P2P, in a channel structure on product upgrade and price of used products. They establish that overall such markets result in less frequent product upgrades and lower prices. This paper is particularly of interests to us because we also have used products traded on two markets. [Tilson, Wang, and Wei \(2009\)](#) develop an interesting model in which new products are offered on two markets but used products are offered on only one market, while in our paper and [Yin et al. \(2010\)](#) it is the opposite situation. One of the results in [Tilson et al. \(2009\)](#) particularly relevant to us is that transaction cost of used products raises price and decreases leasing quantities. [Gavazza, Lizzeri, and Roketskiy \(2014\)](#) and [Stolyarov \(2002\)](#) find a similar result in different settings. [Huang, Yang, and Anderson \(2001\)](#) have a more general model while incorporating indefinite time horizon, concurrent selling and leasing, heterogeneous consumers, and so on into an active secondary market with transaction cost. They show that transaction cost has significant impact on market segmentation and that a monopolist makes different scrap-page decisions in different settings, both of which are relevant for our research. Another very relevant result of this paper is that the price for used products is based on demand and supply equilibrium. [Esteban and Shum \(2007\)](#) analyzed an active decentralized secondary market in an oligopoly setting. With some restrictive assumptions of no transaction costs and limited consumer heterogeneity, they obtain the equilibrium in duopoly competition. An important empirical contribution is that they provide estimate of some parameters with

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