

Play it again, Sam? Versioning in the market for second-hand video game software

Abstract

Information goods are characterised by high fixed costs and low marginal costs of production. A potentially effective strategy which can be adopted by firms operating in such markets is versioning, whereby various features are added or subtracted from a number of distinct versions of the good. This effectively serves as a means of second degree price discrimination designed to extract prices closer to the maximum willingness to pay from different groups of consumers. This study tests the effectiveness of versioning as a means of exploiting differences in willingness to pay in second-hand markets for information goods by undertaking the first hedonic price analysis of video gaming software. The empirical evidence presented in this paper is based on the analysis of an extensive cross-sectional dataset consisting of over five thousand observations of pre-owned video game prices in the US. Controls are introduced for a variety of other observable characteristics, including the quality of the game-play experience, the publisher, genre and theme of the game. The results are consistent with theoretical expectations and demonstrate significant variations in willingness to pay can be exploited through the strategic use of versioning. The practice is therefore argued to represent an effective means by which firms in these markets can enhance revenues.

Keywords: Video games; versioning; information goods; hedonic pricing

JEL Codes: D4; D12; L11; Z1

1. Introduction

Video gaming has rapidly evolved into a major force in the global entertainment sector. In 2015, annual revenues from the worldwide video games market were estimated to be approximately \$91 billion, with around \$22 billion of this total generated in the US alone (NewZoo, 2015). The size and rate of growth of the market for video games exceeds those of many other mainstream forms of entertainment, such as music and movies. By way of illustration, Guinness World Records recently confirmed that the game *Grand Theft Auto V* achieved a record-setting \$816 million in worldwide sales during the first 24 hours of release (“Confirmed”, 2013). This figure represents the highest revenue ever generated by the launch of an entertainment product and comfortably exceeds earnings from *Star Wars: The Force Awakens*, which at the time of writing holds the current worldwide box-office record as a result of generating \$529 million during its opening weekend in December 2015 (“All Time Box Office”, 2015).

In theoretical terms, video gaming software is an obvious example of an information good, which is defined in terms of high fixed costs of production and negligible marginal costs. Economic theory on pricing of information goods outlined in the seminal work of Varian (1995) and developed in studies by Anderson & Dana (2009); Bhargava & Choudhary (2001a, 2001b, 2008); Linde (2009); Shapiro & Varian (1998) and Varian (2000; 2001) highlights how a special kind of second-degree price discrimination known as versioning or quality differentiation can be particularly effective in such markets. The practice involves releasing different versions of the same underlying product, thereby encouraging consumers to ‘self-select’ in accordance with their willingness-to-pay (WTP). This has the obvious potential to enhance profits, even in the somewhat perverse case where producers incur costs in degrading the quality of ‘high WTP’ products for sale to the low WTP market.

The aim of this paper is to investigate variations in consumer WTP resulting from versioning through the analysis of data from the market for used video games. The reason for this particular focus is that

new software tends to be sold at a set RRP which is more-or-less constant for each hardware platform and means that consumer demand typically adjusts to meet a fixed price. However, prices of used video games are able to vary to a far greater extent in response to variations in demand; essentially allowing free market valuations of titles according to variations in consumer WTP. The specific research question to be addressed is therefore '*to what extent does consumer WTP for video game software vary in the presence of versioning?*' In addressing this question, the study offers unique evidence on the extent to which versioning is likely to lead to enhanced revenues for video game publishers. Further, the analysis is intended to serve as a useful aid to strategic decision making with respect to the effective use of versioning, both in this particular context and in other markets for information goods.

The remainder of the paper is structured as follows. Section 2 contains a discussion of the data and methods used in this study, while Section 3 outlines the empirical findings. Section 4 then presents a summary of the conclusions of the study, as well as the managerial implications for software developers and publishers.

2. Data and method

The previous section introduced the concept of the versioning of information goods and highlighted how the practice can be revenue (and profit) enhancing so long as two or more consumer groups exist with significant differences in their WTP. This section outlines the approach used in this study to test the extent to which these assumptions hold in a market context where price is effectively unrestricted and hence allowed to vary to a greater extent in response to variations in consumer WTP. The market for pre-owned video gaming software in the US is of considerable strategic importance to video games publishers, being valued at somewhere between \$2 - \$3 billion annually, with over 47 million people in the US purchasing one or more used titles each year (J.J. Games, 2010). Several major retailers have a significant presence in this market; most notably Gamestop, which generates around

half of their gross profits from the sale of pre-owned video games (“Gamestop continues run”, 2013), as well as Wal-Mart, Best Buy, Toys R Us and Amazon. The used market is highly attractive to retailers because they are able to retain 100% of the sale price, whereas royalties have to be paid to developers and publishers on the sale of new titles. For this reason, the resale of video gaming software has been strongly resisted by firms further up the supply chain, with several employing a range of strategies specifically designed to curtail such activity. For example, Electronic Arts (EA) have previously distributed single use access codes along with new copies of games that would allow access to online multiplayer features. If the game was subsequently resold in the second-hand market, the new owner had to purchase another access code directly from the publisher in order to unlock those aspects of the game. Another notable case relates to Microsoft, who initially intended to employ technical restrictions for its Xbox One console that would block the use of second-hand titles entirely. In both cases, the firms involved were forced to back-track on these measures due to significant PR backlash.

In order to address the primary research question of this study, a dataset containing a cross-section of prices for used video games titles was collected in August 2010. The data are sampled across a number of hardware platforms, with original release dates ranging from the mid-1990s up to the present day. Price data are obtained from BRE Software’s Game Price Guide Online¹, which catalogues over 15,000 pre-owned video game prices and is updated three times a week. The dataset also includes information on a range of observable control characteristics relating to each title that could plausibly explain variation in market prices. In the context of addressing the aim of this particular study, the most crucial characteristic is whether or not the game is a ‘special edition’ (i.e. a version designed to appeal to high value consumers). The BRE price guide also contains information on the platform of release and whether the game comes bundled with a physical peripheral or accessory; each of these factors are controlled for in the empirical analysis.

¹ <http://gamepriceguide.net/>

Additional supplementary information for each title was extracted from the Video Games Database maintained by MobyGames². This information includes platform of release, censorship rating, maximum number of players allowed simultaneously and the timing of release, both in absolute terms and relative to the appropriate hardware platform. Controls are also included for publisher and genre, as well as a measure of the opinion expressed by professional critics to serve as a proxy for underlying quality. In the same way films or books are subject to widespread critical attention in the popular media, video games are scrutinised by critics via specialist press appearing both in print and online. Studies such as Combris *et al.* (1997) have chosen to exclude similar information from their hedonic price estimation of Bordeaux wine on the grounds that the critical response to an experience good is not a relevant inclusion, as purchasing occurs before tasting takes place. However, this study argues that review scores from professional critics are a valid inclusion in the price estimation, as they represent an observable characteristic known to consumers in advance of purchase. Review scores are obtained from the Metacritic website³, which supplies a ‘metascore’ out of 100 for an extensive catalogue of video games based on the weighted average of review scores published by a variety of printed and online sources around the world.

The relevant categories and specific variables included in the empirical analysis are summarised in Table 1 and have mostly been coded in dichotomous terms, with mean and standard deviations reported where appropriate. After filtering the data and eliminating a small number of outliers from the remaining sample (39 such observations are identified, accounting for approximately 0.7% of the sample), the final number of observations used in the empirical analysis is 5,118. In particular, it should be noted that the mean value of the ‘Special Edition’ variable (0.025) is relatively small, indicating somewhat limited use of versioning in this particular market during the time period under analysis. However, the data clearly show an increase in the number of special edition variants captured by the dataset over time. Less than 1% of the titles sampled titles from 2000-2004 were

² <http://www.mobygames.com/>

³ <http://www.metacritic.com/>

special editions, while the proportion increases to 6% for 2008-2009 and 9% for 2010. Given that there is no reason to suspect any bias in the sampling of data, this trend is likely to indicate an increase in the use of the practice over time. Conversely, this pattern may also support the contention that premium editions are more likely to be kept by their original owners, whereas standard editions are disproportionately resold.

[Table 1 about here]

Using these data, a hedonic pricing analysis is undertaken in order to empirically estimate variations in consumer WTP for used video games. The hedonic approach is based upon the premise that the value of a good is a direct function of its objectively quantifiable utility-bearing characteristics (Lancaster, 1966) and that these characteristics are essentially traded in bundles within implicit markets (Rosen, 1974). However, a particular issue surrounding the application of hedonic pricing analysis where utility from consumption is not known with certainty *ex ante* is that a wealth of relevant characteristics can be difficult to describe and hence are not easily quantifiable (Oliner & Sichel, 1994; Hollanders & Meijers, 2002). Despite these inherent difficulties, hedonic pricing analysis has previously been applied to computer software in studies such as Gandal (1994); Brynjolfsson & Kemerer (1996); Harhoff & Moch (1997); Castranova (2004); Prud'homme *et al.* (2005) and Chakravarty *et al.* (2006). However, as far as the author is aware, this is the first study to undertake a hedonic pricing analysis based on the characteristics of video gaming software.

The data described in Table 1 are fed into a hedonic pricing estimation model, which is specified in Equation (1):

$$\ln Price_i = \beta_0 + \beta_1 SpecialEdition_i + \beta_2 Review_i + \beta_3 Rating_i + \beta_4 Age_i + \beta_5 MaxPlayers_i + \beta_6 Online_i + \beta_7 Licensed_i + \beta_8 Accessory_i + \beta_9 Multiplatform_i + \beta_{10} Console_i + \beta_{11} Genre_i + \beta_{12} Developer_i + \epsilon_i \quad (1)$$

Where $\ln Price_i$ is the natural log of the pre-owned video games price for the i^{th} video game title and $Review$, $Console$, $Genre$ and $Publisher$ are vectors containing a variety of dummy variables designed to capture the presence or absence of relevant features for each title within these stated categories. Other

variables represent individual title characteristics as described in Table 1. Of specific interest is the estimated value of β_1 , which provides evidence on the extent to which versioning exploits differences WTP among consumers and leads to significant variation in the value of pre-owned video games.

3. Results

Table 2 presents estimation output from two different regression models. Specification (i) follows the functional form outlined in Equation (1), while Specification (ii) includes a number of additional interaction terms. In both cases, the dependent variable is the natural log of the pre-owned game price and so coefficients can be interpreted as percentage changes in price resulting from a one unit change in the respective independent variable. Where a majority of these variables are dichotomous, the stated coefficient can be interpreted as the given percentage variation in price associated with the presence of this characteristic. Heteroskedasticity consistent standard errors are reported and used to determine the statistical significance of parameter estimates.

[Table 2 about here]

In specification (i), a majority of the general characteristic variables are statistically significant at or above the 95% confidence level. The R^2 value is approximately 0.58, which shows that the model provides a reasonably good explanation for the variation in the data in the context of a hedonic regression. Other than the clear heterogeneity of prices between hardware platforms, the other largest variations in price are observed for special editions and games that come bundled with an accessory, which respectively add thirty-nine per cent and sixty-two per cent to the value of a title. The large and positive coefficient attached to the former suggests significantly variation in WTP between high and low value groups in the presence of versioning. This further implies that versioning is indeed an effective strategy by which publishers can encourage consumers to ‘self-select’ into different groups as a means by which to enhance revenues. The positive and comparatively large coefficient estimated for titles that come bundled with an accessory is to be expected, since the consumer would be paying

not only for the software itself, but also for a physical peripheral (such as a mock-instrument, special controller etc.) which itself has an intrinsic value.

The estimated coefficients for the other characteristic variables are mostly in accordance with theoretical expectations, with a few notable exceptions. The presence of a title on multiple gaming platforms and licensed titles are each typically valued at around six per cent less than the respective alternatives. This suggests that consumers in this market value platform exclusivity and games based on original concepts. Online features are also found to associate negatively and significantly with WTP, such that market value is reduced by around ten per cent when an online multiplayer mode is offered. These findings are somewhat surprising in the presence of potential network externalities associated with the consumption of these goods, given that platform exclusivity obviously restricts the size of the installed user base. Furthermore, the presence of an online multiplayer mode allowing the opportunity to connect with other players represents a utility enhancing characteristic, which should resultantly associate with a higher WTP. One possible explanation for the latter finding is that the appeal of online play may significantly diminish once games reach the second hand market. If online interest and activity is disproportionately clustered around the latest releases, players of older titles may resultantly struggle to find opponents in sufficient quantity and regularity, hence decreasing WTP for this feature. Finally, when measured relative to other maturity ratings, games that are rated as suitable for teen players are associated with prices that are approximately two per cent higher relative to games suitable for all ages. Games with a mature rating associate negatively with price, but the estimated coefficient is not statistically significant. As mentioned above, dummy variables which reflect the hardware platform of release are found to universally exert a significant influence on price, with signs and magnitudes that are entirely in line with expectations⁴.

⁴ An obvious question to raise at this time would be the suitability of running single regressions based on the common sample, when the evidence clearly suggests that pre-owned software prices are strongly influenced by the gaming platform for which the title appears. The same regression analysis is conducted on separate sub-samples of the data, organised by console and the estimated coefficients attached to each of the other variables included in the model are virtually unchanged. Thus, for expositional clarity, only results of the estimations run on the common sample are included in this report although these separate regressions add a measure of reassurance regarding the robustness of the parameter estimates.

In terms of variables designed to control for the more subjective qualities of each title, the model output suggests that the quality of a game has a relatively small but significant influence on its market value. The magnitude of the coefficient suggests that the market price of pre-owned video games is relatively inelastic to variations in quality, as a one per cent increase in the Metacritic rating is estimated to increase the value of a typical game by just under half of one per cent. This is somewhat surprising given the significant influence that quality is seen to have on sales of new video games (Cox, 2014) and suggests that quality is a less important determinant of demand in the second hand market. Around half of the dummy variables representing games released by major publishers are significant at or above the ninety-five per cent confidence interval, suggesting that several major publishers have the potential to significantly add (or subtract) value from pre-owned video games. Five of the seven genre dummy variables are also found to be statistically significant, suggesting clear heterogeneity in the value of games based on content, design etc.

Specification (ii) includes interaction terms between key model variables; specifically, age, special edition and review score. While these results present a negative coefficient estimate for the special edition variable, this is not found to be statistically significant from zero at the 95% confidence level. Instead, this result should be considered alongside the (significantly positive) coefficient estimated for the interaction between the special edition variable and the review score, which unsurprisingly indicates that special editions of more highly rated (better quality) titles tend to command higher used values than special editions of less highly rated titles. Furthermore, the negative coefficient capturing the relationship between special editions and the age of a title indicates that special editions are likely to decline in value over time, suggesting that second-hand demand is greatest for special editions of newer titles. Finally, a relatively small negative relationship is estimated for the coefficient capturing interaction between the age of an individual and the review score implies that critical response has a diminishing influence on price as individual titles become older. In other words, the smaller than anticipated association between review scores and used software prices could potentially be caused by a consumer's own experience 'superseding' reviews from professional critics; an effect which seems to grow stronger as individual titles age over time. Aside from these specific insights, the inclusion of

interaction terms has only a modest effect upon the model diagnostics, while the estimated coefficients of non-interacted variables remain largely consistent with previously reported values.

4. Summary and Managerial Implications

This paper uses a hedonic price estimation to analyse the effective use of versioning in the second hand market for information goods, while also controlling for an extensive range of other factors affecting the demand for pre-owned video games. The results highlight several key factors that explain variations in pre-owned video games prices, not least of which relate to the effect of versioning on consumer WTP. Special edition variants of particular titles, as well as games released for newer platforms or that come packaged with an accessory, associate with significantly higher values. In contrast, the market attaches a lower value to licensed and cross-platform titles, as well as those with online multiplayer modes. Significant heterogeneity is also observed in the demand for games across hardware platforms, publishers and genres.

These findings provide empirical evidence in support of the theory relating to the effectiveness of versioning in markets for information goods; particularly those with the potential for significant network externalities (Jing, 2000). Additionally, these findings also have several significant managerial implications for video game publishers. First, as a result of the significantly higher WTP observed among consumers of premium content, it is suggested that video games publishers might enhance revenues by operating a more widespread policy of second-degree price discrimination. Indeed, given the significant variation in consumer WTP observed between premium and non-premium versions of the same game, an obvious potential exists for releasing a broader selection of versions for each product. This would have the potential of encouraging self-selection and exploiting variations in WTP between, for example, high, medium and low value consumers, as opposed to simply high and low.

Second, assuming that publishers perceive the sale of pre-owned video games as a threat to revenues, these findings highlight how various strategies are likely to lead to reduced WTP within the used market. Obvious examples are the decreases in WTP found to associate with multi-platform releases and the inclusion of online functionality. Publishers are therefore recommended to focus on releasing their titles on multiple platforms, as well as integrating online multiplayer modes into their games as much as possible. Firms may be able to suppress demand in second hand markets through strategic provision of online functionality and expediting the withdrawal of online support for their older games following the release of newer titles.

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Tables and Figures

Table 1: Model Variables				
Variable Name	Description	Mean (Std. Dev.)	Min	Max
GENERAL CHARACTERISTICS				
PRICE	Quoted market used price in USD	15.79 (9.669)	2.95	179.95
SPECIAL EDITION	Game is listed as a special edition	0.025	0	1
REVIEW	Review score from Metacritic (/100)	69.283 (13.679)	12	98
AGE	Age of game (years) at time of data collection	4.870 (2.464)	0	10
MAXPLAYERS	Maximum number of players in offline mode	1.849 (1.313)	1	8
ONLINE	Game allows for online play via the internet	0.206	0	1
LICENSED	Game content/characters are licensed (film, TV etc.)	0.398	0	1
ACCESSORY	Game comes with an accessory (instrument etc.)	0.022	0	1
MULTIPLATFORM	Game appears on more than one console (non-exclusive title)	0.524	0	1
RATINGS (Mutually Exclusive, Non-exhaustive)				
RATING T	Game has been awarded a Teen rating	0.324	0	1
RATING M	Game has been awarded a Mature rating	0.152	0	1
CONSOLE (Mutually Exclusive, Exhaustive)				
GBA	Game is for the Nintendo Gameboy Advance system	0.093	0	1
GCN	Game is for the Nintendo Gamecube system	0.095	0	1
NDS	Game is for the Nintendo DS system	0.089	0	1
WII	Game is for the Nintendo Wii system	0.065	0	1
PS2	Game is for the Sony Playstation 2 system (BASE CASE)	0.269	0	1
PS3	Game is for the Sony Playstation 3 system	0.073	0	1
PSP	Game is for the Sony Playstation Portable system	0.064	0	1
XBOX	Game is for the Microsoft Xbox system	0.151	0	1
X360	Game is for the Microsoft Xbox 360 system	0.103	0	1
GENRE (Non-mutually Exclusive, Exhaustive)				
ACTION	Game is of the action genre (BASE CASE)	0.625	0	1
ADVENTURE	Game is of the adventure genre	0.068	0	1
EDUCATIONAL	Game is of the educational genre	0.006	0	1
RACING	Game is of the racing genre	0.141	0	1
RPG	Game is of the role-playing game genre	0.111	0	1
SIMULATION	Game is of the simulation genre	0.093	0	1
STRATEGY	Game is of the strategy genre	0.100	0	1
SPORTS	Game is of the sports genre	0.211	0	1
PUBLISHER (Mutually Exclusive, Non-exhaustive)				
2K	Game is published by 2K Games	0.021	0	1
ACCLAIM	Game is published by Acclaim	0.017	0	1
ACTIVISION	Game is published by Activision	0.082	0	1
ATARI	Game is published by Atari	0.027	0	1
CAPCOM	Game is published by Capcom	0.040	0	1
DISNEY	Game is published by Disney Games	0.008	0	1
EIDOS	Game is published by Eidos Interactive	0.021	0	1
EA	Game is published by Electronic Arts	0.131	0	1
INFOGRAME	Game is published by Infograme	0.010	0	1
KONAMI	Game is published by Konami	0.047	0	1
MICROSOFT	Game is published by Microsoft	0.022	0	1
MIDWAY	Game is published by Midway Games	0.030	0	1
NAMCO	Game is published by Namco	0.032	0	1
NINTENDO	Game is published by Nintendo	0.047	0	1
ROCKSTAR	Game is published by Rockstar Games	0.012	0	1
SONY	Game is published by Sony	0.047	0	1
SEGA	Game is published by Sega	0.053	0	1
THQ	Game is published by THQ	0.061	0	1
SQUARE ENIX	Game is published by Square Enix	0.014	0	1
UBISOFT	Game is published by Ubisoft	0.058	0	1

Table 2: Regression Output

Specification	(i)		(ii)	
Variable Name	Coefficient		Coefficient	
	(Std. Error)		(Std. Error)	
GENERAL CHARACTERISTICS				
CONSTANT TERM	1.912 (0.032)	**	2.258 (0.058)	**
SPECIAL EDITION	0.394 (0.032)	**	-0.219 (0.222)	
REVIEW	0.004 (0.000)	**	0.010 (0.001)	**
AGE	0.065 (0.009)	**	0.009 (0.004)	
MAXPLAYERS	0.008 (0.004)		0.008 (0.004)	
ONLINE	-0.098 (0.014)	**	-0.101 (0.014)	**
LICENSED	-0.060 (0.011)	**	-0.055 (0.011)	**
ACCESSORY	0.616 (0.044)	**	0.605 (0.043)	**
MULTIPLATFORM	-0.061 (0.012)	**	-0.065 (0.011)	**
RATINGS				
RATINGT	0.024 (0.012)	*	0.024 (0.012)	*
RATINGM	-0.020 (0.016)		-0.020 (0.016)	
PLATFORM				
GBA	0.124 (0.020)	**	0.051 (0.021)	**
GCN	0.297 (0.018)	**	0.227 (0.018)	**
NDS	0.397 (0.033)	**	0.137 (0.020)	**
WII	0.670 (0.051)	**	0.283 (0.023)	**
PS3	0.774 (0.022)	**	0.363 (0.023)	**
PSP	0.463 (0.035)	**	0.203 (0.021)	**
XBOX	-0.183 (0.018)	**	-0.249 (0.017)	**
X360	0.612 (0.045)	**	0.274 (0.022)	**
GENRE				
ADVENTURE	0.024 (0.019)		0.030 (0.019)	
EDUCATIONAL	0.003 (0.073)		0.000 (0.073)	
RACING	0.035 (0.014)	*	0.036 (0.014)	*
RPG	0.113 (0.016)	**	0.109 (0.016)	**
SIMULATION	0.068 (0.018)	**	0.067 (0.018)	**
STRATEGY	0.037 (0.017)	*	0.038 (0.017)	*
SPORTS	-0.164 (0.014)	**	-0.159 (0.014)	**
DEVELOPER				
2K	-0.169 (0.040)	**	-0.176 (0.039)	**
ACCLAIM	-0.060 (0.036)		-0.075 (0.035)	*
ACTIVISION	-0.002 (0.019)		-0.005 (0.020)	
ATARI	-0.058 (0.032)		-0.054 (0.033)	
CAPCOM	0.009 (0.024)		0.009 (0.024)	
DISNEY	-0.208 (0.058)	**	-0.196 (0.057)	**
EIDOS	-0.075 (0.025)	**	-0.077 (0.025)	**
EA	-0.107 (0.018)	**	-0.100 (0.017)	**
INFOGRAME	0.105 (0.017)	*	0.097 (0.052)	
KONAMI	0.094 (0.023)	**	0.089 (0.023)	**
MICROSOFT	-0.194 (0.035)	**	-0.198 (0.034)	**
MIDWAY	-0.016 (0.027)		-0.014 (0.027)	
NAMCO	0.074 (0.029)	**	0.079 (0.029)	**
NINTENDO	0.129 (0.026)	**	0.135 (0.026)	**
ROCKSTAR	-0.110 (0.044)	*	-0.123 (0.042)	**
SONY	-0.078 (0.025)	**	-0.084 (0.025)	**
SEGA	-0.020 (0.023)		-0.003 (0.023)	
THQ	-0.004 (0.020)		-0.009 (0.019)	
SQUAREENIX	-0.007 (0.037)		-0.014 (0.037)	
UBISOFT	-0.027 (0.021)		-0.025 (0.021)	
INTERACTION TERMS				
SPECIAL EDITION x REVIEW	-		0.010 (0.003)	**
SPECIAL EDITION x AGE	-		-0.076 (0.021)	**
REVIEW x AGE	-		-0.001 (0.000)	**
R Squared	0.580		0.590	
F	151.252	**	149.110	**
N	5078		5078	

* Denotes significance at the 95% confidence level; ** denotes significance at the 99% confidence level