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Diversity and Innovation: The Effects of Diverse Creator Teams on Video Game Characteristics and Sales

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Abstract:

I analyze the effects of gender diversity on video game production teams. I hypothesize teams with greater gender diversity produce more games with uncommon characteristics than less diverse teams, and the games these teams develop generate higher revenue and unit sales compared to games developed by less diverse teams. I find teams with more women disproportionately develop games that are non-violent and have playable female leads. I examine whether there is an optimal ratio of women to hire for each game genre in order to maximize revenue by analyzing the relationship between the percentage of women on a team in each genre and total revenue. While I do see evidence of firms over- or under-hiring women in some genres before 2001, it appears for the most part firms have optimized their hiring practices in regards to gender diversity from 2001 onward.

I. Introduction

In Silicon Valley, "diverse teams make better products" has become a commonly repeated phrase (Emerson 2015, Hu 2015 and Maxwell 2015). If diversity does lead to better innovations, the technology industry is failing to maximize its potential so long as it fails to recruit and retain diverse talent. There is ample anecdotal data regarding instances where a more diverse team may have led to better innovations. Some high profile examples are film photography being optimized for white skin and the Apple Watch heart rate sensor not functioning properly for people who have wrist tattoos (Cima 2015 and Kastrenakes 2015). However, there are insufficient empirical studies to formalize the conclusion that diversity leads to better, rather than simply more, innovations. I use quantitative analysis to determine which kinds of products more diverse teams tend to create and if the resulting products perform better in the market than products of the same genre developed by less diverse teams. I have chosen video games as the focus of my study, because unlike other products, it's relatively easy to determine who was involved in the creation of a specific game. In contrast, it would be nearly impossible to determine exactly who was involved in developing a specific feature of, for example, the Apple Watch.

In my analysis I attempt to determine whether more diverse teams produce games in less common genres or with unusual characteristics, such as having a playable female lead. I then examine, holding genre constant, whether games produced by teams with a higher percent women perform better in the market in terms of sales and revenue than games created by less diverse teams.

While there are many qualitative studies that discuss the concept of diverse teams producing more patents and other forms of innovations than less diverse teams, there is a limited amount of conclusive quantitative evidence of such a trend and almost no studies on the nature of the innovations themselves.

I hypothesize that teams with more gender diversity produce more games in less common genres that sell more units and generate more revenue than games produced by teams with less gender diversity. This concept originates from the idea that people with a wider range of experiences and perspectives will have more ideas to draw from in the creative process and will have insight into how to create games that appeal to a wider audience, as researched by Gao et al. (2015), Parrotta et al. (2013) and Herring (2009).

I find women are more likely to be hired on teams that produce games in stereotypically female domains. However, I lack sufficient data to determine the extent to which women self-select to these genres due to prior experience and interests driven by larger societal influences as compared to firms making biased decisions about which teams women fit best.

Firms developing games after 2000 appear to have improved their ability to hire the optimal gender ratio for most genres. I initially find that women are being hired on sports game teams by firms at a rate that does not maximize revenues. However, when I examine each specific sport the results are insignificant. Therefore, this result appears to be a reflection of the broad nature of the sports category. Overall, these findings suggest firms have optimized over time to find the appropriate ratio of women per team for each genre in order to maximize revenue and unit sales. My results suggest teams with more

women are far more likely to produce games that are non-violent and have playable female leads. However, women are less likely to produce games in uncommon genres.

II. Industry Overview

In the wake of Gamergate, a violent harassment campaign directed at female members of the gaming community, the potential value of diversity is being discussed with increasing frequency within the gaming community ("Gamergate Controversy"). In many cases, this conversation is centered around the demographics of gamers and those gamers' preferences. There is an implicit, and sometimes explicit, assumption that the majority of "serious" gamers are teenage boys and young men. A study commissioned by the Entertainment Software Association estimated women to account for about 48% of US gamers, and Pew Research (2015) found that women constitute more than half of international gamers, challenging the commonly held assumption that gaming is dominated by teenage boys (Crandall & Sidak 2006). Specifically in the case of console gaming, more than half of the US console gaming population are women (Pew Research 2015). Therefore, the industry is failing to capitalize on half of the potential video game consumer market if firms focus primarily on creating games that are intended to appeal to young men. Ericsson (2013) finds 25% of US consumers play some form of video games at least once a day. According to Davidovici-Nora (2014), these consumers are primarily "casual gamers," who play simple games, such as Candy Crush, on their phones or tablets. Additionally, there is little empirical analysis of the relationship between the diversity of game developers and the types of games that these developers create as a result of their diversity or lack thereof.

The gaming industry emerged into the mainstream in the early 1970s with Atari's first popular success, Pong ("Pong Game"). In 1978, Space Invaders was released and arcade games became increasingly common in public spaces, which introduced the possibility of gaming as a form of leisure to the average American consumer ("Corporate History"). The growing popularity of personal computers during this time period helped to accelerate the adoption of in-home consoles. Now, Gartner (2013) estimates the total global video game revenues to exceed $93 billion.

There are three primary gaming platforms: PC, mobile, and console. Mobile is currently by far the fastest growing market, but in the US, console gaming retains a large market share within the gaming industry (Feijoo et al. 2012). Mobile gaming began its ascent to popularity following the 2007 release of the first iPhone. From the start developers on mobile focused more on games that women were thought to enjoy such as puzzle and role playing games as compared to the types of games produced on other gaming platforms (Soh and Tan 2008). While the prevalence of console gaming is decreasing, 56% of US households owned at least one dedicated gaming console in 2012 (De Prato 2013).

When the gaming industry began, many video games were built by individual developers working out of their own homes (Crandall & Sidak 2006). However, as gaming technology became increasingly complex in the years following Atari's initial release of Pong, large gaming companies began to dominate the market, because those firms' hit games could earn a profit large enough to cover the costs of all the failed games (Martin 2015). Today, mobile has re-enabled the individual developer to produce games at a relatively low cost. Large firms, namely Supercell, King, LINE and GungHo Online,

earn about 20% of the total revenue in the mobile app market according to App Annie (2015), which shows a medium level of concentration in the mobile apps.

The video game industry is characterized by being a “hit” industry. A relatively low proportion of games perform well in the market while the rest fail to achieve even mediocre sales. For example, Gretz (2009) finds that only 10% of video games released in 1998 made a profit and this trend has continued into the present. Cox (2013) reports that the top 10% of video games make up more than 54% of the total unit sales each year. Video game producers focus their efforts on high sales volumes, which is a sustainable business model, because as Aoyama and Izushi (2003) demonstrate, software publishers experience high upfront costs throughout the development and initial marketing process and very small marginal production costs. Large firms typically spend between $15 and $60 million in the production and marketing process for a video game in order to maximize the chances of the game becoming a hit ("How Much Does It Cost To Make A Big Video Game?").

In general, the industry has struggled to maintain consistent sales and growth (van Dreunen 2011). Companies that are able to cover the costs of their failed games with a small number of hits are more likely to survive slower periods of growth in the gaming industry. Once a company develops a hit, they often produce many sequels of the game in order to fully capitalize on the success of the initial game (Kücklich 2008 and Rouse 1999). This can be illustrated by my initial dataset which consisted of 9428 games. Once I eliminate sequels, only 4427 games remain. Therefore, the industry is dominated by large firms, such as Nintendo, which occupies nearly 90% of the total market share of video games and consoles, that have the capital to invest in high quality games and

marketing which can sustain company operations when games inevitably fail ("Video Game Industry").

In 2013, there were more than 1.2 billion active gamers worldwide according to De Prato et al. (2014). Until 2009, Europe, the US and Japan were the largest markets for video games. However, emerging markets like China, whose video game industry growth far outpaced established markets, overtook the West and Japan in 2009 according to IDATE (2011). While there has been growth in other regions, De Prato et al. (2014) attributes the continued growth and success of the video game industry to emerging markets including China, India and Brazil. Not only has the Chinese market grown quickly, but the majority of Chinese consumers' spending on games is going toward games developed within China, finds De Prato et al. (2014). Thus, China and neighboring regions have emerged not only as major video game consumers, but also as some of the most prolific producers of video games. Despite the dominance of gaming consumption and production in China, the US possesses the largest number of in-home console game players.

Given that the firms in the gaming industry are focused on constant innovation and, as I will describe extensively in the following section, there appears to be a correlation between diversity and innovation, it is essential to understand the effects of hiring more women on video game production teams.

III. Literature Review

Innovation is central to the gaming industry, because in order to produce a hit, game creators must constantly generate new ideas regarding every aspect of the game,

ranging from the style of animation to how a gamer interacts with the game. As a result, the video game industry is highly dynamic. Storz et al. (2012) finds there are both frequent incremental and radical innovations in gaming, with radical innovations defined as the creation of a new genre and incremental innovations including any innovations that occur within genres. De Prato et al (2014) asserts that the growth of the video game industry can be partially attributed to the industry's ability to rapidly innovate content and form in the face of new technologies and emerging markets, which attract gamers from underserved demographic backgrounds. In addition, De Prato et al. claims the emergence of mobile and online console gaming has transformed the industry. De Prato et al. finds that social interaction aspects of online gaming has helped the medium retain popularity over time.

One of the risks of innovation is that creativity can lead to more variation in the popularity of a game. For example, in the popular game Minecraft, players can develop their own game maps. In Goltz et al.'s (2014) analysis of the popularity of game maps, they find that more creative maps have a much higher variance in popularity than games that take fewer risks. Thus, while game developers can be rewarded for their innovation, it is also far more likely for an innovative game to be a flop when compared to a less creative map. However, since the video game industry is focused on finding hits, gaming companies should be willing to pursue innovation despite the higher risk of failure compared to less creative games.

Cox (2013) examines characteristics of successful in-home console video games. Cox finds both critic and user reviews to have a large impact on unit sales. In addition, Cox finds video game unit sales are quality elastic, with quality measured using a game's

metacritic score, meaning a small change in quality can increase or decrease demand significantly. The implications of this elasticity suggest that it is crucial for game developers to innovate and improve on as many of the small details of a game as possible. Additionally, games with a "mature" rating sell 10% more units than any other age rating. Games that are available on multiple platforms sell 8% more units than games available on only one platform. Although it is likely there is some reverse causality in that model, because it is reasonable to assume that many of the most successful games will be subsequently produced for multiple platforms. Finally, the vast majority of unit sales occur in the initial months following the release according to Cox.

Given the centrality of innovation in the gaming industry, there is often pressure on producers to increase the amount of innovation occurring within the company. While managers may attempt to encourage creativity with monetary rewards, Grandadam et al. (2012) finds that there is no amount of monetary reward that can spark innovation. Prioritizing innovation is complicated by the fact that it is difficult to account for the effects of innovation on a business, but many managers believe innovation is important nonetheless. Since diversity is thought to impact innovation and experts believe that innovation is central to developing sustainable economic growth, it is essential to understand the relationship between diversity and innovation. Wu (2015) claims that because the majority of game reviewers are white men and rate games higher that fit their own preferences, games that would appeal to other demographics often fail to receive the acclaim the games deserve. Therefore I will also examine non-revenue related relationships between games and gender diversity.

The scholarship around innovation and diversity varies widely and there have been few conclusive findings that can be broadly applied at this point. The effect of diversity on innovation seems to be highly dependent on context. For instance, Richard (2000) finds that when a company is pursuing high growth, a diverse team performs better in terms of productivity, return on equity and market performance than a homogenous team. Given the findings of Cox (2013) which state that the vast majority of an individual game's sales occur in the first few months following a game's release, games can be considered to always be in high growth mode during production. Therefore, if Richard's findings can be extended to the gaming industry, gaming companies will experience increased innovation as creator diversity increases.

Grandadam et al. (2012) finds Montreal to be one of the most innovative video game clusters in the world. Grandadam et al. attributes one aspect of this creativity to companies financially incentivizing and socially encouraging employees to take part in local cultural activities, which suggests a wide exposure of cultural backgrounds contributes to increased creative productivity.

Parrotta et al. (2013) finds that ethnically diverse employees have access to a wider range of experiences and knowledge bases, such that when leveraged collectively, leads to increased and varied innovation in terms of number and subject matter of patents. Similarly, Parrotta et al. finds age diversity to be important, which they posit is because younger workers tend to be more comfortable with new technologies while older workers tend to have more industry expertise. Gao et al. (2015) find higher rates of sexual orientation diversity within a firm leads to an increased number of patents, but is not necessarily related to an increase in revenue or unit sales. However, if the employees are

diverse, but have significantly overlapping experiences and expertise, such as similar education and work experience, Lazear (1999) finds that there are no longer increased levels of innovation due to racial and gender diversity. Thus, the improvement in innovation appears to originate from combining a wide range of perspectives, which can be captured in diverse groups, but is not necessarily existent in or exclusive to those groups. It is therefore necessary to focus on intellectual diversity rather than one-dimensional recruiting based on factors like race or gender alone.

Some scholars worry that while certain kinds of diversity might lead to increased productivity, conflict between racial and ethnic groups might make it difficult for these groups to benefit from their wider collective knowledge base. McMahon (2010) finds that members of minority groups evaluate people within their group more positively than those outside of their group. In a business context, this can result in poor interpersonal relations in a diverse office. Skerry (2002) and Gong (2006) find that racial and ethnic diversity leads to increased conflict in the workplace. Additionally, Herring (2009) claims that putting pressure on companies to include increased diversity in the workplace could lead to lower productivity and quality due to hiring workers who are underqualified for their roles, which could also lead to resentment from other employees. However, such a problem can likely be avoided by not setting quotas for marginalized groups and instead focusing on actively recruiting the best diverse talent.

Gong (2006) results suggest that the increased level of conflict exists only at the point of introduction of diversity and fades over time as employees develop relationships and take part in diversity training. Therefore, when hiring a more diverse pool of employees, employers must provide workers with the skills to manage diversity in order

for the diversity to be beneficial. Additionally, providing such training could help to retain diverse talent, because a person is more likely to remain in a given firm if they are treated well and feel safe and productive in their work environment.

McMahon (2010) and Yan (2013) find that while diversity can help enhance teams' creativity and innovation, the diversity is only beneficial when knowledge between team members is being shared with frequency. If there is significant interpersonal conflict in an office, workers are unlikely to frequently or effectively share information. Chowdhury (2004) concurs, finding that a "divergent belief structure" is central to the team innovation process, but is only beneficial when all team members are able and willing to consistently share their ideas, questions and concerns with other members of the team. While this concept of having a wide range of beliefs and assumptions could potentially be found on a racially or gender diverse team, Chowdhury emphasizes those forms of diversity are not a prerequisite to developing a diverse knowledge base. Chowdhury (2004) analyzes that demographic diversity variables and finds diversity is not correlated with team entrepreneurial effectiveness and innovation according to extensive surveys of managers and other team members. Instead, Chowdhury reports that team commitment and cognitive comprehensiveness are integral to entrepreneurial team effectiveness and innovation.

Herring (2009) finds a correlation with large companies and higher diversity rates in workforces. The companies with more diverse employees obtain a larger number of patents compared to firms lacking in diversity holding firm size constant. Herring theorizes that because large companies make an increased effort to prevent and address workplace discrimination in order to avoid legal issues, they are better able to recruit and

retain diverse talent. Herring finds a correlation between racial diversity and sales, as well as gender and sales but the effect is not nearly as strong as that of racial diversity.[1] Both gender and racial diversity increase a company's number of customers on average as well as lead to a larger than average market share and profitability. Herring concludes that a diverse workplace leads to increased debate over ideas that otherwise might be taken for granted in a less diverse group. As a result, the diverse team engages in increased creativity, which ultimately leads to better solutions. He finds increasing the diversity of a workplace has a direct return on investment, having an impact on both revenues and number of customers.

Kalev et al. (2006) find that ensuring people of diverse backgrounds are involved in company leadership is more important than increasing the overall share of diversity in a company. Therefore, it is central to examine not only the number of diverse workers on any given team, but also the diversity of the project leads, managers and executives. Similarly, Chen et al. (2015) find that firms with increased board gender-diversity achieve higher innovative success, defined by number of patents and citations. However, this innovation is not necessarily correlated with increased revenues unless the company is pursuing a growth strategy.

Aleman (2013) reports that workforce diversity is increasing in the United States due to demographic shifts driven largely by immigration. Additionally, Aleman finds underrepresented groups in the US are becoming increasingly educated. Asian, Latino, and Black graduate enrollment rates have tripled in the past 20 years. Thus, the

[1] Unfortunately, I am unable to include racial/ethnic identities in my analysis, due to constraints in my access to demographic data. In future studies, it would be relevant to explore the effects of racial diversity on team performance.

importance of predicting the effect of increased diversity in the workforce is less of a question about whether we should encourage it, but an attempt at predicting what will happen when diversity inevitably increases in the workforce.

Based on demographic research by Stuart (2015), 15% of all directors of Standards & Poor 200 companies are racial or ethnic minorities and 85% of companies on the S&P 200 have at least one minority director. Additionally, Stuart finds women consist of 31% of the newly elected directors this year, a slight increase from 2014. Given the heightened awareness of the lack of diversity in many American companies, the findings of this study could be applied to other fields, ranging from hardware and software development, to the automobile industry, and to investment banking, where it may be more difficult to quantify creativity and innovation (DeAmicis 2014, Jones & Trop 2015, Ricker 2015 and Shahani 2016).

Based on this literature, I study the effects of a gender diverse team of video game creators on various video game outcomes ranging from the uniqueness of games, critic scores and sales.

IV. Hypothesis Development

a. **Hypothesis 1:** ***Gender diverse teams will be more likely to produce games in uncommon genres than non-gender diverse teams.***

   Based on the findings of Gao et al. (2015), Parrotta et al. (2013) and Herring (2009) that diverse teams produce innovations at a higher rate due to a larger set of experiences to draw from, I hypothesize that this idea extends to the kinds of innovations diverse groups might produce. Due to the wider range of experiences

that a group possesses when there are a higher percentage of women, I predict that gender diverse teams will produce games in uncommon genres more frequently than teams with a lower percentage of women. I test this hypothesis by analyzing which genres women are more or less likely to work on and whether teams with a higher percentage of women produce more games that are *not* categorized within the action or platformer genres, which constitute about 50% of the sample.

b. Hypothesis 2: ***Gender diverse teams will produce fewer violent games than non-gender diverse teams.***

Many popular video games are centered around violence. Given my hypothesis that gender diverse teams will create more games in unusual genres than non-gender diverse teams, I hypothesize teams with a higher percentage of women women will create more non-violent games than teams with a lower percentage of women.

c. Hypothesis 3: ***Gender diverse teams will produce more games with female leads than non-gender diverse teams.***

Most popular video games have male leads. Only 19.6% of games in my sample have playable female leads. I predict that teams with additional women will produce games with more playable female leads. This prediction is based on the idea that each person will bring to the innovation process their personal perspectives. An aspect of those experiences is the gender and appearance of main characters. I predict women are more likely to suggest there should be female lead

characters in the game given their own experiences as women, which will therefore result in more female characters in the games women are involved in producing.

d. Hypothesis 4: ***Games produced by gender diverse teams will obtain higher unit sales and revenues than non-gender diverse teams holding the game genre constant.***

Taking into account the research of Cox (2013) and Herring (2009), I predict that diverse teams will innovate more than a less diverse team, which will lead to higher quality products. Based on literature by Herring (2009), I predict the quality of these games will be reflected in higher revenue and unit sales.

If this hypothesis proves to be correct, one implication is that rate at which companies are correcting for diversity deficits or surpluses should increase rapidly. Currently, many companies face social pressure to increase diversity rates. As a result, customers may choose to boycott a company that fails to live up to their moral standards, which would in turn reduce profits. However, if diversity directly affects revenue, company management may increase the rate at which firms are correcting for diversity deficits or surpluses, because revenue is more directly connected to profits. This is likely to be particularly true in games, where production and distribution costs would not differ much across games within the same category.

e. **Hypothesis 5:** ***Games produced by gender diverse teams will receive lower critic scores than games produced non-gender diverse teams.***

Given the hypothesis by Wu (2015) that most video game reviewers are male and prefer games that cater to male audiences, I predict that teams with higher percentages of women will produce games that receive lower critic reviews.

f. **Hypothesis 6:** ***Firms historically have under- and over-allocated women on stereotypically male and female genres, respectively if optimizing for revenue, unit sales and critic scores. I predict firms are making adjustments over time to correct for gender bias.***

Given the pervasiveness of gender stereotypes in the video game industry and society in general as well as the fears of introducing diversity into previously non-diverse spaces articulated by Skerry (2002), Gong (2006), Herring (2009) and McMahon (2010), I predict video game production companies have historically failed to hire the optimal number of women on each team. I hypothesize that over time, due to an increasing awareness of unconscious bias since the early 21st century, as noted by Banks & Ford (2009), Lee (2005) and Pollard-Sacks (1999), as well as general societal shifts in gender norms, firms have improved their ability to determine the best person to hire for each role, regardless of gender.

V. Data

The data regarding game characteristics, revenue, unit sales, competitors and platform information in this paper comes from NPD, a market research firm. The NPD

database contains retail sales and publishing information on all video games published in the US and Canada as well as many games published internationally ("Video Games Market Research & Business Solutions"). The sample I draw from contains all games that were published between 1985 and 2010 that are available in the NPD database. I choose not to look at games that were published in the past five years in order to ensure that the games in my sample are no longer earning significant revenue. Given the findings of Cox (2013) that the majority of a game's sales occur in the three months following release, I can assume that games released in 2010 will have accurate lifetime total revenues. The critic scores come from GameSpot and games are rated on a 10-point scale.

The original sample contains the 9428 games available in the NPD database during my chosen time frame. As teams producing sequels are typically not given creative freedom to change significant characters or themes, I have chosen to drop all games that were sequels in order to avoid analyzing a biased sample. Sequels are often the largest revenue generators in the video game industry, which could be a concern regarding the validity of my results. However, in this case as I am concerned with relative revenue as well as other non-revenue related categories. Therefore, I conclude that excluding sequels will not lead to inaccuracies in my results. 4427 games remain.

Once I obtain the list of games and characteristics, I gather the list of creators for each game and console combination from MobyGames.com, a comprehensive online guide to video games using a web scraper. There are about 55,000 unique creators in the dataset. In order to obtain gender, I use a list of typical male and female names to label the data with a binary female variable ("Most Common First Names and Last Names."). This method will potentially misgender a small number of creators, but should not lead to

significant errors. For gender ambiguous names or names that were not in the original list, I determined gender manually by searching for online profiles of the person. I dropped entries that could not be identified from my sample. If a game was missing more than 5% of its creator's genders, I dropped the game from my dataset. The resulting sample includes 2805 games and contains creators that are 17% women and 83% men.

In addition to determining team composition, I also use MobyGames to determine the experience levels of the creators. I define experience as the number of games a creator has been involved with publishing prior to publishing this game. On average, team members have produced thirteen games prior to the games they created in this sample. The female average is slightly higher, at fourteen games.

The average team has 18 contributors and while 60% of teams have at least one female member, the average team is composed of only 12% women. While there are a large proportion of teams with no women, the remainder of the observations follow close to a normal distribution with positive skewness for the few teams that have a large percent females. Only 66, just over 2%, of the games in my dataset have at least 50% female representation. See Chart 1 to see the distribution of percentage of women per team.

Women begin appearing on teams in 1989. Soon quickly after some women are introduced onto teams, many more women became involved in video game teams. Most of these teams had far less than 50% women. The mean percentage of women per team before 2001 is 9.6%. Chart 2 shows that the mean distribution women per team does seem to be increasing over time. However, in the early 2000s, the range of percentages women per team begins to constrict, suggesting firms are potentially shifting toward

some measure of optimal percentages of women per team over time. While fewer teams have no women post-2000, fewer teams also have more than 30% women on their teams. Given that there are trends over time of the percentage of women on teams, I control for time effects in many of the regressions.

For full variable definitions and summary statistics, see Table 1. My sample consists of 19.6% games with a playable female lead and 62% that are non-violent. 50% of the games are action or platformer games, while the remainder are scattered in a variety of other categories such as role playing and racing. I create a binary variable which is equal to one when a game is in an uncommon category (i.e. a category that is *not* in the action or platformer categories), which I will use as one of my dependent variables. The games in this dataset are scattered across 18 different platforms with the largest proportion of games being produced on Playstation 2 (19%), Playstation (17%) and Genesis (10%).

VI. Empirical Method & Results

A. Revenue and Sales

To begin my analysis, in Table 2 I examine the relationship between the natural log of total revenue and unit sales and percent-women without controlling for the type of game. I regress the natural log of total revenue and unit sales on the percentage of women per team. The results in columns 1 and 3 show each additional percentage point of women on a team leads to a 2.47% increase in total revenue and a 2.09% increase in total unit sales, which is significant at the 1% level. These results suggest that Hypothesis 4,

that teams with more women will produce games with higher revenues and unit sales, may be correct.

However, once I control for other factors, including year and console effects, whether a game has a playable female lead, is non-violent, critic reviews, whether or not a game is rated as mature, number of creators and average team experience, the results are no longer significant. I choose the control variables based on the analysis of Cox (2013) of the factors that lead to a hit game. While one might think including critic scores in the regression could lead to bias, most scores for games produced prior to 2011 are published a while before a game is released.[2] Video game companies typically allow reviewers to try their video games prior to their release in order to attempt to encourage the publishing of reviews and news articles. Companies use this publicity to build up hype as a form of cheap marketing. If the impact of percent women on a team is through the critic score, when I include critic score in the model, I would expect percent women to become insignificant. However, given Wu's (2015) assertion that most reviewers are male, a direct effect of percent women may remain even while controlling for critic scores. Similarly, whether or not a game is rated as "Mature" can be used as a control variable, because game producers have a strong understanding of how their game is going to be rated once it is released. Additionally, other researchers, including Cox (2013), have used the same rationale and used a mature binary variable as a dependent variable in their regressions.

[2] This is beginning to change as online components of gaming are becoming increasingly central to the games themselves (Crossley 2016).

$$y = \beta_0 + \beta_1 percent\ women\ per\ team + \beta_2\ playable\ female\ lead + \beta_3\ non\text{-}violent + \beta_4 critic\ review + \beta_5 mature + \beta_6 number\ of\ creators + \beta_7 average\ team\ experience + \beta_8 year\ controls + \beta_9 console\ controls + \varepsilon \quad (1)$$

In addition, I run the same regression with a quadratic term in order to test if there is a level of female participation that maximizes sales or revenue. Table 2, columns 2 and 4 include a quadratic term, both percent women per team and percent women per team squared are significant. See the full specification below:

$$y = \beta_0 + \beta_1 percent\ women\ per\ team + + \beta_2\ percent\ women\ per\ team\ squared + \beta_2\ playable\ female\ lead + \beta_3\ non\text{-}violent + \beta_4 critic\ review + \beta_5 mature + \beta_6 number\ of\ creators + \beta_7 average\ team\ experience + \beta_8 year\ controls + \beta_9 console\ controls + \varepsilon \quad (2)$$

With the controls, I find revenues are maximized when teams are composed of 24% women and unit sales are maximized at 25% women per team. It is worth noting that if the quadratic specification accurately reflects reality, firms are far below 25% women per team at 12% overall and 15% for games published after 2000. Therefore, firms should continue increasing the percentage of women hired on each team.

Given the conflicting nature of the results in Table 2, I cannot confidently conclude on whether or not Hypothesis 4, where I assert teams with higher percentages of women will be more likely to earn higher revenues and unit sales, is correct.

One explanation for why revenue and sales may not be directly correlated with the percentage of women on a team is that if women are working on games that appeal to niche markets or non-traditional gamers, their innovations may not be reflected in these regressions. Therefore, I control for factors including genre in future regressions.

B. Critic Scores

Given that critic scores are a determinant of the revenue and sales of video games, in Table 3 I examine if critic score is correlated with female participation on production teams, and therefore an indicator of critics not rating female work and preferences as highly as male work.

$$\begin{aligned} critic\ score\ &= \beta_0 + \beta_1 percent\ women\ per\ team + \beta_2\ mature + \beta_3 average \\ &team\ experience + \beta_4 number\ of\ creators + \beta_5 year\ controls + \beta_6 console \\ &controls + \varepsilon \end{aligned} \tag{3}$$

In my initial regressions, I find a positive relationship between female participation on game development teams, suggesting the opposite of my initial hypothesis, but the significance of this result disappears once I control for console and year effects. Therefore, the results as to whether hiring additional women on a team tends to lead to lower critic scores as I assert in Hypothesis 5 are inconclusive.

C. Game Characteristics

Next, I determine whether the percentage of women on a video game production team is correlated with non-revenue related characteristics including games in unusual genres, games with playable female leads, non-violent games and games rated "Mature". Using the model below, I display the full results in Table 4.

$$y = \beta_0 + \beta_1 percent\ women\ per\ team + \beta_2 number\ of\ creators + \beta_3 average\ team\ experience + \beta_5 year\ controls + \beta_6 console\ controls + \varepsilon \quad (4)$$

Column 2 shows that games from uncommon categories, which in this case are defined as games that are not in the platformer or action genres, are correlated with 35 percentage points lower for each 10% increase in women per team, which is significant at the 5% level. Teams with fewer people are also positively correlated at the 1% significance level with the likelihood of producing a unique game. While this result does not support my initial hypothesis that women are more likely to create unique games it is important to understand that using broad genre categories is a blunt measure of uniqueness. Ideally, I would use a uniqueness score for each game, but at this time I do not have a reliable method of objectively discerning the extent to which a particular game is unique. It is also possible that women are less willing to take risks and make games that are less likely to be popular. This could be a reflection of women experiencing marginalization in the industry or larger societal effects that lead women to be less willing or able to enter into uncertain circumstances.

For each additional percent of women on a production team, games are .78% more likely to have a playable female lead as can be seen in column 4. This finding is

significant at the 5% level and suggests that adding a single woman to a team could increase the likelihood of the team choosing to develop a playable female lead significantly. I conclude Hypothesis 3, that teams with more women will be more likely to produce more games with playable female leads is correct.

Similarly, in column 6 I show for each additional percent of women on a team, a game is .71% more likely to be non-violent which is also significant at the 5% level. Therefore, I determine that Hypothesis 2, that teams with higher rates of women will tend to create more non-violent games is true. Finally, there appears to be no significant correlation between the percentage of women on teams who produce games rated "Mature" as seen in column 8.

In addition to analyzing each characteristic of games individually, I run regressions on combinations of these variables, such as a games being both unique and having a playable female lead. For the most part, these regressions did not lead to significant results. A few notable exceptions include that games that are unique and non-violent are negatively correlated with the percentage of women on the team and significant at the 10% level. Additionally, for each additional percent of women on a team, games are .55% more likely to be both non-violent and have a playable female lead.

D. Genre Effects

In Table 5, I determine if genres are correlated with a higher or lower percentage of women. See Tables 6 and 7 for full summary statistics on the distribution of games across the genres. I regress percent women per team on each broad and specific genre

variable individually controlling for console and year effects. Controlling for console and year effects helps ensure that I do not see a tendency toward a game having more women simply because those types of games became popular toward the later end of my sample where there is a higher mean percentage of women overall.

$$percent\ women\ per\ team = \beta_0 + \beta_1\, genre\ dummies + \beta_2 year\ controls + \beta_3 console\ controls + \varepsilon \quad (5)$$

Within the seven broad category definitions, I find a higher percentage of women to be associated with platformer and games categorized within the other genre and a lower percentage of women to be correlated with racing and sports games. The remainder of the broad categories were not statistically significant.

Within the specific categories, women were more likely to be working on children's, arcade, quiz/ game show, platformer and card games and less likely to be on teams making first person shooter, action oriented racing, baseball, bundles, other shooter and head to head fighting games. For the most part, the allocation of women in the categories seems to fit gender stereotypes such as "women understand children better than men" and "women do not know as much about sports as men". These tendencies are likely some combination of societal influences leading women to be more knowledgeable and interested in stereotypically female topics as well as unconscious bias that leads managers to select more male-heavy teams for stereotypically masculine games.

In Tables 8 and 9 for each genre I attempt to determine whether women are being over- or under-allocated to genres by creating interaction terms with each genre and the

percentage women per team. I use the natural log of revenue and unit sales as well as critic ratings to determine the optimal allocation of women per team by category. I use the natural log of total revenue and unit sales due to the hit nature of video games. Many games flop while a few are great successes. See Chart 3 to see the full distribution of total revenue. Taking the natural log of revenue and unit sales creates a linear regression model that can easily be controlled for variations over time.

$$y = \beta_0 + \beta_1 genre\ dummies\ x\ women + \beta_2\ genre\ dummies + \beta_3 mature \\ \beta_4 number\ of\ creators + \beta_5 average\ team\ experience + + \beta_6 year + \\ \beta_7 console + \varepsilon \quad (6)$$

I run this regression first for the broad genres and again with the specific genres in order to ensure that the effects I see in the specific categories are not due to the broad nature of the initial genres.

Using the broad categories, in Table 8, columns 1 and 2, I find women are under-allocated within the other category and over-allocated in sports and racing games if companies are attempting to maximize revenue or unit sales. Additionally, women are underrepresented in action games if optimizing for revenue and underrepresented in platformer games if companies wish to maximize unit sales. None of the results for female allocation on teams are significant for critic score. These results are worth being skeptical of given the broad nature of the seven categories. One could imagine a circumstance where one sub-category, such as football games, could skew the entire sports genre. Therefore, I examine the same effect using the more specific categories in

order to ensure that no sub-category outliers are leading to significant results for the broader category.

Table 9 shows the results of the specific genre regressions. Within the specific genre categories, I find that women are being over-allocated to fitness, first person shooter, multiple/other sports, other strategy, real time strategy, arcade and sports racing games if firms are attempting to maximize revenue. Women are underrepresented on teams working on head to head fighting and quiz/game show games. If attempting to maximize unit sales, firms are over-hiring women for teams working on first person shooter, multiple/other sports, other strategy and sports racing games and under-hiring women for roles in head to head fighting, quiz/game show and platformer games.

Using critic scores as the dependent variable with the specific genres in column 3 of Table 9, I find women are over-allocated on bundles and casino games. Although both bundles and casinos have less than ten entries in this dataset and therefore I cannot draw broad conclusions from these results.

Having a higher percentage of women on a development team is correlated with higher critic scores in hunting, role playing, tennis and baseball games. This is an indication, at least within the previously listed genres, that increasing the percentage of women on the teams might lead to better games and therefore higher critic scores. While I do not find a direct relationship in this regression between an under-allocation of women in specific game genres leading to decreased revenue, critic scores are integral to the financial success of games. Therefore, if increasing the percentage of women working on certain genres of games leads to higher critic scores, this could also lead to increased revenues.

The results of these regressions partially support Hypothesis 6, regarding firms' tendency to hire too many or too few women for stereotypically female or male genres, respectively. They do not fully support my hypothesis given that there are many categories that are not statistically significant.

E. Genre Effects Before and After 2001

The percentage women per team overall increased in the 2000s period from a mean of 9.58% pre-2001 to 15.35% from 2000 onward. Therefore, the percentage of women on the average team increased by 60% from the period before 2001 to the period after 2000. There are a few reasons to expect to see this kind of shift. One explanation is that more women became involved in the video game industry in the late 1980s, but it took some time for women to gain enough experience to be consistently hired as well as encourage other women to join the industry. Another factor could be that since firms are now attempting to correct for gender bias, they may feel pressure to hire a larger proportion of women even when they find it does not lead to higher revenues. Given the large increase in mean percentage of women per team, I investigate the differences in female team allocation before and after 2001.

Given the shift over time median percent women per team, I conduct the same analysis again, but with pre-2001 and post-2000 interaction terms. The regression is modelled as follows:

$$y = \beta_0 + \beta_1 \textit{ pre-2001 genre dummies } + \beta_2 \textit{ post-2001 genre dummies } x +$$

$$\beta_3 \text{ pre-2001 genre dummies x percent female} + \beta_4 \text{post-2000 genre dummies x percent female} + \beta_5 \text{ mature} + \beta_6 \text{ number of creators} + \beta_7 \text{ average team experience} + \beta_8 \text{year controls} + \beta_9 \text{console controls} + \varepsilon \quad (7)$$

Table 10 denotes the differences I find between gender composition of teams in the broad categories before and after 2001. Women were over-allocated in the sports category pre-2001 and this over-allocation only got worse in the period following 2001 assuming one is optimizing for revenue or unit sales. The increase in the mean percentage of women on sports teams from pre-2001 to post-2000, was lower than the industry average at 38%, suggesting firms may be aware that they are hiring a suboptimal ratio of women, but are under other pressures to continue hiring women. In contrast, women were under-allocated in the platformer genre pre-2001, but this effect seems to stabilize to more appropriate levels in the period after 2001 although the post-2000 coefficient is not statistically significant. The average women per team for platformer games increased just above the industry average at 65%, supporting my theory that firms are actively compensating for the deficit of women in the platformer genre.

The relationships before and after 2001 are more nuanced for the specific categories. To see the full results, reference Table 11. If optimizing for revenue, women appear to be over-allocated on multiple/other sports, sports racing, air combat simulation, and arcade games before 2001. The results are not statistically significant for the period following 2001, but the effects appear to be getting smaller, suggesting firms have optimized for the correct percentage of women per team. Both other sports and sports racing show increases in percent women over the two time periods far below the industry

average at 19% and -7%, respectively. While sports racing and air combat simulations both increase the percentage of women at a rate above the industry average, both average percentages per team are at or below the overall mean of 15%. These adjustments fit with my theory that firms are optimizing for the optimal percentage of women on each team.

Before 2001, women were under-allocated on head to head fighting, quiz/ game show, and platformer games, but companies appear to have optimized for the appropriate number of women in the post-2000 period. Although, again, these results are not statistically significant. Platfomer games increase the rate at which women are hired on the team level by 87% and head to head fight games see an increase in the prevalence of women of a whopping 181%. Quiz games show a 30% decrease in the percentage of women over the two time periods, although the post-2000 mean percentage of women per team is 20%, 5 percentage points above the mean. While I do not first a statistically significant result before 2001, after 2000, women are being over-hired for first person shooter and football games. First person shooter games have experienced an increase in women per team of 86%, which is above the typical increase for the rest of the sample. Football games decreased in the mean percent women per team by about 15%. While the mean percentage of women per team for both genres remains below the average, firms should hire fewer women on these teams in order to maximize revenue.

The results optimizing for maximum unit sales show that women were overrepresented on air combat simulations, soccer, multiple/ other sports, sports racing and arcade games before 2001. However, after 2001 all genres show insignificant results. These results match my previous assertion that firms may be attempting to optimize for

the appropriate number of female participants. Women are underrepresented in head to head fighting, quiz/ game show and platformer games, but the post-2000 period is insignificant. While the result from pre-2001 is not significant, I find women are being hired too frequently for other football and strategy games in the period following 2000.

If aiming to maximize critic score, women were underrepresented on platformer teams pre-2001, but the effect does not appear to continue into the post-2000 period. In terms of the specific categories, women were over-allocated in casino and sports racing games pre-2001 and the effects fade in the following period. Women are underrepresented on space combat, tennis, role playing, head to head fighting and baseball game teams pre-2001, but the effect is not significant in the post-2000 period. All of the previously listed genres increased the mean percentage of women much faster than the rest of the industry, suggesting firms were actively attempting to compensate for the gender deficit. Women are over-allocated in the music/dancing genre post-2000, and has positive but insignificant results for the period before 2001. In the case of platformer games, women are under-allocated pre-2001, but over-allocated post-2001, suggesting the firms over-corrected for gender bias in this genre. The results for puzzle games show that women are underrepresented in the period after 2000, suggesting firms should hire a higher proportion of women on puzzle game teams.

These results support aspects of Hypothesis 6 regarding firm adaption to ideal percentages of women per team since 2000 with the exception of first person shooter, other strategy, and puzzle games.

VII. Conclusion

In this paper I examine the relationship between the percentage of women on video game production teams and various game characteristics as well as sales and revenue. I find women are more likely to be working on games in stereotypically feminine or neutral subject matters, such as children's and platformer games and less likely to be working on games in stereotypically male subject matters, such as sports and racing. However, I find women are over-allocated in sports and racing games, suggesting that there should be even fewer women hired to work on those kinds of games if firms are attempting to maximize revenues. That said there are some stereotypically masculine genres, such as head to head fighting, where my findings suggest firms should increase the rate of hiring women in order to maximize revenues. If firms wish to increase critic scores, and indirectly increase revenues, more women should be hired on hunting, role playing, tennis and baseball games.

While the correlation between the percentage of women on video game production teams and revenue or sales is inconclusive, I do find many other relationships between women and revenue. I find firms consistently hire too many or too few women for genres before 2001 in terms of maximizing revenues, unit sales and critic scores, but in the following period it appears firms optimized for the appropriate percentage of women. This suggests firms have learned from past experiences and the extent to which gender diversity adds value to specific teams. The games which remain in an suboptimal state are first person shooter and other strategy games, where firms should hire fewer women and puzzle games where firms should hire additional women. It is also possible that there are long term benefits to having more women on a particular team even if it

does not immediately lead to additional revenues. For example, there are currently no large firms which serve primarily a female audience.[3] Therefore, a firm might be able to create a new market demographic within console gaming with sufficient funding and strong marketing.

I determine that as the percentage of women on a team increases, the likelihood that the games produced are non-violent and have playable female leads also increases, confirming my initial hypotheses. This finding fits with my initial research that suggests that people bring their own experiences into the innovation process and are likely to reproduce aspects of themselves and their lives in their work. I do not see any relationship between the percentage of women on a team and critic score. However, it would be valuable to examine more deeply the demographics of reviewers and how those demographics affect reviews.

I find teams with higher percentages of women are less likely to produce games in less common genres. While this finding does not support my initial hypothesis, possible explanations include that women are less likely to be trusted to work on games that are pushing boundaries if the industry is systemically sexist and women are perceived as being less competent video game creators. Additionally, it could be that women are self-selecting to work on games in genres that are more established. There could be many reasons for that kind of risk-averse behavior including women wanting to work on games that have a better chance of making it big, trying to develop their reputation by working on games that fit within commonly understood backgrounds, or factors external to the game development community that are leading women to make less risky decisions than

[3] Although there are some niche companies, such as Her Interactive, Silicon Sisters and Purple Moon that do explicitly address the female market

men. One could imagine a multitude of other reasons why having more women on a particular team might make a game less likely to fit within a less well-trodden category, but I would like to emphasize that it is unlikely that the reason is that women are inherently less creative or risk-taking, but rather there are likely larger forces at play both within and beyond the gaming industry. In a future study, it would be valuable to develop a more nuanced measure of uniqueness of games in order to better determine the extent to which women are involved in producing unique games. It would also be beneficial to measure creators' past experience developing unique games when conducting this analysis.

One limitation to this study is the inability to determine where in the creative process an individual is hired onto the game development team. There are likely some members who are more involved in the development of the plot and characters of a game than others. That said, like any other creative endeavor, the game development process is iterative. Therefore, there are typically opportunities for members involved in a variety of roles in the creative development process to provide feedback, especially given the small size of many teams.

In the future, it would be relevant to conduct a similar study from the firm perspective, to determine if certain firms create more diverse games than others and if there are any characteristics that those firms have in common, such as C-suite or board diversity. Another potential new avenue of study would be to use the Storz (2012) method of using the creation of new genres as radical innovations and examining the extent to which women or other diverse demographics affect the likelihood of creating a new genre. One limitation of this kind of study is that it would necessitate having a

dataset with complete information for every game ever created, which would be logistically difficult.

Additionally, it would be useful to analyze diversity characteristics of creators beyond gender, such as race, age, education and sexuality. Once a more complete methodology has been developed for quantifying the amount and type of innovation, these findings and methodologies can readily be applied to other industries.

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IX. Tables

Table 1: Descriptive Statistics

Variable Name	Definition	Mean	Std. Dev.	Min	Max
Percent Women	The percentage of women on the team	12%	14%	0%	100%
Non-violent	Dummy = 1 if game is non-violent	62%	49%	0%	100%
Playable Female Lead	Dummy = 1 if game has a playable female lead	12%	40%	0%	100%
Critic Score	Critic score on a scale of 1-10	5.81	2.64	0.00	9.70
Mature	Dummy = 1 If a game is rated as mature by the Entertainment Software Rating Board	33%	221%	0%	100%
Unique	Dummy = 1 if game not in action or platformer category	50%	33%	0%	100%
Number of Creators	Number of creators on the team that produced this game	18.27	0.49	1.00	208.00
Number of Women	Number of women on the team that produced this game	2.95	558.52	0.00	44.00
One Woman	Dummy = 1 if there is at least one woman on the production team	61%	49%	0%	100%
Total Experience	The sum of the number of games each creator on the team has produced prior to publishing this game	303.99	559%	1.00	6031.00
Average Experience	Average number of games each creator has produced prior to publishing this game	13.06	10.12	1.00	168.33
Total Revenue	Game total revenue	11000000	126.61	6.11	1560000000
Log Total Revenue	Log of game's total revenue	14.44	40100000	1.81	21.17
Sales	Game total units sold	167561.30	2.43	2.00	8111735.00
Log sales	Log of game's total sales	10.56	391959.50	0.69	15.91

Table 2: Revenue and Sales

	A. Log Total Revenue		*B. Log Total Unit Sales*	
	(1)	(2)	(3)	(4)
Percent women per team	2.47***	0.79*	2.09***	0.79*
Percent women per team squared		-1.67**		-1.60**
Playable female lead		0.08		0.06
Non-violent		0.16**		0.13**
Critic Review		0.17***		0.14***
Mature Rating		0.33***		0.28***
Number of creators		0.02***		0.01***
Average team experience		0.03***		0.03***

Notes: (2) and (4) include controls for year and console effects

Table 3: Critic Scores Given Female Participation

	Critic Review		
	(1)	(2)	(3)
Percent women per team	1.81***	0.88**	0.27
Mature Rating		0.15***	0.19
Number of creators		0.02***	0.01**
Average team experience		0.02***	0.02***

Notes: (3) includes controls for console and year effects

Table 4: Game Characteristics

	A. Unique		*B. Playable female lead*		*C. Non-violent*		*D. Mature*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Percent women per team	-0.35**	-0.44**	0.78***	0.61**	0.71	0.36*	0.64**	-0.31
Number of creators		-0.00***		-0.00**		-0.00*		0.01**
Average team experience		-0.00		0.00		0.01**		-0.00

Notes: (2), (4), (6) and (8) include controls for year, genre and console effects. All regressions follow a probit model.

Table 5: Female Allocation by Genre

	Broad Categories	Specific Categories
	A. Action	A. First Person Shooter
	0.05	-0.05*
	B. First Person Shooter	B. Action Oriented Racing
	-0.05	-0.06*
	C. Platformer	C. Action Driving Hybrid
	0.13**	-0.00
	D. Racing	D. Adult
	-0.08*	-0.00
	E. Role Playing Games	E. Air Combat Simulation
	-0.02	-0.02
	F. Sports	F. Baseball
	-0.09*	-0.04***
	G. Other	G. Billiards
	0.06**	-0.01
		H. Bowling
		0.00
		I. Boxing
		-0.00
Percent women per team		J. Bundles
		-0.01*
		K. Cardgames
		0.01***
		L. Casino
		0.01
		M. Children
		0.07***
		N. Arcade
		0.05***
		O. Combat Racing
		0.00
		P. Extreme Sports
		0.01
		Q. Head to Head Fighting
		-0.08***
		R. Fishing
		-0.01
		S. Fitness
		-0.00
		T. Flight Simulations
		0.01

Table continued on following page

	U. Football
	-0.02
	V. General Action
	0.04
	W. General Adventure
	0.05
	X. Golf
	-0.01
	Y. Hockey
	-0.01
	Z. Hunting
	0.00
	AA. Life Simulations
	0.01
	AB. Mechanized Shooter
	-0.02
	AC. MMORPG
	-0.00
	AD. Other Sports
	0.02
Percent women per team	AE. Music/Dance
	0.01
	AF. Other
	-0.00
	AG. Other Shooter
	-0.06*
	AH. Other Strategy
	-0.02
	AI. Party Games
	-0.00
	AJ. Pinball
	0.01
	AK. Platformer
	0.25***
	AL. Puzzle
	-0.03
	AM. Quiz/ Game Show
	0.03***
	AN. - 0.01
	AO. Role Playing Game
	-0.03

Table continued on following page

	AP. Soccer
	-0.01
	AQ. Space Combat
	-0.00
	AR. Sports Racing
	-0.01
	AS. Stelth Action
	-0.01
	AT. Survival Horror
	0.00
Percent women per team	AU. Tennis
	-0.01
	AV. Board Games
	-0.00
	AW. Uncategorized
	0.01
	AX. Virtual Pets
	-0.00
	AY. Wrestling
	0.01

Table 6: Broad Genre Summary Statistics

	Frequency	*Percent*
Sports	400	14.26%
Platformer	917	32.69%
Action	566	20.18%
First person shooter	190	6.77%
Racing	318	11.34%
Other	196	6.99%
Role playing games	218	7.77%

Table 7: Specific Genre Summary Statistics

	Frequency	*Percent*
First person shooter	123	4.39%
Action oriented racing	185	6.60%
Action driving hybrid	14	0.50%
Adult	2	0.07%
Aircombat	28	1.00%
Baseball	28	1.00%
Basketball	48	1.71%
Billiards	7	0.25%
Bowling	8	0.29%
Boxing	23	0.82%
Bundles	5	0.18%
Casino	8	0.29%
Combat racing	61	2.17%
Extreme sports	72	2.57%
Fishing	15	0.53%
Fitness	3	0.11%
Golf	20	0.71%
Hockey	26	0.93%
Hunting	2	0.07%
Life simulation	26	0.93%
Mechanized shooter	45	1.60%
Multiple/other sports	36	1.28%
Music/dance	30	1.07%
Other Shooter	162	5.78%
Other strategy	44	1.57%
Party games	13	0.46%
Pinball	15	0.53%
Real time strategy	22	0.78%
Role playing game	191	6.81%
Soccer	24	0.86%
Space combat	19	0.68%
Sports racing	58	2.07%
Stealth action	27	0.96%
Survival horror	51	1.82%
Tennis	22	0.78%

Table continued on following page

Boardgames	3	0.11%
Virtual pets	3	0.11%
Wrestling	20	0.71%
Puzzle	66	2.35%
Uncategorized	91	3.24%
Football	31	1.11%
Flight simulations	12	0.43%
Head to head fighting	130	4.63%
Squad combat	19	0.78%
Quiz/game show	11	0.39%
Platformer	427	15.22%
General adventure	145	5.17%
General action	284	10.12%
Arcade	42	1.50%
Children	49	1.75%
Cardgames	2	0.07%

Table 8: Effects of Allocation of Women by Broad Genre

	A. Log Total Revenue	*B. Log Total Unit Sales*	*C. Critic Score*
	(1)	(2)	(3)
Sports x women	-2.14***	-1.94***	-0.27
Sports	0.30	0.39**	-0.62**
Platformer x women	0.99	0.78**	0.71
Platformer	-0.51***	-0.35*	-0.38
Action x women	0.74**	-0.81	0.70
Action	-0.40**	-0.28	-0.59**
First person shooter x women	-0.2	-0.84	-1.68
Racing x women	-1.37*	-1.27*	-0.42
Racing	-0.06	0.06	-0.53*
Other x women	1.67**	1.73**	-0.35
Other	-0.31	-0.24	-0.74**
Mature Rating	0.38***	0.33**	0.14
Number of creators	0.02***	0.02***	0.01**
Average team experience	0.04***	0.03***	0.02***

Notes: (1), (2) and (3) include controls for year and console effects

Table 9: Effects of Allocation of Women by Specific Genre

	A. Log Total Revenue	*B. Log Total Unit Sales*	*C. Critic Score*
	(1)	(2)	(3)
First person shooter x women	-2.75**	-2.58*	-0.22
First person shooter	0.02	-0.06	0.32
Action oriented racing x women	-0.78	-0.49	0.43
Action oriented racing	-0.49**	-0.36*	-0.33
Action driving hybrid x women	1.51	0.68	-0.70
Action driving hybrid	0.83	0.84	0.76
Adult x women	-1.51	-1.24	8.47
Adult	-0.25	0.70	-2.01
Aircombat simulation x women	-3.52	-3.04	1.84
Aircombat simulation	0.11	0.04	-0.34
Billiards x women	-4.27	-1.01	-0.94
Billiards	0.34	-0.40	-0.74
Bowling x women	-4.13	-3.72	1.27
Bowling	-0.43	-0.01	-0.67
Bundles x women	-15.29	-15.85	-67.73**
Bundles	-0.38	0.08	1.48
Casino x women	-2.39	-0.73	-15.92**
Casino	0.61	0.63	2.00
Combat racing x women	0.06	-0.53	0.54
Combat racing	-0.41	-0.20	-0.63
Extreme sports x women	-0.59	-0.76	-2.17
Extreme sports	-0.42	-0.21	0.40
Fishing x women	-0.24	2.14	4.65
Fishing	0.36	-0.23	-1.51
Fitness x women	-33.69**	-24.81	-31.60
Fitness	7.00**	5.35**	3.70
Golf x women	2.14	2.11	9.22
Golf	-0.77	-0.68	-1.24*
Hockey x women	-1.03	-1.15	1.49
Hockey	-0.22	-0.13	0.24
Hunting x women	11.38	11.49	31.79**
Hunting	-2.98	-2.80	-11.40***
Life simulation x women	-1.44	-1.28	-2.60
Life simulation	-0.34	-0.41	0.94
Mechanized shooter x women	-1.84	-1.53	-2.93
Mechanized shooter	-0.48	-0.45	0.40
Multiple/other sports x women	-2.80**	-2.43*	-2.56
Multiple/other sports	-0.23	-0.28	-0.09
Music/dance x women	1.03	1.40	-3.21
Music/dance	-0.20	-0.30	0.89

Table continued on following page

Other strategy x women	-3.24*	-4.60**	-0.75
Other strategy	1.47***	-1.54***	0.26
Party games x women	6.10	5.45	-0.04
Party games	-0.65	-0.42	-0.81
Pinball x women	-1.60	-1.41	-0.89
Pinball	-0.12	0.13	0.39
Real time strategy x women	-5.87*	-5.47	-7.16
Real time strategy	0.00	-0.12	1.54**
Role playing game x women	0.51	0.55	2.85**
Role playing game	-0.32	-0.47	0.20
Soccer x women	0.85	0.16	2.99
Soccer	-1.27***	-1.14***	-0.28
Space combat x women	3.07	1.64	5.26
Space combat	-1.21***	-0.84*	-0.55
Sports racing x women	-5.48***	-5.01**	-3.32
Sports racing	0.41	0.35	0.83**
Stealth action x women	-4.17	-4.37	0.89
Stealth action	0.30	0.41	0.99
Survival horror x women	-1.57	-0.50	-1.73
Survival horror	-0.45	0.50	0.62
Tennis x women	-0.69	-1.32	6.83**
Tennis	-0.69	0.13	-1.94***
Boardgames x women	4.13	2.49	3.16
Boardgames	-1.12	-0.84	1.08
Virtual pets x women	8.30	-0.21	2.67
Virtual pets	-0.91	-0.21	0.67
Wrestling x women	-1.96	-1.55	0.71
Wrestling	0.37	0.27	-0.46
Puzzle x women	-0.53	-0.76	2.16
Puzzle	-1.10***	-0.72***	-0.40
Uncategorized x women	0.78	0.98	-0.34
Uncategorized	-3.52***	-3.56***	-0.47
Other shooter x women	0.01	0.04	-1.99
Other shooter	-0.91***	-0.76***	0.06
Football x women	-0.70	-1.62	1.93
Football	0.79**	0.95***	1.93
Flight simulations x women	7.90	9.91	0.40
Flight simulations	-0.68	-0.89	0.56
Head to head fighting x women	2.40**	2.44**	1.74
Head to head fighting	-0.67	-0.65***	-0.31
Baseball x women	-1.60	-3.32	15.47**
Baseball	0.34	0.36	-0.56

Table continued on following page

Squad combat x women	2.30	1.76	-3.35
Squad combat	0.13	0.25	0.49
Quiz/game show x women	6.01**	6.25**	0.90
Quiz/game show	1.27	-1.14	0.52
Platformer x women	1.27**	1.32**	0.87
Platformer	-0.73***	-5.78***	0.16
General adventure x women	-0.00	-1.27	0.67
General adventure	-0.73***	-0.65***	-0.15
General action x women	-.79	0.39	1.51
General action	-0.71***	-0.59***	-0.50
Arcade x women	-1.92**	-1.81	1.23
Arcade	0.40	0.69**	1.23
Children x women	1.47	0.74	1.22
Children	0.26	0.34	-0.96*
Cardgames x women	-1.99	-1.98	-1.10
Cardgames	-2.03	-2.23	1.65
Mature Rating	.27**	0.28**	0.15
Number of creators	0.02***	0.02***	0.01*
Average team experience	0.03***	0.03***	0.02***

Notes: (1), (2) and (3) include controls for year and console effects

Table 10: Time Effects of Allocation of Women by Broad Genre

	A. Log Total Revenue (1)	*B. Log Total Unit Sales* (2)	*C. Critic Score* (3)	*Mean % Women per Team*
Pre-2001 sports x women	-1.49**	-1.47**	0.18	9.29%
Post-2001 sports x women	-3.77**	-3.16**	-2.05	12.86%
Pre-2001 platformer x women	1.03**	1.11**	1.16**	9.85%
Post-2001 platformer x women	-0.28	-0.36	-0.64	16.27%
Pre-2001 action x women	-0.20	-0.35	0.69	9.79%
Post-2001 action x women	-0.33	-1.36	-0.06	16.66%
Pre-2001 first person shooter x women	-1.61	-1.29	-1.50	9.09%
Post-2001 first person shooter x women	-0.64	-0.52	-1.89	14.45%
Pre-2001 racing x women	-0.85	-0.87	0.36	8.70%
Post-2001 racing x women	-1.29	-1.31	-1.03	14.19%
Pre-2001 role playing game x women	-0.15	-0.03	2.58	10.37%
Post-2001 role playing game x women	-1.78	-1.95	-0.23	14.60%
Mature Rating	0.33**	.32**	0.13	
Number of creators	0.02***	0.02***	0.01**	
Average team experience	0.04***	0.03***	0.02***	

Notes: (1), (2) and (3) include controls for year, genre and console effects. The rightmost column contains the mean percentage of women per team for each genre.

Table 11: Time Effects of Allocation of Women by Specific Genre

	A. Log Total Revenue (1)	*B. Log Total Unit Sales* (2)	*C. Critic Score* (3)	*Mean % Women per Team*
Pre-2001 First person shooter x women	-2.41	-2.26	0.45	0.0770
Post-2001 First person shooter x women	-4.42*	-3.65	-1.31	14.33%
Pre-2001 Action oriented racing x women	0.02	0.16	1.50	85.50%
Post-2001 Action oriented racing x women	-0.55	-0.51	-0.08	13.61%
Pre-2001 Aircombat simulation x women	-7.00*	-6.76*	0.19	5.94%
Post-2001 Aircombat simulation x women	-0.39	3.48	-2.06	11.95%
Pre-2001 Billiards x women	-5.32	-1.35	-1.80	9.58%
Post-2001 Billiards x women	-0.07	-1.97	5.34	6.67%
Pre-2001 Bowling x women	-9.35	-10.96	2.23	8.75%
Post-2001 Bowling x women	-4.77	-4.85	1.44	18.75%
Pre-2001 Casino x women	-7.81	-1.05	-28.47***	10.25%
Post-2001 Casino x women	8.98	6.51	0.58	20.95%
Pre-2001 Combat racing x women	2.31	1.71	3.70	11.19%
Post-2001 Combat racing x women	-2.47	-3.13	-3.43	14.13%
Pre-2001 Extreme sports x women	2.12	1.89	-2.42	12.15%
Post-2001 Extreme sports x women	-2.66	-3.01	-0.95	15.66%
Pre-2001 Fishing x women	-1.04	1.73	2.59	8.86%
Post-2001 Fishing x women	11.72	10.04	35.12	8.19%
Pre-2001 Golf x women	2.28	1.64	10.17	6.48%
Post-2001 Golf x women	-2.60	-1.89	1.94	10.24%
Pre-2001 Hockey x women	0.08	-0.29	2.65	8.94%
Post-2001 Hockey x women	-14.49	10.62	-14.26	10.65%
Pre-2001 Life simulation x women	-0.50	-0.33	-1.24	20.57%
Post-2001 Life simulation x women	1.40	1.51	-8.41	11.77%
Pre-2001 Mechanized shooter x women	-1.56	-0.94	-3.63	10.09%
Post-2001 Mechanized shooter x women	-2.70	3.94	-0.21	8.13%
Pre-2001 Multiple/other sports x women	-3.07**	-3.36**	0.24	14.17%
Post-2001 Multiple/other sports x women	-3.54	-1.13	-0.16	16.88%
Pre-2001 Music/dance x women	0.37	1.08	4.12	21.24%
Post-2001 Music/dance x women	1.73	1.77	-7.25*	13.96%
Pre-2001 Other strategy x women	-1.62	-1.71	1.44	8.45%
Post-2001 Other strategy x women	-3	-9.28**	-8.30	10.02%
Pre-2001 Pinball x women	-1.69	-1.44	-1.20	20.74%
Post-2001 Pinball x women	-3.97	-2.87	2.31	10.06%
Pre-2001 Real time strategy x women	-2.55	-2.31	-10.26	6.69%
Post-2001 Real time strategy x women	-5.72	-5.67	-2.90	14.15%
Pre-2001 Role playing game x women	1.19	1.16	4.38*	9.27%
Post-2001 Role playing game x women	-2.11	-2.36	1.30	15.08%
Pre-2001 Soccer x women	-0.33	-0.82	3.12	5.59%
Post-2001 Soccer x women	-0.9	0.78	-6.69	15.06%
Pre-2001 Space combat x women	3.89	2.59	5.97*	10.84%
Post-2001 Space combat x women	-1.2	-3.50	1.84	10.39%
Pre-2001 Sports racing x women	-7.64***	-7.60***	-6.20*	7.89%
Post-2001 Sports racing x women	-3.26	-2.81	-2.03	15.22%
Pre-2001 Stealth action x women	5.74	3.99	13.61	6.73%
Post-2001 Stealth action x women	-4.19	-4.35	-6.15	13.61%
Pre-2001 Survival horror x women	0.85	0.55	-0.85	14.30%
Post-2001 Survival horror x women	-4.18	-3.43	-2.68	14.98%
Pre-2001 Tennis x women	2.76	2.18	15.04***	5.43%
Post-2001 Tennis x women	-2.42	-2.72	-1.50	13.48%
Pre-2001 Wrestling x women	-1.65	-1.12	-1.31	41.67%
Post-2001 Wrestling x women	-0.61	-0.33	4.63	11.69%
Pre-2001 Puzzle x women	-1.3	-1.19	0.02	9.77%
Post-2001 Puzzle x women	1.62	0.15	10.63**	8.01%
Pre-2001 Other shooter x women	0.07	0.23	-2.54	7.30%
Post-2001 Other shooter x women	-0.71	-1.27	1.16	13.13%
Pre-2001 Football x women	0.61	-0.43	3.40	8.45%
Post-2001 Football x women	-13.09*	-12.88*	-7.76	7.31%

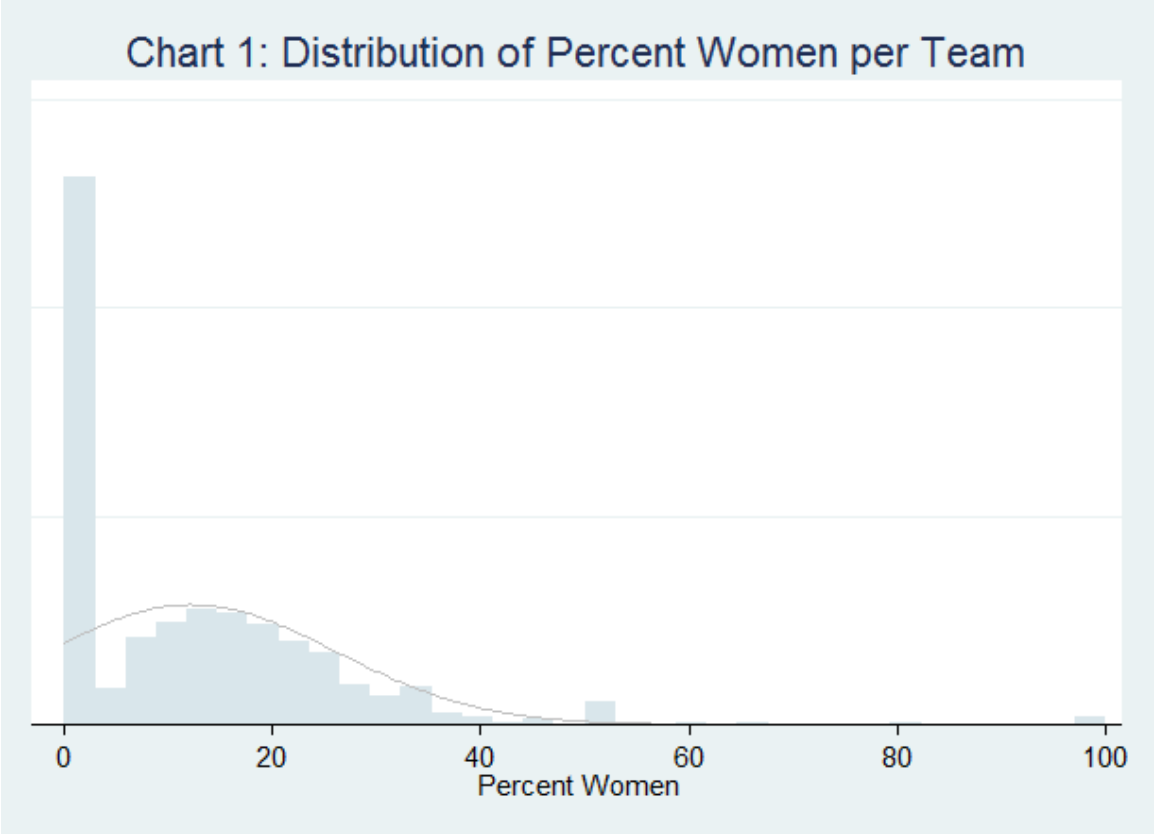
Table continued on following page

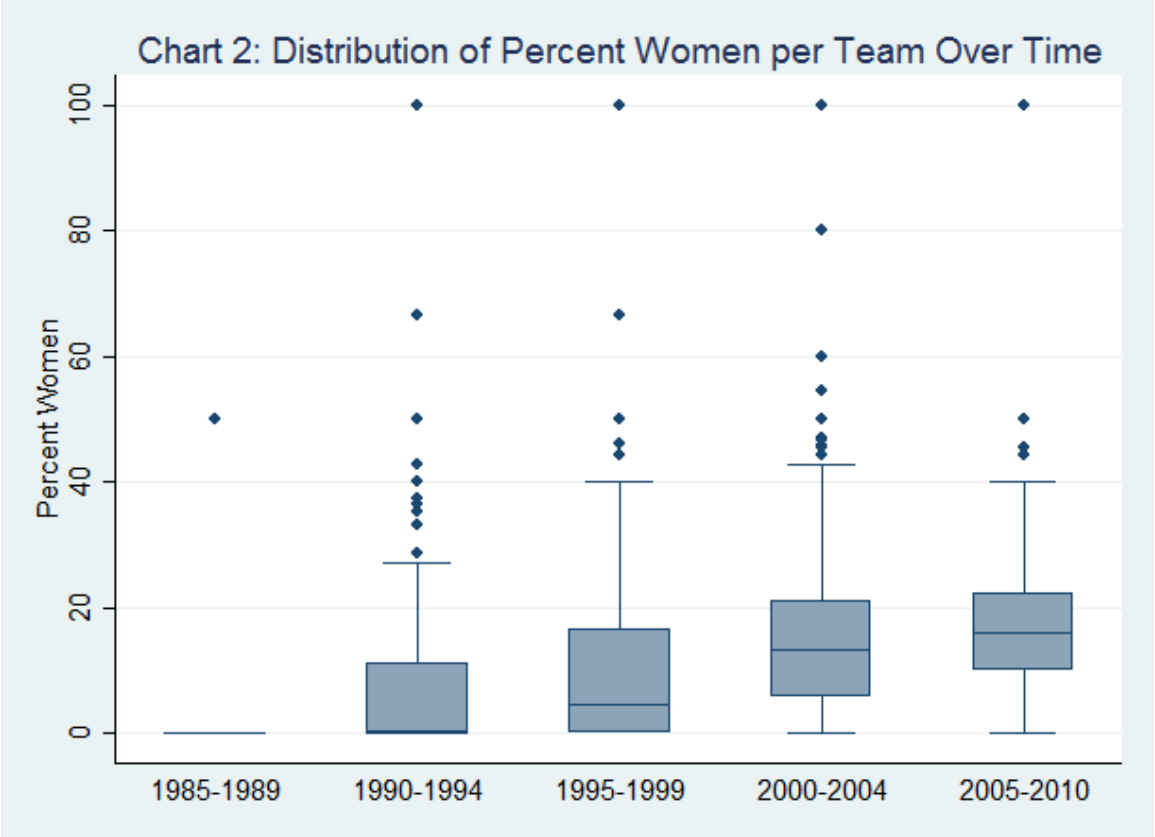
Pre-2001 Head to head fighting x women	3.88***	3.91***	4.22**	5.61%
Post-2001 Head to head fighting x women	-2.24	-1.94	-4.43	15.76%
Pre-2001 Baseball x women	1.68	-1.34	29.09*	0.91%
Post-2001 Baseball x women	-11.26	-9.47	21.77	9.68%
Pre-2001 Squad combat x women	-5.99	-10.30	6.48	20.14%
Post-2001 Squad combat x women	2.95	2.76	-4.30	19.60%
Pre-2001 Quiz/game show x women	9.19***	9.86***	-3.46	30.63%
Post-2001 Quiz/game show x women	0.29	-0.37	7.53	21.66%
Pre-2001 Platformer x women	1.76***	1.80***	1.83***	11.01%
Post-2001 Platformer x women	-0.99	-0.82	-2.45*	20.62%
Pre-2001 General adventure x women	-1.04	-1.18	-0.99	10.59%
Post-2001 General adventure x women	-0.18	2.19	0.99	18.49%
Pre-2001 General action x women	0.06	0.28	1.12	10.34%
Post-2001 General action x women	0.6	-0.06	1.16	16.92%
Pre-2001 Arcade x women	-2.18**	-2.11**	1.00	17.78%
Post-2001 Arcade x women	-0.15	0.32	3.14	16.66%
Pre-2001 Children x women	0.65	0.66	0.43	13.26%
Post-2001 Children x women	3.67	2.94	5.90	25.85%
Mature Rating	0.25**	0.26**	0.10	
Number of creators	0.02***	0.02***	0.01***	
Average team experience	0.03***	0.03***	0.03***	

Notes: (1), (2) and (3) include controls for year and console effects

X. Charts

histogram pct_women, normal





Notes: The two boxes for each range of years signify the interquartile range - the values that signify the range of the middle fifty percent of the data. The line in the boxes marks the median value for that range of years. The whiskers extend to the 1.5 interquartile range from the nearer quartile, with quartile 1 (Q1) signifying the 25% point and quartile 3 (Q3) signifying, the 75% point (i.e.Q3+1.5(Q3-Q1) and Q1-1.5(Q3-Q1)). The dots represent outliers beyond the whiskers.

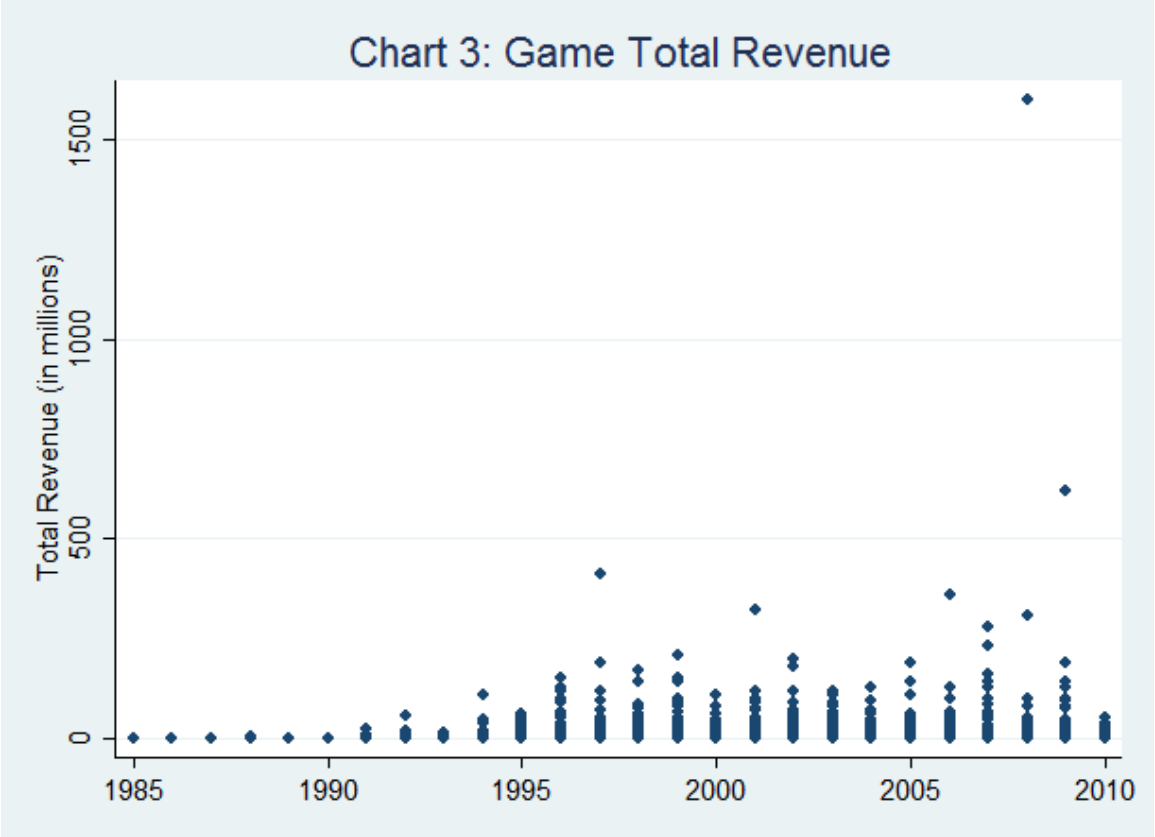


Chart 3: Game Total Revenue
Total Revenue (in millions)
0
500
1000
1500
1985
1990
1995
2000
2005
2010