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Thesis

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(Major in Marketing)

Analysis of the Quality Signal Attributes and the difference between Post-release and Pre-release Sales in the Video Game Industry

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Abstract

This study is motivated by two research questions: What product attributes do consumers in the video game market use as quality signals when making their purchase decisions? To what extent do the theoretical quality signals impact pre-release sales differently to post-release sales? The methodology used in this study is based on the works of Basuroy et al. (2006). By testing for moderation effect of review disagreement and mediation effect of review score on the potential signalling variables, the study provides empirical evidence towards justifying a difference between pre-release and post-release sales. Theory stated that sequel, major publisher and exclusivity are quality signal attributes. The sample data used in the OLS regressions are based on games released in 2014 and 2015. Findings show that of the three theoretical quality signal attributes, conclusive evidence is only found towards major publisher being a quality signal attribute, and thus having a stronger positive impact on pre-release sales compared to post-release sales. Due to the unavailability of reviews pre-release, exclusive games are found on average to make comparatively less sales pre-release than post-release. Managerial implication of the study is that publishers of exclusive games should not expect low sales post-release due to low sales pre-release and major publishers of games should not overestimate post-release sales due to high pre-release sales.

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Contents

List of Figures and Tables

1 Introduction

The video game industry is one of the fastest growing industries with an average of 9% to 14% annual growth rate in the last 25 years (Zackariasson and Wilson 2010). Today more Americans play video games than go to the movies (The NPD Group, 2009). In 2012 global revenues were estimated to be at $67 billion for just the console, portable hardware and software market (Marchand and Hennig-Thurau, 2013). It is in pace with older industries such as the movie industry and larger than the music industry, making it a significant contributor to the global economy (Zackariasson and Wilson 2010). The video game industry is a great example where currently the majority of the firms include pre-ordering in the selling process (Plunkett 2015). Over the last decade, due to problem of stock outs in physical stores and the resulting dissatisfied customers, major firms had begun to always provide the option of pre-ordering their products. Since then, it has become the norm for majority of the firms, even non-major firms, to make pre-ordering available. However, pre-ordering becomes a risky task for users because of a core characteristic of video games. The characteristic is that the video game industry is an example of the experience goods market. Experience goods are products that are dominated by product attributes that require the consumption of the product to deduce the information pertaining to those attributes. The risk comes from experience product markets being characterized by product-quality information asymmetry between the potential consumer and the supplier (Eliashberg and Sawhney, 1994). Since realistically, consumption of the product before its purchase is not a possibility in most markets, consumers look for credible information that firms can provide using what can be called quality signals. Depending on the market, the type of signals can vary. Product attributes that act as quality signals for video games are sequel (Basuroy et al. 2006), exclusivity (Lee, 2007), and size of the associated publisher (Cox, 2014).

The purpose of this paper is two-fold. Firstly, using real-world video game sales data, the research will determine the differences in the impact of signalling variables on pre-release sales and post-release sales. Signalling attributes that impact sales, can be impacting sales at different levels or having different directional effects depending on whether it is pre- or post-release sales, mainly due to the presence of information from critic reviews post-release of a game, which is not always available before release. Secondly, using the same data, we will be empirically testing to what extent the theoretical notion that sequel, exclusivity and size of publisher purported to be signalling attributes are in fact true. Since video games are known to be an experience good (Fromme and Unger, 2012), it's a very applicable situation for consumers to use attributes as signals to perceive quality of a product. In addition, the results of the empirical models will be able to answer why certain games are more successful during pre-release, but fail to be successful after-release as well as whether the same genres are successful pre- and post-release.

Reviews are an important source of information for consumers in many types of markets, and it goes as far as to substituting or complementing older forms of communications of product quality information, such as business to consumer (signals) and offline word of mouth (Chevalier and Mayzlin, 2006). Firstly to define word of mouth (WOM), it is the flow of information from one actor to another through oral communication, which can be face to face between friends and family or even in-between strangers through online channels. This source of information however is highly lacking during the pre-order process of selling a game. Aside from friends and family members not having access to the game, a large portion of the games published come with a review embargo (Schreier, 2015). A "review embargo" is a legal method of controlling the day and time critics are allowed to publish their reviews. It serves two purposes. Firstly, it stops critics from rushing to be the first one to publish a review at the expense of quality and thoroughness (Schreier, 2015). Secondly, if the firm also sell pre-orders, then the firm will avoid the risk of losing pre-orders due to potential negative reviews that appear before the release (Morran, 2014). In most cases this means that when pre-orders are being sold, its reviews are not available. Therefore, understanding which signalling attributes are core to the success of a game pre-release, and how much weaker their impact is after the release can have large managerial implication towards the marketing strategies employed by the publishing firms.

As the video game industry grows in size it has also been experiencing a fast growth in costs of game production (Usher, 2007). The result is that publishers have become less willing to take risks due to a potential commercial failure of their product (Sacranie, 2010). The risk averse attitude comes from the observation of the many high investment software that have failed to succeed once released. Some of most expensive commercial failures are Shenmue for the SEGA in 1997, Duke Nukem forever for Playstation 3 in 2006 and E.T. The Extra-Terrestrial for Atari 2600 in 1982 (Ramphal, 2015). With mobile gaming coming into the picture as a big contender for the total revenue shares of the video game market, it is becoming ever more important that personal computer games and console games secure sales when possible. For many companies, especially new comers to the industry or smaller publishing companies it has become clear that the cost of an unsuccessful game is too large for them to grow or even survive in this very competitive industry. With how quickly WOM flows at the current internet age, disasters can easily occur as a cause of negative WOM. Therefore, guaranteeing sales through pre-orders before the spread of negative brand image can reduce the potential loss in comparison to a scenario without any pre-orders. Consequently, pre-ordering has become a core process in selling games. Considering how important it has become for majority of the publishers, it has gained a limited amount of attention from the academic community (Cox 2014). Compared to number of research and literature on other entertainment industries, the video game industry has been largely neglected, even though it is an ideal industry to research experience goods, signalling theory, blockbuster and pre-ordering. It is likely that we will be observing pre-ordering become even more prominent in the video game and other industries. Hence, due to how well it has already been established in the video game

industry, it is time to better our understanding of pre-ordering using the video game sales statistics. As the importance of understanding pre-ordering grows, due to its relationship with signalling theory, the importance of knowing how and what factors influence sales as quality signals grows with it.

The following section will contain the literature review of scholarly articles relevant for the study. Followed by a conceptual framework with an explanation on the dependent and independent variables used in the regression model, and their respective hypotheses. The section thereafter will provide a comprehensive clarification on the research methodology. Section 5 will comprise the results and its analysis. The final section will provide conclusions, suggestions for further research in this field of study and potential limitations of this research.

2 Theory and Hypotheses

2.1 Literature review

Experience goods and Word of Mouth (WOM)

Majority of the products that belong to the entertainment industries can be classified as experience goods (Nelson 1970). In his work, Nelson (1970) differentiated between search goods and experience goods. This was later refined to search and experience attributes within products, where a goods' classification is formed based on the balance of attributes (Nelson 1974). According to the refined theory, search goods are classified as such if they are dominated by product attributes for which there is complete information for the consumer before purchase. On the other hand, experience goods are goods that are dominated by attributes that require the use of the product to extract quality information pertaining to those attributes. Video games are products that are dominated by attributes that do not provide the needed information to make a fully informed purchase decision before experiencing the product, making them an experience good. Only a limited number of tangible ques are available for the consumer to deduce complete information on product attributes for the purchase decision. Instead, they heavily rely on intangible inputs such as consumer perception and word of mouth (Neelamegham and Jain, 1999).

The experiential nature of the goods has developed the entertainment industries to a state where word of mouth (WOM) from our friends, family or through other sources of face to face contact is not sufficient to give a completely representation of the product quality (Dellarocas, 2003). Instead, the majority of the WOM that influences consumer's choice of purchase in the entertainment industry is the online reviews, where more reviews leads to a more accurate representation of the game quality (Zhu and Zhang 2010). For music there are sources such as PCMag (also available as physical copy); for movies there exists sites such as rottentomatoes.com or IMDB.com; for video games consumers use Metacritic.com to judge if it's a worthy purchase. In these sites, consumers and professional game critics come together to provide a judgement regarding the quality of the game based on different product

attributes that they experienced during the use of the product. There has already been many studies that show that professional reviews significantly influence the decision making of consumers (Boatwright, Kamakura, and Basuroy 2007; Zhang and Dallarocas 2006; Reinstein and Snyder 2005), just as WOM in general has a strong influence on purchasing behaviour (Godes and Mayzlin 2004; Liu 2006).

While the increase in flow of WOM through online networks has improved the experience of consumers, it has consequently made the market more competitive for the publishers and developers. Online reviews make it easy for critics to have their reviews and their scores accessible on the day of the release and effect most purchases there onwards. High quality games are rewarded through increased sales, whereas lower quality games are punished through lower sales. To decrease the impact of the punishment, publishers have integrated the process of pre-ordering into the normal routine of purchasing games by providing the option of purchasing the pre-order with small additional benefits, or wait for the release to buy standard copy (Plunkett, 2015). Initially, pre-ordering was only a solution to a single problem, which was to decrease the possibility and the impact of stock outs (GameCentral for Metro.co.uk, 2015). It has now become a source of information for firms involved in the supply of a game, such as the publisher, distributor and retailer. The information is mainly to gauge the demand at the release of the game, but also to guarantee sales before the release of the game (Bakalar, 2012). Pre-orders guarantee sales that could have been lost due to negative reviews if the pre-order customer was only able to purchase the game after release and could consult reviews. By guaranteeing sales, publishers are decreasing the possibility of a commercial failures (Leack, 2016). A commercial failure is a product that does not reach expectations of success. By providing limited offers such as extra missions or items in game, publishers hope to attract consumers willing to purchase a product without complete information on its quality. Instead, firms provide signals regarding the quality of the game that they control, to improve the consumer's perception of the product.

Signalling theory and quality signals of video games

Signalling theory was developed from the study of information economics and is based on an important condition of information asymmetry between buyers and sellers when facing a marketing interaction (Spence, 1974). With most physical products, consumers have the chance to use their senses such as touch, smell and observe the product before purchase. Hence, they can perceive a closer to correct quality of the product before consumption. However, experience goods have the problem that sellers know the products' true quality while buyers are limited to assuming a product quality based on observable signals (Basuroy et al., 2006).

Many different signalling mechanism can be found in diverse markets, but what is found to be common within all markets with asymmetric information problem is the game played between suppliers and buyers (Boulding and Kirmani, 1993). Suppliers of high quality products would like to inform the buyers that their product is of high quality and to be able to ask for an appropriate price for its

consumption. Suppliers of low quality products have the goal of misguiding the consumers to acquire undeserved income. The consumers would like to be able to differentiate between the "good" type of sellers that provides accurate product information and the "bad" type of sellers that are looking to deceive them. The role of signals in these situations is to attempt resolving the consumers' classification problem. Consumers can search for signals that realistically can only be sent by "good" sellers. This can be based on the firms' chosen strategies, actions or product attributes (Boulding and Kirmani, 1993).

The brand equity of the seller can be a strong positive or negative signal for the consumer. Brands are increasingly becoming a key strategic asset for firms and have a significant monetary value (Aaker 1991). The advantage that branding provides to the consumer is that branded products that falsely claim high quality are at risk of losing their long-term investment in reputation, and consequently future profits (Rao et al. 1999). Signalling theory therefore states that when branding is taken into account, "bad" sellers are less likely to be found in the market due to the impact this strategy has on the brand's reputation. Thus, the consumers' claim on the unobservable quality of a branded product is likely to be correct. This is found especially to be true in the video game market because of the impactful brand communities of video games, publishers and platform owners, who are willing to scrutinize firms for their actions (Burger-Helmchen and Cohendent, 2011).

It is known that suppliers are better informed about the quality of their own game than the potential consumers (Plunkett, 2015). Publishers have the ability to use market research on potential consumers to gauge the quality perception of their product. In the cases of bad products, it is likely that the managing firm knows their product to be of low quality before the consumers spreads the word through WOM after release. If WOM is not available to help distinguish between high-quality and low-quality products, consumers look for cues that indicate the game's quality. Majority of the cues are controlled by the firm and are based on signalling theory. These credible information that act as "signals" of quality can be warranties, advertising spending or brand names (Basuroy et al. 2006). When it comes to pre-ordering a game, consumers have the option to view "cinematic trailers" of the game before the purchase. However as is the case with movies according to Basuroy et al. (2006), these trailers only provide "partial flavour" and not substantial evidence of its quality. Instead consumers focus on factors such as whether it is a sequel or not and whether it is published by a major brand to distinguish between good and bad quality products (Basuroy et al. 2006). That is not to say that these signals do not provide the same use after release, in fact based on Cox's (2014) study, game reviews, sequel and exclusivity can theoretically be strong quality signals after release. However, their level of impact can differ based whether it is pre-release or post release sale, mainly due to the attenuation of the signals because of reviews as studied by Basuroy et al. (2006).

The theoretical reasoning behind sequel being a signal of quality is that there is a high upfront investment cost for producing sequels (King 2001). This has been widely observed in the movie industry

but is also true for the video game industry. In the movie industry, the increase in cost for sequels is a consequence of the increased importance of having the same actors. In order to secure the actors' participation, the studios are forced to value those actors higher and provide a larger incentive to act in the sequels. For video game sequels, the game developers and voice actors related to a successful game series are of a much higher value to the firm funding the project than a replacement (King, 2001). Therefore, the contracting firm will face a higher upfront cost. For the resulting product to be profitable or to go even, a higher total revenue will be a necessity, hence the higher risk. This is similar to how attempting to produce a blockbuster is found to be intrinsically risky due to the higher investment (Binken and Stremersch, 2009). In addition, a poor sequel dilutes the brand image of the series franchise, in effect decreasing the potential gain of any future instalments within the series (Brodesser, 2000). Therefore, cutting cost at the expense of quality is not a likely choice made by the contracting firm. Thus, consumers can expect sequels to have consistency in their quality and trust the game developer to provide a game with a high enough quality to recover the extra costs of producing a sequel (Kennedy 1994).

There are multiple theories as to why association of a game to a major publisher can act as a determinant of the quality of that game. Firstly, the concept can be a proxy for the size of the firm backing the production and publishing of the game (Cox, 2014). In other words, major publishers are large companies with a lot of capital and the ability to manage a production of a game that can be of high quality. These companies also usually have cohesive marketing to develop positive brand associations and strong brand awareness among the consumers. Knowing that a game is published by a well-known and well branded firm can improve the quality perception of a game. There is also another element of utility derivation, where games published and produced by certain companies have a specific output that is unique to the company (Cox 2014). The uniqueness can come from the look, feel or the playstyle of the game, where having this uniqueness becomes source of having higher quality perception by the consumers for games associated to the respective company.

As for exclusivity, Lee (2007) finds that exclusivity is a strategic decision used by platform owners to increase their competitiveness by getting top developers and publishers working exclusively for them to dominate or at least tip the platform market. Creating exclusive deals with publishers and developers of games with the most potential to becoming a blockbuster can be an attempt to hinder the growth of competition (Prieger and Hu, 2012). This strategy comes with a risk in that a failing exclusive game can negatively impact the brand image of the platform it is related to. Which in combination with the increased cost of game production in general, means that the firms involved do not want to take risk (Sacranie, 2010). Thus it is safe to assume that exclusive games have a low probability of being sourced by a low quality game developer, and therefore consumers can also use this to their advantage by interpreting exclusivity as a signal of higher quality.

Review consensus

The study by Basuroy et al. (2006) focused on the signalling theory in the movie industry. Due to movies being an experience product, its market was characterized by product-quality asymmetry between the consumers and the companies. The difficulty of assessing the quality of an experience product before consumption, makes it necessity for studios to provide signals potential audience can find. The audience can then build an expectation of utility of the product based on these signals. In line with the credibility theory from Rao et al. (1999), Basuroy et al. (2006) found the adverse effect of negative word of mouth as a result of a false signalling to be a deterrent against studios bluffing about their products' quality. Basuory et al. (2006) focused on two popular types of signals that firms can use to communicate the quality of their product, which were sequels and ad expenditure.

While theory stated that sequel and ad expenditure were signals of quality, their paper focused on empirically testing whether the variables were in fact quality signals. This was done by understanding what influence the presence of product quality information from independent and third-party sources had on the potential signals. In other words, they tested if review consensus moderated the strength of the signals' relationship with sales. Review consensus is a measure of agreement between the reviewers about the quality of the product they are reviewing, higher agreement means higher consensus. The resulting attenuation of the positive effect of the signals on sales due to having higher review consensus meant that their hypothesis was correct in that sequel and ad expenditure were signalling variables. These signals have less effect on movies that have higher review consensus because consumers do not require quality signals when they have the information regarding the quality of the product from the independent or third-party source, which they find to be more credible when consensus is higher (Basuroy et al. 2006).

The theoretical reasoning for the interpretation of the moderation effect in Basuroy et al. (2006) comes from the signalling role of education level in the labour market (Spence 1974). The perceived overall quality of a potential employee comes from the observable (trainings) and hard to verify characteristics (soft skills) of the person. Based on Nelson's (1970) theory on experience and search goods, the hard to verify characteristics of the person can be considered as experience attributes, whereas the observable characteristics are close to being search attributes. The presence of experience attributes makes the accurate overall quality evaluation of the employee more difficult to attain due to the information asymmetry problem. However, the education level can act as search attributes and serves as a credible signal of quality for the employer. However, a mere influence of the signal cannot be taken as empirical evidence of being a signal, according to Basuroy et al. (2006), the empirical test is instead the signal's negative interaction with independent information. In other words, both the observable and hard to verify characteristics need to attenuate each other's strength of influence for the observable attributes to be signals of quality. In the case of evaluating an employee, having access to

independent source of information regarding the experience attribute of a potential employee should decrease the impact of education level on the probability of being hired.

Cox (2014) finds reviews to be highly significant for the success of a game, therefore, the signalling characteristics of a product attribute could also be tested in the video game market with the same methodology. Review consensus, in other words the agreement between the critics regarding the quality of a game, should attenuate the strength of the other signalling variables. In the same sense as movies being an experience good, video games are also an experience good (Fromme and Unger, 2012). Thus, based on the theories developed by Basuroy et al. (2006) consumers should theoretically find the impact of signalling (search) attributes such as sequel, size of the publisher and exclusivity to be less influential on their purchasing decision when they have the option to consult reviews with high consensus. The reasoning translated from the movie market to the video game market is that, consulting reviews with high consensus provides a credible source of information regarding the experience attributes of products. Therefore, quality signals which provide information on the search attributes of video games which are dominated by experience attributes, is less impactful on the purchase decision of the consumer. Due to the difference in availability of reviews between pre-release and post-release, evidence of attenuation of the variables in the post-release scenario would suggest that there is a clear source of difference between pre-release sales and post-release sales. On the day of the release, all games receive at the least one critic review, therefore it is guaranteed that consumers have the option to consult an independent source of information. However, before release, not all games have reviews of their content available to the potential consumers. Therefore, consumers of pre-released games are forced to put more value on business to consumer signals to develop a perception of the product's quality.

2.2 Conceptual framework

The conceptual framework of the research is based on the works of Basuroy et al. (2006). Their methodology was already briefly introduced in the section earlier, but is explained in further detail here. The main objective in Basuroy et al. (2006) was to use interaction terms to empirically test the signalling characteristic of sequel and ad expenditure, within the movie industry. Their methodology will be adapted to fit the video game market and expanded upon by also testing for mediation effect of review score in addition to the moderating effect of review disagreement. Furthermore, the result of empirical test for signal variables, will also be a used to analyse the difference between pre-release and post-release sales.

As it was already determined in the literature review, there is a case of asymmetry of information between consumers and firms within the video game market. To solve this issue, search attributes are used as signals of quality by the consumer to develop a perception of quality that they hope to be accurate to the actual quality of the game. If these signals are found to be credible by the

consumer, then they should have a positive impact on the sales of the game. These signalling variables in the video game market should be sequel (similar sense to sequel in the movie industry), size of the publisher (also a proxy for the brand equity of the firm), and lastly exclusivity. Firstly, the signalling variables will be regressed against the number of purchases for a game before its release, which is when reviews are not widely available to the consumer. As a comparison, the signalling variables will then be regressed against the sale quantities after the release of the game, however since reviews are widely available, it will not follow the same model specification as the pre-release model. The reason being that, according to Basuroy et al. (2006) a positive relationship between the variables and the dependent variable, sales, should not be interpreted as a justification for their signalling characteristics. Economics literature shows that the actual test should be the regression of the interaction terms of the signalling variables with review consensus (Basuroy et al. 2006). The results of the study by Basuroy et al. (2006) suggested that review consensus acted as a moderator between the relationship of the signals and sales. Moderating effect occurs when the relationship between an independent variable and a dependent variable depends on a third variable, which in this case was review consensus. However, in this study the moderating role of independent information will not be accounted for by review consensus, instead by the use of review disagreement. Review consensus is defined as the agreement between the reviewers regarding the quality of reviewed product, the closer the review scores of all reviews, the higher the consensus. As for review disagreement, the closer the scores the lower the value. Therefore, the major difference is that instead of the empirical test being a negative coefficient for the interaction term, we will be observing positive coefficients for the interactions terms. The hypothesis of this study will follow that of Basuroy et al. (2006) in that it is expected that review disagreement does act as a moderator between the relationships of the potential signals and sales, and thus empirically proving that sequel, size of publisher and exclusivity are signalling (search) attributes. If the hypothesis is true and review disagreement does positively moderate the effect of the signalling variables on sales, then it is also empirical evidence of a difference between pre-release and post-release. The reason for this interpretation is that games with high review disagreement are in a similar situation as games being sold pre-release, since in both cases reviews have low credibility. In the case of some pre-released products there are no reviews at all because of the embargo. Therefore, variables that have a stronger effect post-release due to games having high review disagreement as tested by the moderation effect, should also have large impact on sale pre-release. Therefore, understanding which variables act as signals when reviews are less accessible will also help understand which variables impact pre-release and post-release sales differently.

H_{1a}: *The interaction effect of sequel and review disagreement on sales post-release is positive.*

H_{1b}: *The interaction effect of exclusivity and review disagreement on sales post-release is positive.*

H_{1c}: *The interaction effect of publisher size and review disagreement on sales is positive.*

The first key independent variable is whether a game is a sequel to an existing franchise. Due to the high cost faced by consumers when purchasing a new game, they prefer to have an expectation of the experience provided by the product. This can either be a search attribute or an experience attribute. As a search attribute, sequels of games belonging to a franchise provide this assurance of quality without any external influence such as marketing or WOM. Producing sequels have a higher upfront cost for the managing firm in comparison to a newly branded game (King 2001). While these games do not require as much marketing as a newly branded game, the higher upfront cost comes from the increased value of the same assets responsible for the earlier games in the franchise. It is also in the best interest of the publisher to keep the quality of the games consistent to not ruin the image of the brand and thus the potential for further development of the franchise through new instalments (Kennedy 1994). Therefore, sequels of franchises will inherently have higher pre-order numbers due to the trust the consumers have in the franchise without any consultation of independent source of information such as reviews.

H_2: *A sequel belonging to a franchise has a higher quantity of sales than an original game.*

Making exclusive contracts between game developers or publishers with platform owners is mainly a strategy that is used for the benefit of the firms involved (Lee, 2007). However, as explained earlier in the paper, exclusivity can be a source of indirect information pertaining to the quality of the game. A commercial failure of a console exclusive game can have a large impact on the related console owner's brand. Therefore, it is unlikely that the developers that are willing to cut cost or produce low quality content will be contracted by the platform owner to produce a game (Gil, 2014). Hence, consumers looking to purchase games can use exclusivity as a signal for higher quality. There should be a positive relationship between being an exclusive game and experiencing higher sales in both context of sales, pre-release and post-release. It should be noted that sales of non-exclusive games are recorded separately for each platform (e.g. a game released on Xbox One and PS4 are taken as two separate games even though they are the same games).

H_3: *Games exclusive to a particular consoles have higher sales than games that are characterized as multi-platform games.*

A core difference between the multitudes of games released for any of the consoles is that the publisher that is responsible for the marketing of the game is different. With the advancement of online technology and the adaption of the population to digital content, problems such as stock outs have become less relevant. Therefore, the success of a publisher in terms of unit sale is more heavily based on their ability to market the product than to manage the physical stock (Jessell, 2014). With pre-orders, stock outs are completely out of the picture. The success of a publisher is entirely based on the marketing

15

efforts. Therefore the publishing firms that consistently markets their product better due to higher marketing budget and their ability to reach a larger audience, will have a larger brand awareness and trust by the consumers of the market (Cox 2014). Stronger brand awareness and image helps the name of the publisher be a signal of quality for the consumer. Therefore, while holding all other variables constant, major publishers should experience larger sales than minor publishers both before and after the release of the game.

H$_4$: *Games that are published by companies that can be categorized as major publishers have higher sales than games that are associated with smaller publishers.*

Hypothesis summary

|	
H$_{1a}$	*The interaction effect of sequel and review disagreement on sales post-release is positive.*
H$_{1b}$	*The interaction effect of exclusivity and review disagreement on sales post-release is positive.*
H$_{1c}$	*The interaction effect of publisher size and review disagreement on sales is positive.*
H$_2$	*A sequel belonging to a franchise has a higher quantity of sales than an original game.*
H$_3$	*Games exclusive to a particular consoles have higher sales than games that are characterized as multi-platform games.*
H$_4$	*Games that are published by companies that can be categorized as major publishers have higher sales than games that are associated with smaller publishers.*

Table 1 Summary of Hypotheses
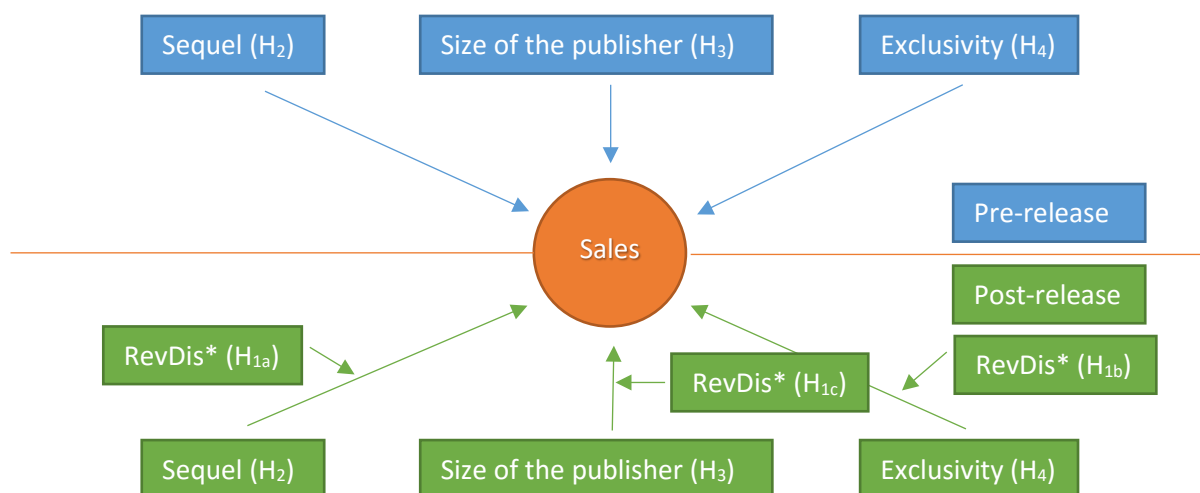
*Figure 1 Framework Summary (*RevDis: Review Disagreement)*

3 Research Methodology

3.1 Empirical setting

The video game industry is relatively new compared to the other entertainment industries (Cox 2014). It is still going through a lot of changes at a rapid rate. One of the more recent changes that occurred in the course of the last decade is the ability for consumers to pre-order. Another shift which also found in the music industry, is the digitalization of products, which has had a strong impact on the video game industry, especially on the concept of pre-ordering products. Due to past problems such as stock outs in physical stores, pre-ordering became the norm to make sure consumers receive a copy on the day of the release (Bakalar, 2012). It also became a method of measuring the potential success of a game at release. However, ever since digital downloading was introduced to the market, stock-outs have become a rare occurrence. Yet, pre-orders are still on the rise (Leack, 2015).

Pre-orders are also visible in other entertainment industries such as the music or the movie industry, where digital content on online sites such as Itunes.com can be pre-ordered before they are officially available for purchase (Yankellow, 2013). It can also be part of project rewards on crowdfunding sites such as Indiegogo or Kickstarter, where funding a certain project can reserve a copy of a final product at launch (Frith, 2016). However, the video game industry has become obsessed with pre-orders more so than other industry, to the extent that all games sold by major publishers begin selling pre-release (Plunkett, 2012). In addition, video games are products that are dominated by experience attributes which makes reviews and WOM highly impactful in the market (Fromme and Unger, 2012). Reviews on released product are always available, however reviews on products before release are either not accessible at all due to embargos (Schreier, 2015) or not credible due to low number of available critic reviews. The combination of having a strong impact from reviews on post-release sales (Cox 2014) and the difference in availability of reviews makes the sample ideal to study the difference between pre-release and post-release sales. Which is done through the use of review disagreement's moderation effect on the potential signalling variables.

Even though pre-ordering is well established in the video game industry, it is mainly a concept used by the larger publishing firms in the market for the more popular games (Plunkett, 2012). Therefore to focus on the part of the market that pre-ordering is most relevant for, the sample will be based largely on popular games in the video game market. More specifically, the sample will be based on the weekly top 40 games released in 2014 and 2015 in terms of the quantity of pre-orders according to VGChartz.com.

At the current state of the industry, pre-orders are mostly available only for games produced for consoles and personal computers (Plunkett, 2015). Console games have the largest share in sales

with an average of 66% between the years of 2008 to 2012 (Marchand and Hennig-Thurau, 2013). Therefore, it is ideal to centre the research of this paper on games produced for consoles. In addition, with the market becoming more competitive with lower total revenue share controlled by console games (Marchand and Hennig-Thurau, 2013), understanding the similarities and differences between pre-order and post release sales can be a source of competitive advantage to ensure guaranteed sales before release.

3.2 Data Collection and definition

All data used in this study is secondary data. Secondary data is defined as data that is collected from an external source. All the secondary data is from reliable sources, is suitable for the study and provide adequate information. The timeframe of the data is between 2014 and 2015. The observations are all games released within the mentioned timeframe and is limited to games released in United States of America (USA). This means that games that were available for pre-order during 2015, but released in early 2016 are not part of the sample. However, games that were available for pre-order at the end of 2013 but released in 2014 are part of the sample. In the dataset, observations related to the pre-order sales, are consistent with the observations in the post-release sales. In other words, games that were available for pre-order are also the games observed post-release within the dataset. This section explains the collection procedure for each variable and their respective definition.

Pre-release sales

The number of pre-order quantities for each observation is sourced through VGChartz.com's weekly pre-order list. VGChartz.com is a website that is managed by VGChartz, a business intelligence and research firm. They publish weekly estimates related to the worldwide hardware and software sales in the video game industry. In addition to the datasets, they also provide news and articles about the video game market.

The pre-order quantities are collected from one of their databases that lists the most pre-ordered games in the USA ranked by unit sales. The list is made of 40 observations and is updated each week with the new weekly pre-order figure and the total pre-order quantity for each game on the list. Once the game is released, it is removed from the list. Each observation's cumulative total pre-orders that is reported on the week of the release by VGChartz.com is recorded as the total pre-order quantity for that observation.

Post-release sales

After the release of a game, VGChartz.com also reports the global weekly sales of all games until week 10. The weekly sale figures can also be found specific for each region. The different regions being USA, Europe, UK, Germany, France, Japan. Depending on the popularity of the game, VGChartz.com at times only reports the sale figures for some of the previously listed regions. However, the database

consistently reports the units sold in USA for all games found in pre-order dataset. The weekly reported sale figures for each game that was released in 2014 and 2015 is summed to provide the post-release sales. The sales statistics are limited to the US just as pre-release sales are.

Critic review score

The source of the critic reviews is an online site called Metacritic.com. It is a website which aggregates reviews of products from multiple industries, such as music, games, movies, TV, and also formerly books. Reviews pertaining to a product can be posted online with a score ranging from 0 to 100 and a short product description with personal opinions regarding the experience provided by the product. The scores of all reviews are then averaged to provide an overall product score. The site differentiates the scores between critics and users by providing two different averaged scores, one pertaining to the critics and the other pertaining to the users. Users that review games online, are not a randomly drawn sample of the video game consumer population. Instead, extremely satisfied or dissatisfied consumers are more likely to express their opinion publicly (Anderson, 1998). Therefore, critic review score will be used instead of the user score to avoid the bias.

Instead of using the total average score provided by the site, each individual review score by the critics and its date of posting is collected. Each game is considered to have a timeframe that is based on the number of weeks it was available for pre-order plus the 10 weeks post-release. Reviews that were posted online after this timeframe are dropped. A new average score is calculated using only the scores posted before the release and inside the 10 weeks of sale. Since originally the scores can range from 0 to 100, the mean score of each game will also have a scale of 0 to 100.

Review disagreement

The standard deviation (s.d.) of the individual critic review scores for each game is calculated. Same as critic review score, the scores that were posted after the timeframe for each game are dropped. Standard deviation is a measure that indicates the dispersion of a set of a dataset from its mean. In this case, the s.d. of critic review scores of a game indicates the dispersion of the critic scores from the mean score of that game. Higher the variation within the scores, the more strongly the critics disagree with each other.

Review disagreement is useful in this study because the consumers that consult reviews on Metacritic.com, also observe the variation in the review scores. Metacritic.com distinguishes between the scores as high, medium and low. High being scores above 75, medium being scores in-between 50 and 75, and lastly low being scores below 50. Consumers that consult the site for the average review score can also see the number of games that received scores that are high, medium and low. In addition, consumers also have the ability to arrange the individual critic reviews based on review score to observe

the range of scores. Hence, consumers have the option of taking score variation into account when making their purchase decision.

Sequel

Sequel is a dummy variable that takes the value of 1 if the game is a sequel of a franchise and 0 if it does not belong to any series or is the first game of the series. The data is collected using each game's Wikipedia article which provided information regarding a game's involvement in a series or a direct mention of it being a sequel. Most sequels are also numbered in their title based on the number of instalments in the series, which logically differentiates them to original games without the need of a source.

Exclusivity

Video games exclusive to the 8th generation consoles are listed in the Wikipedia.com article titled "List of video game exclusives (eighth generation)." This information is aggregated on the site through the use of multiple news articles or blog posts as sources that mentioned the exclusivity of a game to a console. The site provides a list for each console, with games that were introduced to the 8th generation market that are exclusive to that console. The major sources are blog.us.playstation.com, Nintendo.co.jp, Nintendolife.com, IGN.com, destructoid.com, gameinformer.com, gamespot.com, and polygon.com. The 8th generation of consoles are PlayStation 4, Xbox One and Wii U.

Exclusivity is a dummy variable that is denoted as 1 for all games in the dataset that are mentioned in the lists, and 0 for all other games that can be categorized as multi-platform games. A game is categorized as exclusive to a console if the developer in charge of the game has an agreement with a platform owner associated to the game in production. This agreement inhibits the ability of the developer to work with any other platform owners, at least in association to the particular game. In other words, the developer is forced to only produce the game for a single platform.

Major publishers

Large scale publishers according to Cox's (2014) study are Activision, Disney, EA, Rockstar, Microsoft, Sony and Nintendo. According to his results, the stated publishers are associated with higher sales than the base case of non-major publishers. In his study, Cox (2014) had originally considered more firms to be major publishers, however the empirical evidence only suggested the stated firms to be as such. Therefore, the improved criteria will be used to differentiate between major publishers and non-major publishers. This data will be represented by a standard dummy variable. The games that were published through major publishers will be coded as 1, and games that were published through non-major publishers will be coded as 0.

Sale duration

Depending on whether the variable is regressed against pre-release or post-release sales, duration of sale is defined differently and collected differently. Sale duration for pre-orders is the number of weeks each game was available for pre-order. The appearance of a game onto the top 40 pre-order list on VGchartz.com is denoted as the start of the sale. This method of defining sale duration meant that some of the less popular games only had a presence of 3-4 weeks while popular games had over 20 weeks on average. The beginning dates of pre-order of a sample of semi-popular to less popular games was compared to the dates provided by news sources and it was deemed that the VGchartz.com "start date" of pre-order to be accurate to a large extent. The sources are IGN.com, gamepreorders.com, gamesradar.com and pcgamer.com.

Unlike pre-orders where you have a limited set of time to purchase the product before release, sale after release does not have a set time constraint. A game after the release technically is available for purchase for an indefinite period. While the data collected is until 10 weeks of sale, not all games sold consistently till the 10 week mark. Just as with pre-orders where marketing is "active" through the duration of the pre-order period, the games after release are also marketed only to a certain extent. Some games consistently sell large quantities until the end of the 10 weeks whereas other games sell majority of their copies by week 2. Therefore sale duration for post-release observations is calculated by estimating the number of weeks taken to sell 80% of the total post-release copies sold within the 10 weeks. Within the post-release model, using this variable as a proxy for duration of marketing, makes it comparable to the time variable in the pre-order model. Games that are available for pre-order for a longer duration of time are marketed longer, same as games that sell consistently for a longer period of time after release.

Price

Since the sale figures are regionally limited to the US, the price is denoted in dollars. Depending on the demand and the popularity of the game, video games have their original price decreased at a monthly rate after the release. In addition, there are no databases or a source of secondary data that provide aggregated list of the original price of a game at release. Furthermore, due to reasons such as exclusivity or other strategic reasons, not all retailers or online video game distribution platforms such as Microsoft store sold all games in the dataset at release. Due to stated reasons, multiple sources needed to be consulted to collect the original prices of all games. The sources are retailers such as Amazon.com, Gamestop.com, Walmart.com, BestBuy.com, and store.xbox.com, in addition to the video game distribution platforms such as Uplay store and Steam store. The prices of the observations are for the standard copy of the game. The price of pre-order are consistent with the price of post-release sales.

Seasonality

Seasonality is a dummy variable. Which means that it can either be coded as 1 or 0. If a game was released during the month of December, then the observation will be coded as 1. If it was released

during any other month, it will be coded as 0. This means that the variable is the same for both pre-order and the post-release datasets.

The video game industry is known to show a large degree of seasonality (Derdenger 2010). This can be observed in appendix 1. Since the video game industry is a two-sided market, the seasonality trend can even be observed with both the software sales and the hardware sales. Software sales being the sold video games for all consoles and personal computer, and hardware sales being the sold platforms. This annual trend of the industry makes it important to account for seasonality when studying factors impacting sales.

Online connectivity

The data regarding whether a game can be played online, offline or both was found using each of the individual game's Wikipedia.com page. The game's description indicates whether it is a multiplayer, single player or both, which means online gameplay, offline gameplay and both respectively.

This data will be represented by categorical dummy variables. Categorical dummy variables are slightly more complicated than standard dummy variables. Internet experience as a categorical variable has 3 different levels but is coded into two dummy variables. One will be ONL (online gameplay) and the other is ONLOFF (online and offline gameplay). If a game only has online game play, the dummy variable ONL will be coded as 1, and ONLOFF will be coded as 0. If a game has online and offline gameplay, then ONLOFF will be coded as 1 and ONL will be coded as 0. Even though there are 3 levels, there is only two variables because offline games are the reference category. This means that if a game is constrained to offline gameplay, then both ONL and ONLOFF are coded as 0. The resulting estimates of the two dummy variables will represent the variables' difference to the reference category.

In addition to being a simply product attribute, online connectivity can be interpreted as a proxy for internet activity of the user. Consumers purchasing online games have more internet activity on average compared to consumers of offline games (Zhu and Zhang 2010). The reason is such that, games that require the user to be online are most attractive for users that prefer to be online and have contact with other users (Zhu and Zhang 2010). Online games can abuse this fact and use multiple advertising channels, online and offline, to their advantage. While offline games will mainly find their success through offline advertisement. Therefore, this factor needs to be controlled for when studying sales.

Genres

Information pertaining to the release date, genre, developer and cast of each individual game can be found on the respective game's Metacritic.com page. Therefore, this site is also used as a source for categorizing each game to a genre. Genres are split into 7 different types of categories: role playing game (RPG), shooter, sport, racing, action-adventure, fighting and lastly miscellaneous (party,

platformer, puzzle and rhythm games). This data will be represented by categorical dummy variables, similar to internet experience. Instead of having 3 levels of categorical variables with 2 dummy variables, genre has 7 levels with 6 dummy variables. The reference category will be miscellaneous genre.

Table 2 will provide a summary of the variable definition with the respective names used in the equation, description, measurement and the variable type.

Regression model

Using the variables defined in the section above, the model specifications of the pre-release and post-release model will be provided below. Recall that the framework requires a pre-release model with the signalling variables and control variables to be compared against a post-release model with signalling variable, control variables and the interaction terms of the signalling variables with review disagreement. Model 1 will represent the pre-release model and model 2 will represent the post-release model.

$$
\begin{aligned}
PRESALES_i = \beta_0 &+ \beta_1 SEQ_i + \beta_2 EXC_i + \beta_3 MAJPUB_i + \beta_4 SALEDUR_i + \beta_5 PRICE_i \\
&+ \beta_6 SEASON_i + \beta_7 ONL_i + \beta_8 ONLOFF_i + \beta_9 RPG_i + \beta_{10} SHT_i \\
&+ \beta_{11} SPT_i + \beta_{12} RAC_i + \beta_{13} ADV_i + \beta_{14} FIG_i + \varepsilon_i
\end{aligned} \tag{1}
$$

$$
\begin{aligned}
PRESALES_i = \beta_0 &+ \beta_1 SEQ_i + \beta_2 EXC_i + \beta_3 MAJPUB_i + \beta_3 REVSCORE_i \\
&+ \beta_4 REVDISAG_i + \beta_5 REVDISAG * SEQ_i + \beta_6 REVDISAG * EXC_i \\
&+ \beta_7 REVDISAG * MAJPUB_i + \beta_8 SALEDUR_i + \beta_9 PRICE_i \\
&+ \beta_{10} SEASON_i + \beta_{11} ONL_i + \beta_{12} ONLOFF_i + \beta_{13} RPG_i + \beta_{14} SHT_i \\
&+ \beta_{15} SPT_i + \beta_{16} RAC_i + \beta_{17} ADV_i + \beta_{18} FIG_i + \varepsilon_1
\end{aligned} \tag{2}
$$

Where:

PRESALES = Pre-release sales

SEQ = Sequel

EXC = Exclusivity

MAJPUB = Major publisher

REVSCORE = Review score

REVDISAG = Review disagreement

SALEDUR = Sale duration

PRICE = Price of products

ADV = Action-adventure games

FIG = Fighting games

POSTSALES = Post-release sales

SEASON = Seasonality effects

ONL = Online gameplay

ONLOFF = online and offline gameplay

RPG = Role playing games

SHT = First person shooter games

SPT = Sport games

RAC = Racing games

Variable name	Measurement	Description	Type	Variable name	Measurement	Description	Type
PRESALES	A count	Total US unit pre-orders of game	Ratio	ONL	Online gameplay = 1 Other type of gameplay = 0	Games are categorized based on the availability of different types of gameplay, split between online and offline gameplay.	Categorical Dummy
POSTSALES	A count	Total US unit sales of game post-release	Ratio	ONLOFF	Both only and offline gameplay = 1 Other type of gameplay = 0		
SEQ	Game is sequel to a franchise = 1 Non-sequels = 0	Games that belong to a franchise are considered to be sequels.	Dummy	OFF	Reference category		
EXC	Game is exclusive to a console = 1 Non-exclusive = 0	Games that have a contractual obligation to only sell for one console.	Dummy	RPG	Role playing game = 1 Other genre = 0	Games are categorized based on the dominant genre of a game. The source of the information is Metacritic.com.	Categorical Dummy
MAJPUB	Game is published through a major publisher = 1 Non-major publisher = 0	Games that are sold through publishers that are considered "major" by Cox (2014) and based on his results.	Dummy	SHT	First person shooter = 1 Other genre = 0		
REVSCORE	Integer	Average review score based on the individual reviews posted within each game's timeframe on Metacritic.com.	Ratio	SPT	Sports = 1 Other genre = 0		
REVDISAG	Integer	Standard deviation of review scores for each game.	Ratio	RAC	Racing = 1 Other genre = 0		
SALEDUR	A count	Pre-order duration based on number of weeks available for pre-order.	Ratio	ADV	Action-adventure = 1 Other genre = 0		
		Post-release duration based on number weeks to reach 80% (total being units sold in 10 weeks) units sold.		FIG	Fighting = 1 Other genre = 0		
PRICE	Integer	The cost of a game in dollars	Ratio	MSC	Reference Category		
SEASON	Game is sold in December = 1 Non-seasonal months = 0	Games sold in the month of December are considered to be sold in a seasonal month for video games.	Dummy				

Table 2 Variable definition summary

3.3 Data description

In this section, descriptive statistics for both pre-release data and post-release data will be provided and they can be found in table 4 and 5 respective. Firstly, descriptive statistics of pre-release data that stands out or is interesting for the result section will be discussed. This will be followed by a discussion of the post-release data. In addition to looking at the descriptive statistics of pre-release and post-release data individually, they will also be compared.

The tables will provide statistics on the number of observations, maximum, minimum, mean and standard deviation. The number of observations will stay constant regardless of the variable. On continuous variables, the maximum will indicate the highest value observed for that variable and minimum will indicate the lowest value observed for that variable. The mean provides a number that expresses a central value for that variable. It is calculated by adding all quantities of the variable and dividing the sum by the number of observations. Standard deviation is a measure that indicates how dispersed the values are from the mean of the variable.

The interpretation is slightly different for the standard and categorical dummy variables. The maximum and minimum will always result in 1 and 0 respectively. By summing all observations and dividing the sum by the number of observations, the mean will provide a value that represents a proportion. For example, a 0.76 mean for sequel means that 76% of the observations are sequels. The resulting s.d. is closely linked to the resulting mean of a variable and provide a similar interpretation. The closer the mean is to 0 or 1, the lower the s.d., and therefore low s.d. of a variable can be interpreted as the sample having an uneven distribution. The closer the mean is to 0.5, the higher the s.d. which means that there is a more even distribution between 0s and 1s within the observations.

Pre-release data

First to look at the dependent variable, pre-release sales have an average of 136,745 units sold. More interestingly, there is a large difference between the maximum and minimum. The minimum units sold is 13,340 units, whereas the maximum units sold is close to a billion at 935,999 units sold. The difference in the maximum and minimum, in addition to the high s.d. reconfirms the key findings by Cox (2014). He found that the video game market is a market that is dominated by a few firms that make successful blockbusters, and these blockbusters make majority of the revenue in the market. More specifically, 10% of the titles observed in Cox's (2014) sample accounted for 54% of total units sold. Therefore, his observations stands to be true even during 2014 and 2015, with a sample made of relatively popular games.

	Observations	Minimum	Maximum	Mean	Std. Deviation
PRESALES	139	13340.00	935999.00	136745.02	162604.83
SEQ	139	0.00	1.00	0.76	0.43
EXC	139	0.00	1.00	0.24	0.43
MAJPUB	139	0.00	1.00	0.49	0.50
SALEDUR	139	0.90	99.50	21.15	19.85
PRICE	139	19.99	64.99	55.78	9.01
SEASON	139	0.00	1.00	0.26	0.44
ONL	139	0.00	1.00	0.07	0.26
ONLOFF	139	0.00	1.00	0.60	0.49
OFF	139	0.00	1.00	0.32	0.47
RPG	139	0.00	1.00	0.19	0.39
SHT	139	0.00	1.00	0.20	0.40
SPT	139	0.00	1.00	0.16	0.37
RAC	139	0.00	1.00	0.06	0.25
ADV	139	0.00	1.00	0.24	0.43
FIG	139	0.00	1.00	0.06	0.25
MSC	139	0.00	1.00	0.09	0.28

Table 3 Pre-release data descriptive statistics

As shown in table 3, 76% of the dataset is made of sequels. This is an interesting value because Basuroy et al. (2006) found that 6.3% of their sample consisted of sequels, which was consistent with past studies of the movie industry (Dominick 1987). Cox (2014) however found that 53% of his sample for the video game industry were sequels. While 76% is very high, the difference is not significantly high when compared to 53% instead of 6.3%. Cox's (2014) sample also came from VGChartz.com however consisted of all games released in the USA until September 2010. The difference to the Cox's (2014) sample's proportion figure can be due to the different timeframe or because of the current sample's restriction to the more popular games in the market. This difference in proportion of sequels makes it more interesting to study to what extent sequel is a quality signal. Sequel was found to be a significant quality signal for the movie industry, however due to higher percentage of games being sequel in the video game market, its influence as a quality signal may be more diluted. Furthermore, due to the increase in cost of game production, publishers are less willing to take risks as it is becoming increasingly more expensive to weather a commercial failure (Sacranie, 2010). Since sequels are less risky than original games, it might have caused an increase in the number of sequels released in the past years.

Table 3 also indicates that 24% of the games in the sample are exclusive to a console, which can be any console used in the sample, Xbox One, PlayStation 4 or Wii U. It is not a surprising proportion, similar to 49% of the games being published through major publishers. Since the sample of

the study is a more popular game focused sample than a sample representing the exact population of video games, it is reasonable that almost 50% of the games are associated to major publishers.

An interesting figure to look at is the duration of sale, which on average is 21.15 weeks while having a standard deviation of 19.85. This shows that there are huge differences in the number of weeks publishers choose to allocate as pre order period. For example the minimum duration is 0.9 weeks while the maximum is 99.5 weeks. The reason for the large difference can be related back to two theories. Recall that pre-release sales is a method of gauging demand at the time of release, but it is also a method of securing sales before WOM can influence sales (Leack, 2016). The less risk averse publishers, or the more confident publishers could find having a long duration for pre-release sale unnecessary. Some publishers may find it more economical to allocate their marketing budget for the week of release or after the release, whereas other (larger-) publishers may find it more economical to secure sales before release by having a longer duration even if it costs more. Note that, logically, having a longer period of time for sale will result in larger number of sales. However this is expected to be marginal if the product is not marketed in tangent during the duration of sale.

Seasonality patterns with the sales statistics is not found in all industry. In most other industries, a single month is not likely to have a very large impact on sales. However the mean of the variable season clearly shows the importance of the month of December. Entertainment products such as video games experience large spikes in sales during holiday season, therefore publishers look to introduce their games during this period. Generally this found to be true for video games sold after their release (Derdenger, 2010). According to table 3, this appears to be also true for pre-orders. 26% of all video games sold as pre-orders during the years of 2014 and 2015 are sold in December.

Majority of the games in the sample have both online and offline gameplay, while a minority have only online gameplay. It seems that while it is expected to see at least some offline games, publishers are not eager to specialize only on online gameplay.

As for the genre of the games, in comparison to online connectivity, the proportion of shares of the categorical variables is less dominated by one or two categories. The most popular genre is adventure games that account for 24% of all video games in the sample. Followed by shooters and RPGs. This finding differs from Marchand and Hennig-Thurau's (2013) concluding that shooter is the most popular genre in the video game market. This observed difference to Marchand and Hennig-Thurau (2013) data could be because of multiple reasons. When observing a sample made of mostly popular games, adventure is the most popular genre. However, it is possible that when a sample is based on the entire popular, shooter is more popular. Another reasoning could be a shift in the popularity over time. Adventure games could have been experiencing larger success in the past years, thus resulting in shift in focus of the market from shooter games to action-adventure games.

Post release data

	N	Minimum	Maximum	Mean	Std. Deviation
POSTSALES	139.00	18515.00	3882090.00	524806.31	633359.72
SEQ	139.00	0.00	1.00	0.76	0.43
EXC	139.00	0.00	1.00	0.24	0.43
MAJPUB	139.00	0.00	1.00	0.49	0.50
REVSCORE	139.00	58.00	96.92	78.96	8.23
REVDISAG	139.00	3.54	103.17	9.86	9.41
SALEDUR	139.00	2.00	9.00	4.81	2.27
PRICE	139.00	10.00	64.99	55.42	9.81
SEASON	139.00	0.00	1.00	0.26	0.44
ONL	139.00	0.00	1.00	0.08	0.27
ONLOFF	139.00	0.00	1.00	0.60	0.49
OFF	139.00	0.00	1.00	0.33	0.47
RPG	139.00	0.00	1.00	0.19	0.39
SHT	139.00	0.00	1.00	0.20	0.40
SPT	139.00	0.00	1.00	0.16	0.37
RAC	139.00	0.00	1.00	0.06	0.25
ADV	139.00	0.00	1.00	0.24	0.43
FIG	139.00	0.00	1.00	0.06	0.25
MSC	139.00	0.00	1.00	0.09	0.28

Table 4 Post-release data descriptive statistics

Firstly to discuss the difference between pre-release sales and post-release sales. The maximum number of pre-order units sold is 935,999, whereas the maximum number of units sold after release (constricted to 10 weeks) is 3,882,090. The mean units sold before release is 136,745 and the mean units sold after release is 524,806, which is almost 4 times higher while also being similar to the difference in maximum units sold. Clearly the scale is much larger for the units sold after release, however it isn't higher by a fixed value. In fact, the minimum units sold post-release is similar to pre-release, with 13,340 and 18,515 respectively. To account for this difference when comparing the estimates of the pre-release and post-release model, the dependent variable needs to be log-transformed. Log-transforming is done by using natural logs of the values of the variable instead of the raw values. This way, the estimates of the regression model will be in the form of a percentage, which is more easily comparable between models. In addition log-transformation also solves problems related to the residuals of a variable. More information regarding the log-transformation can be seen in appendix 2.

Since the signalling variables are product attributes related to a game it stays constant regardless of whether the game is being sold pre-release or post-release. This means that the descriptive statistics of the sequel, exclusivity and major publisher are the same for pre-release and post-release data. The

same is true for the categorical variables genre and online connectivity and two continuous control variables which are price and season.

The biggest difference in the datasets comes from the introduction of review score and review disagreement. Recall that in this study it is assumed that before the release of a game, consumers looking to make a purchase decision cannot consult reviews. However, all games at release have at least one review. The fact that minimum score in the dataset is 58, proves that point. The highest score is 96.92, which means that the game with the respective score is technically the highest quality release in 2014 and 2015 if quality is to be entirely based on the average review score. The mean is 78.96 with a standard deviation of 8.23. The high average review score and moderate magnitude of the s.d. suggests that most games in the sample are relatively of good quality. In a sample with games that generally have good review scores, if review score is still highly impactful on sales in comparison to other variables, then it follows the findings of Cox (2014). He finds that games need to be of the highest quality to become a blockbuster. Therefore, even though review sites such as Metacritic.com consider a score of 75 to be "good," a strong estimate for review score in this sample would show that games should look to achieve the highest quality and firms should not be content with producing a "good" quality product. In other words, a strong estimate would suggest that increase in quality even among games that are mostly of "good" quality has a high impact on sale.

It should be noted that sale duration is defined differently when used in the post-release model to how it is used in the pre-release model. In section 4 it was explained that the duration as a variable is adapted to the post release scenario. Sale duration is the number of weeks taken for a game to sell 80% of its total units sold. As seen table 5, on average the sale duration is 4.8 weeks. Minimum being 2 weeks and maximum being 9 weeks. This means that even in a sample that is mostly made of popular games, games on average make majority of their sales within their first month, instead of having a more consistent sale over the 10 week period.

4 Results

4.1 Primary Model results

The regressions are performed on SPSS 24 and the results pertaining to the comparison between pre-sale model and post-release model are presented in this section. The main approach, which is to investigate the moderating effect of review consensus on signalling variables will be followed by a robustness check section. One of the alternative approaches to this study is to observe the potential mediating effect of review score on the signalling variables to understand if it is a cause for any observable difference between pre-sale signalling variables and post-release signalling variables.

	Log(Sales)			
	Pre-release[a]		Post-release[b]	
	Coefficient	p-value	Coefficient	p-value
(Constant)	4.250	0.000	3.172	0.000
SEQ	-0.034	0.615	-0.532	0.344
EXC	-0.010	0.894	0.775	0.035
MAJPUB	0.185	0.007	-0.318	0.429
SALEDUR	0.011	0.000	0.044	0.006
PRICE	0.004	0.180	0.006	0.072
SEASON	0.198	0.004	0.285	0.001
ONL	-0.219	0.088	0.188	0.166
ONLOFF	-0.049	0.477	-0.030	0.707
RPG	0.220	0.078	0.075	0.616
SHT	0.243	0.045	0.213	0.146
SPT	0.171	0.161	0.104	0.480
RAC	-0.041	0.786	-0.050	0.777
ADV	0.143	0.226	0.154	0.269
FIG	0.204	0.172	0.289	0.110
REVSCORE	-	-	0.023	0.000
LogREVDISAG	-	-	-0.384	0.536
LogREVDISAG*SEQ	-	-	0.620	0.311
LogREVDISAG*EXC	-	-	-0.971	0.011
LogREVDISAG*MAJPUB	-	-	0.788	0.062
[a]Dependent variable: logPRESALES				
[b]Dependent variable: logPOSTSALES				

Table 5 Pre-release and post-release regression results

Moderating effect of Review consensus

Table 5 provides the resulting estimations and their respective p-values of the post-release model, which in addition to the signalling factors that are observed in the pre-release model, also includes review score, review disagreement and the interaction terms of review disagreement and the signalling variables. It is argued in H_{1a}, H_{1b} and H_{1c} that the coefficients of the interaction terms will act as an empirical test to see which variables truly act as quality signals. With the methodology of using review disagreement as moderating variable, understanding which variables are signalling variables will indicate how factors' influence on pre-release sales differ from post-release sales. A positive coefficient of an interaction term with review disagreement and a signal attribute would suggest that an increase in disagreement within the critics' review scores, increases the impact of the interacting signal attribute on sales. A negative coefficient would represent the opposite notion. If a variable's impact increases due to an increase in disagreement, it suggests that consumers are using the factor as an alternative to reviews as a quality assurance, making it a signalling attribute.

The interaction term between review disagreement and exclusivity is highly negative and significant ($p < 0.01$). Contrary to the initial H_{1b}, increase in disagreement within the critics' community regarding the quality of a game, decreases the impact of exclusivity on sale. Exclusivity's main effect on sales post-release is moderately significant ($p < 0.05$) and positive in this equation, unlike the other core variables such as sequel and major publisher which turned out to have insignificant effect on sales post-release. This suggest that there is a positive relationship between being an exclusive game and sales. However, the interpretation of the interaction term is that this positive relationship weakens when the game receives critic reviews that have large variations in its scores. The result indicates that while there is a positive relationship between exclusivity and sales, there is no conclusive evidence to suggest that it comes from being a signalling variable. For the variable to be a signalling attribute, exclusivity's impact should be increasing when critic consensus decreases. An interpretation of the result is that when consumers don't find credible source of information for the experience attributes of a game, they find exclusive games to be a riskier purchase. Since it is not likely for the consumer to find credible independent source of information for products available for pre-order, the result thus states that exclusivity has a lower impact on sales pre-release compared to post-release. This is supported by the insignificance of exclusivity in the pre-release model.

Major publisher is another variable that had a positive coefficient when regressed as an interaction term with review disagreement. The result provides conclusive evidence towards H_{1c}, which stated that major publisher is a factor that signals higher quality to the consumer. The interpretation is that increased disagreement between the critics regarding the quality of a game, increases the impact major publisher has on the sales of the product after release. In other words, when consumers look for other signs of quality when review score does not provide sufficient or definite information, major publisher is one of them. The value of a game being associated to a major publisher (and being clearly branded as such) increases when the game's quality cannot be easily determined using WOM. The implication of this result in pre-release context is that in a scenario where WOM is not used as a source for information, this is conclusive evidence that size of the publisher associated to the game is used by the consumer to perceive the quality of the product. There is empirical evidence to say that major publisher as an attribute has a higher impact on pre-orders than post-release sales. This result is in line with the initial positive and significant relationship between MAJPUB and pre-release sales.

We do not find enough evidence to accept the H_{1a} due to the insignificance of the interaction term between review disagreement and sequel. Increase in disagreement between the critics does not modify the impact of sequel on sales. It seems that consumers do not rely on sequel as a product quality attribute when they cannot find a source of WOM that provides definitive information regarding the quality of the product. Therefore when consumers are faced with a purchase decision without any WOM, for example when pre-ordering, they do not perceive sequels to have higher quality compared to non-sequels. There is not enough evidence to say that there is a difference in the impact of sequel on

sales between pre-release and post-release. This is further supported by the observed insignificance of the main effect of sequel expressed in both pre-release and post-release models.

The significant control variables are sale duration, price and season. It should be noted that sale duration is defined differently in the post-release model to the pre-release model. Sale duration pre-release is the number of weeks the game was available for pre-order. On the other hand, Sale duration post-release is the number of weeks taken to reach 80% of units sold of the total games sold within the first 10 weeks. Therefore, it is not directly comparable. However, the positive and significant ($p < 0.01$) influence on sales is an indication that the duration of marketing is correlated to higher sales in the entire sale process in the video game market. Secondly, even though price is insignificant during pre-release, it is significant ($p < 0.1$) and positive for games sold after release. A one unit increase in price leads to a 0.6% increase in sales, ceteris paribus. While it is marginal, it is an indication that consumers might be interpreting higher prices as more secure purchases, meaning that there is a behavioural element to the variable. As expected based on past papers, seasonal variations in quantities sold is a significant factor impacting games sold both pre- and post-release. With a large significance ($p < 0.1$), games sold in December have on average 28.5% more units sold compared to other months while holdings other variables constant. The resulting p-values for genres shows that there is no evidence to suggest that there is a difference in sales between games due to the genres. Unlike pre-release where RPG and SHT are the more popular genres, after the release, these games don't look to keep their popularity.

Factors impacting Pre-release sales

To discuss the results of the pre-release equation with respect to hypothesis H_2, H_3 and H_4. The results can be found in table 5. The initial expectation regarding the impact of signalling variables was that they are significant and positive. We find that major publisher as a product attribute has a strong and positive relationship ($p < 0.05$) with pre-release sales. This suggests that major publishers are likely to sell more pre-orders than non-major publishers. More specifically, while holding all other variables constant, association of a game with a major publisher such as Activision, Disney, EA, Rockstar, Microsoft, Sony and lastly Nintendo should on an average, increase the number of pre-orders by 18.5%. As for the other potential quality signalling attributes, the highly insignificant effect of sequel and exclusivity is enough evidence to reject H_2 and H_3. This means that the product attributes sequel and exclusivity do not influence product sales before release and therefore cannot be considered as quality signals.

As for the control variables, duration of the pre-order has a strong positive effect ($p < 0.01$) on the number of pre-orders. A one week increase in the duration of the pre-order, increases sales by 1.1%. Having a longer duration means that it is more likely that more potential consumers will stumble upon the pre-order offer compared to having a shorter duration for the sale. Since duration of the sale also

pertains to the duration the product is marketed before the release, it seems that the publisher can reach a bigger audience by marketing the product for a longer time.

Seasonality is known to be a large factor of success for games and consoles in the video game market. Therefore it isn't out of the ordinary that the control variable SEASON has a strong positive impact ($p < 0.01$) on sales. 26% of the games are sold during the holiday season, and these games on average had 19.8% more sales than games sold in other months while holding all other variables constant. This could be because of the increased need for purchasing products for personal use or as gifts during holiday seasons in the US. This proves to be true for the products that have already been release, especially for the entertainment industry, however there is evidence that it is also true for products pre-release.

Interestingly, at a significant level ($p < 0.1$), games that specialize in offline gameplay on an average sell 21.9% more than games that only have online gameplay when holding other variables constant. The level of online connectivity of a game is supposed to indicate the level of the internet activity of the user. Where, consumers of online games would be expected to have on average more internet activity (Zhu and Zhang 2010). Based on the results, games with both online and offline gameplay don't have a significant difference in sale compared to offline games. Offline games having more sales than online specialized games suggests that users of offline games are more trust worthy of their games' qualities when information on the experience attributes of the products are not available.

Table 5 also shows that genres such as fighting, action-adventure, racing and sports, do not have a significant difference to the reference category in quantities sold when holding other variables constant. On the other hand, genres such as RPG and first person shooters do have higher sales than the reference category, miscellaneous genre. While according to the result of this study, this relationship with sales does not exist post-release. These findings are in line with the results of other studies on post-release sales and show that first person shooters are also the most popular genre before the release of a game just as they are post-release (Marchand and Hennig-Thurau 2013)

4.2 Robustness check

As a robustness check, testing for mediation effect of review score will be used as another empirical test to determine which variables are in fact signalling attributes, and are a source for the difference between sales pre-release and post-release. Similar to the attenuation of the potential signalling variables due to the certainty of quality perceived by the consumer based on review consensus, accounting for review score should also attenuate the impact of the signalling variables. The difference in methodology being that instead of having a moderating effect, review score will act as a mediating variable. The concept of mediation states that instead of a direct causal relationship between the independent variable and the dependent variable, the independent variable influences the mediating variable, which in turn influences the dependent variable. The test will be performed first by regressing review score against the signalling variables and control variables, as represented by equation 3 in

appendix 3. Significance of the signalling attributes will give an indication of whether they can be mediating variables, however does not give definitive proof regarding the signalling attribute of the variable. This will be followed by regressing the post-release sales against the core independent variables twice, once without controlling for review score and once while controlling for review score, as represented by equation 4 and 5 respectively in appendix 3. It should be noted that the variables regressed against post-release sales will only be the core independent variables, which are the quality signal attributes, while only controlling for review score in the second equation.

If the mediating relationship exists and the presence of review score attenuates the effect of the core variables, they can be considered signalling variables. For example, sequels can have a pattern of receiving higher review scores compared to original games, suggesting that it influences the perceived quality of the game as stated by the independent source of information, and these positive reviews should then positively impact sales of the sequels. If this mediating relationship exists, and controlling for review score within a model with the signalling variables decreases the impact of sequel on sales, then there is evidence to suggest that sequel signals higher quality. The expectation is that all signalling variables positive influence review score, therefore making review a mediating variable. A simple representation of this concept in a diagram can be found as figure 2. The
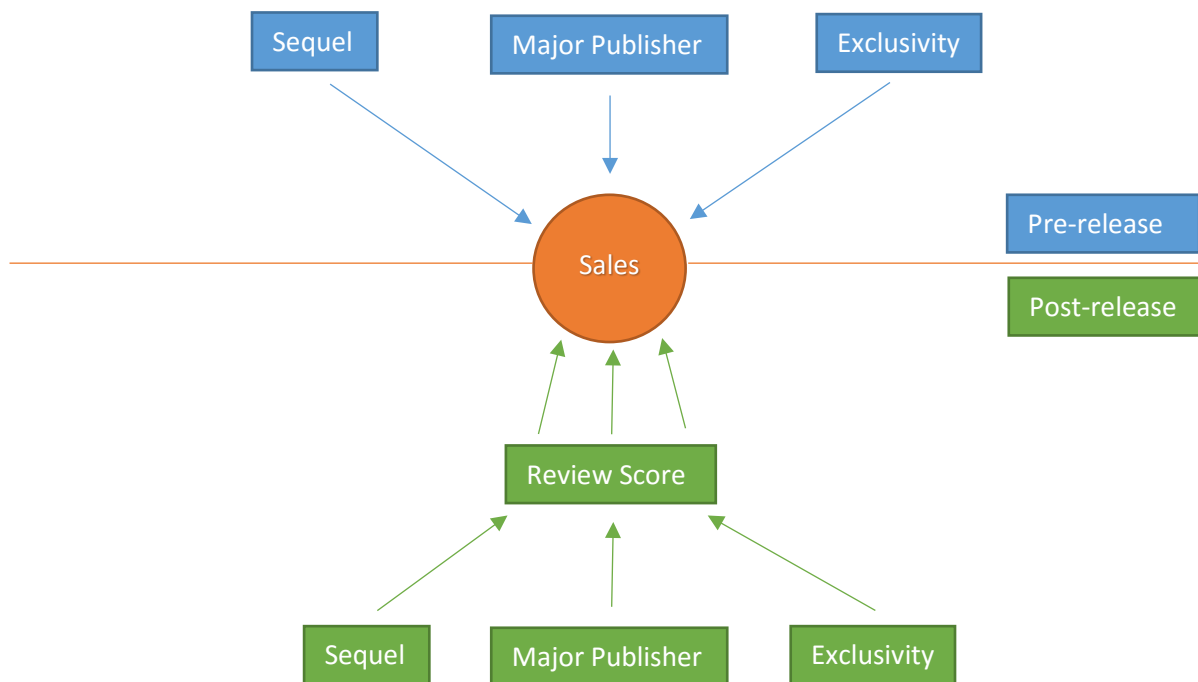

Figure 2 Concept of review score mediation effect

As explained earlier in the conceptual framework section, sequels have a tendency to have an increase in their costs compared to the prequel. This increase in cost requires the resulting product to be of higher quality or at least of the same quality as the prequel to have a profitable return on the investment. In addition, franchises in the video game industry last many years and have many

instalments such as the Call of Duty or Assassin's Creed franchise. Therefore, to secure their future sales and success of the franchise, the publisher is forced to sustain higher quality. Hence, the initial H_2 is that sequels have a positive influence on sales. This positive influence (post-release) can be a trend that is a result of sequels getting higher review scores than the alternative original games, even though critics are likely to be harsher on sequels than original games since the game under question is easily comparable to its prequel (Edmund, 2011). The expectation is that review score is strongly influenced by the product attribute sequel.

Similar to sequels, where the associated publisher is forced to make higher investments, major games associated with major publishers are expected to be of high quality. Low quality games published through major publishers hurts the brand image, just as a bad sequel would hurt the franchise as a brand. Therefore, major publishers are required to make larger investments into their games. Whereas non-major publishers can be sufficed to having a mediocre quality game with low investment. This might induce a pattern of games publisher by major publishers getting better review scores compared to games published through non-major publishers. The expectation of a positive relationship between exclusivity and review score is also due to the influence of game quality on brand image, however it is the brand image of the platform owner. Exclusive games need to be of high quality if the platform owner wants to dominate the market using exclusive games and not hurt the brand, thus forcing a higher investment which could lead to exclusive games having better review scores than the competing multi-platform games.

Results

According to table 6, MAJPUB positively ($p < 0.1$) influences review score. The estimate itself is 3.019, which means that games associated with major publishers on average have 3.019 points higher review score than the alternative games. The average review score in the sample is 78. In a scale that ranges from 0-100, a 3019 increase is only a moderate increase. However it is of significance that it has a positive influence regardless of the magnitude. Looking at table 7, when controlling for review score, MAJPUB moderately influences sales ($p < 0.1$) post-release. However, at similar p-values, MAJPUB has a weaker impact on sales after release than pre-release. More precisely, a game being published through a major publisher on average has 28.2% higher sales than games published by non-major published when sold pre-release. When sold post-release, games associated to major publishers have only 24% higher sales on average than games associated to non-major publishers. This difference in impact suggests that review score attenuates the impact of major publisher as a product attribute on sales, which is empirical evidence that review score mediates the impact of major publisher on sales. Thus, there is empirical proof to interpret major publisher as a quality signalling attribute.

	Review score[a]	
	Coefficients	p-value
(Constant)	71.423	0.000
SEQ	1.214	0.474
EXC	1.294	0.474
MAJPUB	3.019	0.070
SALEDUR	0.960	0.004
PRICE	0.007	0.922
SEASON	-3.532	0.037
ONL	-5.456	0.055
ONLOFF	-2.982	0.082
RPG	6.948	0.024
SHT	5.502	0.064
SPT	0.137	0.964
RAC	0.900	0.808
ADV	2.197	0.443
FIG	-0.962	0.796
[a]Dependent variable: REVSCORE		

Table 6 Post-release signals regressed against Review score

	Log(Sales)[a]			
	Coefficients	p-value	Coefficients	p-value
(Constant)	5.260	0.089	3.497	0.341
SEQ	0.155	0.090	0.121	0.082
Exclusive	-0.155	0.099	-0.186	0.090
MAJPUB2	0.282	0.084	0.240	0.077
Review score	-	-	0.023	0.004
[a]Dependent variable: logPOSTSALES				

Table 7 Signals regressed against post-release sales

The other potential signalling variables, sequel and exclusivity, look to have insignificant impact on review score. Due to their insignificance, there is not enough evidence to suggest that review score acts a mediator between the relationship of sequel and sales, and exclusivity and sales. Interestingly, as seen in table 5 when including the control variables, sequel's estimate is insignificant in both pre-release and post-release models. Based on table 7, without accounting for the control factors, sequel has a significant ($p < 0.05$) and positive impact on post-release sales. In addition, even though review score does not mediate the effect of sequel on sales, controlling for review score does have an attenuating effect on the impact of sequel on post-release sales. Therefore, while it is not due to the mediating effect of review score, or the moderating effect of review disagreement, there is a minor

signalling attribute to sequel. The difference in significance of sequel and the other signalling attributes observed between table 7 and 5 is an indication of the limitation of the sample used in this study.

Exclusivity is an interesting case because in a model specification that excludes review disagreement and its interaction terms in addition to control variables, it has negative and significant impact on sales. Again, an indication of the limitation of the sample. However, this observed relationship can be justified by the findings of Gil (2014). Exclusive games have a smaller market to work with, and therefore experience less positive network externalities and also have a less comprehensive marketing scheme due to having lower revenue in flow. It can be theorised therefore that this negative impact of having a smaller market is more influential on sales than the positive influences that come from being an exclusive game.

An interesting observation from table 6 is the difference in impact towards review score between the genres. Recall that the most popular genres pre-release are RPG and SHT. On the other hand, for post-release there are no difference in the impact towards sales between the different genres. Yet, review scores for RPG and SHT look to be significantly higher for RPGs ($p < 0.05$) and SHTs ($p < 0.1$). Furthermore, offline games being sold pre-release had more sales on average than the alternative game types. Again, this relationship change post-release because there are no difference in sales between online game types. At a moderate significance ($p < 0.05$), offline games on average receive higher reviews in comparison to the other types. This similarity in relationship between variables regressed against review score and pre-release sales, indicates that games that end up with higher review scores post-release also have a tendency of getting higher sales pre-release even though consumers do not have complete access to independent source of information on experience attributes of the product until release. Therefore, to a certain extent, consumers are using the correct quality signalling attributes for their purchase decision before release of the product.

5 Conclusion

One of the main purposes of the paper was to use real-world video game sale data to investigate the difference in impact of signalling variables on pre-release sales and post-release sales. Another purpose of the paper was to also research to what extent the variables that theoretically can be qualified as quality signal attributes impact sales as a signalling variable would. This was investigated using moderation effect of review disagreement on the potential signalling variables as an empirical test. The study was extended by also using mediation effect of review score as an empirical test for explaining to what extent the variables are in fact quality signals. This study also gave an opportunity to understand what theoretical control factors impact pre-orders and how they differentiate in magnitude and significance between pre-release model and post-release model.

The video game industry has been constantly growing and developing over the last decade. One of the core changes in the last decade is the introduction of pre-orders by publishing firms and its acceptance by the video game consumers. What started as a solution for stock-outs of the physical copies of popular games in the early part of last decade, has become a staple part of the release process of video games. Most games, regardless of digital or physical, are sold pre-release. The video game industry is among the ideal industries to study pre-orders, mainly because of the impact review scores have sales. Due to its importance post-release (Cox 2014), and its unavailability for pre-released products, by understanding how its presence changes the impact of signalling variables, we understand how signalling variables differ between pre-release and post-release. Yet, pre-ordering as a method of selling products, has been largely ignored by the academic community. Therefore, the objective of studying pre-orders in addition to studying signalling attributes, was also to increase the interest of academians in this subject and provide managerial advice to the decision makers in the video game market.

The findings from the initial empirical test using interaction terms showed that review disagreement increased the impact of major publisher as an attribute on sales. The take away from the results is that there is empirical evidence towards major publisher being a quality signal attribute, which in turn tells us that a major difference between pre-order and post-release is the impact of major publisher on sales. The managerial implication is that major publishing firms with an objective to increase pre-release sales should prioritize branding their product in close association to their firm's brand. In other words, the goal of the manager of a major publishers is to use the fact to their advantage that the major publishers are a positive quality signal and increase the probability that potential consumers of their pre-release product associate the product to a major publisher. This strategy should in turn increase the sales pre-release, and thus reduce the potential loss at release if the product receives negative reviews and WOM. The study also finds that, contrary to expectations, a decrease in credibility of reviews as represented by an increase in review disagreement, lowers the impact of exclusivity on sales. This suggests that the consumer behaviour when reviews cannot be consulted, as is the case with pre-release, is to find exclusive games a riskier purchase. This means that before the release, exclusive games are likely to do worse in terms of sales than after their release. Therefore, managers should take this relationship into account when predicting sales at release. In other words, low quantities sold of an exclusive game in most cases does not also mean that the game will have low quantities sold after release. Basuroy et al. (2006) found in their study that sequel did act as a quality signal attribute, however one of the reasons for it not being true in the case of video games could be because of the higher risk averse attribute the actors of the video game market. 76% of the sample in this study are sequels, and one of the reason for the high proportion being that publishers are looking to be more risk averse (reference). Sequels have a lower risk of failure compared to original games, however if

publishers only focus on making sequel, at a certain point consumers and critics become critical of what makes a good sequel and thus reduce the positive impact of sequel on sales.

The second empirical test using mediation effect of review score also supported the initial results of the first method. The findings showed that review score did attenuate the impact of major publisher on sales post-release. In addition it was the only quality signal variable that had a significant impact on review score. It is additional proof that major publisher is a product attribute that signals higher quality and is a source of difference between pre-release and post-release sales. In accordance with the results of the moderation effect test, the other theoretical quality signals are not signals based on the used sample. When controlling only for review score, there was attenuation of the sequel's impact on sales post-release. However, due to its insignificant effect when regressed against review score, the attenuation was deemed not to be because of the mediating effect of review score. There are additional differences to the first method, such as the negative effect of exclusivity. Interestingly, when not including the interaction terms and review disagreement, exclusivity had a negative effect on sales. It is believed that it is a relationship that is caused by exclusive games having a smaller potential market compared to multi-platform games. In addition, while review disagreement had a negative moderating effect on exclusivity, review score had no mediating effect on exclusivity. Therefore, the only consistent result was the significance of major publisher as a quality signal attribute

The sample used in this study had some clear limitations. One of the main limitation being that the weekly updated list of pre-orders used as a source for the pre-release sales was limited to 40 observations. The list provided by VGChartz found in VGChartz.com, was restricted to only providing the top 40 pre-orders, ranked based on the number of pre-orders. Therefore, observations that had smaller number of pre-orders are not listed. This restricted the sample to focus on majority of the popular games, which is one of the main reasons as to why 76% of the sample are sequels. In comparison, Cox's (2014) sample which was also on the video game market had 53% sequels. The large number of sequels in the sample could be a source of the insignificance that is observed in both pre-release and post-release models. The reason for the large number of sequels could be another limitation due to the source of the sample dataset was that it was restricted to the US. The relationship between the quality signals and sales can be drastically different in other regions due to the prevalence of different cultures. An extension of this study could therefore be to research quality signals in other regions and how they differ in terms of their impact on sales. If quality signals have drastically different relationship to sales in other regions such as Europe and Asia, then the difference in impact between pre-release sales and post-release sales can also be different.

These limitations and potential problem of endogeneity in the dataset could be the cause of the odd results observed in the post-release model. One of the odd findings being that exclusivity which theoretically should signal higher quality, actually signals a riskier purchase. Therefore, this study can

be extended and results can be tested using the methodology on a larger sample size. In addition, additional factors such as price or online connectivity of a game can be tested to see if they act as quality signal attributes. The resulting positive impact of price on sales is an indication that may possible.

The sample used in this study was based on games release in 2014 and 2015, which can be extended to include more years. Since pre-order statistics on VGChartz.com ranges back to 2009, the same study can conducted on a sample of observations from 2009 and 2010 to determine how consumer behaviour and their use of signals has changed in the past years. The sample can also be extended to include less popular games to create a sample that is a closer representation of the population. This can be more viable study in the future as pre-ordering becomes a norm for less popular game in addition to currently being a norm for popular games.
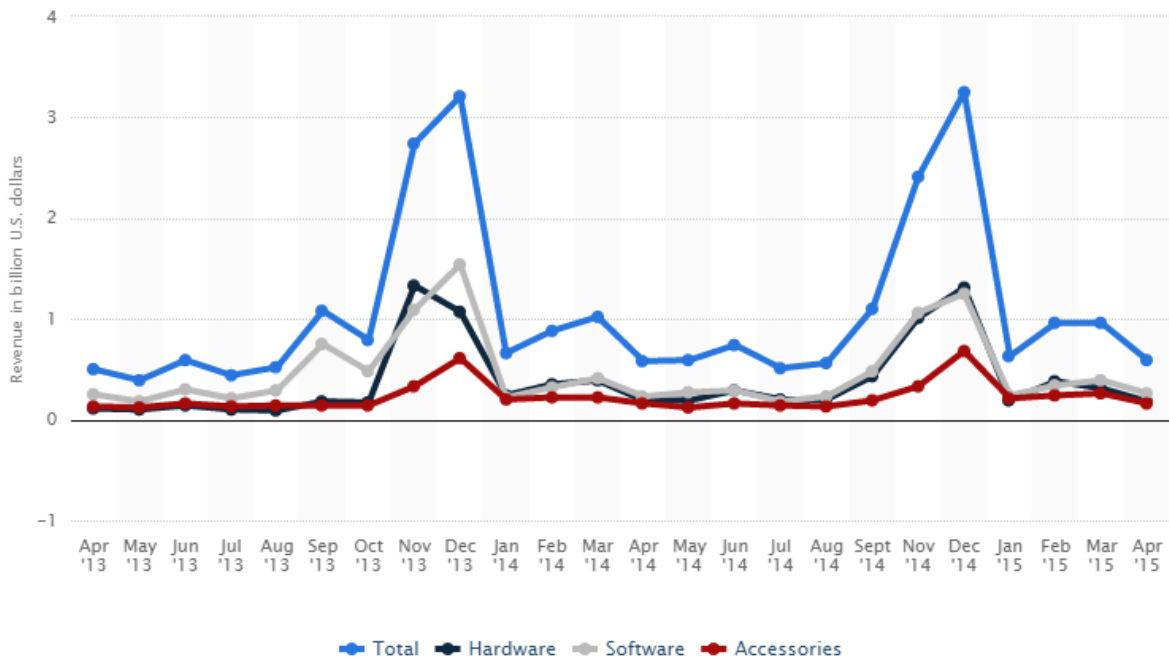
6 Appendix

6.1 Appendix 1

Figure 3 Seasonality in the video game industry. Source: www.Statista.com/statistics
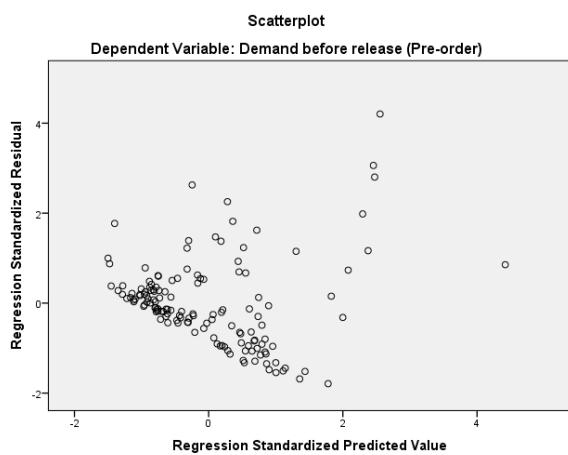
6.2 Appendix 2

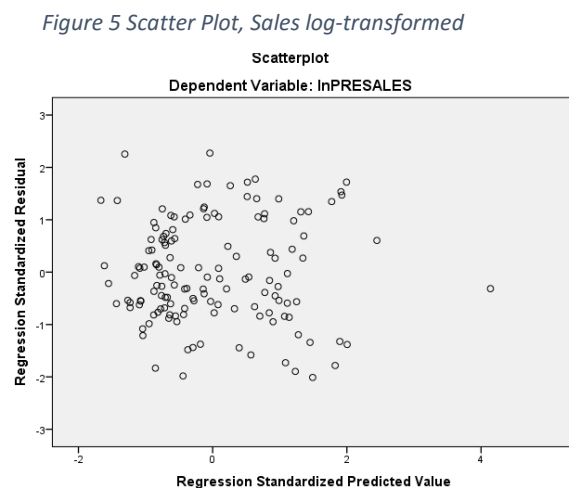*Figure 5 Scatter Plot, No transformation*

Figure 5 Scatter Plot, Sales log-transformed

If a model is well-fitted, there should be no observable pattern in a plot of the residuals against the fitted values. The figures above are plots of residuals against the fitted values of models of

different specification. First figure is without any log-transformed variables and figure 2 is a plot where the sales values was log-transformed. It is observable that compared to the first figure, the second figure shows a pattern to a lower extent in the plotting of the datasets. It is sufficient to transform the dependent variable of the model to pass the heteroscedasticity tests. Therefore, all models in this research will include the sale variable as log-transformed. Transformation of additional continuous variables with log did not improve the plot, thus the state of figure 2 is found to be sufficient for the research to be valid.

6.3 Appendix 3

$$
\begin{aligned}
REVSCORE_i = \beta_0 &+ \beta_1 SEQ_i + \beta_2 EXC_i + \beta_3 MAJPUB_i + \beta_4 SALEDUR_i + \beta_5 PRICE_i \\
&+ \beta_6 SEASON_i + \beta_7 ONL_i + \beta_8 ONLOFF_i + \beta_9 RPG_i + \beta_{10} SHT_i \\
&+ \beta_{11} SPT_i + \beta_{12} RAC_i + \beta_{13} ADV_i + \beta_{14} FIG_i + \varepsilon_i
\end{aligned}
\tag{3}
$$

$$
PRESALES_i = \beta_0 + \beta_1 SEQ_i + \beta_2 EXC_i + \beta_3 MAJPUB_i + \varepsilon_i
\tag{4}
$$

$$
PRESALES_i = \beta_0 + \beta_1 SEQ_i + \beta_2 EXC_i + \beta_3 MAJPUB_i + \beta_4 REVSCORE_i + \varepsilon_i
\tag{5}
$$

Where:

PRESALES = Pre-release sales

SEQ = Sequel

EXC = Exclusivity

MAJPUB = Major publisher

REVSCORE = Review score

SALEDUR = Sale duration

PRICE = Price of products

SEASON = Seasonality effects

ONL = Online gameplay

ONLOFF = online and offline gameplay

RPG = Role playing games

SHT = First person shooter games

SPT = Sport games

RAC = Racing games

ADV = Action-adventure games

FIG = Fighting games

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