

## Market prices of remanufactured, used and new items: evidence from eBay

João Quariguasi Frota Neto (corresponding author)

University of Bath, School of Management.

Contact: Wessex House, room 9.10, Bath, United Kingdom, e-mail:  
jqfn20@bath.ac.uk, telephone: +44 (0) 1225 383886

Jacqueline Bloemhof,

Wegeningen University, Logistics, Decision and Information Sciences.

Contact: Leeuwenborch, 6th floor, room 6015, Wageningen, The Netherlands, e-mail:  
jacqueline.bloemhof@wur.nl, telephone: +31 (0)317 - 484726.

Charles Corbett

University of California at Los Angeles (UCLA), Anderson School of Management.

Contact: Gold Hall, Suite B-507, 110 Westwood Plaza, Los Angeles, California, e-mail:  
charles.corbett@anderson.ucla.edu, telephone: +1 (310) 825-1651.

**Keywords:** remanufacturing, sustainable supply chains, reverse logistics, willingness-to-pay, information asymmetry.

1  
2  
3  
4 **Market prices of remanufactured, used and new items: evidence from eBay**  
5  
6  
7

8 **Abstract**  
9

10 Extending the life-cycle of products has received ample attention in the field of reverse logistics, but  
11 research on the market acceptance of remanufactured products is still in its infancy, especially how  
12 they compare to used products. In this paper, we investigate how consumers perceive  
13 remanufactured products relative to used and new products. We construct a database containing  
14 1,716 eBay listings, and use that to investigate the factors that influence the differences in prices  
15 between used, remanufactured, and new iPods. Our results confirm that remanufactured products  
16 are sold at a discount relative to new products. New to the literature on reverse logistics are the  
17 following results. For all types of iPods we find evidence that remanufactured products command a  
18 premium over their used counterparts. Also, for two types of iPod, a positive description of the  
19 product increases the average price for used products relative to remanufactured ones, which  
20 suggests that consumers need less reassurance regarding the quality of remanufactured products  
21 than used ones. Furthermore, for the third type of iPod, and for all new and remanufactured  
22 products, we find no evidence that a positive description significantly affects price. We explain our  
23 findings through the lenses of information asymmetry and adverse selection. We also observed that  
24 price dispersion is higher for used than for remanufactured products, indicating that  
25 remanufacturing may homogenise the quality of products, or at least the way consumers perceive  
26 them. We conclude that consumer perception of remanufactured products relative to their used and  
27 new counterparts, and hence their willingness to pay, depends in subtle and not yet well-understood  
28 ways on the nature of the product.  
29  
30  
31  
32  
33

34  
35 **Keywords: remanufacturing, sustainable supply chains, reverse logistics, willingness-to-pay,**  
36 **information asymmetry.**  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

## 1. Introduction

For many years, a myriad of different products have been returned to be re-processed and put back into the market. Cameras, car parts, mobile phones, MP3 players, PCs, photocopy machines and power tools are some examples (Apple Computers 2007a, Fleischmann et al. 2003, HP 2009, Kerr and Ryan 2001, Ketzenberg et al. 2003, Krikke et al. 1999, Li et al. 2009, Savaskan et al. 2004, Tang and Teunter 2007, González-Torre et al. 2010, Van Wassenhove and Zikopoulos 2010, Chan et al., 2012). Returned products must be collected, tested and repaired, and sometimes upgraded before they are returned to the market as refurbished, remanufactured or reconditioned. (In this paper, following existing literature, such as Blackburn et al. (2014), we do not make a distinction between refurbished and remanufactured products.) In other words, it is not possible for us to ascertain in this paper that the products that are sold as remanufactured in our dataset are of exactly the same functional and cosmetic conditions as new ones.

Although some products that have undergone a process of cleaning and repairing are equivalent to new ones (Thierry et al., 1995, p. 119), research indicates that consumers may not perceive them as such (Guide and Li 2010, Quariguasi Frota Neto 2008, Subramanian and Subramanyam 2012).

In this paper, we shed more light on consumers' perceptions of used, remanufactured, and new products by examining differences in the Willingness-to-Pay (WTP) for these three product conditions. (From here on we refer to used, remanufactured and new as "product conditions".) Our study addresses the following two research questions: First, how much are consumers willing to pay for remanufactured products relative to used and new ones? Second, do cues about the product's quality provided by the seller have a differential impact on consumer WTP for these three product conditions? The comparison of remanufactured vs. new has been studied previously. The

1  
2  
3  
4 contribution of our work lies in the comparison with used products, and in exploring the role of  
5  
6 cues about product quality on these comparisons.  
7  
8

9 To empirically investigate the differences in prices between used, remanufactured, and new  
10  
11 products, we create a dataset containing 1,716 real transactions of three models (Classic, Touch and  
12  
13 Nano) of used, remanufactured, and new iPods sold on eBay. We confirm that remanufactured  
14  
15 products are purchased at a discount compared to new ones, keeping all else constant. We also find  
16  
17 that for all three iPod types, remanufactured products are purchased at a premium compared to used  
18  
19 ones. These findings are relevant to corporate decisions concerning whether to re-sell,  
20  
21 remanufacture, or dispose of end-of-life products, as we further elaborate later (Debo et al. 2005,  
22  
23 Galbreth and Blackburn 2006, Inderfurth 2004, Klaus and Hendri 2000, Parlikad and MacFarlane  
24  
25 2007).  
26  
27  
28  
29

30 We also find that for two of the three product types, textual quality cues have significantly less  
31  
32 effect on consumer WTP for remanufactured iPods than on that for used ones. We draw on the  
33  
34 theories of asymmetry of information and adverse selection to explain that difference. The effects of  
35  
36 a visual quality cue, the number of pictures shown in each of the listing, are rather inconclusive.  
37  
38  
39

40 The rest of this paper is organized as follows. In Section 2, we review relevant literature and  
41  
42 outline our hypotheses. In Section 3, we describe the data collection method and research  
43  
44 methodology. In Section 4 we report our empirical results. In Section 5 we discuss the main results  
45  
46 of our analysis. In Section 6, we summarize the conclusions of this paper, its limitations, and  
47  
48 propose avenues for further research.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 **2. Hypotheses and Related Literature**  
5  
6  
7  
8

9 Our first objective is to compare the magnitude of consumer WTP for remanufactured relative to  
10 new and used product conditions. Our second objective is to examine whether information  
11 asymmetry about product quality has a differential impact on consumer WTP for used,  
12 remanufactured, and new product conditions. In this section we outline our hypotheses and briefly  
13 describe the related literature.  
14  
15  
16  
17  
18  
19  
20  
21  
22

23 **2.1. How do consumers perceive remanufactured products relative to new and used**  
24 **products?**  
25  
26  
27  
28  
29

30 Although the literature on remanufacturing has bloomed, there has been relatively little empirical  
31 work carried out in this field (Atasu et al. 2008, Prahinska and Kocabasoglu 2006, Rubio et al.  
32 2008). In particular, articles that study the demand side are few. Most research on reverse logistics  
33 makes assumptions on consumers' WTP and consequently on the relationships between prices and  
34 sales volumes of new and remanufactured items, e.g. Debo et al. (2005) and Ferrer and Swaminathan  
35 (2006). Although some of these assumptions are plausible, e.g. that the WTP for remanufactured  
36 items is lower than that for new ones, they are not yet based on systematic empirical research.  
37  
38  
39  
40  
41  
42  
43  
44

45  
46  
47 Among the few empirical studies in this area, Guide and Li (2010), using field experiments  
48 consisting of auctions of power tools and computer systems, investigate the cannibalization that  
49 remanufactured products may cause. Their evidence indicates that there is a significant difference in  
50 consumers' WTP for remanufactured and new items for both consumer and commercial products.  
51  
52 Using data from a controlled experiment with university students, Quariguasi Frota Neto (2008)  
53 finds that the price of a new product affects the WTP for its remanufactured counterpart, and that  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 remanufactured products are sold at lower prices than otherwise similar new products. Subramanian  
5  
6 and Subramanyam (2012) exploit data on prices of remanufactured and new products collected from  
7  
8 eBay and online stores, and also obtain evidence that consumers prefer new over remanufactured  
9  
10 products. Ovchinnikov (2009) surveys students to find that the WTP for remanufactured products is  
11  
12 influenced by the sales price of their new counterparts. Agrawal et al. (2010), in turn, show that the  
13  
14 existence of a remanufactured product line affects the WTP for their new counterparts, and that  
15  
16 such effect is different if the OEM or an independent remanufacturer introduces the line. Abbey et  
17  
18 al. (2014) use experiments to find that, among others, consumers are more attracted to a  
19  
20 remanufactured product if it carries a greater discount relative to a new product. Hazen et al. (2012)  
21  
22 show that consumers with greater levels of ambiguity tolerance are willing to pay higher prices for  
23  
24 remanufactured products, and that this effect is moderated by perceived product quality. We refer to  
25  
26 Section 3.5 in Agrawal and Toktay (2009) for an extensive literature review on this topic. Our first  
27  
28 hypothesis continues this early focus on the difference between remanufactured and new products;  
29  
30 although not novel in itself, it serves to replicate the findings of prior research:  
31  
32  
33  
34  
35  
36  
37  
38  
39

40 H1. Selling prices of new products are, *ceteris paribus*, higher than those of remanufactured  
41  
42 products.  
43  
44  
45

46  
47 One of our contributions lies in examining the difference in consumer WTP between  
48  
49 remanufactured and used product conditions. Akerlof (1970) highlighted the information asymmetry  
50  
51 that exists when selling used products. Remanufacturing a used product is a way to reduce the  
52  
53 variance in quality of used products, and hence could help to mitigate that information asymmetry as  
54  
55 long as buyers perceive remanufacturing as having that effect. We believe that “remanufacturing”  
56  
57 conjures up associations with terms like “inspection”, “by company”, “quality control” and, in the  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 buyer's mind, may improve the expected functional and cosmetic quality of the product. Tellingly,  
5  
6 we found examples of buyers complaining on online forums that they have received their  
7  
8 remanufactured iPods with small scratches, while they expected to receive like-new products. On the  
9  
10 same forums, we found that keywords like "testing" and "tested" appeared frequently. Given the  
11  
12 improved functional and cosmetic quality of remanufactured relative to used products, we expect  
13  
14 remanufactured products to elicit a higher consumer WTP than used items.  
15  
16  
17

18  
19         Labelling an item as "remanufactured" might have two opposing effects on the final price paid  
20  
21 for the item. On the one hand, consumers may be reassured that that they are getting a product that  
22  
23 has been inspected, restored to essentially to the same conditions as a new product, and tested. For  
24  
25 electronic items, for instance, it may indicate that batteries or malfunctioning screens have been  
26  
27 replaced. Moreover, consumers may believe that remanufactured products are more homogeneous  
28  
29 in quality than used products, and in particular that there is less downside risk associated with  
30  
31 remanufactured products. Buyers' natural loss aversion would then render remanufactured products  
32  
33 more attractive than their used counterparts due to their lower variability in quality, creating a  
34  
35 premium for the former, even if average quality of the two conditions were similar (Kahneman and  
36  
37 Tversky, 1979). On the other hand, consumers may be concerned that a product labelled as  
38  
39 "remanufactured" must have been damaged, as otherwise it could have been simply resold as-is  
40  
41 rather than requiring remanufacturing. Products with moving parts (e.g., engines) are subject to  
42  
43 gradual wear and tear; remanufacturing might be seen as a desirable way to restore such products to  
44  
45 as-new conditions. Products with no moving parts (e.g. some electronics) do not experience gradual  
46  
47 wear and tear; it either works or it is physically broken. For such a product to be labelled  
48  
49 "remanufactured", consumers might assume that it must have been broken, as otherwise there  
50  
51 would have been no point in remanufacturing it. For many products, both effects may exist side-by-  
52  
53 side; however, the information asymmetry associated with used products is well-documented, while  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 the potential negative inference associated with remanufacturing is speculative. We thus obtain the  
5  
6 following hypothesis:  
7  
8  
9

10  
11 H2. Selling prices of remanufactured products are, *ceteris paribus*, higher than those of used  
12  
13 products.  
14  
15  
16  
17

18 Next, we develop hypotheses related to additional factors that may mitigate this information  
19  
20 asymmetry.  
21  
22  
23  
24

## 25 **2.2. Information asymmetry and quality signalling in the markets of used, remanufactured** 26 27 **and new products** 28 29 30 31 32

33 Our second objective is to measure the differential impact of adverse selection on consumer  
34  
35 willingness to pay for used, remanufactured, and new products. The adverse effect of information  
36  
37 asymmetry on the functioning of markets was first formalized in the seminal paper of Akerlof  
38  
39 (1970), in the context of the second-hand car market. Akerlof states that sellers have no incentive to  
40  
41 sell high-quality second-hand cars when buyers cannot perfectly observe the quality of the cars  
42  
43 before purchase, and as a result good sellers are pushed out of the market, which then is eventually  
44  
45 dominated by low quality products and sellers.  
46  
47  
48

49 Literature has suggested that the problem of information asymmetry is magnified in  
50  
51 electronic markets such as eBay (Lee et al. 2000), as buyers do not have the opportunity to try out  
52  
53 the product before purchase or, as Resnick et al. (2006) put it, to “squeeze the orange”.  
54  
55 Furthermore, consumers cannot rely on some of the quality cues commonly found in the brick-and-  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65



1  
2  
3  
4 mortar environment, as those provided by the quality of presentation in the shop where the  
5  
6 products are sold.  
7

8  
9 The fact that online markets have not died out, despite these inherent disadvantages, shows  
10 that consumers, sellers, and online market platforms have found ways to signal and assess the quality  
11 of products and sellers without actually seeing them, quality being a chief source of competitive  
12 advantage for sellers (Morgan and Piercy, 1996). Literature tells us that consumers use a plethora of  
13 these signals when shopping online, e.g., advertisements (Milgrom and Roberts 1986, Wiggins and  
14 Lane 1983), brand names (Doods et al. 1991), country of origin (Miyazakiet et al. 2005), credit  
15 ratings (Akerlof 1976), seller's reputation (Lucking-Reiley et al. 2007, Melnik and Alm 2002, Resnick  
16 et al. 2006), graphical representations (Koppius et al. 2004, Ramachandran et al. 2008), prices  
17 (Dawar and Parker 1994, Farrell 1980, Milgrom and Roberts 1986), product reviews (Ramachandran  
18 et al. 2008), and warranties (Boulding and Kirmani 1993, Srivastava and Mitra 1998).  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31

32  
33 We indirectly assess the magnitude of the adverse selection problem for used,  
34 remanufactured, and new products by measuring the effect of quality cues on consumer WTP for  
35 these three product conditions. Specifically, we investigate how a textual product description and the  
36 number of pictures displayed in a listing affect the WTP for used, remanufactured and new  
37 products. We expect information asymmetry about product quality to be more severe for  
38 remanufactured than for new products, due to the uncertainties associated with remanufacturing.  
39 We also expect information asymmetry to be more severe for used than for remanufactured  
40 products, since the former lack the additional manufacturing testing and quality checks of the latter.  
41 We predict that more severe information asymmetry increases consumers' need for additional  
42 information on the product, translating into a stronger impact of quality cues on consumer WTP.  
43 We thus obtain the following predictions on the relative impact of quality cues on the three product  
44 conditions:  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4  
5  
6  
7 H3. Selling prices of remanufactured products are, *ceteris paribus*, more affected by quality  
8  
9 cues than those of new products.

10  
11  
12  
13  
14 H4. Selling prices of remanufactured products are, *ceteris paribus*, less affected by quality cues  
15  
16 than those of used products.  
17  
18  
19  
20

21 The extent to which textual descriptions affect consumer WTP and sales volumes has been  
22  
23 previously studied in the context of seller feedback (Ghose et al. 2007) and product reviews (Archak  
24  
25 et al. 2011). While these studies focus on descriptions of the quality of the seller (seller feedback), we  
26  
27 explore the effect on consumer WTP of a textual cue for the quality of the product.  
28  
29

30 Prior research has also examined the effect of visual representations of the product on WTP  
31  
32 (Koppius et al. 2004, Lewis 2007). Koppius et al. (2004) examined the Dutch flower market and  
33  
34 found that visual representation (positively) affects WTP. Lewis (2007) found evidence of a similar  
35  
36 effect on second-hand cars sold on eBay.  
37  
38  
39

40 Seller feedback is less relevant for our research than product-specific quality cues. There is  
41  
42 no clear reason why consumer feedback associated with a seller would have a different effect on our  
43  
44 three product conditions (new, remanufactured, used). Arguably, a seller with favourable feedback  
45  
46 regarding, for example, delivery timeliness might be able to command higher prices than a not-so-  
47  
48 reputable seller. However, we believe that this positive effect should apply equally to all product  
49  
50 conditions. We therefore consider seller feedback only as a control variable, and focus on the  
51  
52 hypothesized differential effect of product-specific quality cues on consumer WTP for used,  
53  
54 remanufactured, and new products.  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 Somewhat related to our study, Ramachandran et al. (2008) find that certification increases  
5  
6 consumer WTP for, and purchase likelihood of, used vehicles, and that the extent of these increases  
7  
8 is moderated by the amount of information available. Our work differs from that of Ramachandran  
9  
10 et al. (2008) as we investigate the effect of quality cues, i.e. a positive description of an item, rather  
11  
12 than the amount of information available on the product.  
13  
14

15  
16 Finally, remanufacturing reduces the variance in quality of products relative to used ones, as  
17  
18 it brings products of different cosmetic and functional conditions to similar standards. If consumers  
19  
20 perceive remanufacturing in that way, then increased homogeneity in product quality should also be  
21  
22 reflected in more homogeneous prices for remanufactured products relative to used ones.  
23  
24

25  
26  
27  
28 H5. There is less variability in sales prices for remanufactured products than there is for  
29  
30 used products.  
31  
32

### 33 34 35 **3. Data Collection and Methodology** 36 37

38  
39 We first motivate why we focus our analysis on iPods. We then describe how we construct the  
40  
41 samples of iPods used in our analysis. We then discuss the control variables included in our  
42  
43 regressions and provide descriptive statistics.  
44  
45  
46  
47

#### 48 49 **3.1. Why iPods ?** 50 51 52 53

54 Auctions are commonly used in scholarly work to elicit WTP. Ariely et al. (2005), Muller and  
55  
56 Mestelman (1994), and Resnick et al. (2006), for instance, emulate real auctions in laboratory settings  
57  
58 to measure consumer WTP. Guide and Li (2010), Harrison and List (2004), Katkar and Reiley  
59  
60  
61  
62

1  
2  
3  
4 (2006), and Lucking-Reiley et al. (2007) conduct real auctions, while Eaton (2005), Melnik and Alm  
5  
6 (2002), Lucking-Reiley et al. (2007), and Subramanian and Subramanyam (2012) use secondary data  
7  
8 collected from completed electronic auctions to estimate WTP.  
9

10  
11 By contrast, we proxy consumer WTP by studying selling prices of iPods on eBay. The first  
12  
13 iPod was launched in October 2001 by Apple Computers. iPod is by far the most popular brand of  
14  
15 MP3-players, with a market share of 72.3% as of 2007. More than 100 million units had been sold  
16  
17 worldwide as of 2007 (Apple Computers 2007b, Bloomberg 2007). We focus our analysis on iPods  
18  
19 for three main reasons. First, the product is very homogeneous, which reduces the number of  
20  
21 control variables required in our analysis (Eaton 2005). Second, iPods are among the most traded  
22  
23 items on eBay. This frequent trading allows us to obtain a large number of observations for used,  
24  
25 remanufactured, and new items sold at approximately the same time. iPods are sold in five models:  
26  
27 Classic, Mini, Shuffle, Touch, and Nano (Table 1). The iPod Classic is the original Apple MP3  
28  
29 player. It consists of a small hard drive, an LCD display, and a “click wheel” for users to scroll  
30  
31 through and select from the music selection shown on the display. The iPod Mini is a smaller  
32  
33 version of the iPod Classic but with the same components. The iPod Shuffle is comparable to the  
34  
35 iPod Mini, but is much smaller, and has less memory. The iPod Touch is the first iPod without  
36  
37 moving parts (other than an on-off switch). It has a touch screen instead of the click wheel, and it  
38  
39 uses flash memory rather than a hard drive. The iPod Nano is even smaller than the iPod Mini.  
40  
41 Similar to the iPod Touch it uses flash memory, but the first five generations of iPod Nano  
42  
43 (including all those in our data) do still have a click wheel. (See  
44  
45 <http://support.apple.com/kb/ht1353> for a summary of different types of iPods.)  
46  
47  
48  
49  
50  
51  
52  
53

54 A third reason why iPods are particularly suitable for our research purpose is that they are  
55  
56 commonly sold in used, remanufactured, and new conditions. eBay clearly outlines the product  
57  
58 condition of each auctioned iPod. Used iPods are sold in large numbers on eBay, and traded by both  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 individuals and companies. These are products in working condition that have not been repaired and  
5  
6 have mostly not been tested. Remanufactured iPods, in turn, are frequently sold, usually by  
7  
8 independent remanufacturers rather than by individuals. Although Apple does sell remanufactured  
9  
10 iPods, it virtually never uses eBay for this purpose. iPods are remanufactured for two main reasons:  
11  
12 first, when items are returned for repair, in which case they are remanufactured and redirected to the  
13  
14 secondary market, and second, when items in perfect condition are returned to the seller. Such  
15  
16 items, which are often in “like-new” condition, only need to be tested to be sold as remanufactured  
17  
18 (Ferguson and Toktay 2006). These returns are called commercial returns, and the receiving end is  
19  
20 the Original Equipment Manufacturer (OEM), e.g. Apple in the case of returned iPods. The  
21  
22 category “new” refers to brand new products manufactured by the OEM.  
23  
24  
25  
26  
27  
28  
29  
30  
31

(INCLUDE TABLE 1 HERE)

32  
33  
34  
35 We constructed our sample of used, remanufactured, and new iPods in the following way. In  
36  
37 a first step, we used a software agent and started from a sample of 4,700 observations of iPods  
38  
39 advertised on eBay from June to August 2009. More specifically, iPod Classic data were collected in  
40  
41 August, Nano data were collected in July, and Touch data were collected in June of the same year. The  
42  
43 agent focused on the three (at that time) most popular types of iPods: Classic, Touch and Nano.  
44  
45  
46

47 We programmed the software agent to retrieve all text visible to the buyer, i.e., not only the  
48  
49 data contained in the HTML files that generates the listings, but also the text contained in all files  
50  
51 linked to them, e.g. other HTML files, pictures, etc. that can be accessed by clicking on the first file.  
52  
53 Some past studies have used only the first HTML file (e.g., Heijst et al. 2008), or parts of this file.  
54  
55 However, a careful analysis of the files reveals that a host of important data would be lost had we  
56  
57 not collected the data from these auxiliary files. This was particularly true for listings of iPods sold  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 by independent companies, who are more likely to use dynamic resources compared with  
5  
6 consumers. Ignoring this data would therefore bias the results.  
7  
8

9 In a second step, the relevant data were parsed, meaning that for each listing, all text visible  
10 to the buyer is included in a single text file. Subsequently, items sold as “buy it now” and items not  
11 sold were eliminated from the sample.  
12  
13  
14

15  
16 After these automated steps, we manually selected and checked the data for accuracy. For  
17 each observation, we compared the data obtained by the agent with the raw data from the eBay  
18 listings for potential errors and empty fields. We detected virtually no errors in the data in cases  
19 where the software agent had to simply collect the value of a variable (e.g., number of positive  
20 consumer feedbacks for a given seller). However, we uncovered various errors and omissions in  
21 cases requiring some level of interpretation from the software agent (e.g. determining the existence  
22 of a warranty or the presence of a major defect in the product), which we then manually corrected.  
23  
24 We manually eliminated listings of products that were defective or sold for spare parts, did not  
25 belong to the categories of products being investigated (e.g. iPod copycats), were sold in a currency  
26 other than U.S. dollars, were sold to a buyer outside the United States, or had other special  
27 characteristics, e.g. products that have been autographed by celebrities. We then sampled remaining  
28 observations and create a set with 1,716 observations, roughly equally distributed among the three  
29 product types: 632, 541 and 543 observations of, respectively, iPods Classic, Touch and Nano.  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48

### 49 **3.2 Variables**

50  
51  
52  
53

54 In this section we describe the variables used in this paper. For each traded iPod, we collect the  
55 following information: selling price, number of positive keywords found in the listing, number of  
56 pictures of the product in the listing, product condition (i.e. used, remanufactured, new), number of  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 positive seller feedbacks, number of negative seller feedbacks, memory, product generation, shipping  
5  
6 cost and warranty provided by the seller or by the OEM. *PRICE*, our dependent variable, was  
7  
8 obtained directly from the listing, and it represents the final price paid for the product.  
9

10  
11 Textual data is deemed relevant in predicting prices and demand for a product and has been  
12  
13 used in prior studies to predict the final prices of eBay auctions (Heijst et al. 2008). The variable  
14  
15 used to capture the presence of a favourable product description contained in the listings is obtained  
16  
17 by simply counting the number of times a keyword or sentence indicating a high cosmetic or  
18  
19 functional quality level is mentioned in the listing, e.g. “mint” and “brand new”. Table 2 shows  
20  
21 examples of favourable descriptions. These keywords were obtained from a sample of 50 iPod  
22  
23 listings that were not included in the main sample used for the analyses. The selection of the  
24  
25 keywords was initially carried out by two coders (individuals who are not co-authors of the current  
26  
27 paper). The coding was then thoroughly checked for consistency by one of the authors of this paper.  
28  
29 We noted that a number of the keywords chosen kept recurring over different listings, which  
30  
31 suggests that this list captured most of the positive descriptions. The final list is the union of the two  
32  
33 lists. We call the number of positive keywords contained in a given listing *POSKEYWORD*.  
34  
35  
36  
37  
38  
39

40 Inevitably, the list of keywords we used to define *POSKEYWORD* is not complete, and the  
41  
42 degree to which any other keyword affects consumer perception will vary from keyword to keyword.  
43  
44 We cannot measure consumers’ perception of an entire product description directly from our data,  
45  
46 but as long as the measurement error between this unobservable perception variable and our  
47  
48 *POSKEYWORD* proxy is not correlated with the difference in price between used, remanufactured  
49  
50 and new items, this is not a concern.  
51  
52  
53

54 Another quality cue examined in this paper is the number of pictures of the product shown  
55  
56 in a given listing, which is labelled as *ORIGINAL.PICTURE*.  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 (INCLUDE TABLE 2 HERE)  
5  
6  
7  
8

9 We also classified each item as used, remanufactured or new following the classification  
10 provided by the seller. In case the seller did not provide this information in a way our software agent  
11 recognized, we checked the listing and classified the product ourselves, based on the description of  
12 the product (variable *CONDITION*).  
13  
14  
15  
16  
17

18 We used the sellers' negative and positive feedbacks received in the last 90 days as a control  
19 variable. Ratings on eBay work as follows. Buyers and sellers rate each other, and the feedback is  
20 registered in three forms: the content of each feedback in the form of a text, the number of positive  
21 and negative feedbacks received, and the proportion of negative to positive feedbacks. In line with  
22 past research, we use the absolute number of positive and negative feedbacks as our measure of  
23 seller's quality (Lucking-Reiley et al. 2007, Melnik and Alm 2002), which we designate as  
24 *POSFEEDBACK* and *NEGFEEDBACK*, respectively.  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34

35 In addition, we controlled for other key characteristics of the products, namely memory and  
36 generation (variables *MEMORY* and *GENERATION*). Generation captures both age and features  
37 of the products. We also control for shipping costs and handling charges (variable *SHIP*). To  
38 calculate these costs, we consider the cheapest shipping alternative (but exclude the option to pick  
39 up the product). We calculate all shipping costs using the address of one of the authors, who is  
40 located in the United States. Using this address or any other should not change our results for the  
41 following reasons. First, the vast majority, i.e. 94% of all of the listings, do not require such  
42 calculation, either because one shipping price applies for the entire country or because the listing  
43 offers a free shipping policy. Second, shipping prices are, in most cases, substantially lower than the  
44 final price of the product, i.e. less than 5% for each of the iPods. Third, we have no reason to  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65



1  
2  
3  
4 believe that these differences in shipping prices are in any way correlated with the condition of the  
5  
6 product (i.e. used, remanufactured and new).  
7

8  
9 We initially also controlled for warranties provided by the seller and the OEM. We registered  
10  
11 any warranty offered that is 30 days or longer because we believe that a buyer will not consider  
12  
13 shorter warranties to be very meaningful. Warranties covering less than 30 days are rare, so ignoring  
14  
15 or including them would not make much difference. The most common warranty periods are for 30,  
16  
17 60 or 90 days, and in very few cases warranties are extended for more than 90 days. Warranties  
18  
19 provided by the OEM are, on the other hand, almost invariably for one year, but for used products  
20  
21 part of this warranty has already expired. In this case, we consider a product to be covered by an  
22  
23 original warranty if there are at least 30 days of original warranty left (e.g., a product with a one-year  
24  
25 warranty that was first purchased less than 11 months ago). We did not include warranties in our  
26  
27 final analysis, however, because few listings offered products with warranty, and even fewer  
28  
29 products with original warranty. Note, however, that the results are robust to the inclusion of these  
30  
31 variables.  
32  
33  
34  
35  
36  
37  
38  
39

#### 40 **4. Analysis**

41  
42  
43  
44 In this section we present our analysis and empirical results. We estimate the following equation  
45  
46 separately for each type of product (Classic, Touch, and Nano).  
47  
48  
49

$$\begin{aligned} \text{PRICE} = & \beta_0 + \beta_1 \text{POSKEYWORD} + \beta_2 \text{ORIGINAL.PICTURE} + \beta_3 \text{CONDITION} \\ & + \beta_4 \text{POSFEEDBACK} + \beta_5 \text{NEGFEEDBACK} + \beta_6 \text{MEMORY} + \beta_7 \text{GENERATION} \\ & + \beta_8 \text{SHIP} + \beta_9 \text{POSKEYWORD} \times \text{CONDITION} + \beta_{10} \text{ORIGINAL.PICTURE} \times \\ & \text{CONDITION} \end{aligned}$$

50  
51  
52  
53  
54  
55  
56  
57 This regression is used to test hypotheses 1, 2, 3 and 4. The analyses were carried out in R  
58  
59 *Statistical Computing*. The model parameters were initially estimated using OLS. We eliminated all  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 observations with studentized residuals greater than 3. The number of such outliers was very small,  
5  
6 less than 2% of observations in the sample for each of the product types.  
7

8  
9 To assess the suitability of OLS, we tested for the presence of multicollinearity and  
10 heteroscedasticity. To test for multicollinearity, we first analysed the correlations between  
11 independent variables for the three types of iPods. We found for all three models that the  
12 independent variables exhibit low correlation, with one notable exception, the pair *POSFEEDBACK*  
13 and *NEGFEEDBACK*. We used the Variance Inflation Factor (VIF) test for all three iPod models  
14 (Classic, Touch and Nano), which showed that VIFs were mostly below the suggested limit of 10,  
15 with the exception of iPod Touch, which presented in one case a VIF of 1,400 (Ranaweera and  
16 Neely 2003, Neter et al. 1995), caused by the correlation between positive and negative feedbacks.  
17 Suppressing these variables from the regression eliminates collinearity, without changing any of our  
18 main results. In summary, our results are not significantly affected by collinearity.  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32

33 The Breusch-Pagan test indicated heteroscedasticity for the iPod Classic ( $\chi$ -square of 89.64),  
34 Touch ( $\chi$ -square of 40.44), and iPod Nano ( $\chi$ -square of 232.7), but in all cases, calculating the t-  
35 values using White's heteroscedasticity consistent standard errors (White 1980), we obtained results  
36 that were similar to those of the OLS model. In summary, our results are affected by neither  
37 collinearity nor heteroscedasticity.  
38  
39  
40  
41  
42  
43  
44

45 To test hypothesis 5, we measure the standard deviation of price for each of the product  
46 types and conditions, and perform an F-test of equality of variances.  
47  
48  
49  
50  
51

## 52 **5. Results and Discussion**

53  
54  
55  
56

57 The average price of used, remanufactured and new iPod Classics was \$116.7, \$167.7 and \$220.9,  
58 respectively. There were, on average, 1.68 positive keywords per listing, or 1.38, 2.03 and 2.00 for,  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 respectively, used, remanufactured and new items. Used iPod Touches fetched, on average, higher  
5  
6 prices than remanufactured ones. The prices for the used, remanufactured and new conditions were,  
7  
8 respectively, \$181.2, \$169.9 and \$226.3, and the number of positive keywords per category was 2.20,  
9  
10 2.78 and 3.33. The average price of used, remanufactured and new iPod Nanos was, respectively,  
11  
12 \$68.4, \$85.8 and \$105.1, and the average number of positive keywords per listing was, respectively,  
13  
14 1.00, 2.15, and 2.58 for used, remanufactured and new iPods. The average number of feedbacks  
15  
16 received by sellers trading remanufactured products was also higher than that of the rest because  
17  
18 companies, rather than individuals, are engaged in selling remanufactured products. Descriptive  
19  
20 statistics are summarized in Tables 3 and 4.  
21  
22  
23  
24

25  
26  
27  
28 (INCLUDE TABLES 3 AND 4 HERE)  
29  
30  
31  
32

33 The results for the regression are shown in Table 5, and the implications for our hypotheses  
34  
35 in Table 6. Unsurprisingly, consumers pay more for new items than for remanufactured ones for all  
36  
37 three products, controlling for other factors, although for the iPod Nano this effect is not  
38  
39 significant. This generally supports H1. Consumers pay a significant premium for remanufactured  
40  
41 products relative to used products for all three product types, which supports H2, an effect that has  
42  
43 not been previously documented in the literature.  
44  
45  
46  
47  
48

49 (INCLUDE TABLES 5 AND 6 HERE)  
50  
51  
52  
53

54 This result is important for both sellers and online platforms. Since remanufacturing can  
55  
56 increase selling price relative to used items, sellers of remanufactured products should state the  
57  
58 condition of the product (e.g. “this product has been tested and refurbished”). In our sample, for  
59  
60  
61  
62

1  
2  
3  
4 instance, the premium for remanufactured over used products was approximately \$29 for the Classic  
5  
6 and \$9 for the Touch and Nano. This would be an important piece of information for any party  
7  
8 deciding between selling used products as-is or incurring the additional expense of remanufacturing  
9  
10 them.  
11  
12

13  
14 Electronic platforms should also acknowledge the importance of such classification, and  
15  
16 include remanufactured products as a category of its own. Take the case of eBay, for instance. In the  
17  
18 United States, iPods are classified as “used”, “refurbished” (i.e. remanufactured) or “new”, while in  
19  
20 other international eBay platforms, products are classified simply as “used”, “new” or “others”.  
21  
22

23  
24 Our results suggest that used, remanufactured and new products are perceived differently by  
25  
26 consumers. Remanufactured products are not only less desirable than new products, as others have  
27  
28 assumed in prior research on reverse logistics (Atasu et al. 2008, Debo et al. 2005, Oraiopoulos et al.  
29  
30 2009), but they are more desirable than used products.  
31  
32

33  
34 Regarding hypothesis H3, we do not find any difference in the effect of positive keywords  
35  
36 on the prices paid for remanufactured and new products, in any category of iPod. We also do not  
37  
38 find the effect of positive descriptions to be significant for remanufactured or new products. We do  
39  
40 find a difference between remanufactured and used products though. The number of positive  
41  
42 keywords has a significant (positive) effect on the selling prices of used products, but not of  
43  
44 remanufactured ones, for iPod Classic and Nano. This result provides partial support for hypothesis  
45  
46 H4. For the iPod Touch, however, we do not find a significant difference in the effect of a positive  
47  
48 description across remanufactured and used products. These findings suggest that it can be  
49  
50 important for sellers of used items to provide information on the quality of their products, though  
51  
52 we would have to speculate why this effect does not appear for the iPod Touch. It may be that the  
53  
54 lack of moving parts means that the product is either working or not, and that quality cues therefore  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 provide less useful information to consumers than for products with more moving parts and hence  
5  
6 more subject to physical wear and tear.  
7

8  
9 We draw on the theory of information asymmetry and quality cues to explain the effect of  
10 such positive descriptions. Used products are perceived as being more heterogeneous in quality than  
11 remanufactured or new products, and as a consequence, the market for used products suffers more  
12 from information asymmetry. Relevant and effective quality cues, therefore, affect WTP for used  
13 products more than they do for remanufactured or new products. Our results might seem to  
14 contradict standard signalling theory, because they suggest that sellers can use cues that have no  
15 direct or indirect financial consequence to significantly affect perceived quality. Quality cues that are  
16 associated with extra costs to bad sellers (e.g. advertisement expenditure) or that are legally binding  
17 (e.g. warranties) are considered to affect perceived quality more than those that do not translate in  
18 any financial or legal obligation, also known as “cheap talk”. However, the fact that buyers can  
19 report sellers who misuse such cues, thereby increasing negative feedbacks and hence reducing  
20 future cash flows (Lucking-Reiley et al. 2007), discourages sellers from misrepresenting their  
21 products.  
22

23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40 Regarding H5, we also find empirical evidence in support of this hypothesis. For iPod  
41 Classic, the standard deviations of prices of used and remanufactured items are, respectively, 0.45  
42 and 0.16. For iPod Touch, these values are 0.24 and 0.19. For Nano, we have, respectively, 0.38 and  
43 0.24. The F-test of equality of variances rejects the hypotheses that the variances are the same for  
44 used and remanufactured for each of the three types of iPod ( $p < 0.05$  for iPod Classic, and  $p < 0.01$   
45 for iPod Touch and Nano). This confirms that, for all products, the variance in prices is  
46 significantly smaller for remanufactured products than for used products.  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

## 6. Conclusions, Limitations and Further Research

In this paper, we empirically investigate the WTP for remanufactured products relative to new and used items using an especially collected dataset of iPods sold on eBay. We find evidence that, while consumers do not consider remanufactured products as perfect substitutes for new ones, remanufacturing does increase consumer WTP relative to used products. This result supports the common assumption of the CLSC literature that consumers expect a discount when buying remanufactured products (Aras et al. 2010, Debo et al. 2005, Mitraa and Webster 2008, Oraopoulos et al. 2009, Sarvary and Van Wassenhove 2008). This finding may generalize to products that can be brought up to the functional and cosmetic standards of their new counterparts through remanufacturing, but not to products that cannot. This should be the case for most electric appliances, which currently constitute the majority of remanufactured items. Mobile phones, personal computers, MP3-players, digital cameras, and game consoles are some examples of products that are commonly remanufactured. On eBay in the US, 78% of the refurbished products advertised are in the categories “computer & networking”, “Cell Phones & PDA”, “electronics”, “camera & photo” and “video game”. We acknowledge, however, that there may be examples of product categories in which used products are preferred over remanufactured ones, such as perhaps for products that have been broken and cannot be fully repaired to their original conditions. Safety-related products may fall into this category, e.g. child car seats.

Furthermore, we analyze whether quality cues, in particular a positive description of the product, has a differential impact on the WTP of used, remanufactured and new products. For two of the three iPod types, quality cues have a stronger impact on consumer WTP for used products than for new or remanufactured products. We explain these patterns drawing on theories of quality

1  
2  
3  
4 cues and information asymmetry to explain our findings. These results hold while controlling for a  
5  
6 range of product characteristics that may affect consumer WTP for iPods.  
7  
8

9         A practical implication of our findings on the impact of quality cues is that sellers of used  
10 items should consider spending extra effort in order to convey, whenever possible, their positive  
11 quality attributes. For sellers of new or remanufactured products this is less important, as our results  
12 suggest that quality cues matter little or not at all for these product conditions. For used products,  
13  
14 though, each additional positive keyword increases average price by \$8.54 for the Classic, and by  
15 \$3.09 for the Nano. Another implication of our findings for businesses is that, for certain products,  
16 remanufacturing a used product can significantly increase its price. We are reluctant to extrapolate  
17 too far from our findings. Nevertheless, we believe that the type of analysis executed in this study  
18 could help firms to determine whether the potential increase in consumer WTP resulting from  
19 upgrading a product from used to remanufactured is sufficient to cover the costs of  
20 remanufacturing. For instance, for the iPod Classic, the price difference between remanufactured  
21 and used is \$29, which provides an upper bound for the amount a firm should be willing to spend to  
22 remanufacture each item. While the price differential is not the only consideration in deciding  
23 whether to remanufacture, it is clearly a key factor, especially for independent remanufacturers who  
24 have less or no other strategic considerations to take into account.  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43

44         Our results do have some inevitable limitations. First, we only consider iPods, and though  
45 this is one of the most traded items on eBay, we cannot automatically assume that our findings hold  
46 for other types of products. Second, our analysis only examines textual quality cues and one type of  
47 visual cue, i.e number of pictures.. Third, our list of keywords, although extensive, cannot cover all  
48 possible keywords that can be used to describe a product. Fourth, we do not observe the total  
49 volume of sales by each seller, so we cannot correct for that.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4           Given the limited research attention paid to marketing of remanufactured products so far,  
5  
6 and the complexity of this topic, we believe that yet a number of other factors and the extent to  
7  
8 which they affect the prices of remanufactured products need to be further investigated. One  
9  
10 question that remains unanswered is whether remanufactured products are sold at a premium  
11  
12 because they suffer less from adverse selection (due the fact that they are more homogeneous) or  
13  
14 simply because they are perceived as having, on average, higher quality than used products.  
15  
16 Laboratory experiments could be used to disentangle these two effects. Another interesting question  
17  
18 is whether the type of product sold, e.g. consumer versus commercial product, moderates the  
19  
20 differences in prices.  
21  
22  
23  
24  
25  
26  
27

## 28   **References**

- 29  
30   Abbey, J. D., Meloy, M. G., Guide, V. D. R., & Atalay, S. 2014. Remanufactured Products in Closed-  
31  
32 Loop Supply Chains for Consumer Goods. *Production and Operations Management*. In press  
33  
34 (DOI: 10.1111/poms.12238)  
35  
36  
37   Agrawal, B., L.B. Toktay. 2009. Interdisciplinarity in closed-loop supply chain management research.  
38  
39 Chapter 12 in Ferguson, M.E. and G.C. Souza, 2010, *Closed-Loop Supply Chains: New Developments to*  
40  
41 *Improve the Sustainability of Business Practices*, CRC Press, .  
42  
43  
44   Agrawal, V., A. Atasu, and K. van Itterdum. 2010. The effect of remanufacturing on the perceived  
45  
46 value of new products. Working paper, Georgia Institute of Technology, College of Management.  
47  
48  
49   Aras, N., R. Güllü, and S. Yürülmez, 2010. Optimal inventory and pricing policies for  
50  
51 remanufacturable leased products. *International Journal of Production Economics* 133(1): 262–271.  
52  
53  
54   Archak, N., A. Ghose, and P.G. Ipeiritis. 2011. Deriving the pricing power of product features by  
55  
56 mining consumer reviews. *Management Science*,57(8): 1485-1509.  
57  
58  
59   Akerlof, G.A. 1976. Reply to professor Heal. *The Quarterly Journal of Economics*, 90 (3), 503.  
60  
61  
62  
63  
64  
65



1  
2  
3  
4 Akerlof, G.A. 1970. The market of lemons: quality uncertainty and the market mechanism. *The*  
5  
6 *Quarterly Journal of Economics*, 90(3), 488-500.  
7  
8  
9 Apple Computers. 2007a. 100 million iPods sold.  
10  
11 <http://www.apple.com/pr/library/2007/04/09ipod.html> (access date: October 2010).  
12  
13  
14 Apple computers. 2007b. Apple store (U.S.) Special deals. 2007. <http://store.apple.com> (access date:  
15  
16 November 2007).  
17  
18 Ariely, D., A. Ockenfels, A.E. Roth. 2005. An experimental analysis of ending rules in internet  
19  
20 auctions. *RAND Journal of Economics*, 36(4), 890-907.  
21  
22  
23 Atasu, A., V.D.R. Guide, and L.N. Van Wassenhove. 2008. Product reuse economics in closed-loop  
24  
25 supply chain research. *Production and Operations Management*, 17(5), 483 - 496.  
26  
27  
28 Bloomberg. 2007. U.S. top selling computer hardware for February 2007.  
29  
30 <http://www.bloomberg.com/apps/news?pid=conewsstory&refer=conews&tkr=AAPL:US&sid=ag>  
31  
32 [gTRzHFt1Do](http://www.bloomberg.com/apps/news?pid=conewsstory&refer=conews&tkr=AAPL:US&sid=ag) (access date: October 2010).  
33  
34  
35 Boulding, W., A. Kirmani. 1993. A consumer-side experimental examination of signaling theory: Do  
36  
37 consumers perceive warranties as signs of quality? *The Journal of Consumer Research*, 20(1), 111-123.  
38  
39  
40 Chan, F.T.S., H.K. Chan and J. Vipul. 2012. A framework of reverse logistics for the automobile  
41  
42 industry. *International Journal of Production Research*, 50(5), 1318-1331.  
43  
44  
45 Dawar, N., P. Parker. 1994. Marketing universals: Consumer's use of brand name, price, physical  
46  
47 appearance, and retailer reputation as signals of product quality. *Journal of Marketing*, 58(2), 81-94.  
48  
49  
50 Debo, L. , L. B. Toktay, L.N. Van Wassenhove. 2005. Market segmentation and product technology  
51  
52 selection for remanufactured products. *Management Science*, 51(8), 1193-1205.  
53  
54  
55 Doods, W.B., K.B. Monroe, D. Grewal. 1991. Effects of price, brand and store information on  
56  
57 buyer's product evaluation. *Journal of Marketing Research*, 28(3), 307-319.  
58  
59  
60  
61  
62  
63  
64  
65

- 1  
2  
3  
4 Eaton, D.H. 1995. Valuing information: Evidence from guitar auctions on eBay. *Journal of Applied*  
5  
6 *Economics and Policy*, 24(1), 1-19.  
7  
8  
9 Farrell, J. 1980. Prices as signals of quality, PhD thesis, University of Oxford, United Kingdom.  
10  
11 Ferguson, M. E., L.B. Toktay. 2006. The effect of competition on recovery strategies. *Production and*  
12  
13 *Operations Management*, 15(3), 351–368.  
14  
15  
16 Ferrer, G. and J.M. Swaminathan. 2006. Managing new and remanufactured products. *Management*  
17  
18 *Science*, 52(1), 15-26  
19  
20  
21 Fleischmann, M., J.A.E.E. van Nunen, and B. Grave. 2003. Integrating closed-loop supply chains  
22  
23 and spare-parts management at IBM. *Interfaces*, 33(6), 44-56.  
24  
25  
26 Galbreth, M.R., J.D. Blackburn. 2006. Optimal acquisition and sorting policies for remanufacturing.  
27  
28 *Production and Operations Management*, 15(3), 384-392.  
29  
30  
31 Ghose, A., P. G. Ipeiritos, and A. Sundararajan. 2007. Opinion mining using econometrics: A case  
32  
33 Study on reputation systems.” Proceedings of the 45th Annual Meeting of the Association of  
34  
35 Computational Linguistics. Prague, 416–423.  
36  
37  
38 González-Torre, P., M. Álvarez, J. Sarkis, and B. Adenso-Díaz. 2010. Barriers to the implementation  
39  
40 of environmentally oriented reverse logistics: Evidence from the automotive industry sector. *British*  
41  
42 *Journal of Management*, 21(4), 889–904.  
43  
44  
45 Guide, V.D.R., K. Li. 2010. Market cannibalization of new product sales by remanufactured  
46  
47 products. *Decision Sciences*, 41(3), 547-572.  
48  
49  
50 Harrison, G.W., J.A. List. 2004. Field experiments. *Journal of Economic Literature* 42 (4), 1009–1055.  
51  
52 Hazen, B. T., Overstreet, R. E., Jones-Farmer, L. A., & Field, H. S. 2012. The role of ambiguity  
53  
54 tolerance in consumer perception of remanufactured products. *International Journal of Production*  
55  
56 *Economics*, 135(2), 781-790.  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3  
4 Heijst, D., R. Potharst, and M. van Wezel. 2008. A support system for predicting eBay end prices.  
5  
6 *Decision Support Systems*, 44 (4), 970-982.  
7  
8  
9 HP. 2009. Why buy remanufactured? 2009. [http://www.hp.com/united-states/renew/why buy](http://www.hp.com/united-states/renew/why-buy-refurbished.html)  
10 [refurbished.html](http://www.hp.com/united-states/renew/why-buy-refurbished.html) (accessed date: October 2009).  
11  
12  
13 Inderfurth, K., 2004. Optimal policies in hybrid manufacturing/remanufacturing systems with  
14 product substitution . *International Journal of Production Economics* 90(3): 325–343.  
15  
16  
17 iPod history. iPod history. 2010. <http://www.ipodhistory.com/> (accessed October 2010).  
18  
19  
20  
21 Kahneman, D., A. Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica*,  
22  
23 47(2), 263-292.  
24  
25  
26 Katkar, R., D.H. Reiley. 2006. Public versus secret reserve prices in eBay auctions: Results from a  
27 pokemon field experiment. *The B.E. Journal of Economic Analysis & Policy*, 6(2), 1-23.  
28  
29  
30  
31 Kerr, R., C. Ryan. 2001. Eco-efficiency gains from remanufacturing: A case study of photocopier  
32 manufacturing at Fuji Xerox Australia. *Journal of Cleaner Production*, 9(1), 75-81.  
33  
34  
35 Ketzenberg, M. E., Gilvan C. Souza, V.D.R. Guide. 2003. Mixed assembly and disassembly  
36 operations for remanufacturing. *Production and Operations Management*, 12(3). 320-335.  
37  
38  
39  
40 Klaus, M., and C.T. Hendri. 2000. Reverse-logistics strategy for take-back. *Interfaces*, 30(3), 156-165.  
41  
42  
43  
44 Koppius, O., E. van Heck, M. Wolters. 2004. The importance of product representation online:  
45 empirical results and implications for electronic markets. *Decision Support Systems* 38(3), 161-169.  
46  
47  
48  
49 Krikke, H.R., A. van Harten, and P.C. Schuur. 1999. Business case Océ: Reverse logistic network re-  
50 design for copiers. *O.R. Spectrum*, 21(3), 381-409.  
51  
52  
53  
54 Lee, Z., I. Im, and S.J. Lee. 2000. The effect of negative buyer feedback on prices in internet auction  
55 markets. ICIS '00 Proceedings of the twenty-first international conference on Information systems,  
56 286-287.  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100  
101  
102  
103  
104  
105  
106  
107  
108  
109  
110  
111  
112  
113  
114  
115  
116  
117  
118  
119  
120  
121  
122  
123  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133  
134  
135  
136  
137  
138  
139  
140  
141  
142  
143  
144  
145  
146  
147  
148  
149  
150  
151  
152  
153  
154  
155  
156  
157  
158  
159  
160  
161  
162  
163  
164  
165  
166  
167  
168  
169  
170  
171  
172  
173  
174  
175  
176  
177  
178  
179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
270  
271  
272  
273  
274  
275  
276  
277  
278  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
340  
341  
342  
343  
344  
345  
346  
347  
348  
349  
350  
351  
352  
353  
354  
355  
356  
357  
358  
359  
360  
361  
362  
363  
364  
365  
366  
367  
368  
369  
370  
371  
372  
373  
374  
375  
376  
377  
378  
379  
380  
381  
382  
383  
384  
385  
386  
387  
388  
389  
390  
391  
392  
393  
394  
395  
396  
397  
398  
399  
400  
401  
402  
403  
404  
405  
406  
407  
408  
409  
410  
411  
412  
413  
414  
415  
416  
417  
418  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428  
429  
430  
431  
432  
433  
434  
435  
436  
437  
438  
439  
440  
441  
442  
443  
444  
445  
446  
447  
448  
449  
450  
451  
452  
453  
454  
455  
456  
457  
458  
459  
460  
461  
462  
463  
464  
465  
466  
467  
468  
469  
470  
471  
472  
473  
474  
475  
476  
477  
478  
479  
480  
481  
482  
483  
484  
485  
486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538  
539  
540  
541  
542  
543  
544  
545  
546  
547  
548  
549  
550  
551  
552  
553  
554  
555  
556  
557  
558  
559  
560  
561  
562  
563  
564  
565  
566  
567  
568  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
590  
591  
592  
593  
594  
595  
596  
597  
598  
599  
600  
601  
602  
603  
604  
605  
606  
607  
608  
609  
610  
611  
612  
613  
614  
615  
616  
617  
618  
619  
620  
621  
622  
623  
624  
625  
626  
627  
628  
629  
630  
631  
632  
633  
634  
635  
636  
637  
638  
639  
640  
641  
642  
643  
644  
645  
646  
647  
648  
649  
650  
651  
652  
653  
654  
655  
656  
657  
658  
659  
660  
661  
662  
663  
664  
665  
666  
667  
668  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688  
689  
690  
691  
692  
693  
694  
695  
696  
697  
698  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
710  
711  
712  
713  
714  
715  
716  
717  
718  
719  
720  
721  
722  
723  
724  
725  
726  
727  
728  
729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
740  
741  
742  
743  
744  
745  
746  
747  
748  
749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768  
769  
770  
771  
772  
773  
774  
775  
776  
777  
778  
779  
780  
781  
782  
783  
784  
785  
786  
787  
788  
789  
790  
791  
792  
793  
794  
795  
796  
797  
798  
799  
800  
801  
802  
803  
804  
805  
806  
807  
808  
809  
810  
811  
812  
813  
814  
815  
816  
817  
818  
819  
820  
821  
822  
823  
824  
825  
826  
827  
828  
829  
830  
831  
832  
833  
834  
835  
836  
837  
838  
839  
840  
841  
842  
843  
844  
845  
846  
847  
848  
849  
850  
851  
852  
853  
854  
855  
856  
857  
858  
859  
860  
861  
862  
863  
864  
865  
866  
867  
868  
869  
870  
871  
872  
873  
874  
875  
876  
877  
878  
879  
880  
881  
882  
883  
884  
885  
886  
887  
888  
889  
890  
891  
892  
893  
894  
895  
896  
897  
898  
899  
900  
901  
902  
903  
904  
905  
906  
907  
908  
909  
910  
911  
912  
913  
914  
915  
916  
917  
918  
919  
920  
921  
922  
923  
924  
925  
926  
927  
928  
929  
930  
931  
932  
933  
934  
935  
936  
937  
938  
939  
940  
941  
942  
943  
944  
945  
946  
947  
948  
949  
950  
951  
952  
953  
954  
955  
956  
957  
958  
959  
960  
961  
962  
963  
964  
965  
966  
967  
968  
969  
970  
971  
972  
973  
974  
975  
976  
977  
978  
979  
980  
981  
982  
983  
984  
985  
986  
987  
988  
989  
990  
991  
992  
993  
994  
995  
996  
997  
998  
999  
1000

1  
2  
3  
4 Motors. *American Economic Review* 101 (4), 1535-1546.  
5  
6 Li, J., M. González, and Y. Zhu, 2009. A hybrid simulation optimization method for production  
7  
8 planning of dedicated remanufacturing. *International Journal of Production Economics* 177 (2) (2009): 286–  
9  
10 301.  
11  
12  
13 Lucking-Reiley, D., D. Brian, N. Prasad, D. Reeves. 2007. Pennies from eBay; The determinants of  
14  
15 price in online auctions. *The Journal of Industrial Economics*, 55(2), 223-233.  
16  
17  
18 Melnik, M., J. Alm. 2002. Does a seller e-commerce reputation matter? Evidence from eBay  
19  
20 auctions. *Journal of Industrial Economics*, 50(3), 337-349.  
21  
22  
23 Milgrom, P. and J. Roberts. 1986. Price and advertising signals of product quality. *The Journal of*  
24  
25 *Political Economy*, 94(4), 796-821.  
26  
27  
28 Mitraa, S. and S. Webster, 2008. Competition in remanufacturing and the effects of government  
29  
30 subsidies. *International Journal of Production Economics* 111(2): 287–298.  
31  
32  
33 Miyazaki, A.D., D. Grewal, and R.C. Goodstein. 2005. The effect of multiple extrinsic cues on  
34  
35 quality perception: a matter of consistency. *Journal of Consumer Research*, no. 32 (1): 146-153.  
36  
37  
38 Morgan, N. A., & N. F. Piercy. 1996. Competitive Advantage, Quality Strategy and the Role of  
39  
40 Marketing. *British Journal of Management*, 7(3), 231–245.  
41  
42  
43 Muller, R.A., S. Mestelman. 1994. Emission trading with shares and coupons: A laboratory  
44  
45 experiment. *The Energy Journal* 15(2), 195-211.  
46  
47  
48 Oraiopoulos, N., M.E. Ferguson, L.B. Toktay. Relicensing as a secondary market strategy. Working  
49  
50 paper, Georgia Institute of Technology, College of Management, 2009.  
51  
52  
53 Ovchinnikov, A. Revenue and Cost Management for Remanufactured Products. 2011. *Production and*  
54  
55 *Operations Management* (early view), doi: 10.1111/j.1937-5956.2010.01214.x  
56  
57  
58 Parlikad, A.K., D. MacFarlane. 2007. RFID-based product information in end-of-life decision  
59  
60 making. *Control Engineering Practice* 15(11), 1348-1363.  
61  
62  
63  
64  
65

- 1  
2  
3  
4 Prahinska, C., C. Kocabasoglu. 2006. Empirical research opportunities in reverse supply chains.  
5  
6 *Omega, The International Journal of Management Science*, 34(6), 519-532.  
7  
8  
9 Quariguasi Frota Neto, J. 2008. Eco-efficient Supply Chains for Electrical and Electronic Products.  
10  
11 Ph.D. thesis, Rotterdam School of Management, Erasmus University, The Netherlands.  
12  
13  
14 Ramachandran, V., S. Viswanathan, S. Gosain. 2008. The impact of online information on the  
15  
16 purchase of certified used cars. Working paper, Robert W. Smith School School of Business,  
17  
18 University of Maryland.  
19  
20  
21 Resnick, P., R. Zeckhauser, J. Swanson, K. Lockwoos. 2006. The value of reputation on eBay: A  
22  
23 controlled experiment. *Experimental Economics*, 9(2), 79-101.  
24  
25  
26 Rubio, S., A. Chamorro, and F.J. Miranda. 2008. Characteristics of research on reverse logistics.  
27  
28 *International Journal of Production Research*, 46(4), 1099-1120.  
29  
30  
31 Savaskan, R.C., S. Bhattacharya, and L.N. Van Wassenhove. 2004. Closed-loop supply models with  
32  
33 product remanufacturing. *Management Science*, 50(2), 239-252.  
34  
35  
36 Srivastava, J., and A. Mitra. 1998. Warranty as a signal of quality: The moderating effect of consumer  
37  
38 knowledge and quality evaluations. *Marketing Letters*, 9(4), 327-336.  
39  
40  
41 Subramanian, R., and R. Subramanyam. 2012. Key drivers in the market of remanufactured  
42  
43 products. *Manufacturing & Service Operations Management*, 14(2), 315-326.  
44  
45  
46 Tang, O., R. Teunter. 2007. Economic lot scheduling problem with returns. *Production and Operations*  
47  
48 *Management*, 15(4), 488-497.  
49  
50  
51 Thierry, M., M. Salomon, J.A.E.E. van Nunen, L.N. Van Wassenhove. 1995. Strategic Issues in  
52  
53 Product Recovery Management. *California Management Review*, 37(2), 114-135.  
54  
55  
56 Van Wassenhove, L.N. and C. Zikopoulos. 2010. On the effect of quality overestimation in  
57  
58 remanufacturing. *International Journal of Production Research*, 48(18), 5263-5280.  
59  
60  
61 White, H.. 1980. A heteroskedasticity-consistent covariance matrix estimator. *Econometrica*, 48(4),  
62  
63  
64  
65

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

817-838.

Wiggins, S.N., and L.W. Lane. 1983. Quality uncertainty, search and advertising. *American Economic Review*, 73(5), 881-889.

**Table 1. Launch dates for Apple iPod versions used in this paper**

iPod model	Release date	Models
Classic	October 2001	6
Touch	January 2005	4
Nano	September 2005	6

Note: the iPod Classic was first released under the name iPod (without model specification).

Source: iPod history (<http://www.ipodhistory.com/>), accessed July 2010.

**Table 2. Examples of favorable item descriptions**


---

The item in this auction is in **Grade A condition**.

100% guaranteed in **excellent working** condition or your money back!

100% Functional, 100% **Brand New**.

**Like new** condition!

This iPod **works perfectly**, has had very little use, and is in truly **excellent condition!**

80 Gb iPod Classic 5 Generation is very lightly used, in **great condition!**

Note: This item is in **excellent condition**.

---

Note: Examples of positive descriptions included in the eBay listing analysed. The highlighted text is coded into variable *POSKEYWORD*. For the fifth sentence, for instance, the software agent finds “works perfectly” and “excellent condition” and sets *POSKEYWORDS*=2. The software searches all text visible to the consumer. The software agent identifies the following items: “as new, like new, brand new, few scratches, barely used, mint, good condition, great condition, hardly used, genuine, excellent condition, original box, immaculate, sealed, working condition, never used, almost new, perfect condition, spanking new condition, nearly new, great cosmetic condition, like new condition, works perfectly”.

**Table 3. Number of used, remanufactured and new products in the sample**

Item (iPods)	Classic			Touch			Nano		
No. of observations	1,500			1,700			1,500		
No. of observations used	632			541			543		
Product condition	used	rem.	New	used	rem.	new	used	Rem	new
No. of observations used	410	110	112	206	129	206	216	157	170
Average price	\$116.7	\$166.7	\$220.9	\$181.2	\$169.9	\$226.3	\$68.4	\$85.4	\$105.1

Note: Number of observations and average prices for iPods Classic, Touch and Nano.

**Table 4. Descriptive statistics**

Variable	iPod Classic					iPod Touch					iPod Nano				
	Mean	Median	St. Dev.	Min	Max	Mean	Median	St. Dev.	Min	Max	Mean	Median	St. Dev.	Min	Max
PRICE	135.5	143.90	64.60	10.40	425.00	195.6	183.5	51.47	100.0	371.1	84.59	82.99	29.98	4.990	240,00
ORIGINAL															
PICTURE	1.032	0.000	1.520	0.000	12.00	1.141	0.000	1.749	0.000	13.00	0.5885	0.000	1.1046	0.000	9.000
POSKEYWORD	1.513	1.000	1.782	0.000	12.00	2.695	1.000	3.395	0.000	14.00	1.825	2.000	1.776	0.000	9.000
POSFEEDBACK	55769	95.00	11913	0.000	38090	4582	128.0	8903	0.000	63640	6071	164.0	12,88	0.000	69,280
NEGFEDBACK	18.88	0.000	44.56	0.000	669.0	44.04	1.000	134.2	0.000	923.0	41.90	1.000	155.0	0.000	1,349
MEMORY	88.48	80.00	44.10	1.000	160.0	14.14	8.000	8.548	0.005	32.00	7.018	8.000	4.480	0.000	80.00
GENERATION	5.198	6.000	1.624	0.000	7.000	1.360	2.000	0.796	0.000	3.00	2.562	3.000	1.503	0.000	6.000
SHIP	3.885	0.000	5.081	0.000	30.00	4.145	0.000	13.91	0.000	300.0	3.654	0.000	4.614	0.000	19.99



**Table 5. OLS regression of sale prices of new and used items relative to remanufactured items**

Variable/Product	iPod Classic	iPod Touch	iPod Nano
(Intercept)	38.68*** (0.000)	76.78*** (0.000)	36.68*** (0.000)
POSKEYWORD	-2.706 (0.269)	0.065 (0.911)	-0.899 (0.180)
ORIGINAL.PICTURE	-1.800 (0.438)	-4.940 (0.084)	-0.536 (0.841)
CONDITION=NEW	36.69*** (0.000)	30.85*** (0.000)	5.982 (0.116)
CONDITION=USED	-29.30*** (0.000)	-9.114* (0.084)	-9.599** (0.004)
POSFEEDBACK	0.000 (0.864)	-0.001** (0.028)	0.932 (0.000)
NEGFEDBACK	-0.002 (0.682)	0.032 (0.277)	0.001** (0.040)
MEMORY	0.974*** (0.000)	4.489*** (0.000)	1.692*** (0.000)
GENERATION	4.662*** (0.000)	30.06*** (0.000)	14.02*** (0.000)
SHIP	-5.681 (0.010)**	-0.068 (0.399)	-2.149*** (0.000)
(CONDITION=NEW)*POSWORD	2.936 (0.274)	-0.069 (0.930)	0.387 (0.705)
(CONDITION=USED)*POSWORD	8.539** (0.001)	-0.346 (0.698)	3.087** (0.015)
(CONDITION=NEW)*ORIGINAL.PICTURE	14.17*** (0.000)	2.731 (0.418)	4.011 (0.193)
(CONDITION=USED)*ORIGINAL.PICTURE	5.614** (0.021)	6.354 (0.418)	1.474 (0.607)
R-squared	0.84	0.80	0.71
R-squared with control variables only	0.71	0.71	0.67
N	693	542	542

Note: The table shows the coefficients and associated p-values (between brackets) for the OLS regression analyzing the price of new and used items relative to remanufactured for the three product types.

\* denotes significance at  $p < 0.10$ , \*\* at  $p < 0.05$ , \*\*\* at  $p < 0.01$ , and the p-values reported are for two-tailed tests of significance. All values are presented with 4 significant digits.

**Table 6. Results for hypotheses H1, H2, H3 and H4.**

	iPod Classic	iPod Touch	iPod Nano
H1	accepted (p<0.01)	accepted (p<0.01)	rejected
H2	accepted (p<0.01)	accepted (p<0.10)	accepted (p<0.01)
H3, textual cue	rejected	rejected	rejected
H3, visual cue	rejected (but significant in opposite direction with p<0.01)	rejected	rejected
H4, textual cue	accepted (p<0.01)	rejected	accepted(p<0.01)
H4, visual cue	accepted (p<0.05)	rejected	rejected
H5	accepted (p<0.05)	accepted (p<0.01)	accepted (p<0.01)

Note: The p-values reported are for two-tailed tests of significance. The hypotheses tested are as follows.

H1. Selling prices of new products are, *ceteris paribus*, higher than those of remanufactured products.

H2. Selling prices of remanufactured products are, *ceteris paribus*, higher than those of used products.

H3. Selling prices of remanufactured products are, *ceteris paribus*, more affected by quality cues than those of new products.

H4. Selling prices of remanufactured products are, *ceteris paribus*, less affected by quality cues than those of used products.

H5. There is less variability in sales prices for remanufactured products than there is for used products.

(Note that we follow common convention by reporting p-values for the two-tailed test that the corresponding coefficient is different from zero, not for the one-tailed test of each specific hypothesis.)

**Table 7. Correlation Matrix for iPod Classic**

	POSKEYWORD	ORIGINAL.PICTURE	CONDITION=NEW	CONDITION=USED	POSFEEDBACK	NEGFEEBACK	MEMORY	GENERATION	SHIP
POSKEYWORD	1.00								
ORIGINAL.PICTURE	-0.04	1.00							
CONDITION=NEW	0.16	-0.15	1.00						
CONDITION=USED	-0.23	0.27	-0.63	1.00					
POSFEEDBACK	0.12	-0.23	-0.12	-0.37	1.00				
NEGFEEBACK	0.09	-0.12	-0.09	-0.18	0.67	1.00			
MEMORY	0.16	-0.28	0.29	-0.42	0.28	0.14	1.00		
GENERATION	-0.01	-0.18	0.02	-0.13	0.16	0.00	0.44	1.00	
SHIP	-0.12	0.20	0.01	0.18	-0.30	-0.20	-0.19	-0.18	1.00

**Table 8. Correlation Matrix for iPod Touch**

	POSKEYWORD	ORIGINAL.PICTURE	CONDITION=NEW	CONDITION=USED	POSFEEDBACK	NEGFEEBACK	MEMORY	GENERATION	SHIP
POSKEYWORD	1.00								
ORIGINAL.PICTURE	-0.09	1.00							
CONDITION=NEW	0.02	-0.09	1.00						
CONDITION=USED	-0.11	0.40	-0.61	1.00					
POSFEEDBACK	0.07	-0.30	-0.22	-0.13	1.00				
NEGFEEBACK	0.04	-0.20	-0.16	0.06	0.90	1.00			
MEMORY	0.01	0.01	0.08	0.10	-0.15	-0.07	1.00		
GENERATION	-0.03	-0.13	0.17	-0.26	-0.14	-0.24	-0.08	1.00	
SHIP	-0.05	0.11	0.00	0.12	-0.08	-0.03	0.15	-0.05	1.00

**Table 9. Correlation Matrix for iPod Nano**

	POSKEYWORD	ORIGINAL.PICTURE	CONDITION=NEW	CONDITION=USED	POSFEEDBACK	NEGFEEBACK	MEMORY	GENERATION	SHIP
POSKEYWORD	1.00								
ORIGINAL.PICTURE	-0.20	1.00							
CONDITION=NEW	0.12	-0.08	1.00						
CONDITION=USED	-0.38	0.37	-0.52	1.00					
POSFEEDBACK	0.09	-0.17	-0.25	-0.21	1.00				
NEGFEEBACK	0.03	-0.11	-0.16	-0.04	0.78	1.00			
MEMORY	0.09	0.02	0.20	-0.11	-0.05	-0.09	1.00		
GENERATION	0.26	-0.17	0.18	-0.33	0.20	-0.01	0.19	1.00	
SHIP	-0.29	0.14	0.04	0.30	-0.24	-0.14	0.01	-0.11	1.00