Video Game Sales: Does Diversity Pay?

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Abstract

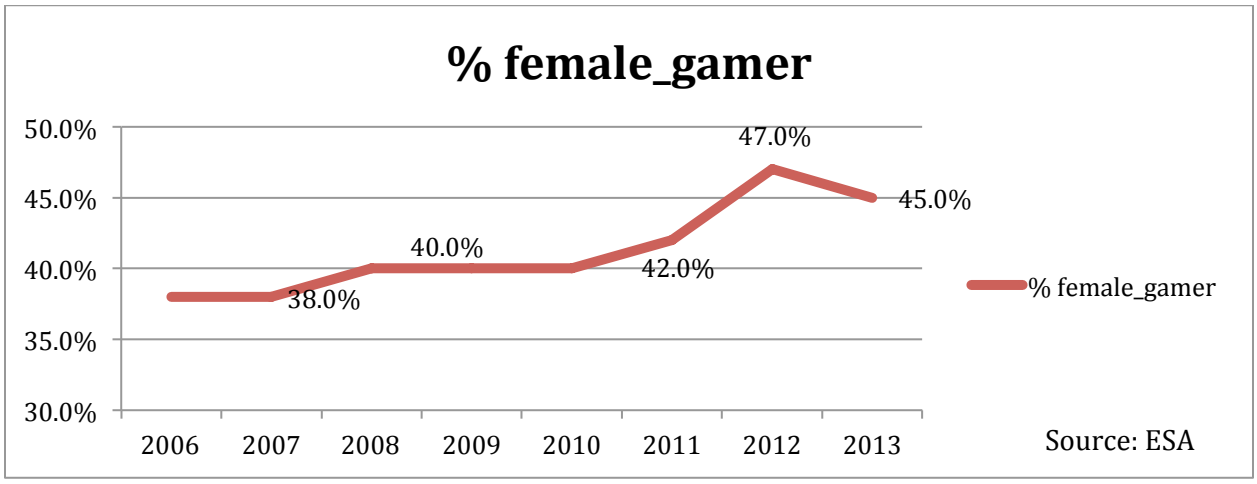
The video game industry has grown into a mature market in the past decade, surpassing the size of the U.S. film industry in 2009. As a result of the rise in popularity of video gaming amongst many demographic groups of the American population, the underrepresentation of female and ethnic minorities in video games has become an increasingly relevant topic of discussion. This paper empirically examines the effects of including female and ethnic minority lead characters on the equilibrium sales volume of video games. Through the use of a reduced-form regression, the equilibrium quantity is regressed on a list of exogenous variables pertinent to the interest of this study. The findings suggest that the inclusion of female and minority lead characters affects sales of different genres of games in distinct manners, suggesting that the video game market has a heterogeneous consumer base with a diverse range of preferences. In addition to empirical work, one of the main contributions of this paper is creating a new and unique dataset (N=712) on game attributes, especially with regard to character gender and ethnicity. This paper's findings have implications on the game design decisions for video game producers.

I. Background and Motivation

Despite being associated with negative press since its inception, as of 2012 the videogame industry has grown into a $20.77 billion dollar industry in the US alone. (Anon A, 2013) To put this figure into perspective, the US domestic box office sales for movies totaled $10.99 billion dollars in year 2013. (Anon B, 2013) As of 2012, approximately 58% of the US population is engaged in some form of videogame playing. Since video game playing has become increasingly relevant to the American lifestyle, this paper is concerned with examining the sign and magnitude of the effect of gender and ethnic representation on video game sales. Specifically this paper examines the racial and gender representation of lead characters in order to determine whether greater variety in representation translates into higher sales for game producers.

Data from the Entertainment Software Association's annual report exhibit a persistent increase in the percentage of female gamers in the US since 2006. This trend is illustrated in Figure 1:

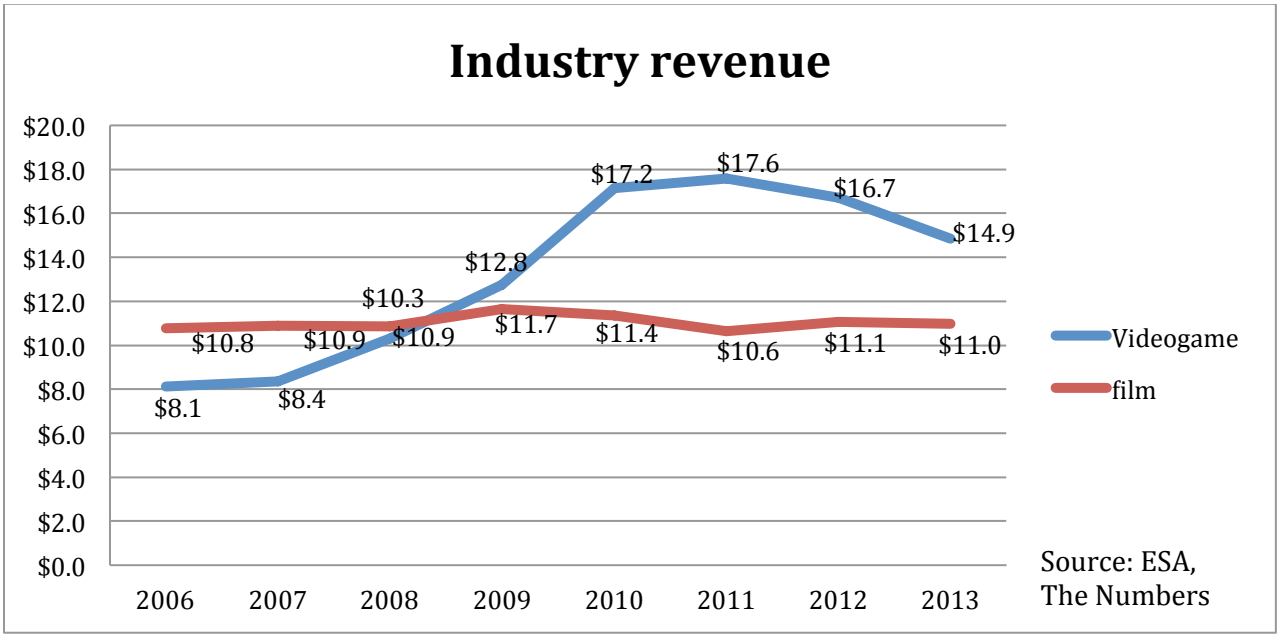
Figure 1: Percentage of female gamers, 2006-2013



Not only has there been an increase in the female gaming population, there in fact has been a rise in the popularity of video games across all demographics, especially minorities. Research conducted by The Kaiser Family Foundation in 2011 shows that African American youths between the ages of 8 and 18 spent 30 more minutes a day playing video games than their white counterparts. (Packwood, 2011) The same study shows that Hispanic youths spend on average 10 more minutes playing video games than their white counterparts. In a separate survey conducted by Simmons Research, evidence indicates that Hispanics are 32% more likely than non-Hispanics to consider video games as their main source of entertainment. (Saylor, 2012) In addition, the Hispanic millennial generation is 54% more likely to buy a video game on the day of its release than non-Hispanic gamers.

Be it console, PC or mobile gaming, video games have replaced traditional entertainment for some subsets of the American population. (Anon A, 2013) Although video gaming has not replaced television programming as American's primary source of entertainment, the medium has outperformed the film industry in the past decade. To illustrate this point, a comparison of the video game industry's annual revenue with those of the film industry between 2006 and 2013 is presented in Figure 2.

Figure 2: Annual Revenue by industry, in billions of US $, CPI adjusted



From 2006 until 2011, the video game industry experienced exponential growth in annual revenue. Over the same time period film industry sales plateaued. In 2009 the video game industry revenue surpassed that of the film industry for the first time, and continues to do so into 2013. However, annual revenue for the video game industry began to decline after 2011. This phenomenon can be attributed in part to the rise in popularity of online video game purchase platforms such as Steam, Xbox Game Store, and PlayStation Store (whose sales data are not disclosed to the public). In the meantime, the three major players in the console market, namely Sony, Nintendo, and Microsoft, have been shifting their focus towards launching a new generation (eighth generation) of consoles released in the winter of 2013. This expectation may have contributed to a decline in consumer and developer interest in the current platforms.

As the growth trend continues, the video game industry in the US has become increasingly relevant as a topic of economic interest. To put the profit-generating potential

of the video game industry into perspective, in recent years major video game titles have come to rival Hollywood blockbusters in terms of revenue figures. Grand Theft Auto V, developed by Scotland-based video game company Rockstar North, is 2013's best selling video game. It is confirmed to have broken 6 Guinness world records, among them, 'highest revenue generated by an entertainment product in 24 hours' and 'fastest entertainment property to gross $1 billion.' Precisely, Grand Theft Auto exceeded $1 billion in sales in merely three days (Lynch, 2014). In comparison, The Hunger Games: Catching Fire, the highest grossing film of 2013, has taken in, as of February 25, 2014, approximately $4 million since its opening in November. (Anon C, 2014) This speaks volumes about the rapidly growing relevance of video gaming as a medium of entertainment in the mainstream media.

As a result of this unprecedented level of social penetration that certain video game titles have been able to achieve, the contents delivered by video games may have similar effects in shaping their audience's cognitive perception of gender or an ethnic group to that conveyed in more conventional media such as books and movies. Consequently, the goal of this paper is to examine the gender and racial representation across an array of video game categories in order to determine whether inclusion of such options affects the volume of sales. Ultimately, this paper seeks to validate or disprove the widely held belief within the video game industry that minority and female characters don't contribute positively to sales. These results will have implications for future video game design and profitability. The remainder of the paper is organized as follows. Section II reviews the literature from a range of subject areas that serves to motivate this paper. Section III introduces the methodology. Section IV discusses the results. Finally, Section V presents the conclusions.

II. Literature Review

It is well known that conventional media venues such as books, magazine, movies and T.V. influence the public's perception of gender and ethnicity. What is less clear is the impact of video games. Researchers, beginning as early as the late 1990s, have studied the representation of minority characters in video games and its effects. In a frequently cited paper, Dietz (1998) discovered that females are absent from 41% of the games in the sample, and that the characters are mainly Anglo-Saxon. Similar research was presented in a more recent paper "The Virtual Census: Representations of Gender, Race and Age in Video Games". In this paper, Williams et al. (2009) found a systematic underrepresentation of females, Hispanics, Native Americans, children and the elderly. The study was conducted on a sample of 150 top selling games from March 2005 to February 2006. These findings are relevant to Miller and Summers' (2007) paper "Gender Differences in Video Game Characters' Roles, Appearances, and Attire as Portrayed in Video Game Magazines". In this work, Miller and Summers find that negative traits associated with female and/or ethnic characters can perpetuate gender and racial stereotypes and impact players' self-esteem, especially when the medium is interactive. In "The U.S. Video Game Industry: Analyzing Representation of Gender and Race", Dunlop (2007) examines the same issue within the context of identity development of youths. Illuminating the fact that gender roles and race are but ideological constructs, Dunlop suggests that the underrepresentation and the misrepresentation of minorities characters may 'influence young players' perception about self and other, regardless of their own ethnic background.' (Dunlop, 2007, pg105)

Anecdotal evidence suggests that it is the industry's rule of thumb to assume that ethnic and female characters simply do not sell. The June 2013 action-adventure title

'Remember Me' made the headline of many online video game news sites due to the fact that it features a female protagonist of color (but of ambiguous ethnicity). The creative director Jean-Max Morris revealed to the press that the title's funding efforts were hampered by a number of publishers' refusal based on the belief that games led by female protagonists have little sales potential, Jean-Max Morris notes, 'You can't have a female character in games. It has to be a male character' (Makuch, 2013, para. 2). In the same vein, Epic Games art director Chris Perna publically stated that though having a female lead would be 'interesting', judging by what has sales potential, 'it's tough to justify' the decision to include female leads (Makuch, 2013, para. 3). Additionally, indie title 'Papo y Yo', the surrealist adventure of a Latino boy Quico, became the center of controversy when IGN rated the title 4/10, while other online critics differed greatly in opinion, giving scores in the 7-9 range. These three anecdotes serve as the motivating pieces of this paper: does the industry's mantra really hold true statistically? Would gamers enjoy games with protagonists from a diverse range of backgrounds despite the game publishers' beliefs otherwise?

Given that female and minority characters are underrepresented in mainstream video game titles, it is therefore of interest to ask why this happens and why it matters. To answer the first question, this research draws upon the concept of statistical discrimination, pioneered by Edmund Phelps (1972) in his paper "The Statistical Theory of Racism and Sexism" published in The American Economic Review. Statistical discrimination is often applied to the discussion of discrimination in the labor force. It refers to the presence of behavior characterized by preferring one group over another group that has achieved identical qualifications, due to a lack of information about the true ability of the latter

group. In other words, when faced with two job applicants with the same qualifications, an employer would discriminate against a certain applicant if he/she believes the applicant to be less qualified. This theory can equally be applied to explain for the lack of female and ethnic representation in the video game market. The publishers, who are the 'employer' in this discussion, may have pre-conceived beliefs about how titles with females and ethnic protagonists would sell, without much concrete information to support or disprove the belief. This belief, in fact, is a chicken or the egg causality dilemma since there are less than a handful of games with female and/or ethnic protagonists published and adequately advertised each year. Games with white, male protagonists are the preferred, more familiar genre. The industry has historically produced more of these games and has achieved respectable profits from publishing them. Consequently, games with minority protagonists are the games upon which the publishers don't have much information, and therefore discriminate against.

Another theory that explains the lack of variety in the video game market is the idea of preference externality. Developed by Joel Waldfogel (1999), professor at University of Pennsylvania's Wharton School, preference externality refers to a consumer's utility obtained from having other consumers who share the same taste preferences present in the same market. His paper "Preference Externalities: An Empirical Study of Who Benefits Whom in Differentiated Product Markets" seeks to answer two key questions: 1) whether preference externalities exist in the market, and 2) if so, who benefits whom. The research finds that, the utility of a consumer is largely positively affected by the size of the group sharing the same preferences, and less or negatively impacted by the size of other groups. The main impediments to spillover externalities across different groups are: large fixed

costs and orthogonal (different) preferences. As a result, a consumer with atypical preferences will encounter less variety in the market. Relating the concept to this research, video games with female and/or ethnic characters are seen as an atypical product and a market that companies are reluctant to enter. For this reason, one may suppose that developing games with minority lead characters will involve an upfront fixed cost, such as investments in market research, or an entirely different game design workflow to cater to the minorities' interests. For instance, switching to a female/minority lead may involve a different approach to script-writing, new research efforts, as well as adjustments to the playability and mechanisms of a game. Given the large fixed cost associated with game development, the critical decision becomes whether the cost of new game development/modification is greater than the potential gain in sales. So far, most companies have foregone the potential market segment by not targeting females/minorities, assuming that the return does not justify the fixed cost. However, an implicit idea behind preference externality is that the upfront investment can eventually build enough momentum until it exceeds a critical mass, which will then justify the initial cost (i.e. existing minority communities tend to attract people of the same background). In addition, it is unclear whether having female or ethnic protagonist caters to a group that has orthogonal preferences to the existing pool of video game players. The key connection here is whether the existing pool of video game players, 45% of whom are females (Anon A, 2013), share preferences with the group that prefer the inclusion of female/minority characters. If increased percentage of female gamers contributes to the popularity of games with female leads, firms can benefit from developing games that tap into this preference

group by forgoing short run profits (due to the large fixed cost) in order to reap significant long-run gains.

The last explanation for the underrepresentation of female characters in video games stems from the simple fact that there are fewer female game creators. In addition, those who are in the industry are generally paid less than their male counterparts. The fact that female game developers earn less than their male counterparts is likely due, at least in part, to the fact that they may not be high enough up in the corporate hierarchy to influence the overall development of the games they work on. This includes choices about the gender and ethnic portrayal of lead characters. The Game Developer Magazine's annual salary survey (data shown in Figures 3 and Figure 4) tries to capture income and compensation-related data from anonymous developers (who are subscribers of the magazine). The results are telling regarding how few females are involved in the video game industry. This could be due to lower salaries across game-related professions, the lower proportion of females that pursue computer science or engineering-related degrees, and/or an unwillingness to work in a mostly male-dominated working environment.

Figure 3: Percentage of female video game developers

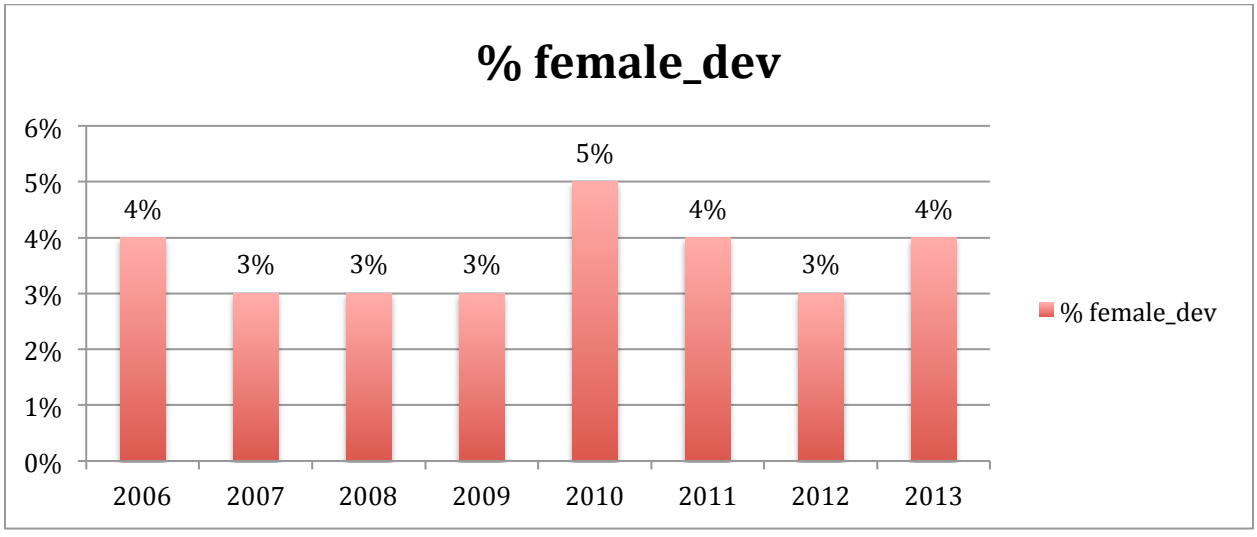
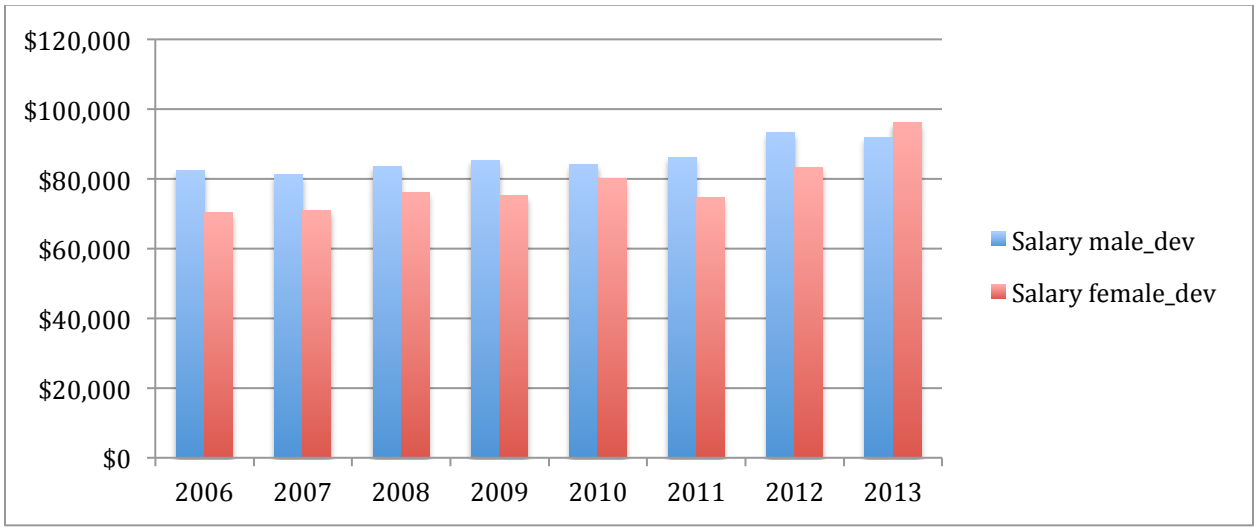


Figure 4: Annual salaries of male and female developers, in US dollar



Intuitively the discrepancy in the percentage of female and male developers is a result of having less females working in the STEM fields. This could explain why female developers have the lowest percentage in all three categories. In addition, the tech industry at large is still heavily male-centric. A survey of the board of directors in the Silicon Valley 150 (SV 150) reveals that over 43.3% of the SV 150 companies have no female members on their board of directors (Gongloff, 2014). In comparison, 47% of the Standard and Poor's 100 companies have at least two women on their board of directors. A working environment with little to no female leadership may have partially contributed to the lack of interest in producing contents geared towards females.

While gamers have become accustomed to seeing white, tough-guy protagonists, the question remains: is maintaining the status quo a truly profit-maximizing move? The results of this research attempts to answer this question. If sales are not affected or are, in fact, augmented by the inclusion of non-white and/or female characters, then the finding suggests that having female and or minority characters is a commercially viable strategy. From a marketing perspective, it seems reasonable to assume that consumers are more

likely to purchase a game if they are able to identify with the characters portrayed in the stories. This intuition leads us to look at the composition of gamers, and examine whether the current composition is undergoing transition.

Jesper Juul, media studies professor at MIT, weighs in on the changing paradigm of video games and gamers in his book *A Casual Revolution: Reinventing Video Games and Their Players.* He notes that games have transitioned from being mainly intense and complex to casual games that are "easy to learn and play, fit well with a large number of players, and work in many different situations."(Juul, 2010, pg5) Games that enable this casual experience are pulling in a very different and/or heterogeneous gamer base than that which characterized the early gaming population.

To examine the profit-generating potential of marketing to females, one can examine what other industries have done in their attempts to expand into new demographic markets. For example, there is a wealth of literature on the difference in decision processing, and hence marketing, between men and women. One critical difference is the degree of brand loyalty. To examine the effects of gender on customer loyalty, Nelson Ndubisi conducted a survey on customers from 15 banks in Malaysia (N=220), and regressed customer loyalty[1] on gender and relationship marketing. (Ndubisi, 2006) The results indicate that female customers are significantly more loyal than their male counterparts. This finding provides some empirical motivation for firms to adopt marketing strategies targeted to attract female customers.

With this finding in mind, we will look at two industries that have made strides in marketing to women, namely the NFL and Marvel comics. These two firms are germane to

[1] Loyalty is defined as a combined score of 'bank as first choice among other banks' and 'first bank that comes to mind when making a purchase decision'.
[2] These four genres are widely accepted categories in the industry, they are chosen for their narrative gameplay

this discussion due to their similarly segmented target audience and their perceived image as male-dominated. In addition, both firms are in the entertainment business. On one hand, the NFL has been increasingly building its female fan base by expanding its female merchandise line for the past three years. Acting upon the realization that 44% of football fans are now women (Dosh, 2013), the NFL has leveraged the publicity potential of wives and daughters of its coaches. Notably NY Jets' owner's wife Suzanne Johnson helped to create a female-friendly brand image for the NFL's women's clothing line. Additionally, the NFL partnered with companies that have successfully established themselves in the women's fashion business, such as Marie Claire (Lyle, 2013) and Victoria's Secrets. (Strawer, 2013)

In a similar vein and perhaps more comparable to video game makers, Marvel Comics has been orchestrating efforts to diversify the ethnic and gender composition of their superheroes. Two years ago Marvel raised controversy and excitement when it first introduced Miles Morales, a black, Hispanic version of Spider-Man, to replace Peter Parker in an alternative take on the series. Following the effort to diversity its selection of heroes, in February 2014 Marvel plans to begin a new series about a teenage Muslim girl superhero living in Jersey City who struggles with her faith. In Marvel's chief editor Axel Alonso's words, people are more 'inspired to pick up the book…[when the hero] looks like [them]' (Gustines, 2013, para. 13), again echoing the message that consumers tend to respond to characters that they find more relatable.

III. Methodology

As noted above, the purpose of this paper is to examine the impact of including female/ethnic lead characters on video game sales volume. Four genres, 'Action', 'Role-Playing Games' (RPG), 'Adventure', and 'Shooter' games are considered relevant to this study.[2] For each genre, a reduced form log-linear (Poisson) regression is performed, where the dependent variable is the log of the equilibrium quantity of a particular video game sold, regressed on a list of exogenous variables described in Section III b. This study uses the number of units sold of a game within its first three months of release as a measure of equilibrium quantity.

a. Data:

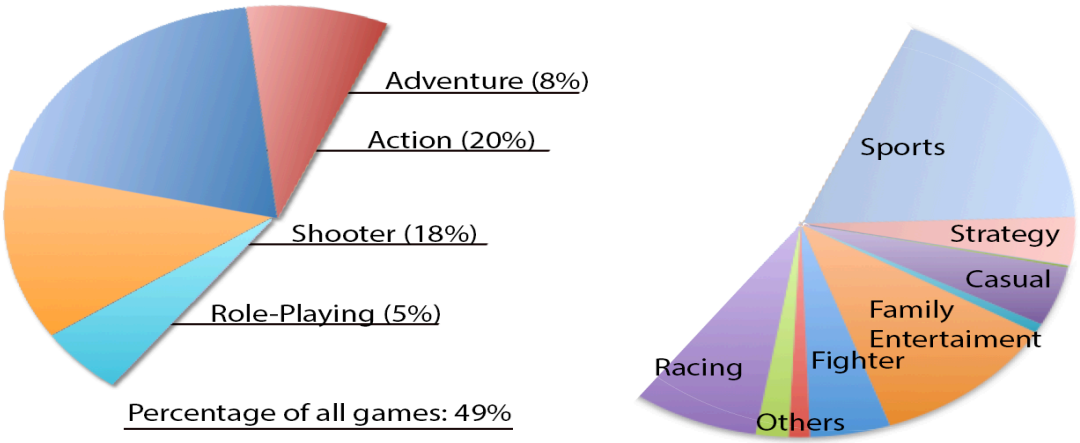
This paper will be using market research data from NPD Group Inc., (formerly known as National Purchase Diary) the industry's most reputed source of retail game sales data, and the most widely used data source for researchers and market analysts. NPD Group has tracked over 10 years of retail data from retailers that handle the highest volume of video game purchases; Amazon.com, BestBuy, GameStop, Wal-Mart, Target, Toys R'Us, NewEgg.com, and RadioShack are among a total of 50 major retailers that supply monthly sales data to NPD Group. It is estimated that NPD's data accounts for up to 90% of total retail game sales. The data will include a report of 8 years (96 months) worth of video game monthly software sales data, from October 2005 to December 2013. Each entry includes the game's title, publisher, developer, introduction date, genre, subgenre, platform

[2] These four genres are widely accepted categories in the industry, they are chosen for their narrative gameplay structure.

(Wii, PS3, Xbox), Entertainment Software Rating Board (ESRB) rating, item code, units sold, dollar amount sold, and the average price of the title.

The NPD Group data is not without limitations. Due to the recent and rapid adoption of online game purchasing and increased online visibility of indie producers, the actual size of the video game industry is indeterminate and growing. There are three major venues from which games are purchased: in retail stores (mostly console), online (steam, indie, free-to-play, downloadable contents), and mobile app stores (smartphones, tablets). NPD data draws primarily from the first source. Hence, the results of this research consider the console game market only. As can be seen in Figure 5 below, the console game market is quite diverse. This research has limited its scope to examine sales data of 4 console genres: Action, Adventure, Shooter, and Role-Playing Games. These four genres are chosen because they all feature a continuous plot and have at least one protagonist among a cast of distinct characters. Other genres do not fulfill this criterion either because they have no protagonist or no storytelling element. Since the gaming industry has evolved into a much larger entity than just console games alone, the demographics of players of mobile games and methods of content delivery are fundamentally different from those of console games. Therefore, while the results of this research are specific to the console game market, the paper's methodology can be applied to other platforms as data become available.

Figure 5: Percentage of sample in Adventure, Action, Shooter, and RPG genres



b. Variables:

The dependent variable is units sold of a game within its first 3 months of release. Count data is chosen over revenue data for the purpose of avoiding inflation-related adjustments. Because the data sample ends in December 2013, three months are chosen (over any other number of months) in order to be able to include as much data as possible. The 3-month period is used to align sales data for games released across different time periods. Doing so eliminates the scenario where a game that has survived a long time will outsell a similarly popular title that was only released a few months prior to the cutoff date of the dataset.

Since the dependent variable is a count, it is better modeled through running a Poisson regression. A Poisson regression, also known as a log-linear model, makes the assumption that the dependent variable produces a random flow of counts independent of each other.

Due to the paucity of data documenting the attributes of video game characters, a manual collection of attribute variables for each title in the sample was conducted (N=712).[3] The four genres of interest to this study are extracted to separate spreadsheets. Since the dataset includes games released on PS3, Xbox 360, and Wii, some games are released on more than one platform. The titles that are released on both PS3 and Xbox 360 are collated into one entry, combining sales from both platforms.[4] For each title, the following variables are collected:

- **FirstFem:**. This indicates whether the protagonist is a female character, including the case where one of the multiple playable characters is female. (FF = 1 if is female, 0 otherwise)
- **FirstFemExclusive:** A female lead is only recognized if she is the only playable character. (FFE = 1 if is exclusively female, 0 otherwise)
- **FirstEthnic:** This indicates whether the protagonist is a non-white character, including the case where one of the multiple playable characters is non-white. The following are not considered ethnic characters:
    - Aliens, fantasy races, skeleton, and non-human characters are not considered ethnic;
    - Characters whose ethnicity is not deliberately revealed or leaves no further information to go on are not counted as ethnic;
    - White but neither American nor European characters are considered as ethnic. (i.e. Syrian)

[3] One of the main contributions of this work is to put together a new and unique dataset on game attributes. The data collection process took approximately 100 hours. The raw sales data is available through EcoTeach for future Duke student research.
[4] This paper removes all Wii-exclusive titles from the sample, because Wii-exclusive games have less sophisticated graphics and narratives than those released across multiple platforms.

    - Anime-style racially ambiguous characters are not counted as ethnic;

(FE = 1 if is ethnic, 0 otherwise)

- **FirstEthnicExclusive:** An ethnic lead is only recognized if he/she is the only playable character. (FEE = 1 if is exclusively ethnic, 0 otherwise)
- **SecondFem:** Whether there exists a female supporting character. Some games may have more than one or two supporting characters; to account for this, this variable includes all characters that take a significant role in a game. Female/ethnic villains are not counted as a supporting character in order to avoid misinterpretations of this coefficient. (SF = 1 if there exists a female supporting character, 0 otherwise)
- **SecondEthnic:** Whether there exists a non-white supporting character in the game. (SE =1 if there exists an ethnic supporting character, 0 otherwise)
- **GenderCust:** Whether the gender is customizable. This applies to cases where the protagonist is fully customizable, or the choices of playable protagonists include characters of both genders/non-white races. (GC = 1 if gender customizable, 0 otherwise)
- **RaceCust:** This indicates whether the race of the protagonist is customizable. (RC = 1 if race customizable, 0 otherwise)
- **AvgScore:** Scores from Gamespot and IGN will be averaged. (Gamespot and IGN are both video gaming websites that provide gaming news, official and user reviews on a large collection of video games.) This variable ranges on a scale of 1 to 10. For games that do not have an official rating, the website's community-voted score is used. When a game has at most 1 rating, it is considered an outlier and is dropped from the sample. In evaluating the score of a collection pack, the scores of each game included in the pack

are averaged. In cases where the games included in the pack do not share similar attributes, the pack will take on the attributes of the highest rated game found in the pack. For simplicity, since PS3 and XBOX 360 scores were highly correlated, Xbox scores are chosen. This paper treats the two platforms as interchangeable due to similar prices, speed and graphics performances.

- **SpecialEdition:** As popular titles often release special editions that include extra bonus features, they tend to cost more than the regular version. For this reason, in the NPD dataset a game and its own special edition are 2 separate entries with separate prices and sales information. (SED = 1 if a special edition, 0 otherwise)
- **Human:** This indicates whether the protagonist is human, or retains a human form, regardless of whether the character has transcended human status. (H=1 if human, 0 otherwise)
- **Identity:** This indicates whether the identity of the protagonist is defined. A counter-example would be a silent first-person protagonist whose name, gender, identity are never explicitly revealed. For a protagonist that has no identity, the GenderCust, RaceCust, firstFem, firstEthnic values are automatically 0 to reflect that there was no deliberate attempt to portray a character. (ID = 1 if identity is defined, 0 otherwise)
- **Tie-In:** Whether the game is affiliated with the promotion of a film or TV-show. This excludes the reverse case where a game is adapted into a film. (T = 1 if is tie-in game, 0 otherwise)
- **Franchise:** Whether the game belongs to a franchise. (i.e. sharing the same background setting, spin-off series) A few notable examples include Call of Duty, Bioshock, Battlefield, etc. (F = 1 if belongs to a franchise, 0 otherwise)

- **FullCust:** A game qualifies as fully customizable if the character creation mechanism allows the player to create characters of different races as well as of both genders. In this case, FirstFem and FirEthnic will both be 1, however FirstFemExclusive and FirstEthnicExclusive will both be 0 by variable definition. (FC = 1 if fully customizable, 0 otherwise)
- **MultiplePlayable:** Takes on 1 if the game offers multiple playable characters. (MP = 1 if there exists multiple playable characters, 0 otherwise)

Number of units sold and Special Edition are the only readily available variable from the NPD dataset. Total 3-month sales are collected by manually summing up the first three monthly sales data for each observation. To gather each title's attributes, I first consult Wikipedia for plot synopsis, number of playable characters, character customizability, tie-in, and franchise status. If more information on a character is needed, the next step is to access the game's own Wikia page, which often includes a screen capture of the characters' appearance as well as additional information on his/her background. If certain attributes are still inconclusive, I find gameplay footages of the title for evidences of a particular attribute. Under the uncommon scenario that I couldn't obtain sufficient knowledge on a title, it is dropped from the sample. To collect scores for each title, I wrote a Python script that enabled me to collect the scores directly from IGN and Gamespot and record them in a spreadsheet. Aside from average score, each independent variable is binary.

The criteria for dropping a title from the sample include: Wii-exclusivity, titles with negligible sales (i.e. 0 unit sold), less than 3 months worth of sales data, little to no

information available about the game online, rated by less than 2 sources, and games that do not exhibit any defining characteristics of the genre. (i.e. inappropriately categorized)

c. Regression Formulation:

As described in the abstract section, two regressions will be run for each genre, the first regression uses a relaxed definition for lead female and lead ethnic characters, which recognizes games with multiple playable characters of different races and genders as lead characters. The second regression takes on a more rigorous approach to defining a lead character. The restricted regression replaces FirstFem and FirstEthnic with variables FirstFemExclusive and FirstEthnicExclusive to only account for games where the sole playable character is a female/minority character. Due to this change, the variable FullCust is added to capture games that feature a character customization mechanism, and MultiplePlayable is used to address games that feature multiple playable characters.

Regression without exclusive female/ethnic:

$$\boldsymbol{ln}(\boldsymbol{3\widehat{MoUnits}}) = \beta_0 + \beta_1 SpecialEdition_i + \beta_2 Human_i + \beta_3 Identity_i + \beta_4 GenderCust_i + \beta_5 RaceCust_i + \beta_6 FirstFem_i + \beta_7 SecondFem_i + \beta_8 FirstEthnic_i + \beta_9 SecondEthnic_i + \beta_{10} TieIn_i + \beta_{11} Franchise_i + \beta_{12} AvgScore + \epsilon_i$$

Regression with exclusive female/ethnic:

$$\boldsymbol{ln}(\widehat{\boldsymbol{3MoUnits}})$$

$$= \beta_0 + \beta_1 SpecialEdition_i + \beta_2 Human_i + \beta_3 Identity_i + \beta_4 GendeCust_i$$

$$+ \beta_5 RaceCust_i + \beta_6 FirstFemExclusive_i + \beta_7 SecondFem_i$$

$$+ \beta_8 FirstEthnicExclusive_i + \beta_9 SecondEthnic_i + \beta_{10} TieIn_i + \beta_{11} Franchise_i$$

$$+ \beta_{12} AvgScore_i + \beta_{13} FullCust + \beta_{14} MultiplePlayable + \epsilon_i$$

The key gender and ethnic variables are demand shifters, while other variables, such as SpecialEdition and FullCust, may conceivably be supply shifters as well as demand shifters. It is important to note that this paper is not attempting to estimate a structural equation, such as a demand curve. Instead, this work applies a reduced form equation to estimate equilibrium quantity as a function of exogenous variables. Since the endogenous variable price (not present in the reduced form equation) is at once a supply-shifter as well as a demand-shifter, the reduced form equation will generate a single equation in which the quantity demanded and supplied (the equilibrium quantity) is a function of an array of independent variables. Since the equilibrium is the intersection between supply and demand curves, one cannot infer properties pertaining to either curve from the regression results.

Although the second regression yields a more rigorous interpretation of the variable, the major difference between the two regressions lies in the number of observations that fall under each variable, and consequently the strengths of their respective results. This distinction will be discussed more extensively in section IV.

d. Summary Statistics:

As shown in Table 1, the release dates of all four genres are concentrated around November, immediately prior to Christmas season: (the highest percentages are highlighted in yellow)

Table 1: Percentage of total Monthly Release Distribution, by Genre

Genre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Action	3.1	4.1	6.3	5.8	6.3	12.4	4.6	8.4	10.1	16.0	18.6	4.4
Adventure	3.1	7.4	12.7	1.2	8.3	8.0	1.5	1.9	9.6	18.2	21.0	7.1
Shooter	4.0	10.3	11.7	3.0	6.7	11.3	2.8	4.7	11.3	10.1	21.0	3.0
RPG	5.6	9.1	14.2	6.6	5.6	6.1	4.1	7.1	9.1	17.3	12.7	2.5

Table 2: ESRB Rating Distribution by Genre, total over Wii, PS3, and Xbox360 titles

Genre	Everyone	Everyone10+	Teen	Mature
Action	108	192	224	212
Adventure	60	87	60	117
Shooter	10	23	133	329
RPG	1	12	85	99

Another pattern of interest is the distribution of ESRB ratings for the 4 genres shown in Table 2. While Action is relatively evenly distributed across all ratings, Adventure, Shooter, and Role-Playing Games (RPG) have a tendency to cluster around the upper end of age groups. The Shooter genre, due to combat-related violence, has the highest number of Mature-rated games of all the genres. The distribution of games by rating can have implication for the type of gamers each genre attracts. This information may aide in interpreting the differences in regression coefficients across genres, as gamers may exhibit selection bias.

Table 3: Variable Mean/Standard Deviation, by Genre

Variable	Shooter (228)		RPG (111)		Action (264)		Adventure (109)	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
3MoUnits	**586597.2**	1629485	**221210.6**	481348.7	**308360.1**	762856.5	**198917.5**	279226.1
AvgPrice	**$51.64**	23.32336	**$49.93**	16.33437	**$45.77**	20.32932	**$41.00**	14.39612
FullCust	**0.88%**	0.093452	**39.64%**	0.491366	**10.61%**	0.3085	**7.34%**	0.2619875
SpecialEd	**29.82%**	0.458494	**31.53%**	0.466748	**18.18%**	0.3864272	**13.76%**	0.3460863
Human	**98.25&**	0.131575	**100%**	0	**81.44%**	0.3895269	**95.41%**	0.2101728
Identity	**90.79%**	0.289810	**79.28%**	0.407143	**96.59%**	0.1818074	**92.66%**	0.2619875
Multiple Player	**13.16%**	0.338776	**42.34%**	0.496342	**39.02%**	0.4887105	**44.95%**	0.4997451
FirstFem	**12.72%**	0.333922	**71.17%**	0.455020	**32.95%**	0.4709409	**35.78%**	0.4815664
First FemEx	**3.95%**	0.195147	**12.61%**	0.333497	**5.30%**	0.2245196	**4.59%**	0.2101728
Second Fem	**64.47%**	0.479646	**98.20%**	0.133619	**84.09%**	0.3664555	**92.66%**	0.2619875
First Ethnic	**18.86%**	0.392048	**42.34%**	0.496342	**28.41%**	0.4518369	**24.77%**	0.4336743
First EthnicEx	**3.95%**	0.195147	**0.90%**	0.094915	**12.12%**	0.3269935	**9.17%**	0.2899963
Second Ethnic	**66.23%**	0.473972	**36.94%**	0.484822	**51.14%**	0.7242825	**49.54%**	0.5022883
Gender Cust	**8.77%**	0.283508	**56.76%**	0.497660	**27.27%**	0.4462077	**31.19%**	0.4654199
RaceCust	**10.09%**	0.301828	**41.44%**	0.494854	**13.26%**	0.3397597	**16.51%**	0.3730197

Tie-In	**9.65%**	0.295913	**6.31%**	0.244178	**41.67%**	0.493943	**37.61%**	0.4866551
Franchise	**71.49%**	0.452449	**67.57%**	0.470244	**64.77%**	0.4785857	**59.63%**	0.4928989
AvgScore	**7.62**	1.47526	**8.06**	1.19056	**7.04**	1.627991	**6.95**	1.669286

Table 3 lends insight into how differently each genre behaves in terms of the distribution of game design elements. Out of the four genres examined, the RPG genre differs the most. The RPG genre has the greatest degree of customizability, boasting the highest percentage of first female, first ethnic, and fully customizable characters. One can infer from the extra cost associated with designing a fully customizable character (among other design elements), RPG games may generally be of better production quality, which explains their high average scores. On the opposite end of the spectrum, the Shooter genre has the lowest degree of character customizability, accompanied by the lowest percentage of female and ethnic lead characters. In many ways, Shooter games conform to the conventional norm of underrepresentation of female and ethnic leads. The Action and Adventure genres situate between the two opposite ends. Both Action and Adventure have a high percentage of games that have multiple playable characters, however Action games appear to have a higher mix of ethnic lead characters than Adventure games. Finally, secondary rather than primary characters have greater gender and ethnic variation across all genres.

The relaxed definition for female/ethnic leads (denoted by First Fem/Ethnic) yields a more satisfactory number of titles to work with than the stricter definition (denoted by First Fem/Ethnic Ex). The discrepancy in the number of observations is highlighted in Table 4:

Table 4: Distribution of games with female and ethnic leads, count/percentage of total

Genre	Total Obs (N=712)	FirstFem	FirstEthnic	FirstFemEx	FirstEthnicEx
Shooter	228	29 /12.7%	43 /18.9%	9 / 4.0%	9 /4.0%
RPG	111	79 / 71.2%	20 /18.0%	9 /8.1%	1 /0.9%
Action	264	87 /33.0%	75 /28.4%	10 /3.8%	18 /6.8%
Adventure	109	39/35.8%	27/24.8%	5/4.6%	10/9.2%

The absolute number of exclusively female characters doesn't vary much across genres, however in terms of percentage of total, RPG has the largest percentage of exclusively female protagonists. This signals that RPG gamers may be seeking a different gaming experience from, say, first-person shooter gamers. This difference is further pronounced in the relaxed version of the variable, where 71.2% of the titles allow a gamer to play as a female protagonist. The high percentage of exclusive female protagonists is only augmented by the fact that 40% of all RPG games in the sample have full character creation mechanisms.

The action genre has the greatest number of exclusively ethnic protagonists. This number can be attributed to the number of Japanese action titles that featured Asian protagonists. On the other hand, RPG has the lowest number of exclusively ethnic protagonist. By definition of the variable, imaginary/fantasy races are not considered ethnic. Therefore, since RPG games have a tendency to construct worlds that have little basis in real life, the number of observations that qualify as 'ethnic' is therefore low by construction. Again, with only 1 title qualifying as exclusively ethnic, this particular coefficient should not be extensively interpreted.

The fact that the Shooter genre has a uniformly low percentage of female and ethnic representation in the sample supports the conventional wisdom that such games are male-centric. Shooter's distribution of female/ethnic leads doesn't exhibit any irregular patterns, since Shooter games mostly feature straightforward single protagonist campaigns. However, in the case of Adventure games, the distribution is not consistent. This is caused by the high percentage of Adventure games that feature multiple playable characters. By definition, a female/ethnic character cannot be counted as exclusive if they are part of an ensemble of playable protagonists. While FirstFem and FirstEthnic percentages are among the highest of the four genres, only 5 games fall under FirstFemEx and 9 games for FirstEthnicEx.

IV. Results

As mentioned earlier in the methodology section, since units sold is a count variable, a Poisson/log-linear regression is used to model the equilibrium market condition. In this log-linear model, the dependent variable is the natural log of units sold, and independent variables are continuous and dummy variables. To interpret the coefficients on a continuous variable (i.e. AvgScore), a one unit increase in the variable results in a 100*beta percent point change in units sold. Similarly for a dummy variable, a movement from 0 to 1 produces a 100*beta percent point change in units sold.

(Note: relevant coefficients are highlighted in all regression results for ease of comparison)

IV.I. Shooter Genre

Shooter: Log-linear regression, relaxed definition vs. restricted definition (N=228)

Table IV a. Shooter, Relaxed Definition

Independent Variables	Coefficient	Std.Err.
SpecialEdition	-2.440359	0.0003396
Human	0.9951487	0.0009883
Identity	0.6054071	0.0004516
GenderCust	2.050601	0.0008393
RaceCust	-0.0565964	0.0005029
FirstFem	-0.6345001	0.0007014
SecondFem	-1.115849	0.0001993
FirstEthnic	-1.090219	0.0005042
SecondEthnic	0.74938	0.0002386
TieIn	0.0469929	0.0004755
Franchise	0.3858234	0.0002956
AvgScore	0.8305251	0.0001185
Constant (β_0)	5.237874	0.0014233

* Pseudo R2 = 0.5724
* Prob > Chi2 = 0.000
*All P>|z| = 0.000

Table IV b. Shooter, Restricted Definition

Independent Variables	Coefficient	Std.Err.
FullCust	0.1934265	0.0015074
MultiplePlayable	-1.196664	0.0007734
FirstFemEx	-0.689547	0.000791
FirstEthnicEx	-1.443198	0.0007463
SpecialEdition	-2.446187	0.0003396
Human	1.022449	0.0009897
Identity	0.7145921	0.0004535
GenderCust	1.561751	0.0007667
RaceCust	-0.1888455	0.0005243
SecondFem	-1.134241	0.0002004
SecondEthnic	0.7333788	0.0002401
TieIn	0.124115	0.0004766
Franchise	0.3743597	0.0002958
AvgScore	0.839895	0.0001204
Constant (β_0)	5.058803	0.0014362

*Pseudo R2 = 0.5776
*Prob > Chi2 = 0.000
*All P>|z| = 0.000

All coefficients in Table IV a. and IV b. are significant at any significance level. Approximately 57% of the variations in the natural log of 3MoUnits of the Shooter genre can be explained through this model. Most results conform to expectations and economic theory; Special edition games will naturally reduce sales since many special editions are limited editions and often more expensive to produce than their regular versions, thus catering to a more dedicated fan base rather than casual players. Franchise and tie-in can be treated as brand effects. The positive marginal effects can be viewed as the effects of brand loyalty. This also suggests that the market for video games is monopolistically competitive, and that product differentiation does have an effect on the sales of video games.

As highlighted, this paper is most concerned with the coefficients on female and ethnic leads. When compared across two definitions of leading characters, both showed a largely negative impact on sales. In the relaxed version of the regression shown in IV a, changing the protagonist from male to female would reduce expected sales by 63%, and in the restricted version, the drop is 69%. For ethnic leads, the relaxed version shows that a change from non-ethnic to ethnic lead reduces sales by 110%, and 144% in the restricted definition. This result looks quite bleak, however it can suggest a number of things. One the on hand the result affirms the conventional wisdom that first-person shooter games that feature female and racial minority characters do not contribute positively to sales. It is possible that due to the lack of previous success with games that feature minority leads, company executives are not willing to invest adequately in new initiatives that involve minority leads. Recall that this regression is an estimate of the equilibrium, or intersection of supply and demand

curves, and for this reason the amount funded for each title can have a direct impact on the quality and sales of a game. In the same vein, there may be some prejudices being reinforced by the buyers of games, or in other words, minority leads simply don't contribute to gamers' willingness to buy the game. It could also be the case that since the majority of developers are white males, they may simply be producing better quality games that showcase well-scripted white male protagonist since they are more relatable to the developers.

It is surprising, however, to find that allowing the players to customize gender largely boosts sales. In the relaxed definition, being gender customizable increases expected sales by 205%, and in the restricted version, by 156%. These numbers reflect a clear signal that gamers are receptive to having the choice to play as a female character as well as a male character. This discovery conforms to the phenomenon of some gamers preferring to play as a character from the opposite gender when given the choice, often due to aesthetic reasons. When given the choice to play as a minority character, however, sales are reduced by 5.7% in the relaxed version, and 18.9% in the restricted version. The discrepancy between the two coefficients may lie in the addition of the FullCust variable in the second iteration. The relaxed version might have absorbed some of the positive effects from FullCust.

IV.II. RPG Genre

RPG: Log-linear regression, relaxed definition vs. restricted definition (N=111)

Table IV c. RPG, Relaxed Definition

Independent Variables	Coefficient	Std.Err.
SpecialEdition	-1.424977	0.0005663
Human	0	(omitted)
Identity	-0.1057599	0.0006656
GenderCust	-0.9883599	0.0013274
RaceCust	4.798721	0.0190985
FirstFem	1.632977	0.0010123
SecondFem	0.560018	0.0028142
FirstEthnic	-3.985261	0.0191309
SecondEthnic	0.1244791	0.0006029
TieIn	0.0735257	0.0009877
Franchise	0.3828017	0.0005574
AvgScore	0.2767476	0.0003168
Constant (β_0)	8.604058	0.003486

* Pseudo R2 = 0.4352
* Prob > Chi2 = 0.000
*All P > |z| = 0.000

Table IV d. RPG, Restricted Definition

Independent Variables	Coefficient	Std.Err.
FullCust	-1.04942	0.0022686
MultiplePlayable	-0.973411	0.0012932
FirstFemEx	1.006492	0.0011704
FirstEthnicEx	-3.669413	0.0191316
SpecialEdition	-1.481247	0.0005682
Human	0	(omitted)
Identity	0.2583529	0.000692
GenderCust	0.5889684	0.0015195
RaceCust	1.047253	0.0022622
SecondFem	0.3285521	0.0028436
SecondEthnic	-0.2206597	0.0006869
TieIn	0.1965308	0.0020277
Franchise	0.3381684	0.0005695
AvgScore	0.4177799	0.0003318
Constant (β_0)	8.472079	0.0034795

*Pseudo R2 = 0.4223
*Prob > Chi2 = 0.000
*All P>|z| = 0.000

The RPG genre is drastically different from the Shooter genre in terms of the structure of games. Recall that from the summary statistics section one sees that a disproportionally large percentage (40%) of all RPG titles in the sample are fully customizable, 56% of the titles are gender customizable and 41% of the titles are race customizable. With this high degree of customizability present in the genre, RPG games may attract a different group of gamers from that of Shooter games. This is mostly manifested in the largely positive impact a female lead has on the sales of a title. While in the relaxed version, including a female character increases expected sales by 163%, in the restricted version sales are increased by 101%. The difference in magnitude likely resulted from the difference in the number of observations. This result can be an important insight into the type of games preferred by RPG players. It appears that RPG games can gain greatly from including exclusively female protagonists, considering that even including secondary female characters have a large positive effect on sales. However, a full character creation mechanism may not contribute positively to sales as producers of RPG games seem to believe. Due to the lack of truly ethnic characters in RPG titles, the ethnic lead variables will not be interpreted.

IV.III. Action Genre

Action: Log-linear regression, relaxed definition vs. restricted definition (N=264)

Table IV e. Action, Relaxed Definition

Independent Variables	Coefficient	Std.Err.
SpecialEdition	-1.724056	0.0004161
Human	0.2149273	0.0004132
Identity	0.3670453	0.0011286
GenderCust	0.2160133	0.0007801
RaceCust	0.6422846	0.0003872
FirstFem	-0.6663245	0.0007106
SecondFem	0.3396112	0.0005059
FirstEthnic	0.1320082	0.000325
SecondEthnic	0.0410789	0.0002365
TieIn	-0.2485434	0.0002924
Franchise	0.3637076	0.0002623
AvgScore	0.6477361	0.0001171
Constant (β_0)	6.844042	0.0014009

* Pseudo R2 = 0.473
* Prob > Chi2 = 0.000
*All P > |z| = 0.000

Table IV f. Action, Restricted Definition

Independent Variables	Coefficient	Std.Err.
FullCust	-1.294794	0.0005628
MultiplePlayable	-0.1877766	0.0003638
FirstFemEx	-0.7403813	0.0007803
FirstEthnicEx	0.1627637	0.0003196
SpecialEdition	-1.738395	0.0004171
Human	0.1277491	0.0004422
Identity	0.3747822	0.0011303
GenderCust	0.1184549	0.0004223
RaceCust	1.077904	0.0004259
SecondFem	0.2969474	0.0005156
SecondEthnic	-0.0017466	0.0002551
TieIn	-0.4633132	0.0003068
Franchise	0.3254159	0.0002667
AvgScore	0.6591758	0.0001168
Constant (β_0)	6.981573	0.0014048

*Pseudo R2 = 0.507
*Prob > Chi2 = 0.000
*All P>|z| = 0.000

The Action genre reveals yet another pattern that favors the inclusion of minority leads. In the relaxed version of the regression, including an ethnic lead increases expected sales by 13.2%, yet in the restricted version the increase is even larger, by 16.3%. This is not a coincidence, for a number of major productions included in the sample feature ethnic leads, such as a few titles in the Assassin's Creed franchise. It lends some insight into the relationship between production quality and consumers' willingness to purchase a game. In both versions female leads produce a negative expected change in sales, 66.7% and 74.0% respectively. Of the 10 games that have exclusively female characters, only Bayonetta and Tomb Raider (2013) have comparable three-month sales to the genre's mean value. Again, gender customizability is received favorably by gamers, as with most games with role-playing elements. However this time, race customizability also contributes very positively to unit sales, far exceeding the positive effect of gender customizability. Upon closer examination of the data, this result is driven by Grand Theft Auto V's decision to include an African American playable character, and the Saint's Row franchise.

IV.IV. Adventure

Adventure: Log-linear regression, relaxed definition vs. restricted definition (N=109)

Table IV g. Adventure, Relaxed Definition

Independent Variables	Coefficient	Std.Err.
SpecialEdition	-2.01721	0.0010089
Human	-1.373595	0.0013615
Identity	0.4035412	0.0010256
GenderCust	-0.1907416	0.0014512
RaceCust	1.226036	0.0009926
FirstFem	-0.05027	0.0012998
SecondFem	0.9803712	0.0018912
FirstEthnic	-0.0726	0.0007201
SecondEthnic	0.3827207	0.000548
TieIn	-0.31293	0.0005899
Franchise	0.3781036	0.0005726
AvgScore	0.4711494	0.0001969
Constant (β_0)	8.353195	0.0027285

* Pseudo R2 = 0.6008
* Prob > Chi2 = 0.000
*All P>|z| = 0.000

Table IV h. Adventure, Restricted Definition

Independent Variables	Coefficient	Std.Err.
FullCust	0.4771388	0.0009124
MultiplePlayable	0.5019063	0.0007227
FirstFemEx	-0.1749183	0.0013299
FirstEthnicEx	-0.2425076	0.0009421
SpecialEdition	-1.976623	0.0010132
Human	-1.437464	0.0014113
Identity	0.2339265	0.0010673
GenderCust	-0.5789592	0.0009169
RaceCust	0.9247995	0.0009361
SecondFem	1.170332	0.0019434
SecondEthnic	0.5866042	0.0006008
TieIn	-0.518387	0.0007322
Franchise	0.3209757	0.0005801
AvgScore	0.4562991	0.0002037
Constant (β_0)	8.372942	0.0028163

*Pseudo R2 = 0.6266
*Prob > Chi2 = 0.000
*All P>|z| = 0.000

The log-linear regression on the Adventure genre yields the highest pseudo r-square of all genres, explaining approximately 60% of the variations in the log of sales in the first three months. In the relaxed version, including a female lead character reduces sales by 5%, and an ethnic lead character reduces sales by 7.3%. While both changes are statistically significant, compared with the magnitude of changes we have observed thus far, they can be somewhat inconsequential. In the restricted version, an exclusively female lead character reduces equilibrium sales quantity by 17.5%, and an exclusively ethnic protagonist by 24.3%. Note that only 5 Adventure games fall under FirstFemEx, one should take caution in interpreting this percentage change given the small number of observations that fall into this category. Although gender customizability impacts sales negatively in both versions of the regression, race customizability tells a very different story. Race customizability increases sales by as much as 123% in the relaxed version, and 92.5% in the restricted version. The positive coefficient can be partially attributed to the Resident Evil franchise's decision to include playable characters that are ethnic minorities. This result suggests that Adventure game players may prefer the inclusion of minority lead characters.

V. Conclusion

An aggregate summary of female and ethnicity coefficients in Tables IV a. through IV h. is shown in Table 5:

(Note: for Tables 5 through 8, positive coefficients are highlighted, all coefficients are statistically significant at any significance level)

Table 5: Comparison of Female and Ethnic Coefficients, count/coefficient, by Genre

Genre	Total Obs	FirstFem	FirstEthnic	FirstFemEx	FirstEthnicEx
Shooter	228	29 /-0.635	43 /-1.090	9 / -0.690	9 /-1.443
RPG	111	79 / 1.633	20 /-3.985	9 /1.006	1 /-3.669
Action	264	87 /-0.666	75 /0.132	10 /-0.740	18 /0.163
Adventure	109	39/-0.050	27/-0.073	5/-0.175	10/-0.243

A cross-genre comparison reveals that both Shooter and Adventure genres' equilibrium quantities are negatively affected by the inclusion of female/ethnic lead characters. While Shooter games are very negatively impacted, Adventure games are impacted to a lesser extent, possibly because the Adventure genre contains a more heterogeneous mix of games. The most interesting aspect of this comparison lies in the results for RPG and Action. On one hand, including a female lead character in the RPG genre yields an exceptionally large increase in sales regardless of variable definition. On the other hand, sales of Action games are affected positively by the inclusion of ethnic lead characters. These two findings suggest that the industry is affected by more than one consumer demographics and/or preference set.

Similarly, the effects of race and gender customization vary depending on the genre. A cross-genre comparison of RaceCust and GenderCust is shown in Table 6:

Table 6: Comparison of Race and Gender Customizable Coefficients, by Genre

Genre	GenderCust (Relaxed)	RaceCust (Relaxed)	GenderCust (Restricted)	RaceCust (Restricted)
Shooter	2.051	-0.057	1.562	-0.189
RPG	-0.988	4.799	0.589	1.047
Action	0.216	0.642	0.118	1.078
Adventure	-0.191	1.226	-0.579	0.925

In each genre, at least one of the customizable elements impacts sales positively. Despite its negative coefficient on female leads, the Shooter genre is affected very positively by gender customization. This seemingly confounding result may indicate a larger-than-expected disparity between gamers' perception of a game that features a female lead and that of a game that offers the option to play as a female protagonist. Similarly, the Adventure genre achieves higher sales from allowing race customization, while its coefficients on ethnic leads are negative. Both RPG and Action genres, in the restricted version, benefit from both gender and race customizability. Corresponding to results from Table 5, RPG and Action games with greater gender and racial diversity of lead characters tend to experience higher sales volume. This finding suggests that customization on some level is favored across all four genres. To maximize returns, game producers should at least take on some degree of character customization. However, customization should be genre-specific, as each genre responds differently to customizable elements.

Additionally, the findings of this study provide insight into the effects of brand association on video game sales. The effects of brand loyalty are captured through the Franchise and Tie-in variables. A cross-genre comparison is shown in Table 7:

Table 7: Comparison of Franchise and Tie-In Coefficients, by Genre

Genre	Franchise (Relaxed)	Tie-in (Relaxed)	Franchise (Restricted)	Tie-in (Restricted)
Shooter	0.386	0.047	0.374	0.124
RPG	0.383	0.074	0.338	0.197
Action	0.364	-0.249	0.325	-0.463
Adventure	0.378	-0.313	0.321	-0.518

The effect of Franchise is remarkably consistent across all genres. Being in a franchise uniformly increases sales by approximately 30 to 40%. On the one hand, this finding supports the conventional wisdom with respect to the issue of brand loyalty. Consumers are more likely to purchase a game if they have high expectations of the game's quality. On the other hand, this result can be partially attributed to the effects of survival bias. (Elton et al., 1996) In hindsight, games that have achieved commercial success encourage the development of sequel games and receive additional funding. In addition, commercially successful games may also have first-mover advantage in creating an original narrative structure and/or gameplay experience. As noted above, Ndubisi (2006) finds that female customers exhibit significantly higher customer loyalty than their male counterparts. Consequently, the combination of results suggests that enabling gender and/or ethnic customization within a franchised game may produce a highly committed

customer base. It follows that price elasticity for such a customer base would be lower and as a consequence producers could charge more.

The Tie-in coefficients exhibit another interesting pattern. While Tie-in games positively impact sales of RPG and Shooter games, they negatively impact Action and Adventure games. The summary statistics in Table 8 reveals the following pattern:

Table 8: Percentage of Tie-In games, by Genre

	Shooter	**RPG**	**Action**	**Adventure**
Tie-In	9.65%	6.31%	41.67%	37.61%

Where Tie-in titles are four times more prevalent in Action and Adventure genres, the regression coefficients are uniformly negative. In contrast, when Tie-in games are less well represented in Shooter and RPG, their effect on sales is positive. This finding suggests that game producers should be very selective in linking a game to a film or TV show. While producing Tie-in games can be beneficial to sales, it must be done selectively to avoid the negative effects shown by the coefficients on the Action and Adventure genres.

By individually examining four subsets of games, we find that Shooter, RPG, Action and Adventure genres reveal different ways in which game design elements affect the equilibrium sales quantity. Each genre has a unique pattern that is shaped by the way game developers construct the genre, as well as by the varying preferences of gamers favoring different genres. This study finds that being in a franchise contributes positively to sales uniformly across all genres. Nevertheless this phenomenon may be attributed to the effects of survival bias and first-mover advantage. In producing Tie-in games, firms should exercise discretion in selecting the media brand to associate with. Character

customizability enhances sales in all genres, albeit gender and race customization elements affect each genre differently. Lastly, the findings show that while Shooter and Adventure games conform to the conventional pattern where female and ethnic characters contribute negatively to sales, RPG games favor the inclusion of female lead characters and Action games favor the inclusion of ethnic lead characters. These results demonstrate that in order to maximize firm profits, the video game market should not be studied as a homogenous aggregate, but rather as a segmented market that caters to a diverse range of gamer demographics and preferences.

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Appendix A:

Figure 6: Percentage of female video game artists

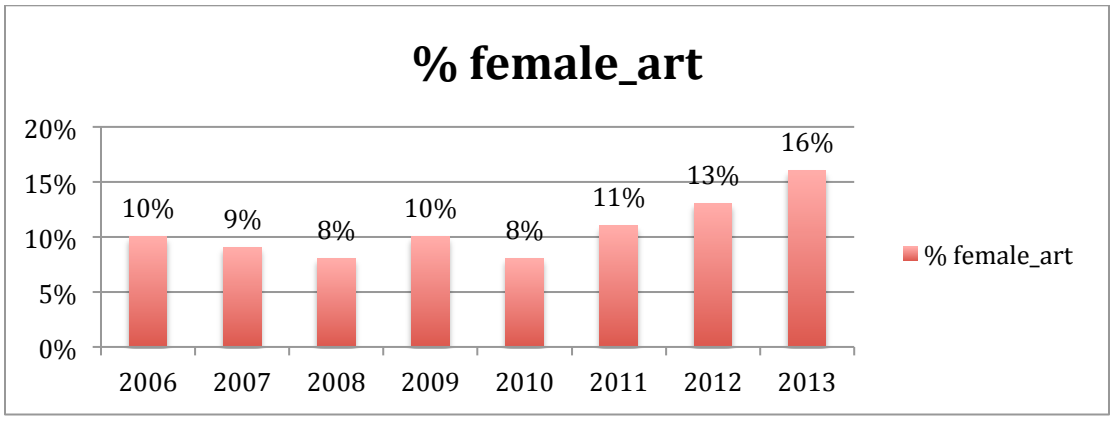

Figure 7: Annual salaries of male and female artists, in US dollar

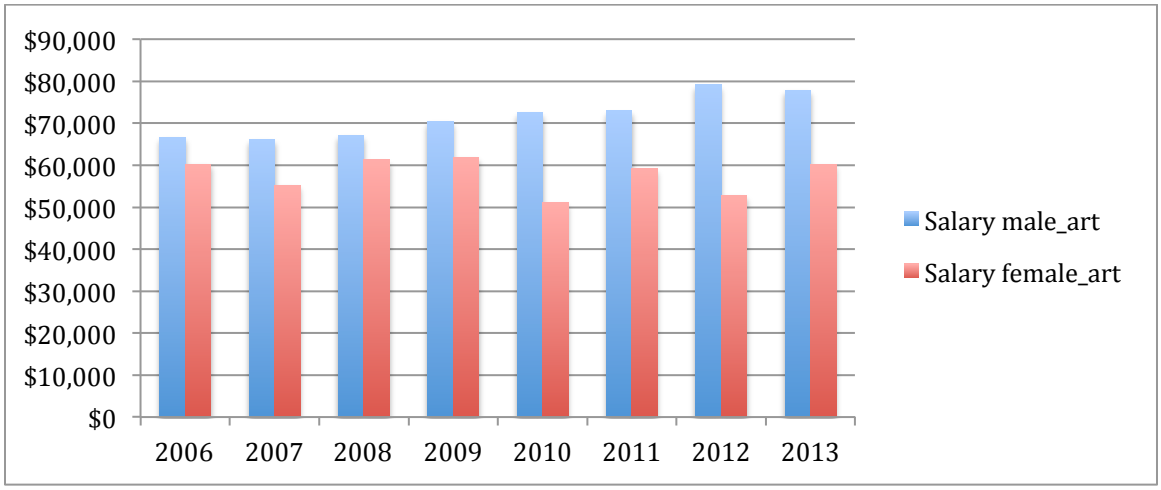

Figure 8: Percentage of female game designers

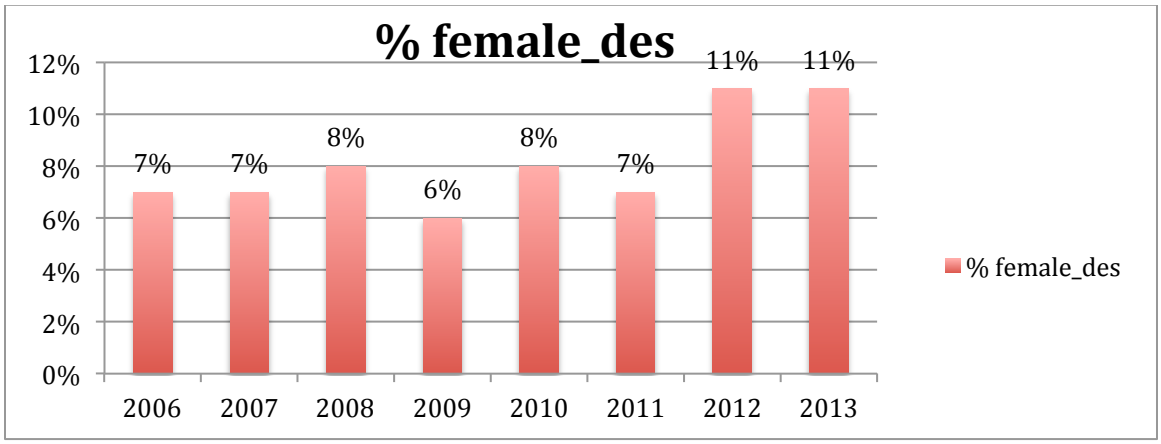

Figure 9: Annual salaries of male and female game designers, in US dollar