

A Microeconomic Analysis of the Competition in the Home Console Videogame Industry

By

Alexandre Moreira Nascimento

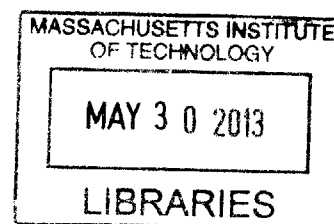
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ABSTRACT

The \$70 billion and 40 year old [83] traditional videogame industry is a fascinating example of intense and dynamic competition, where over eight generations new players could enter the market and reach the leadership while old leaders were pushed out of the market. The fierce competition has been pushing all the manufacturers and game developers to the constant cutting-edge innovation to keep themselves in the market even sometimes literally paying to be there. This work will focus on reviewing the competition in the eight videogame consoles generations, analyzing the seventh generation results from the console and game sales and understanding the factors that influence the competition. For supporting the analysis, this study will use a Microeconomics Dynamic Model for Platform Competition on the current generation market data.

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Introduction

Videogames represent a serious business for America's economy (1). According to Crandall and Gregory (1), "every dollar spent on entertainment software in the United States contributes directly to the GDP". The size of the game market worldwide in 2012 was estimated as to be more than \$100 billion, where traditional videogames market was estimated in a total of \$70 billion, online games (e.g. Facebook games) and subscriptions were around \$24 billion, and mobile games for smart phones and tablets around \$8.5 billion (2).

However, this direct contribution to the nation's output and the market size do not reflect the total contribution of the videogame market industry. Crandall and Gregory (1) point out that the purchase of a videogame stimulates the acquisition of complementary products such as higher definition televisions, videogame accessories, higher internet bandwidth, etc. Besides those directly related products and services, the console's "game hits" also stimulate the purchase of old economy goods such as related toys and clothes.

Other two sources of economic value triggered by the videogame industry are described by Crandall and Gregory (1): investment in human capital and R&D. The game developers make significant investments in specialized human capital and other specialized inputs for building a videogame. The "Global Entertainment and Media Outlook: 2005-2009" from Price Waterhouse Coopers estimated that each million dollars in console game sales had a multiplier effect of 17,595 jobs. Huge investments are also made in R&D for developing more innovative games to attract the consumers with higher expectations. That pushes the consoles manufacturers to develop new, even more powerful generations of game consoles, accelerating the market introduction of the cutting-edge technologies such as main and video processors, storage devices, and so on. Those benefits are enjoyed by other sectors of the economy such as military, healthcare and corporate training.

These dynamics close a reinforcing loop that drives the sector and generates a fierce competition among the players. In fact, the videogame consoles manufacturers are subjected to a highly cyclical demand, with sales fluctuating according to the life cycle of succeeding generations of game machines, for example making annual growth rates to be ranged from as high as 42% to as low as -19%. Those cycles and the intense competition for supremacy in each of the eight generations of videogames have been making very successful companies leave the market while newcomers take their space.

First, this work describes the history of the home console videogame industry and the industry components. In the sequence, it proposes a microeconomic model and tests it using data from the sixth generation of consoles. Then, some counterfactual analysis is done to test the model and understand possible scenarios' outcomes. Finally, some conclusions are presented.

Home Console Videogame Competition Background

The first videogame console, the Brown Box (Figure 1), was created in 1967 by a German engineer called Ralph Baer and his coworkers. They built a vacuum-tube circuit that connects to a TV to show two squares on the screen that could be controlled by the users. Since the game's goal was to chase each other, they named it "chase game". Since then, they have developed 12 games in total for working in the Brown Box console (3) (4) making it possible to play some sports on the TV like Ping-Pong, volleyball, handball, soccer, hockey as well as a "shooting targets" game using a light-gun made with a real rifle (4) (5). The inventors tried for two years to introduce the product into the Cable TV industry without success. Then, they decided to offer the innovation to the TV manufacturers in the U.S., among them Magnavox, that took a license in 1971. In the following year, Magnavox launched their Odyssey Home Video Game, a manufactured version of the "Brown-Box" starting the home console videogame market (5). But TV dealers failed to see the potential of the new device. Also a false rumor that Odyssey only worked on Magnavox TVs damaged the popularity of the console (4). However it has sold 100,000 units in its first year and 350,000 units in all (5).

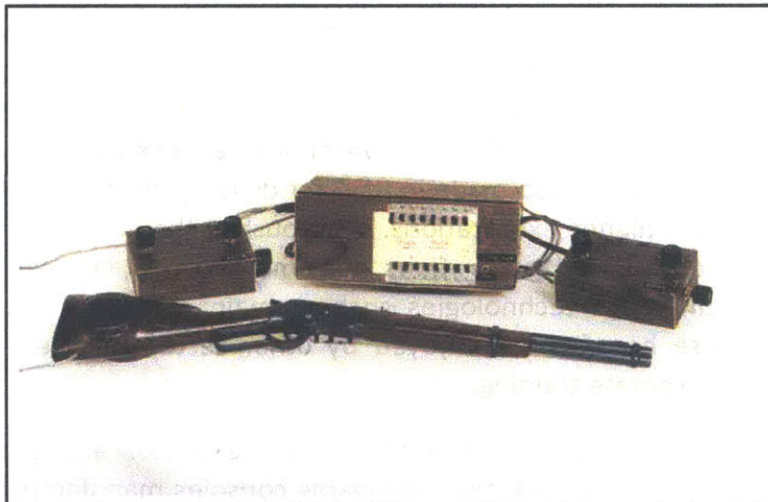


Figure 1 - The "Brown-Box" multi-game unit with its target shooting "rifle"- Source: (5)

In the same year, 1972, Nolan Bushnell founded Atari (4). According to Baer (5) in May of that same year Nolan had played the Odyssey ping-pong game at a Magnavox dealership demo. Months later some companies launched an arcade version of the "pong" and in 1975 Atari launched its home version of Pong in Sears' stores under the Sears Tele-Games label. The system was a success in introducing the home console videogames to the masses and making the households aware of the Atari brand (4).

The competition has been intense since the beginning of this industry in 1976. Magnavox sued Atari and other Pong Arcade game producers for patent infringement because they had not licensed the videogame technology from Magnavox which had the rights to distribute the licenses. In 1977, the judged decided in favor of the patent infringement (5). While still in the

trial, Atari decided to license the Magnavox technology (5) and in 1977, after selling the company to Warner Communications, launched the Atari 2600 VCS, a cartridge-based system, making it possible to play multiple games. Atari 2600 became a big success with games like Space Invaders, Missile Command and Combat (4).

In 1980, Mattel Toys introduced a new platform in the U.S. with a total of 19 games (6) featuring better graphics than Atari 2600 and the first synthesized voices in videogames (4) selling 175,000 units in its first year (6). This was the beginning of the 2nd generation of the videogame consoles. After an extensive ad campaign in 1981 announcing its graphic superiority over Atari platform, the News started to cover the "videogame war". Even with a console price of \$300, while Atari 2600's price was \$150, Mattel sold 850,000 units of Intellivision in 1981.

In 1982, the videogame industry reached the value of \$1.5 billion and Mattel Electronics, a spin-off of Mattel Toys, reached a profit of \$100 million and more than 2 million homes with their platform. The companies publishing Atari 2600 cartridges also started to release games for Intellivision (6). In the same year, ColecoVision, a new videogame console with much higher resolution and popular arcade game titles was introduced in the market and took away the sales from Intellivision and Atari (6).

In 1983, the competition became even more intense. Mattel launched a cheaper version of Intellivision for \$150 and introduced a module for making their console runs the Atari 2600 cartridges. Meanwhile, Atari launched a new console, the Atari 5200, and a new competitor called Vectrex entered in the market raising the intensity of the competition.

The huge intensity of the competition made the videogame market crashes between 1983 and 1984. While the game publishers rushed to launch the games as faster as they could, the majority was unlicensed, flooding the market with poor quality (7), crudely manufactured and uninspired cheap games (8). In fact, while Coughlan (8) pointed out that *"manufacturers and software publishers thought they could sustain the business by producing as many titles as they could churn out, with little regard for quality."*; Bushnell, Atari's former owner, noted that Atari *"had been very successful, but nobody really knew why. All they were doing was pumping out cartridges and selling millions of units but there was no strategic thinking going on."* (8). As a result, the players accounted huge losses between 1983 and 1984, what spread panic and resulted in the bankruptcy of many game companies. That put an end in the second generation of the videogame consoles (4) with Atari 2600 platform as the winner. In fact, while Intellivision has sold a total of 3 million units including both versions and ColecoVision sold 6 million units, they sold together less than a third part of the Atari 2600's 30 million units sold (7).

The third generation of videogame consoles (the 8-bit era) was started by an originally Japanese playing cards company founded in 1889 called Nintendo. They introduced the Famicom in Japan (8) and the Nintendo Entertainment System (NES) in the U.S. (4) in 1983 and 1985, respectively. Their platform had a much better graphics resolution and supported a higher number of colors when compared to the previous platforms. After an initial period of skepticism of the retail because of the crash, the Nintendo's console would soon overcome the market resistance and become a huge success worldwide. The success was boosted by the high

quality of the games developed both in-house and by the third-party firms (4). In 2 years, NES revitalized the videogame industry (8) and sold about 62 million units during its lifecycle (9).

In 1986, a leading operator of arcade centers and an experienced arcade videogame manufacturer in Japan called Sega¹ released the Sega Master System to compete with NES (9). Although it was superior to NES, it could not overturn Nintendo's significant market-share advantage in Japan and North America where NES arrived first. But Sega dominated the South American, European and Oceanic markets, because of its wider availability, being supported until 1996 in some of those places. In addition to the time-to-market, the platform didn't perform as well as NES because it had a much smaller game library (9). That was because Nintendo imposed high non-competitive restrictions on the software development companies for allowing them to create NES games. In addition, Nintendo spent much more on advertising and development of quality games and characters (10).

Atari's reaction happened in the same year Sega Master System was introduced. Under new ownership, Atari finally decided to release the Atari 7800, their substitute for the Atari 5200 platform which was originally designed and announced in 1984 but postponed while they milked the market with their old 2600 platform. It was the first console to have native backward compatibility (12). But at this time Atari could not get game publishers and developers on board because they were locked into Nintendo's agreement (12). So the platform did not have versions of the popular arcade titles of the moment, which were a key driver for the success of a home console platform (12). As a consequence, the 7800 platform was considered only a new way to play the old 2600's games.

But Atari still fought for many years before giving up. Again, it tried to recover its previous success by releasing its last 8-bit system, the Atari XE Game System, in 1987. However, it was unable to compete with the power and graphics of Nintendo's and Sega's platforms (10). So, in 1998, while Coleco filed Chapter 11, Atari sued Nintendo for monopolistic practices but the court sided with Nintendo (13). With only 12% of market-share in the U.S. for all of its consoles together (2600, 5200, 7800 and XE Game System), Atari officially stopped their videogame console production in 1992, while NES dominated the U.S. market with a market-share of 80% (12) and could be found in more than one third of the households in America and Japan (10). The Master System sold 2 million units and for a while held 11% market-share (10).

From 1985 to 1989, Nintendo held a near monopoly in the U.S. home console videogame industry. In fact, it priced its platform very close to production costs, earning its profits from games according to Schilling (10). For example, just one of their in-house produced games, the "Super Mario Brothers 3" grossed over \$500 million in the U.S. in 1989. Nintendo managed well to keep its power over the supply chain by restricting the volume and pricing of the consoles sold through distributors to limit their bargaining power, imposing limitations on the number of titles developers could produce per year and, finally, requiring them to preorder a minimum

¹ Sega was founded by two Americans in 1951 to import pinball machines for U.S. armed forces in Japan, although they imported also jukeboxes. After being acquired by Gulf + Western in 1969, Sega developed its own domestic manufacturing capabilities, entering by late 1970s to the amusement arcade business as supplier of machines and management of arcades.

number of cartridges from Nintendo's own contracted manufacturers to produce them (14). According to Farhoomand (15), for many years they dominated the videogame industry and had sold more than 2 billion game units, including dozens of non-violent and easy-to-play top-selling series which were appealing to all age groups of many different cultures. However, because of these policies, they were sanctioned by the Federal Trade Commission (10).

The fourth generation of home console videogames was started in the U.S. by Sega. In April of 1989, Sega of America announced its intent to release a new console, the Genesis, using a 16-bit processor (16). In September of the same year, it released the first console of the fourth generation in the U.S. (16-bit Era) and raised the quality standards' bar with its new impressive processing performance and stunning graphics. Its launch strategy was boosted by the release of its successful arcade games for Genesis and the backward compatibility with Master System's games, which resulted in a total sales of 600,000 units in the U.S. still in 1989 (10). However, in the same year, NEC released in the U.S. their 16-bit console Turbografix-16 (17) already launched in Japan with another name (PC Engine) two years before (in 1987). However, by December of 1989, NEC's console backed by a total of 12 games had sold only 200,000 units in the U.S. (10), although in Japan they had sold 1.5 million (18).

NEC tried to outperform Sega in the U.S. market by being the first firm to enhance its videogame platform with a compact disc (CD) player. In fact, the TurboGrafix-CD was launched in Japan still in 1988 (as PC-Engine CD), making it the first game console to use a CD-ROM in the world (19) (18). Thereafter, in 1991, Sega launched in Japan a console add-on called Mega-CD to play CD with games and audio and to improve the hardware, enhancing Sega's platform to face the competitor NEC (19). The Mega-CD was released in the U.S. only in 1993 (19). Sega sold a total of 6 million units of the hardware add-on worldwide (19).

But NEC was not the only new player trying to grab a slice of the home videogame market. In addition to NEC, SNK (Shin Nihon Kikaku, or New Japan Project (20)), a successful player in the coin-operated arcade game industry ported its well-known MVS² (Multi Video System) to a home console platform and released the Neo Geo Advanced Entertainment System (AES) in January of 1990 (4)(17) (21). In spite of being marketed as a 24-bit platform, it was actually a 16-bit platform using an 8-bit co-processor that could bring to the customers' home the real arcade games and experience at a superior quality, which were the key drivers for a home videogame platform to succeed. Consequently, Neo Geo AES became highly desired by the gamers although the platform was unaffordable for the masses because the console and games were priced at \$650 (\$1146 in the U.S. 2012 Dollar value) and \$200 (\$352 in the U.S. 2012 Dollar value) respectively (4)(17)(21). But, NeoGeo survived in a niche market and in 1994 SNK released the NeoGeo CD home system for \$300.00, a cheaper version of the AES system. The usage of CD-ROM media allowed its game prices to be reduced to \$50.00 since what made the cartridges expensive was the huge volume of memory needed to store their high-quality games, reaching up to 8 times the size of a Genesis game (22). On the whole, the NeoGeo CD sold twice the AES system (22), probably reaching a total sale of 600,000 units since some believe the AES

² The SNK's MVS (Multi Video System) allowed the arcade operators to put up to six different game titles into a single cabinet, a good advantage due to the space limitation in the arcade stores.

version sold around 300,000 units in the U.S. (23). Although its production was discontinued only in 1997 (21), it continued to have new games released until 2004 (17)(24) while SNK ended their repair service for the home consoles only in 2007 (7). Because of its 24-bit platform and maybe because of the CD-ROM drive, NeoGeo CD is sometimes considered a console of the fifth generation (21).

Nintendo's next move came only in 1991. After delaying a new console release for fear of cannibalizing their 8-bit sales, it released its 16-bit Super Nintendo Entertainment System (SNES or Super NES) with no backward compatibility. While Nintendo reached in the same year only 25 game titles developed, Sega Genesis and NEC's Turbogرافix-16 had sold 2 and 1 million units in the U.S. and had about 130 and 80 game titles in the market respectively (10). Although in 1992 Nintendo still had 80% of the videogame market with their 8-bit and 16-bit consoles sales, it was too late to catch up to Sega quickly. In fact, from 1990 to early 1994, Nintendo's U.S. home videogame console market-share dropped from over 90% to under 40%, while in the same period Sega grew its market-share from 5% to over 60% in the U.S. (27). Consequently, between 1994 and 1995, Sega was the market leader with a minimal portion of their profit coming from the console sales and the major fraction from the games sales and game royalties (10).

Although Nintendo was able to undermine NEC using anti-competitive practices, it could not take over the U.S. market because Sega produced the major portion of its own games in-house and used less restrictive licensing arrangements than Nintendo. Consequently, Sega attracted quickly many game development companies, which increased significantly the number of titles available for their platform. On the other hand, NEC relied totally on third-party development but Nintendo's anti-competitive practices blocked the stronger Japanese game development firms for making games for TurboGرافix-16. Additionally, some game developers started to abandon NEC's platform when they found the system had only a small technological advantage over the 8-bit system. Moreover, NEC used in the U.S. the same advertisement strategy run in Japan, which resulted in a lack of public awareness. Consequently, NEC left the U.S. market early (25) accruing a total sales of less than one million units in the U.S. (17). However, NEC's console reached a considerable success in Japan, outselling Sega (17) (26) and having games release until 1999 (17).

But Nintendo's next strategy would finally improve their new platform's performance. In 1993 Nintendo made a \$15 million launch of Star Fox, the first game to use the new pre-announced proprietary Super FX chip inserted in the game cartridge (27). The Super FX chip was a RISC co-processor custom made to act like a graphic accelerator chip, making it possible to push the Super NES graphical capabilities much further (28). The Star Fox launch succeeded in selling 4 million copies (29). Consequently, in the same year, the Super NES sales accelerated aggressively while the Genesis sales stopped growing. Finally, Super NES outsold Genesis in 1993 (Figure 2), but Sega still kept the biggest market-share for a period (Figure 3).

Sega reacted to the Super NES' turn around still in 1994 by launching a hardware add-on in an attempt to extend Genesis console's lifespan. The Sega Genesis 32X add-on (and Sega 32X in Japan) could upgrade the Genesis console processing and other capabilities to a 32-bit platform

which could enhance sharply both the cartridge and CD games (30). Interestingly, Sega Genesis 32X used the same 32-bit Hitachi processor that would be used in the console they had been working on with Hitachi to be their next generation platform (27). But, they failed since the introduction price was \$159.00, too high for an add-on, and the total number of games released for Sega 32X was only 5 in the U.S. and 6 in Japan. Finally, Sega's add-on was discontinued in 1995 with total sales of only 665,000 units (30).

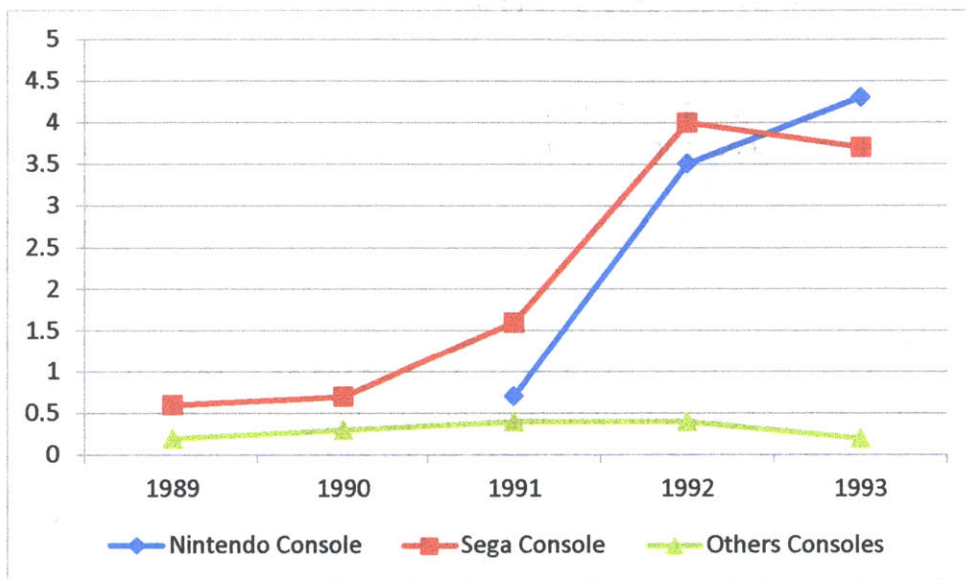


Figure 2 - Unit Sales of 16-bit Systems in the U.S. (millions) - Source: Build using data from (25)

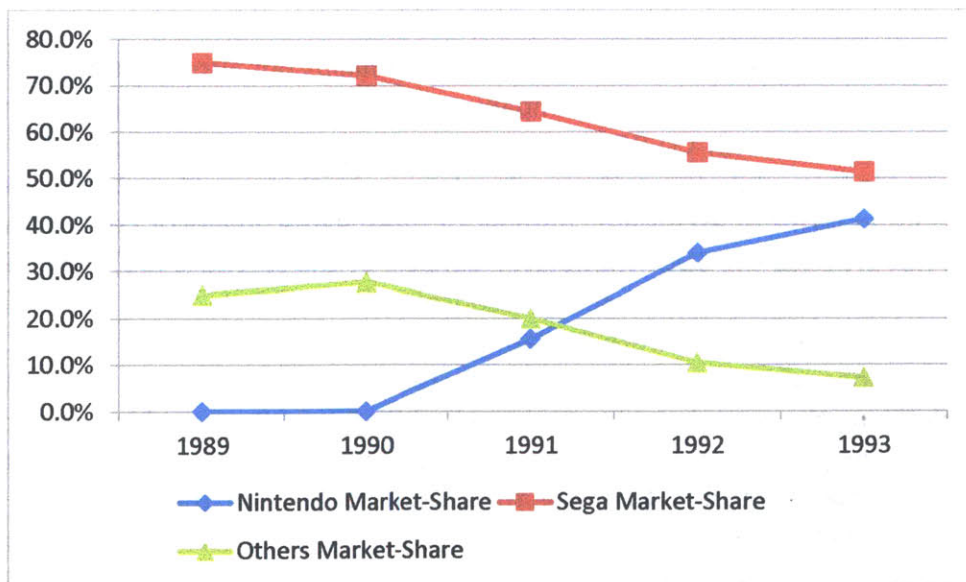


Figure 3 - Market-Share of 16-bit Systems in the U.S. - Source: Build using data from (25)

In the long run SNES proved to be one of the most successful consoles ever made. In fact, Nintendo sold a total of 49.1 SNES units globally and 22.88 million unit in the U.S.(9), much more than the 28.54 million and 15.98 million units of Genesis sold worldwide and in the U.S. respectively (9). On the other hand, the TurboGrafix-16 sold only 2.5 million units in the U.S. and 10 million worldwide during its entire lifetime (26). Although SNES has sold well, Nintendo's near monopoly position has gone on definitely (10). In fact, they had been leapfrogged technologically by Sega according to Schilling (10).

In the same year the SNES was launched (1991), Philips introduced a 32-bit console with their CD-i technology starting the fifth generation of home videogame consoles too early. Additionally, the CD-i was released in the market for \$1000 (27) as a multimedia platform using their Compact Disc Interactive (CD-i) technology (31) that could play audio CDs, video CDs (VCDs), Karaoke CDs and be used as a game console (32). Indeed, they had developed not only games, but also educational titles such as interactive encyclopedias and museum tours which had an appeal before the public internet access was widely available. But the wrong pricing strategy and the confused positioning resulted in poor sales. Later on, Philips marked down its price to \$499.00 and introduced a new budget model for \$400.00 in 1993. However, until June 1994 only 350,000 units had been sold (27). Then, Philips changed its ad strategy to market the CD-i as a videogame platform using a new budget model priced at \$299 (31). But this decision had been made too late since it could not considerably raise the sales. Furthermore, they were reluctant to disclose the technical specifications of the console, which limited the software development for the system (10). In addition, several of its games were considered among the worst ever made (32). Hence, its market-share in 1996 was smaller than 2% (10) and its total sales were 570,000 units (32). Finally, in 1998 (32) (26) Philips discontinued the CD-i System and accrued a total loss of almost one billion dollars on the console since its introduction in the U.S. (31).

The home videogame console market attracted not only Phillips but also other major traditional electronic manufacturers. In fact, a new company called 3DO was founded in 1991 to offer a new 32-bit console system with CD-ROM under an innovative business model: the hardware could be licensed for free while the software development rights would cost only \$3 per disc, with no restrictions in terms of exclusivity, number of titles, game quality or content. Moreover, the 3DO would not produce the 3DO Multiplayer Console or the software (33). Then, Panasonic was the first hardware licensee to launch the console in the U.S. in 1993 and in Japan and Europe in 1994. Additionally, there were 35 game titles in the U.S. by May of 1994, but most of them were conversions of games launched before for other consoles (33). Besides the high quality of the platform, the console had to be launched for \$700.00, a very high price compared to the 16-bit platforms in the market (around 5 times). That was because the business model forced the console manufacturers to make their profit only from the hardware (33) (34). Consequently, even with a price cut to \$500.00 and the entrance of other manufacturers such as Sanyo and GoldStar (now LG), the platform didn't take off and was discontinued in 1996 with a total of 5 million units sold worldwide (26).

Surprisingly, Atari re-entered the home videogame console market in 1993 with a high-tech device called Jaguar and a CD-ROM add-on manufactured by IBM (27). Although it was the first

64-bit platform in the world, the Jaguar was considered a fifth generation device (35), probably because it was technically equivalent to the 32-bit consoles in the market (10). Also, Atari had not inspired great confidence in the game producers and retailers, maybe because of its past struggle. Consequently, the console had only 5 game titles at the time of its release, although Atari had promised 15 titles by the end of 1993 (27). Additionally, many important retailer chains did not distribute it since the 16-bit platforms were performing well in the market (10). Hence, Atari sold only 500,000 units (7) and discontinued the console in 1996 (35). After this big market failure, no American company released a home videogame console again until Microsoft entered the market in 2001 (35).

Finally, Sony debuted in the home console videogame market and they had been helped accidentally by Nintendo. In fact, Nintendo was studying to incorporate a CD-ROM into their Super NES early in 1991. So, they decided to establish a partnership with Sony to create the PlayStation for this purpose. However, the differences of vision about the product generated conflicts and resulted in a rupture of the partnership. Thereafter, Nintendo went to partner with Philips and left Sony with the PlayStation project (15). Then, Sony decided to continue the PlayStation project and created what can be called the Nintendo's worst nightmare. Featuring new and much superior graphic standards (15), the PlayStation was launched in Japan in December 1994 and in the United States in September 1995 (36). As a result, their console brought the video gaming to a whole new level (15) by making it possible for the games to stress three-dimensional gameplay for the first time and using the CD-ROM technology which allowed them to price their games dramatically below the other platforms' cartridge-based games (4).

At the same time, facing the imminent release of Sony's platform, Sega had accelerated their new 32-bit console launch in an attempt to capture some first-mover advantage. Indeed, they achieved the Japanese market in November 1994 and the United States in May 1995 (37). However, they did a very limited launch of the Saturn in the United States through only 4 retail chains and left out of the initial offering the majority of their previously built distribution channels and strong supporters. That was because Sega had not enough manufacturing capacity installed yet and had not built up enough inventory previously. Thence, a lot of those retailers started to feature Sega's console less prominently than the competitor's platform and some of them refused to stock Saturn even after Sega's supply capacity had been addressed (37). In addition to that, Sega had not enough time to work on their project to reduce materials and manufacturing costs, so its console was more costly to produce than the competitor's devices. As a consequence, they had huge losses, counting with less resource to invest in marketing. So, their sales were bad and they could not attract outside game developers, resulting in only 1% of market-share in the U.S. in 1997 and the end of the U.S. production in 1998 (37).

While Sega started badly, Sony used an important lesson learned from the Betamax versus VHS battle for the standard dominance: if a company wants its platform to be massively adopted, there must be a lot of content for it. For this reason, they supported their console with many game titles and were much less restrictive than Nintendo and Sega to license any software for their platform. That resulted in an impressive number of titles available in the market in only

three months after their debut which outnumbered Saturn titles by a four-to-one ratio (36). Meanwhile, in 1996, there were only 10 Saturn game titles in the U.S. market and they were arriving at a slow rate (37). In contrast, PlayStation reached more than 1,300 titles available in Japan and 400 in United States by 1998 with a wider range of game titles (15). Moreover, PlayStation's games expanded the videogame market from the traditional videogame users (teenager boys, 10-17 years old) by offering technically advanced sports and violent fighting games. As a result, Sony accounted about 57% of their consumer-base in age range from 18 years old until more than 34 years old in 1996 (Figure 5) (36).

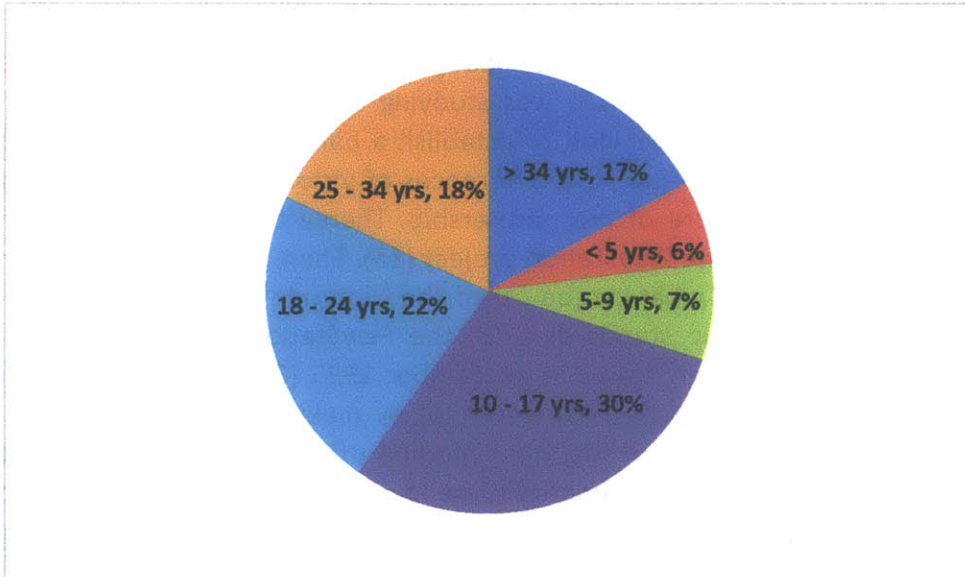


Figure 4 - Age profile of the PlayStation owners in 1996 - Source: Adapted from (36)

Meanwhile, Nintendo have been working to develop its next generation console since the end of its unsuccessful partnership with Sony. However, Nintendo was not sure about the strategic path they should follow: introduce their 32-bit such as Sega and Sony did, but it would be only in mid-1995; or wait until mid-1996 and introduce a cutting-edge 64-bit console. Additionally, Nintendo had to make another decision: should the new console use CD-ROM or cartridge? On one hand, CD-ROM was less expensive to manufacture and allowed shorter productions and delivery cycles, but it was much easier to be illegally copied and would make the console production cost per unit to be around \$210. On the other hand, cartridges were expensive to produce but Nintendo could use its installed manufacturing capacity to produce them and they were much more difficult to be illegally copied and the console unit cost would be around \$160. (38)

Since Nintendo's competitors had the first-mover advantage and especially Sony could get a considerable installed base, Nintendo decided the best next move would be to leapfrog the competition by being the first to introduce the next generation console (38). So, Nintendo introduced the cartridge-based Nintendo64 (N64) in September of 1996 in the U.S.(39), outperforming PlayStation in console's speed and graphics and having one of the two games available at the moment considered the best game ever developed (39). Although N64 tracked

PlayStation price, N64's games were priced around \$15 to \$20 higher than PlayStation's ones and Nintendo's royalties rate were \$18 per game unit sold while Sony's royalties were \$9 per unit, resulting in third-party software developers' gross profit of only \$11 per unit versus \$18 for Sony's platform (39). In addition to that, N64's hardware complexity made game development risky and expensive; moreover, Nintendo reserved the right to block any game release it determined to be of low quality (41). Consequently, Nintendo had to develop 57% of the platform games in-house (while Sony developed only 23% of their games) because of the low attractiveness to the third-party developers. However, N64 was able to achieve 284,000 copies sold in average per title while PlayStation had only 85,000. Although N64 sold well, around 25 million units worldwide by the beginning of 1999, they could not catch up to PlayStation that had an installed base of more than 50 million units worldwide and had sold almost four times as many games as Nintendo did at that moment (39). Figures 5, 6 and 7 illustrate comparatively PlayStation and Nintendo's unit sales of consoles, games and their cumulative values respectively between FY1995 and FY1999 (Fiscal Year Ending March 31).

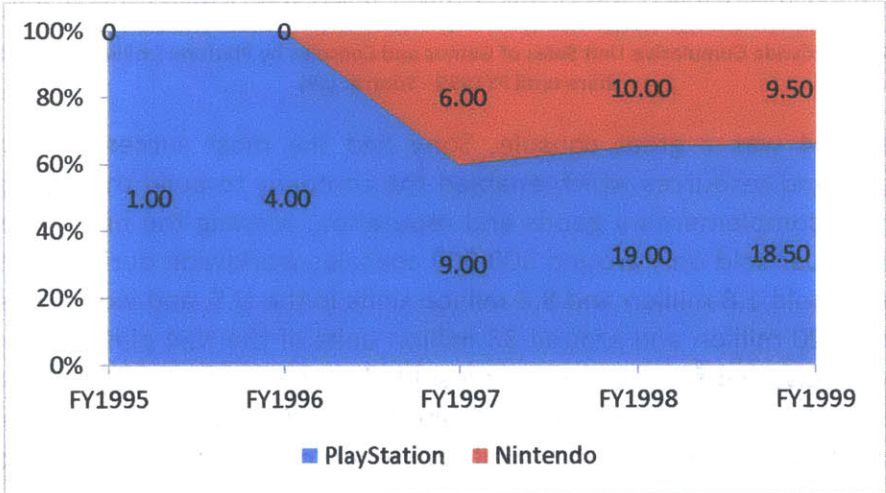


Figure 5 - N64 x PS - Worldwide Unit Sales of Consoles by Platform (millions of units) and Market-share - Source: (39)

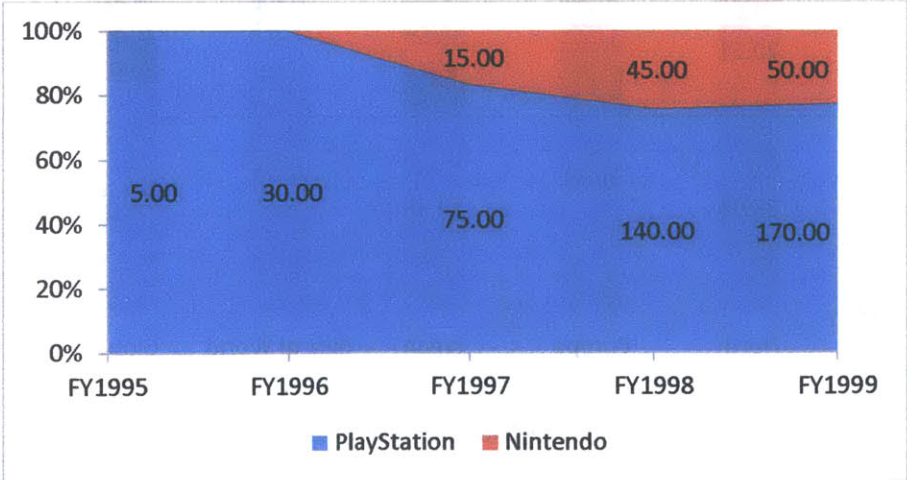


Figure 6 - N64 x PS - Worldwide Unit Sales of Games by Platform (millions of units) and Market-share - Source: (39)

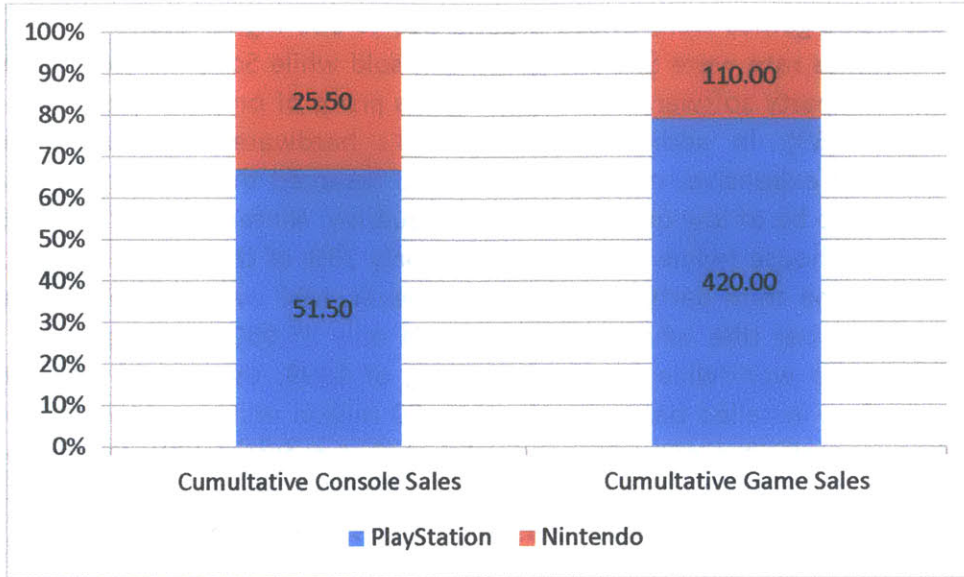
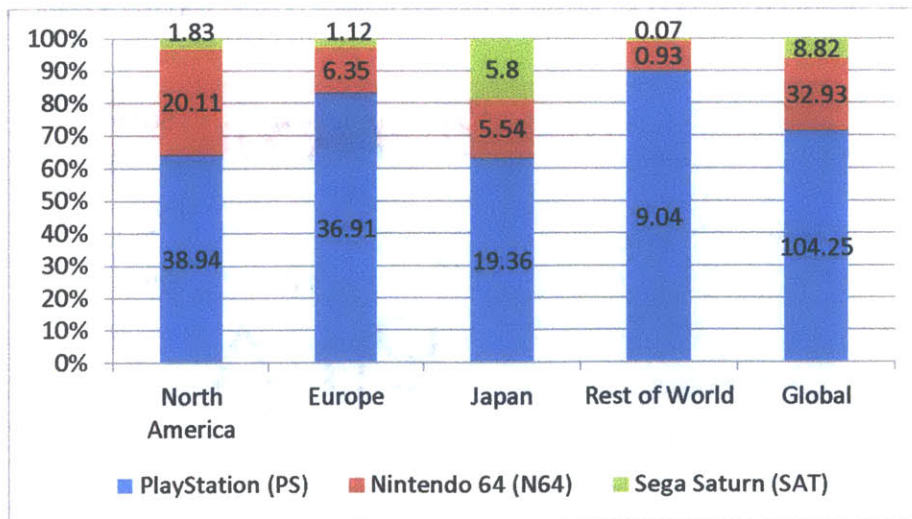


Figure 7 - N64 x PS - Worldwide Cumulative Unit Sales of Games and Consoles by Platform (millions of units) and Market-share until FY1999 - Source: (39)

Although Nintendo64 was a great console, Sony had the most successful combination of product, strategies and resources which enabled the company to build the strongest installed base, availability of complementary goods and reputation, winning the fifth generation round (12). While Atari Jaguar sold only around 500,000 consoles worldwide during its entire lifetime (7) and Sega Saturn sold 1.8 million and 8.8 million units in the U.S. and worldwide respectively (10), Nintendo sold 20 million and around 33 million units of the N64 platform in the U.S. and worldwide respectively, and finally, PlayStation sold almost 39 million and 104 million units in the U.S. and worldwide respectively (Figures 8 and 9) (10). Not surprisingly, Sony stopped the PlayStation production only in 2006 (41) while Nintendo discontinued the N64 production in 2003 (42).



Figures 8 and 9 - Fifth Generation - Platforms Total Sales in Millions of Unit and Market-Share per Region - Source: (10)

After its big failure, Sega started to develop next-generation console in January of 1995, using a strategy of three main elements: to minimize manufacturing costs, to improve relations with third-party game developers, and to standardize hardware across arcade, home video game, and PC systems. So, developing a 3D graphics technology as the standard for game development in the home videogame, arcade and personal computer markets, Sega could offer to the third-party developers the potential to sell the same game across three markets, reducing their game development costs aggressively. In addition to that, the consumers would have their favorite arcade games available quickly on their home videogame platform. So, for producing such graphical, sound and programming environment standards which would allow interchangeability across different markets, Sega created a consortium of high-tech companies including Hitachi, NEC, Yamaha, VideoLogic and Microsoft (41).

Finally, in September of 1999 (44) Sega launched Dreamcast in the U.S. Besides the fact it was the first 128-bit console in the world, it was also the first one to access the internet to allow users to play competitive or collaborative games remotely (12). Before its release, 300,000 units had been pre-ordered and 225,132 consoles were sold in the first 24 hours. Additionally, Sega sold 372,000 units and accrued U\$ 132 million in only four days after its launch. Furthermore, two weeks after the release, a total of 500,000 units had been sold. Equally important was Dreamcast sales' growth of 156.5% from July of 2000 to the end of September of 2000, putting Sega's new console ahead of Nintendo 64 in this period (44). However, PlayStation had captured the largest portion of market-share worldwide and it was still a success accounting more than 1,000 game titles published worldwide.

Sony perceived Sega was striking back with Dreamcast and detected the potential risk of Microsoft's entrance in the home console videogame market. So, for protecting its hegemony, Sony decided to build a new console, investing between \$1 and \$2 billion to develop and produce with its partner Toshiba the new processor called "Emotion Engine", which would push the limits of semiconductor technology. As a result, Sony developed a videogame console that was a supercomputer capable of rendering graphics faster and with more details than any other consumer-level computing platform. In fact, its processor was 15 times faster than the high-end Intel PC processor at that time and even faster than the high-end Macintosh G4. Moreover, the PlayStation 2 contained four additional processors and could accept network adapters via PC card slot since Sony planned to distribute games over the internet in the near future. In addition to that, Sony equipped the console with a dual-mode laser head DVD player to read any DVD or CD-based media which made possible the backward compatibility with all PlayStation 1's games in CD-ROM. (45)

In March 4th of 2000, a Saturday, Sony released the PlayStation 2 in Japan resulting in 980,000 units sold in the first weekend and some "side-effects". The first side-effect happened only six days later: Microsoft announced their plans to develop their home videogame console. The second one was the console restriction to be exported by the Japanese Trade Ministry, because PlayStation 2 was actually a supercomputer at that time and its processor could be used to guide missiles through 3D terrain. But, after some days, Sony could get the export license with full restriction to Iran, Iraq, Libya and North Korea. The third side-effect was announced two weeks later by an independent sales report describing the size of the Japanese DVD market had

been doubled because of the PlayStation 2's launch. In fact, for most people who bought PlayStation 2, it was their first DVD player.

In October of 2000, the PlayStation 2 was released in the U.S. As a consequence of the PlayStation success, Sega cut the Dreamcast price until giving it for free through a rebate of the total price paid in exchange for a two-year contract for SegaNet Internet service. However, Dreamcast has been totally eclipsed in the holiday sales season of 2000 (12). So, in March of 2001 (44), Sega announced that it would stop making consoles and would be a third-party game developer for other platforms, reducing consequently the developers support (12) for its console which had total units sold of 10.6 million (44) and left Sega close to the Bankruptcy (12). Subsequently, Sega signed a deal with Microsoft to produce games for their new console (12). Finally, Sega, a traditional home console videogame producer, had been technologically leapfrogged by Sony definitely.

In November of 2001, Nintendo released in the U.S. the GameCube at \$199, its new console, just two months after the release in Japan (46). The GameCube was the result of a joint venture with Matsushita, Sony's main rival (12), for the creation of a proprietary disc system (mini-DVD) for storage games, avoiding the licensing fees to the DVD Consortium (46), and IBM for the "Gekko" PowerPC processor (46). As a result, the GameCube was the first Nintendo's non-cartridge based console and it was more than 50% faster than PlayStation 2. In fact, while IBM "Gekko" PowerPC run at 486 MHz (46), the PlayStation 2's "Emotion Engine" could run "only" at 299 MHz in its second and faster version (47). In addition to that, GameCube supported online play via broadband and modem adapters (12). However, due to the innovating media used for games, the console had no backward compatibility (12).

Also in November of 2001, Microsoft launched its home console videogame in the U.S. at the same price of PlayStation 2 (\$299). However, it was equipped by a stunning 733MHz Intel processor and an internal 10 gigabyte hard drive, which raised its production costs. Consequently, it was estimated that Microsoft lost between \$100 and \$125 per unit. But Microsoft wanted to build installed base, so it leveraged its existing relationships with distributors and budgeted \$500 million for marketing campaign just for the first 18 months. Since at that time Microsoft was established as a PC games developer, they leverage on it to produce 30-40% of Xbox's games in-house. In addition to that, Microsoft's policies to attract game developers companies included to give for "free" their \$10,000 game development kits and use their well know DirectX technology and Windows based environment to reduce the learning costs and make easier to any PC game developer to develop games for Xbox. Finally, while Nintendo had target to a younger market from 8 to 18 years old, Microsoft targeted the range from 18 to 34 years old, positioning Xbox directly against PlayStation 2's target (from 16 to 24 years old). (12)

So, by the end of 2001, after the Christmas season, both Nintendo and Microsoft had very good results: 1.3 million units of GameCube and 1.5 million units of Xbox had been sold. However, Sony had a significant installed base of 18 million units and around 300 games released at that time. Consequently Sony sold 2 million units of PlayStation2 only in December of 2001 (12). In fact, PlayStation 2 kept its leadership during the entire sixth generation of home console

videogames, achieving 153.68 million of units sold, while GameCube sold 32.93 million units and Xbox sold 24.65 million units worldwide (10) as it can be seen in Figure 10 that also illustrates the total sales in units and the market-share of each platform per world region. Equally important, Sony only discontinued the PlayStation 2 console in January of 2013 (47), while Nintendo and Microsoft discontinued its sixth generation consoles in 2007 (46) (48). Finally, PlayStation 2's victory marked the first time in this industry the same company dominates two console generations in a row. However, Microsoft's Xbox could grab a considerable slice of the market-share and had oversold Nintendo during some period. In fact, by November 2005, Microsoft has sold 23.7 million Xboxes, slightly more than Nintendo's 20.6 million units of GameCube (49).

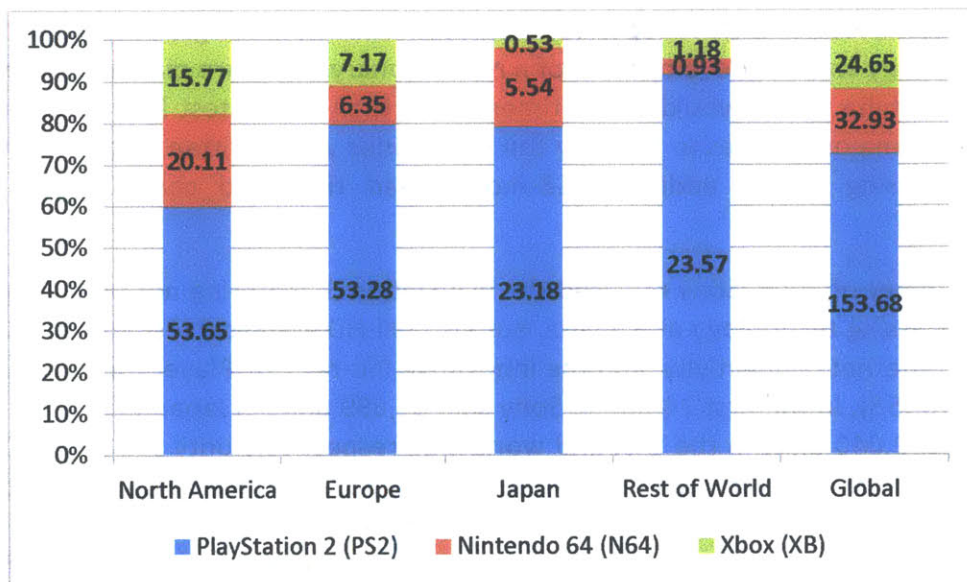


Figure 10 - Sixth Generation - Platforms Total Sales in Millions of Unit and Market-Share per Region - Source: (10)

However, Microsoft had decided to win the videogame war at any price as it was described by Larry Probst, CEO of Electronic Arts: "Bill Gates ... wants to be in a position to win in the next round. He told me he will spend as much as it takes". In fact, Microsoft CEO Steve Ballmer said "We may still be losing money, but I bet we can take Sony next generation" (50). With this objective, Microsoft tried to establish the dominance in the home console videogame industry using its "Windows strategy": provide unmatched support to third-party software developers, supplying them with extensive information and tools for creating software compatible with Windows and do not charge royalties in exchange. But, on the contrary to Microsoft's expectations, the game developers didn't embrace the no-royalty proposal enthusiastically and preferred to pay royalties to keep a quality level and a barrier to small companies (49).

So, even accounting losses of \$8 billion between 2001 and 2008, Microsoft started to prepare itself for the next round earlier (49). So, still in 2003, Microsoft started working in the Xenon project, hiring Peter Moore, former president of Sega of America, and signing agreements with IBM and ATI for producing the console's main and graphical processors respectively (50). So, in November of 2005, Microsoft released the Xbox 360, the first console of the seventh

generation to reach the market, one year before its competitors Sony and Nintendo, trying to capture the first-mover advantage and the Christmas season (49). In the first week, the cutting-edge console, featuring a 3.2 GHz PowerPC Tri-Core Xenon main processor, a 500 MHz ATI Xenos graphical processor, 512 MB, Wi-Fi native network connection, Dolby Digital 5.1 sound, USB 2.0 ports and internal hard drive (50), sold 305,237 units and at that year they had close the total sale of 563,282 units (10). However, since its launch, users have reported concerns over its reliability and failure rate and overheating issues, making Microsoft to extend the Xbox 360's manufacturer's warranty to three years (50) and to recall the defective consoles, which cost around \$1 Billion (51).

While Microsoft's core competitive strategy was the creation of XNA software tools to help to write games faster, easier and cheaper for PC, Xbox and the next generation Xbox, Sony's competitive strategy was the development of a revolutionary hardware platform called the Cell with IBM and Toshiba which would be 10 times faster than the fastest PCs. However, Sony's strategy required major changes in the way the game titles were written to take advantage of the Cell's processing speed, adding a 18-month lead time and costs to the software development. (50)

Finally, in November of 2006, Sony released the PlayStation 3, featuring not only an impressive eight cores processing technology at 3.2 GHz, but also full-HD graphical resolution, HDMI ports, Bluetooth and Ethernet connectivity, and the innovative Blu-ray Disc Player for establishing it as market standard (53). In the first 24 hours, Sony sold 81,639 units in Japan (53) while they sold 667,762 and 1,252,040 units in the U.S. and worldwide respectively until the end of 2006 (10). However, at that moment Microsoft had already sold 3,832,778 and 6,801,532 units of Xbox 360 in the U.S. and worldwide respectively (10) confirming Microsoft's belief about first-mover advantage. It is important to note that both consoles were remarkable technological achievements, not only because of the unprecedented computing power, but also because they had features that went beyond videogames such as allowing interoperability with other electronic products and on-line content and gaming purchase (49).

Meanwhile, since 2001, Nintendo had been working on the concept of a new console using a new form of player interaction. In fact, Nintendo's vision was that power was not everything for a console and too many powerful consoles could not coexist. However, only two years later the engineers and designers start to work on that, finishing in 2005 the new controller interface (54) which could allow the real players movements to be captured precisely and used on the games, bringing the game's interactivity to a new level. On the console side, Nintendo's new machine were significantly less advanced technologically since its graphics processing power was much lower, there was no DVD-compatibility, no support for Dolby Digital surround sound and no hard drive (49).

So, in the same month Sony released the PlayStation 3, Nintendo launched the Wii console in the U.S. for \$250 with one motion-sensor controller, 15 games available and various accessories(49). For instance, by holding the new wireless motion-sensor controller, gamers could move their limbs to dictate the actions of on-screen characters. In addition to that, Wii allowed users to customize the games' characters gender, skin color, hair and etc (49). So, as

Nintendo forecasted it would “break down the wall that separates videogames players from everyone else”, Wii got such enthusiastic consumer reception from preschool children to mature adults, that production fell far short of demand for more than 12 months after its initial release (49). In fact, at the end of 2006, only 2 months after its release, Nintendo has sold 1,075,329 and 2,954,781 units in the U.S. and worldwide respectively (10). Additionally, between the release and August 2008, the Wii outsold its two rivals in every month except one (49). As a consequence, Nintendo got the biggest market-share in the U.S. and also worldwide in less than one year (10).

But, it was not only the motion-sensor controller that had helped Nintendo to succeed. First, Nintendo could provide lower cost of game development due to its console lower complexity and graphical resolution, which was an important factor to get third-party publishers on board. In fact, Nintendo game library grew faster than the competitor ones as it can be seen in Figure 12, showing the number of titles release for Wii has the fastest growth until 2008. Second, Nintendo’s business model became also exciting for small independent producers since it loosened its traditional tight control over content and let these small developers to publish their games on the Wii Wave, their on-line channel for distributing downloadable games (16). Third, in December 2007 Nintendo released the Wii Fit, an extension of Wii for exercise activities, increasing even more the console potential of capturing yet another class of non-gamers since it integrated health and entertainment featuring around 40 different activities such as yoga and push-ups (16). In fact, in only 6 month, the product sold 2 million units only in Japan (16). In addition to that, doctors and therapists started to recommend it for various health purposes (16). Finally, Figure 13 shows the number of game titles released per year and per platform in the generation seven for a comparison.

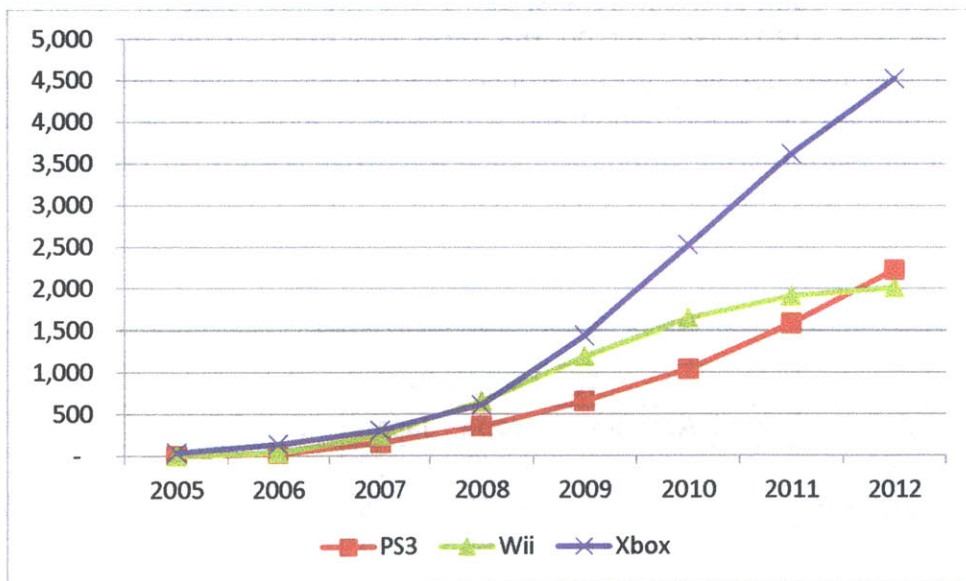


Figure 11 - cumulative Number of Titles Released per Platform per Year - Source: GameSpot

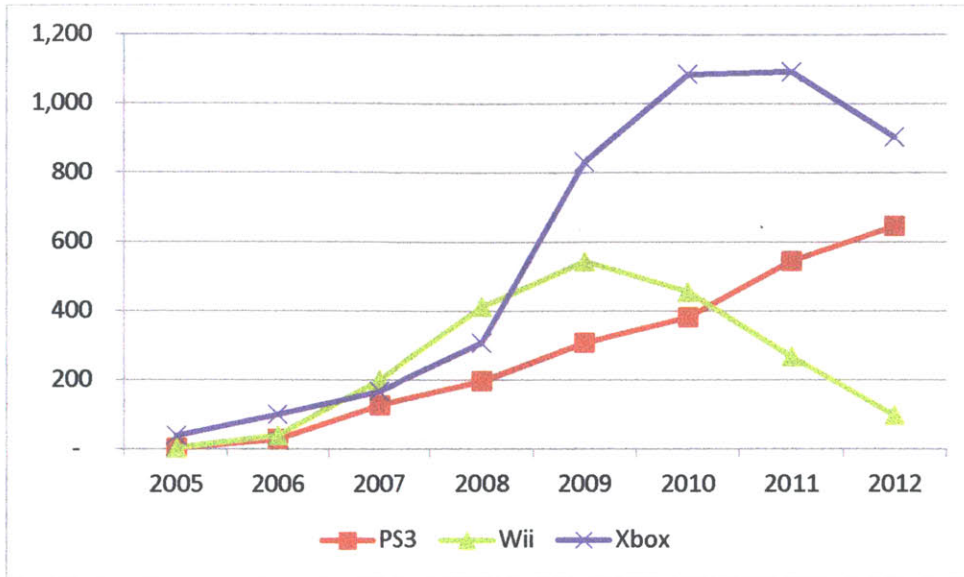


Figure 12 - Number of Game Titles Released per Year per Platform in the Generation Seven - Source: GameSpot

In addition to that, Nintendo is the only manufacturer that has launched the first 8th Generation platform, the Wii-U, in the last quarter of 2012. Sony and Microsoft are now massively announcing their new generation platform, but they have not launched it commercially yet. The simplest Xbox 360 and also PlayStation packages can be found in the retail for prices around \$200.00, but there are bundles that reach \$500.00 and \$300.00 respectively, including additional controllers, game and memory capacity. While the Wii is priced in a range from \$130.00 to \$200.00, the entry-level price for the new Wii-U is around \$350.00 while the highest bundle is priced around \$590.00 (38). Finally, the total sales in units of the current consoles per world region and worldwide is show in Table 1 and the current market-share of the platforms per world region and worldwide is shown in Table 2.

Table 1 - Source: VGChartz.com (2013)

Console	Total sold in Millions of Units				
	North America	Europe	Japan	Rest of World	Global
Xbox 360	42.25	23.07	1.63	7.35	74.3
PlayStation 3	25.97	28.69	9.05	9.18	72.89
Wii	44.37	32.65	12.7	9.23	98.95
Wii-U	1.18	0.53	0.78	0.17	2.66

Table 2 - Source: Sales Units for computing the market-share from VGChartz.com (2013)

Console	Market-Share				
	North America	Europe	Japan	Rest of World	Global
Xbox 360	37.1%	27.2%	6.7%	28.3%	29.9%
PlayStation 3	22.8%	33.8%	37.5%	35.4%	29.3%
Wii	39.0%	38.4%	52.6%	35.6%	39.8%
Wii-U	1.0%	0.6%	3.2%	0.7%	1.1%

As it can be seen, Nintendo has the dominance of the installed base with almost 41% of the market when considering the Wii and the Wii-U together. Sony and Microsoft have roughly the same market-share. The sales of the seventh and eighth generation consoles over the years (since January 2004) confirm the Nintendo dominance along the last generation (Figures 14 and 15).

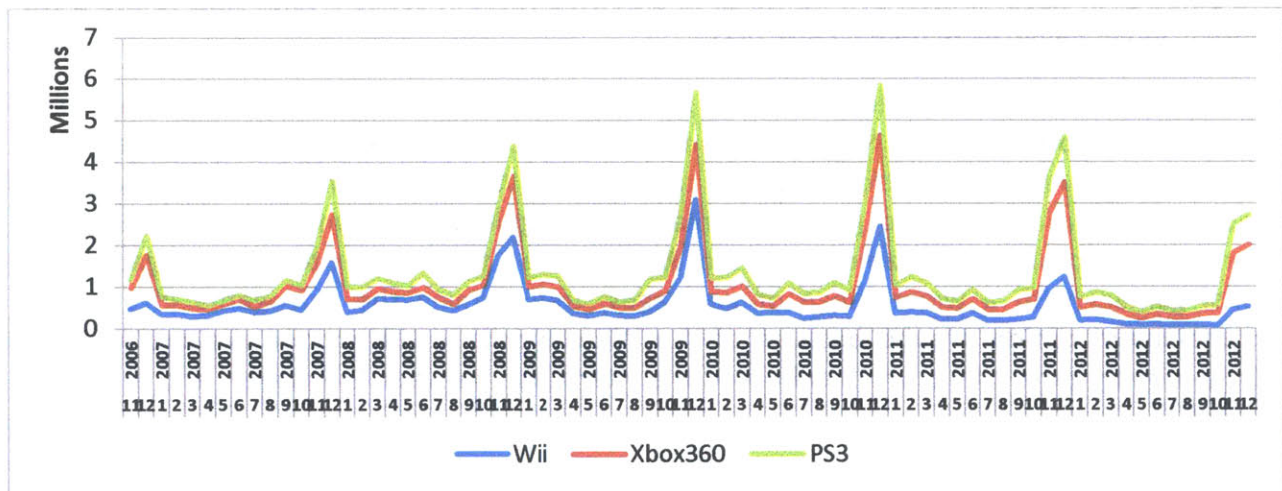


Figure 13 - Monthly Hardware Sales in the U.S. - Source: VGChartz.com database (2013)

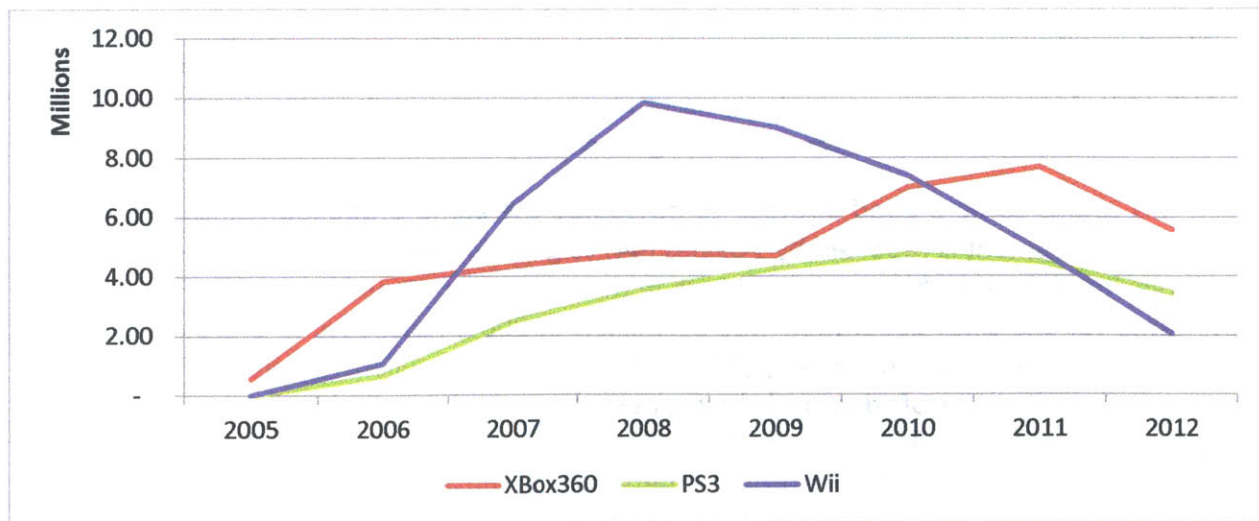


Figure 14 – Yearly Hardware Sales in the U.S. - Source: VGChartz.com database (2013)

Figures 14 and 15 show also Wii sales have been decreasing annually since 2009, what happened also with the other two platforms in 2012. But, Wii sales have been underperforming when compared to its competitors since the middle of 2010. That signals the seventh generation lifecycle has achieved the declining period, and also explains why Nintendo has launched the new generation console while Sony and Microsoft are announcing their new consoles.

It is important to note that Nintendo not only got the biggest installed base along the current generation but also it was the only one to have a profitable console, at least in 2007. While Microsoft started losing \$125.00 per unit sold and reduced right after its losses to \$75.00 per unit, and Sony started losing \$300.00 per unit (due to the high cost of the high-end processor and the Blu-ray device), Nintendo had a gross margin of about \$92.00 (39) (40). Also, while Microsoft had lost more than \$2 Bi in selling their console, Nintendo made about \$50.00 per console sold in the United States (40). Additionally, Sony have reported to lose \$2.16 Bi in 2007 and \$1.16 Bi in 2008, a total of over \$3 Bi in only two years in console sales due to the price strategy much below its marginal costs (41).

Interestingly, Nintendo's strategy of using a lower-tech and consequently cheaper platform proved to be good. In fact, Nintendo seems to have found the right balance between the technological level of the platform and the target users. While the home videogame consoles used to be more targeted to gamers, demanding a significant amount of time invested in learning how to play each game, Nintendo Wii expanded this frontier to the non-gamers or casual gamers with a wider range of user ages, transforming the videogame in a family entertainment option, maybe because of the Wii controllers with motion sensors and the family-friendly game titles, which enhanced the interaction between the players and the game (41) (40).

However, the other side of the home videogame console market is most attractive for the console manufacturers: the games itself. Because of the increasingly complexity and resources required as well as the costs to develop and publish a game along the generations, instead of developing the game by themselves, the console manufacturers license the rights to develop them to the specialized game producer firms, receiving a typical royalty per unit sold of about 10%-15% (43). More popular a console is, more games are produced, increasing the appeal to the consumers buy it, what creates a reinforcing mechanism.

In fact, this seems to be a good strategy to outsource the game production since the cost of new game development is reported by VGsales (44) to grow in a geometrical progression due to the complexity of the new high-tech hardware in the new generations (Figure 16). For example, a new game for the sixth generation was \$3 million in 2007, nowadays it is around \$20-\$30 million for Xbox and PlayStation3 (43) (44) while it is \$5-\$10 million for Wii. For example, a game producer called Ubisoft declared they expect the cost of developing a new game for the next generation will exceed \$60 million (44). "A large portion of this cost goes to paying the talent that's making the games - the programmers, artists, musicians, designers, producers, and testers. And with the size of teams required to make games for the newer consoles doubling when compared to the previous generation, particularly with the number of modelers,

animators, and other artists now needed, you can see why the cost of development keeps making significant jumps for each subsequent new generation of consoles. “(45)

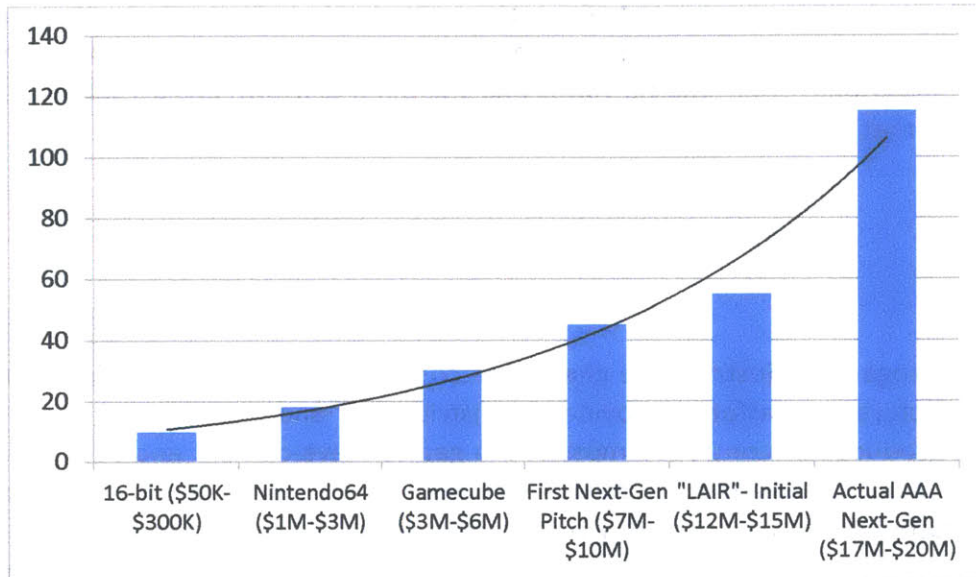


Figure 15 - Team Sizes and Budgets – Geometric Expansion of Project Complexity & Staff - Source: Vgsales

So, again Nintendo developed another important competitive advantage. The EA Games CEO said in January 2009: "Development is typically a third to a fourth as much for a Wii game than it is for a PS3 or an Xbox 360 game" (44). That explains why in the fourth quarter of 2007, for example, 86 new games were released for Wii, 47 for Xbox 360 and only 38 for the PS3 (44). So, Nintendo took advantage of a simpler console not only for the profitability but also in the highest incentive to attract the development of more game titles, creating a higher positive network effect.

Moreover, Nintendo is the only one of the current competitors that is really a videogame company, developing a set of game titles by themselves, allowing them to capture the value with the hardware and the software. This helps also the company to launch a new platform with a set of game titles reducing the dependence of the software development firms in the very early stage of the introduction of a new console in the market, when they have no incentive to do it and when the number of games is crucial to attract the early-adopters, raising the adoption rate which is fundamental to incentive the game producers to invest in the new platform. Another strategy Nintendo used was the backward compatibility with their previous platform, making it possible to the costumers to play also their previous generation games in the current generation. This strategy was used again in their new generation console.

The Home Video Game Console Industry in the Current Generation

This session describes the main components and aspects present in the current generation which shape the competition in the home videogame console industry. First, the value chain components are presented. In the sequence, the effects of the used games market, in especial GameStop, are described. Then, the tie-ratios and the open platform are presented and finally the two-sided market and the digital platform competition topics are presented.

The Value Chain

Traditionally, videogame industry value chains are comprised of game developers, publishers, console manufacturers (platform providers), distributors and consumers (38). Although manufacturers produced or controlled most of the games' development and accessories under this model (39), game development companies and publishers played an important role in the adoption of platforms by consumers. For example, while Nintendo limited developers by requiring them to sign anti-competitive licensee agreements, establishing a near monopoly in the U.S., Sega overcame this limitation by developing the majority of the games for their platform and leapfrogging over Nintendo by using less restrictive agreements. However, Coughlan (38), for example, included in the value chain another important component: content providers. Figure 17 represents Coughlan's value chain structure (38).

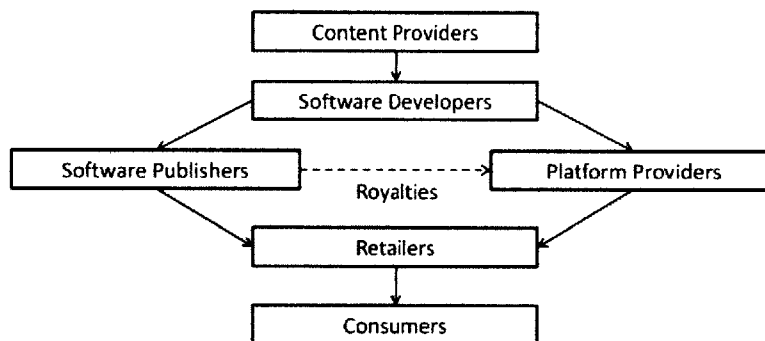


Figure 16 - Traditional Home Console Videogame Value Chain - Source: (40)

Tomaselli *et al.* (40) suggest a more complete value chain structure, illustrated in Figure 18. The value chain's components proposed by them are: the holders of the console technology (platform providers), suppliers and manufacturers of hardware, software developers, publishers, providers of content, network retailers, distributors and consumers (40). Some examples of these value chains can be seen in Figure 19 and 20, provided by Tomaselli *et al.* (40) for the Sony PlayStation 3 and Microsoft Xbox 360. According to the authors, the holders of

the console technology are the companies which design, market and manufacture the videogame consoles, publish software and manage relationships with independent publishers (38). Additionally, they are responsible for approving the games and producing their physical copies.

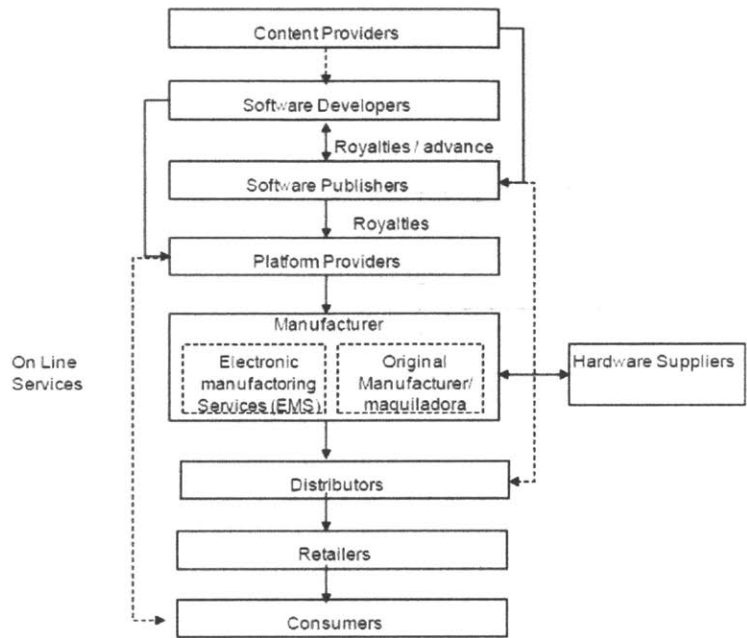


Figure 17 - The Complete Home Console Videogame Value Chain - Source: (40)

The manufacturers of hardware can be the console owners' subsidiaries or manufacturer service providers such as Foxconn and Flextronics, which receive the parts and electronic components and assemble the console. In fact, they are supplied with components such as storage devices, processors, and memories among others by the suppliers of hardware (40).

On the software side of the business, software developers design and produce games for consoles. These software companies can be owned by publishers, console companies or be independently owned. However, most software developers are owned or associated with a publisher because of skyrocketing game development costs. Consequently, publishers are responsible for financing, managing and marketing the games, and also for negotiating intellectual property rights. Although some publishers are independent, many are associated with console providers and sell games to retailers through distributors, which are often controlled by publishers. Finally, the retailers' networks sell the games and consoles through diverse channels such as traditional electronic shops and toy retailers with low margins in console sales but around 25% to 30% in games sales (40).

Another important piece of the videogame value chain is the collaborative intellectual content. In fact, the participation of celebrities, athletes and content licensing of film publishers and distributors, music, TV shows, books and magazines are important for the acceptance of the games (40).

Recently, the internet connection and broadband access have also become very important since online games are increasingly popular (40) and this channel have been used to explore additional revenue streams such as sell games characters, extensions, powerful tools and components.

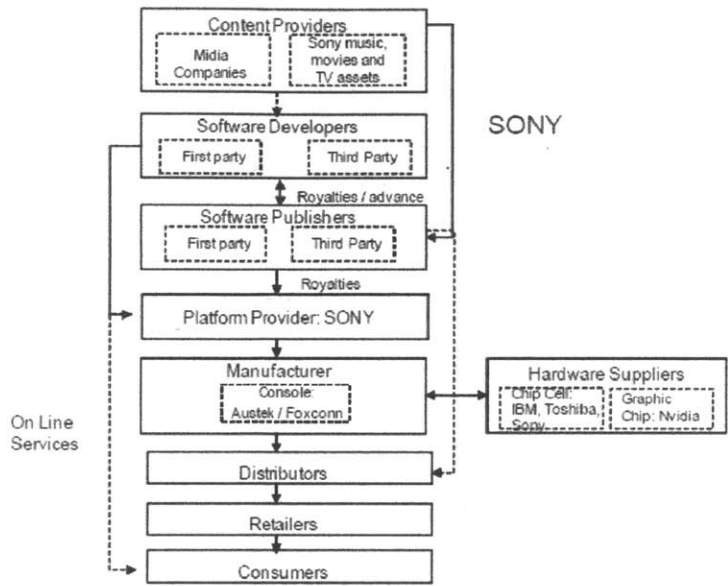


Figure 18 - Sony PlayStation 3 Value Chain - Source: (40)

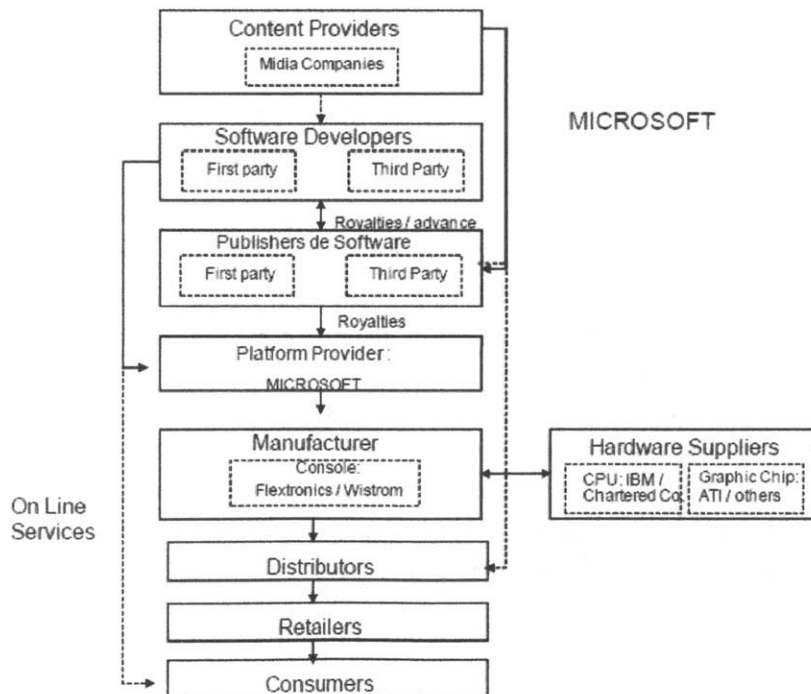


Figure 19 - Microsoft Xbox 360 Value Chain - Source: (40)

It is important to note that, since 2000 some factors shaped this industry configuration (39). First, the computing power has been becoming cheaper, allowing the consoles manufacturer's R&D to develop cutting-edge machines raising the bar of the quality standards along the generations, resulting in an increasing and growing demand for capital for developing new games which could explore the high-tech features of the new platforms. Second, the platform owners started to outsource the console manufacture to manufacturer service providers in Asia and other places where the labor costs are cheaper, making it possible to reduce the videogame prices. In fact, the introduction prices of the videogame consoles have been decreasing as it can be checked in the Figure 22. Third, the growth of broadband could increase the accessibility of online gaming and the development of alternatives distribution channel for games or virtual accessories. Fourth, the consumer base average age has been increasing, moving from children and teenagers to adults in the average of 29 years old. Finally, the rise off exclusives in the game sector where companies such as Electronic Arts has signed exclusive deals with NFL and ESPN (41).

Those factors have affected all the industry players. For example, the software developers had a sharp decline in their profit margins, despite their revenue growth (Figure 21). Those factors pushed the consolidations for scale, shaping a new distribution method (39). Also, it led to an oligopoly structure, driving the consolidation of game developers and publishers. In fact in the past years many publishers have been on acquiring development firms to get competitive advantages by owning and controlling development expertise, proprietary technology and intellectual property and preventing other publishers to access the technologies and context that the best developers could offer (41).

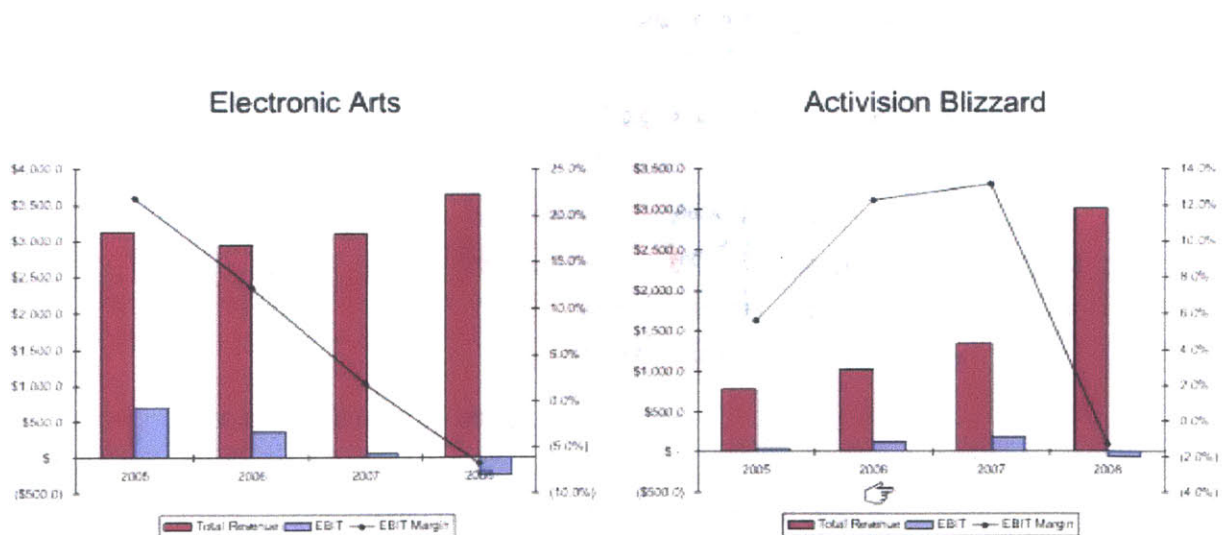


Figure 20 - Game Publishers Profits and Revenue - Source: (39)

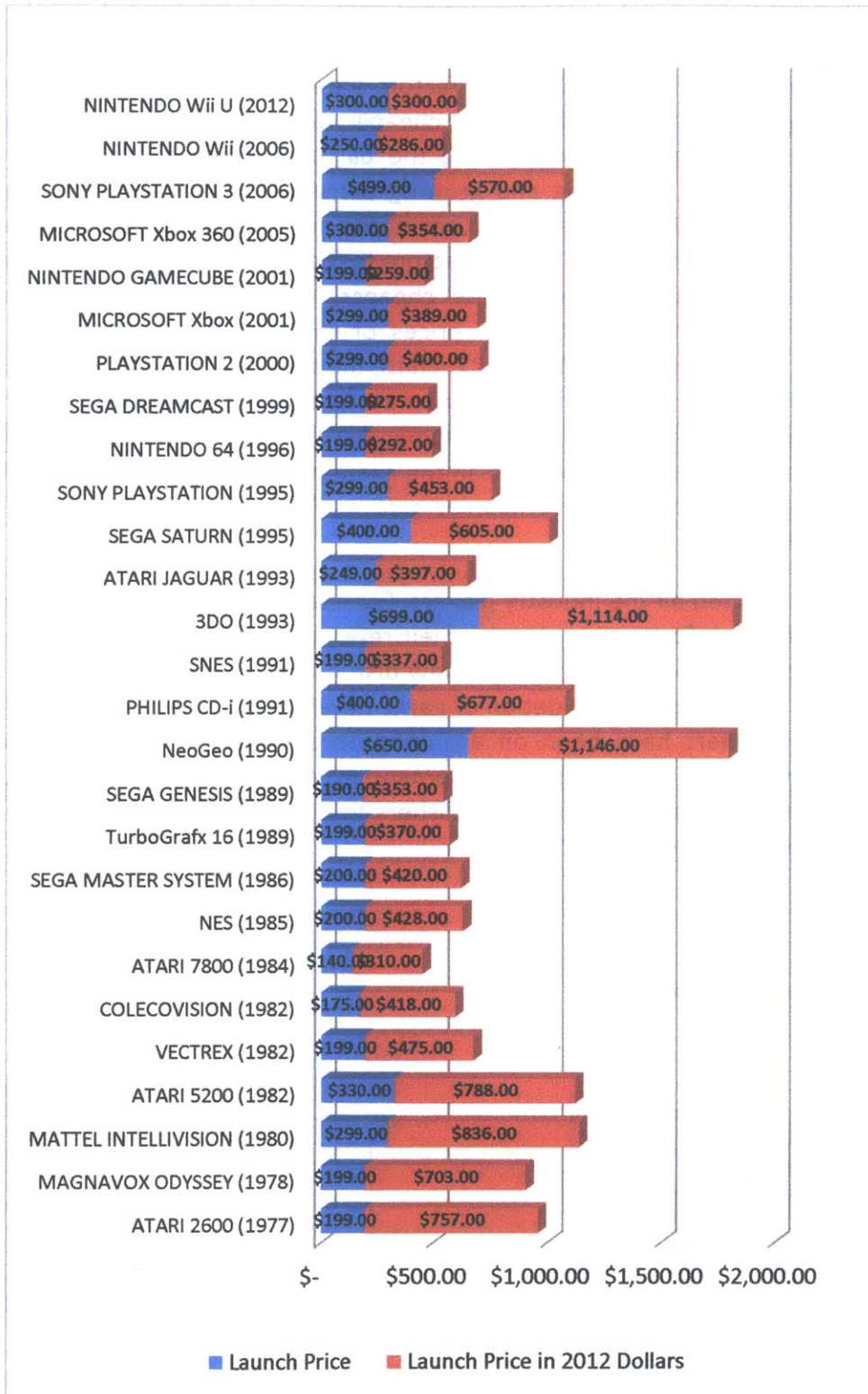


Figure 21 - Historical Prices of Consoles at the launch moment and in 2012 Dollars

Sheth and Sugrue (39) presented the value captured from a total of \$67Bi by each main component of a simplified home console videogame value chain considering only the

publishers, the console providers and the retailers as it can be seen in the diagram show in the Figure 23. According to their estimative, of the total consumer's expenditure, the publishers capture around 49% of the total value while the console manufacturers capture around 37% of the value and, finally, only around 14% are captured by the retailers.

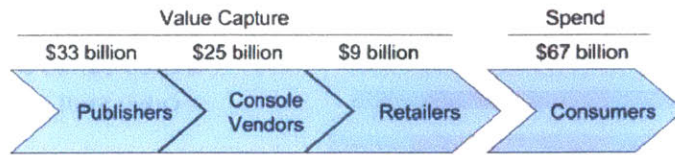


Figure 22 - Value Capture in the Home Console Videogames Value Chain – Source: (39)

So, because of these consolidations, this work will use a simplified version of the value chain for the purpose of the microeconomic model used.

The Used Game Market

In Addition to that, the used game market represented mainly by GameStop videogame retail chain has been playing an important role in the competition dynamics in this industry. First, GameStop has built a very strong physical presence in the U.S. under the brands EB Games, Micromania and GameStop with over than 6,000 locations in 15 countries that made them the “the largest multichannel retailer of videogames" in the world”. Moreover, they have a very impressive stores density as it can be confirmed in Figure 26. Second, they have built a strong trade-in business platform that allow consumers to sell their used games, consoles or accessories and use those credits to buy other new or used games, consoles or accessories. Third, they have built a strong subscriber based rewards program. So, considering their sell used hardware and software at a much cheaper price, they are very attractive to the videogame consumers who started to buy games for a fraction of the brand new ones. As a result, GameStop became a very profitable, getting mostly of their huge profit from the used games and consoles trades as it can be checked in the Figure 24. In addition to that, their business consistence in making profits can be seen in the Figure 25 where their free cash flow is plotted. (42)



Figure 23 – GameStop Profits composition - Source: Gamasutra

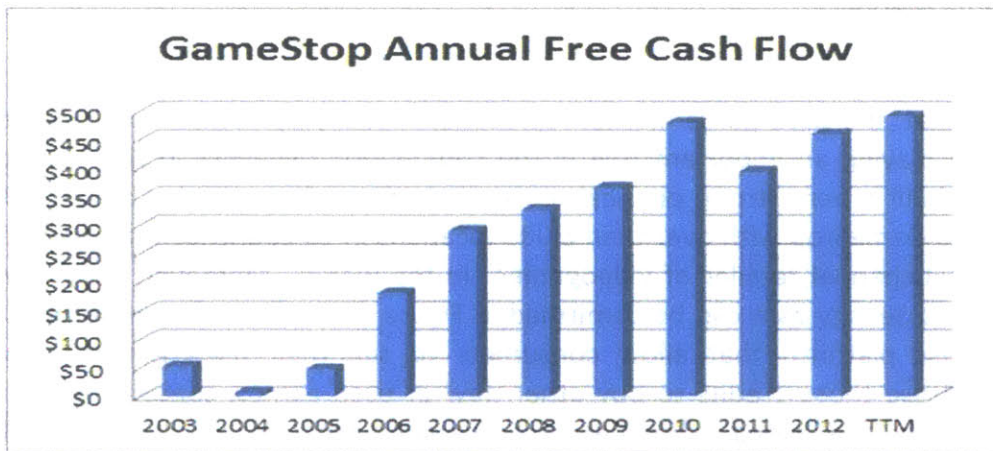


Figure 24 - GameStop Annual Free Cash Flow – Source: Gamasutra

As it could be expected, their success drove some changes in the market. On one hand, their massive sales of used games have been pushing the average game prices down and reducing the sales of brand new games. Consequently, as they make money from selling used games, this reduces the revenue from game sales in the whole value chain since every time a consumer choose to buy an used game, the traditional retailers don't sell their inventoried new games, the publishers don't make money from that sale and there is no royalties paid to the manufacturers and game developer. On the other hand, their presence have been pushing the new game prices down, and as they goes down, more units is expected to be sold, and also the attractiveness of a console is increased since it became more affordable.

GameStop Store Density 2008-2009

Stores per 100,000 State Citizens

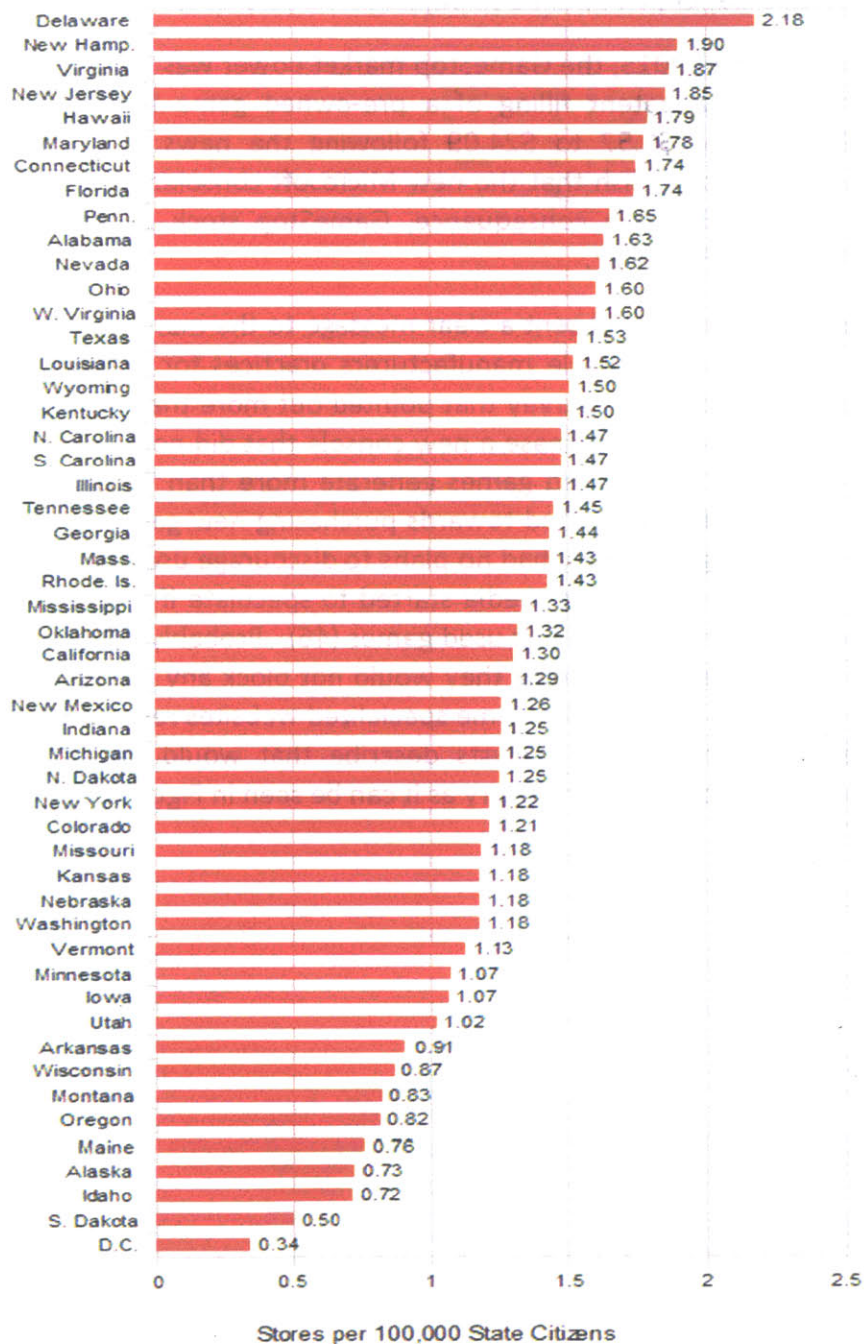


Figure 25 - GameStop Store Density 2008-2009 - Source: Gamasutra

Publishers like EA are already trying to squash used-game sales by locking the multiplayer component, and forcing those secondary consumers into purchasing a "pass" to gain access. Banning used games entirely would likely break the gaming market given that a large chunk of consumers rely on the cheaper price points to build their library. (43)

However, in the beginning of 2013, the GameStop market power was tested. In fact, in January of 2013 Sony announced a patent filling of a pre-owned game blocking technology and GameStop's stocks dropped \$1.57 to \$24.09 following the news (42). Subsequently, the specialized media started to publish that the new Microsoft consoles would feature a system preventing used games (43). As a consequence, GameStop stock prices dropped down in January as it can be seen in Figure 27.

But GameStop president Tony Bartel sent a clear message to the manufacturers. In fact, when asked by the Media about the console manufacturers practices for preventing the usage of used games, he told about a recent survey that pointed out more than 60% of the videogame consumers would be less likely to purchase a new console that did not play pre-owned games. Additionally, Bartel added: "Also, used games generate more than \$1 billion of trade credit annually, 70 per cent of which is credited towards purchasing new games and new hardware" (44). Moreover, Nintendo signaled they had no plans to discourage used-game sales in any way games (45). As a result, the specialized media started to speculate if Nintendo would win the next generation console wars by not killing used games (46). Probably, for those reasons, Sony retreated officially in the media explaining they would not block any used games (47) putting Microsoft in a hard situation. Unofficially, some specialized websites reported Microsoft will not block used games (48) while some analysts describe that would be a big mistake (49). Consequently, GameStop stock prices recovery as it can be seen in Figure 27.



Figure 26 - GameSpot Stock Prices from May of 2012 until April 2013 - Source: Money.msn.com

The Tie-Ratios

A metric typically used in the industry to measure the success of a videogame platform, mainly in the adoption period, is the system's tie-ratio given by the Total Software Unit Sales divided by Total Console Unit Sales. VGsales (46) shows that historically a high tie-ratio and therefore high software sales are demonstrated to be absolutely crucial for a console to be successful. The total tie-ratios of the seventh and eighth generation are shown in Table 3, demonstrating that the Nintendo's platform has the lowest one among the videogame home consoles. It may seem contradictory but it is important to remember that Nintendo has been losing sales positioning since the middle of 2010, and that fact that the lower tie-ratio can mean higher hardware sales, what is the Wii's case. According to VGsales (46) in the Wii's first 14 months on the market they pushed a lot of games (more than 360), but because the console sales were extremely successful, it dropped down the ratio.

Table 3 - Tie Ratios - Source: VGChartz.com (2013)

Console	Total Tie Ratios for the Generation				
	North America	Europe	Japan	Rest of World	Global
Xbox 360	12.16	9.20	7.32	8.33	11.01
PlayStation 3	10.98	7.48	6.09	10.35	8.91
Wii	10.31	7.29	5.33	8.60	8.51
Wii-U	2.36	2.09	1.29	2.41	2.00

Another important consideration is that Nintendo Wii-U has already a Global tie-ratio of 2, while Microsoft and Sony have not launched their eighth generation console yet. The first-mover advantage seems to be another source of competitive advantage that Nintendo are trying to capture in this new videogame home console generation.

The Threat of an Open Platform

Recently there was introduced a new console totally open source console, the Ouya. This Android-based gaming console kickstarter-founded was debuted on 28th March 2013 and is promising to disrupt the videogame console industry. The advanced hardware as specifically designed using standard components to be affordably priced at \$99 and its completely open design allows developers to produce their games at a fraction of the cost of producing for the current videogame console platforms. Any developer can have the software development kit to allow to game programming for the platform for free. All of the already 104 published games including famous games franchises such as Final Fantasy and the future ones can be tested for free before the user decides to buy it. Since the games are downloadable, there are no media,

inventory, distribution or shipping costs reducing final the price for the consumer (47) (48) (49) (50).

While the traditional videogame consoles platforms use proprietary and closed operational system, Ouya took advantage that 3 of 4 handsets sold in the \$260 billion global smartphone market are powered by Android what attracted legions of developers. That resulted in 8,000 developers already registered with low learning barrier due to the well-known OS. Additionally, finally a player has perceived the value of the hacking culture and user innovation for the videogame console industry. In the Ouya's creators own words: *"Hackers welcome. Have at it: It's easy to root (and rooting won't void your warranty). Everything opens with standard screws. Hardware hackers can create their own peripherals, and connect via USB or Bluetooth. You want our hardware design? Let us know. We might just give it to you. Surprise us!"* (47) (48) (49) (50).

The Two-Sided Markets

As a two-sided market, the players want games to play on while the game development companies chose platforms that are popular or have the potential to be in the future. So, the console manufacturers must address a "chicken-and-egg problem" to drive both sides adoption since "a platform cannot sell the console without games to play and cannot attract game developers without the prospect of an installed base of consumers" according to Pindyck (51). The history over the 30 years of competition has been showing that even technically impressive platforms fail when few quality games are written for them (51).

That leads to a more complex dynamics in the decisions the players must do, since they need to choose a price structure and a business model, what is key factor to success of a platform. In the home console videogame industry, the players, such as Sony Sega and Nintendo nowadays, charges game developers per-unit royalties on games and fixed fees for development kits and have chosen the consumers side as a loss leader. In the 5th generation completion, Sony's PlayStation offered a development platform and software application that was much cheaper (about \$10,000 per seat) and much easier to use since it was PC based than their rivals, what drove to the faster adoption of the game development companies, proving to be an important factor that supported the platform supremacy (51).

The Digital Platform Competition

The digital platform competition dynamics can explain the home console videogame industry competition. So, when studying the competition in this industry, it is fundamental to understand all the key elements of a successful platform. According to Cusumano (52), some attributes relate to technology strategy such as the degree of openness, modularity and feature richness. The platform needs to offer an open interface for allowing third party application and

accessories developers to create products and solutions for the platform users, increasing the platform appeal for the users, reinforcing the attractiveness to the third party companies on developing new offerings. Modular platforms will make easier for outside firms to add functionality and content as well as develop new products and services creating a reinforcing loop to bring new customer and firms on board. Finally, the richest platforms will allow solution providers to develop the most compelling products raising the attractiveness of the platform. Cusumano (52) emphasizes the interaction of those attributes can support a strong ecosystem, what is usually essential to generate powerful network effects.

A framework called “Winner-Take-All-or-Most” (WTAoM) can be used to analyze the power of a platform to win the “platform war” as suggested by Cusumano (52). This framework describes three simple conditions a platform must have to win the platform war according to Cusumano (53) and Alstyne et al. (53). The first condition described by Cusumano (52) is the platform to generate a strong network effect. The second condition according to Cusumano (52) is that a platform must minimize the opportunities for competitors to fragment the market through exploiting differentiation strategies or segmentation niches. In other words, being hard to differentiate is essential to the platform success. Finally, the third condition for a winning platform is to make it difficult or costly for users or ecosystem partners such as software and hardware developers to use more than one platform or having more than one “home”. The “multi-homing” effect fragments the market, shaping the environment in such a way that no platform will take all or most.

Under the light of the WTAoM framework can easily validate the conditions for the Windows-PC and VHS platforms success. First, both platforms generated strong network effects. The “direct” network effect can be explained by the adoption of more users leading to more incentives for software and movie distributors to be on board, what would reinforce the adoption. So, there were both cross-side and same-side network effects. The “indirect” effect can be explained by the fact that more users, more pressure the potential ones would be receiving to be on board. Second, it was not easy to differentiate enough for both platforms to really fragment the market by driving massively the adoption of alternatives. In the case of Mac, they could only differentiate for years by the superior graphics quality and tools for image editing and processing, what created a niche market for movie and graphical editors as well as publishers allowing the platform to barely survive. For some years, some other computer platforms existed such as Commodore Amiga and Atari ST as niche players for some graphical and sound applications as well as gaming, due to the superior technological features, but once PC enhanced the graphics, sound and processor capability, they lost their space. In the case of VHS, the only alternative was the Betamax, which survived only as a niche player for professional video recording and edition. Finally, for both platforms the cost of multi-homing was very high, so besides professionals or enthusiasts, it would not make sense multi-homing as well as it would be not viable economically.

In the home videogame console industry, the players have been learning along the past seven generations that competitive dynamics make the racing for scale an imperative. That drove the players to create the most advanced consoles with cutting-edge graphical, sound and connectivity features as well as drop the price as much as they can afford to encourage the

adoption for creating the strong network-effects. In fact, according to Felix (55), in the past the corrected prices of consoles could reach \$1,146, much higher than the average \$250 practiced nowadays. So, basically the console manufacturers drop the price even below their unit cost under the incentive of increasing the market-share to boost the game sales where they can generate some profits.

Applying the WTAoM framework for the home videogame console industry, it is possible to draw some conclusions about the dynamic of the competition. First, there is a strong network effect in the videogame industry, both cross-side and same-side. Users are pushed to adopt the platform their friends adopt since they can borrow or exchange games. It is important to note that intentionally there is no compatibility for software of different platforms, what reinforces the same side network effects. Although usually the third party developers/publishers release the same titles for all the platforms, the first party software play an important role for the early adopters as well as usually represent the most well know game franchises for each platform. That reinforces also the cross-side network effect. Additionally, the network effects tend to increase due to the effect of the manufacturers owned on-line networks where the consoles connect using the internet for allowing users to play competitive or cooperative games with other remote players as well as buy game extensions, new characters, levels, cars, etc. Besides the network effect, the social effects of those networks tend to increase the stickiness to the games, since there is more incentive to the players to enhance their abilities to compete in the network.

Second, there is some possible differentiation and those have been explored not only in the previous generations as well as the current ones. While videogame used to be for teenagers, the first Sony's PlayStation explored the adult men market by publishing realistic sport games as well as titles with intense violence and adult content. By creating a motion sense control and sports titles that took advantage of the technology, Nintendo's Wii was adopted by even older users as well as women motivated by the indoor exercise appeal. Besides those differentiations, both Sony and Nintendo have been exploring the portable videogame market, so players could enjoy games anywhere with portable devices as a new and independent platform.

Third, the multi-homing incentive has been increased over the generations for some reasons. First, because of the real price reduction along the generations what made the consoles much more affordable. Second, the quality and content of the games rose the average age of the users, so adults have much more purchase power and autonomy for the buying decision. Combined, both arguments made multi-homing reasonable. In fact, "serious" videogame players use to have all the consoles or at least the best.

That analysis can lead to the conclusion that no platform will take all or most, so there is room for multiple platforms in the home videogame console market as it can be seen in the table 4, where the WTAoM test was applied for all the home console videogame generations.

Table 4 - WTAoM Framework Test Applied for all the Home Console Videogame Generations

Period	Platforms	Winner	WTAoM Framework Test (Passed?)		
			Strong Network Effect	Low Differentiation	Multi-Homing
Early 1970s	Odyssey 100	Odyssey 100?	Failed	Passed	Passed
Late 1970s	Atari 2600 Odyssey	Atari 2600	Passed	Passed	Passed
Early 1980s	Coleco Atari 5200 Mattel Intellivision	Coleco	Passed	Passed	Passed
Mid-Late 1980s	Nintendo NES Atari 7800 Sega Master System	Nintendo NES	Passed	Passed	Passed
Early 1990s	Sega Genesis Nintendo SNES Philips CD-i	Sega Genesis	Passed	Passed	Passed
Mid-Late 1990s	Sony PS1 Atari Jaguar Nintendo 64 Sega Saturn	Sony PS1	Passed	Passed +/-	Passed
Early 2000s	Sony PS2 Microsoft Xbox Nintendo GameCube Sega Dreamcast	Sony PS2	Passed	Passed +/-	Passed
Mid-Late 2000s	Sony PS3 Microsoft Xbox360 Nintendo Wii	Wii or Xbox360?	Passed	Failed	Failed
Late 2012-Today	Nintendo Wii-U Oyua Xbox 720? Playstation 4?	?	Passed?	Failed?	Failed?

A Dynamic Model for the Platform Competition

A model for the home console videogame sales

As suggested by Pindyck in (37), diffusion models often used in marketing applications can be applied for modeling the dynamics of the platform competition with network externalities.

Considering the diffusion and saturation process for a new semi-durable product such as a home console videogame in a monopoly context, let's suppose $X(t)$ is the stock of consoles in circulation at time t , and X^* is the saturation level, i.e., the maximum stock that could be in circulation after each potential console customer has bought one. Initially, by assumption, let's consider X^* is a constant. Under this model, the actual stock of consoles in circulation could be given by the previous period stock plus the growth in the stock described in the following equation:

$$x(t) = x(t - 1) + \alpha * x(t - 1) * (\ln x^* - \ln x(t - 1))$$

The growth in the stock depends on two factors: (1) last period's stock, because the greater is the number of iPods in circulation, the greater will be the consumer awareness of the product; (2) the potential unsatisfied demand for iPods, as represented by the difference between the log of the saturation level and the log of the stock in circulation. The parameter α determines how rapidly this process of diffusion and saturation occurs. The solution of this equation is a S-shaped curve for the life cycle of a new product.

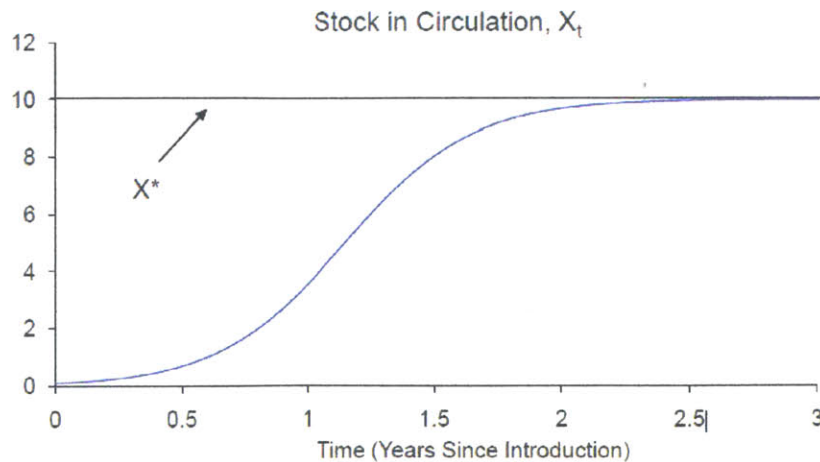


Figure 27 - S Shape Saturation Curve – Source: (37)

The sales of consoles for each period are equal to the increase in the stock plus replacement sales (for lost, broken, or worn-out consoles). Replacement sales are equal to a depreciation rate (δ) times the previous stock. Thus the equation for sales is:

$$Q(t) = x(t) - x(t - 1) + \delta * x(t - 1)$$

Note that sales will start out slowly, then increase as the stock increases, and later decrease and level out as the market saturates. Once the market has saturated, the only sales will be replacement sales (Figure 7).



Figure 28 - Sales when market is saturated - Source (37)

There is no reason, however, for the saturation level X^* to remain fixed. We would expect the saturation level to depend on GDP (as the economy grows, the potential market for iPods will grow) and on price (if the price of iPods falls, the potential market will grow). Thus we might make the saturation level a function of GDP, price, and perhaps other variables:

$$\ln x^*(t) = a_0 - a_1 * \ln P(t) - a_2 * \ln GDP(t)$$

Here, the parameters a_1 and a_2 are long-run price and income elasticities. Now the saturation level will change over time as price and GDP change.

Now, the model must be adjusted for supporting competing firms. So, let $X_{XBox}(t)$, $X_{PS}(t)$ and $X_{Wii}(t)$ be respectively the number of consumers who are using the Microsoft's Xbox360, Sony's PlayStation3 and Nintendo's Wii platforms. Considering the market saturation follows a logistic curve, the dynamics of $X_{XBox}(t)$, $X_{PS}(t)$ and $X_{Wii}(t)$ are given by the following three equations:

$$x_{XBox}(t) = x_{XBox}(t-1) + \alpha_{XBox} * x_{XBox}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]$$

$$x_{PS}(t) = x_{PS}(t-1) + \alpha_{PS} * x_{PS}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]$$

$$x_{Wii}(t) = x_{Wii}(t-1) + \alpha_{Wii} * x_{Wii}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]$$

Or, the expressions can be written just in terms of the difference ($\Delta x(t)$) in the stock between the period t and $t-1$ as follows:

$$\Delta x_{XBox}(t) = \alpha_{XBox} * x_{XBox}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]$$

$$\Delta x_{PS}(t) = \alpha_{PS} * x_{PS}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]$$

$$\Delta x_{Wii}(t) = \alpha_{Wii} * x_{Wii}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]$$

The coefficients in this proposed model can be given by:

$$\alpha_{XBox}(t) = \alpha_{XBox}(P_{XBox}, P_{PS}, P_{Wii}, N_{XBox}, N_{PS}, N_{Wii}, NA_{XBox}, NA_{PS}, NA_{Wii}, NO_{XBox}, NO_{PS}, NO_{Wii})$$

$$\alpha_{PS}(t) = \alpha_{PS}(P_{XBox}, P_{PS}, P_{Wii}, N_{XBox}, N_{PS}, N_{Wii}, NA_{XBox}, NA_{PS}, NA_{Wii}, NO_{XBox}, NO_{PS}, NO_{Wii})$$

$$\alpha_{Wii}(t) = \alpha_{Wii}(P_{XBox}, P_{PS}, P_{Wii}, N_{XBox}, N_{PS}, N_{Wii}, NA_{XBox}, NA_{PS}, NA_{Wii}, NO_{XBox}, NO_{PS}, NO_{Wii})$$

Where P_{XBox} , P_{PS} and P_{Wii} are the prices of each console; N_{XBox} , N_{PS} and N_{Wii} are the total number of game titles of each platform; NA_{XBox} , NA_{PS} and NA_{Wii} are the total number of game titles ranked as AAA (in other words, with very superior quality) and, finally, NO_{XBox} , NO_{PS} and NO_{Wii} are the number of game titles with the on-line playing capabilities, which theoretically increases the network externality effects of each platform due to the proprietary on-line networks of each manufacturer where you can connect to play those games with remote cooperation or competition against other consumers using the same platform in any place in the world.

Here, for the objectives of this study, the proposed expressions for α_{XBox} , α_{PS} and α_{Wii} are:

$$\alpha_{XBox} = a_{XBox} + b_{XBox} * \left(\frac{P_{XBox}}{P_{avg}} \right) + c_{XBox} * \left(\frac{N_{XBox}}{N_{avg}} \right) + d_{XBox} * \left(\frac{NA_{XBox}}{NA_{avg}} \right) + e_{XBox} * \left(\frac{NO_{XBox}}{NO_{avg}} \right)$$

$$\alpha_{PS} = a_{PS} + b_{PS} * \left(\frac{P_{PS}}{P_{avg}} \right) + c_{PS} * \left(\frac{N_{PS}}{N_{avg}} \right) + d_{PS} * \left(\frac{NA_{PS}}{NA_{avg}} \right) + e_{PS} * \left(\frac{NO_{PS}}{NO_{avg}} \right)$$

$$\alpha_{Wii} = a_{Wii} + b_{Wii} * \left(\frac{P_{Wii}}{P_{avg}} \right) + c_{Wii} * \left(\frac{N_{Wii}}{N_{avg}} \right) + d_{Wii} * \left(\frac{NA_{Wii}}{NA_{avg}} \right) + e_{Wii} * \left(\frac{NO_{Wii}}{NO_{avg}} \right)$$

Where P_{Avg} , N_{Avg} , NA_{Avg} and NO_{Avg} are the respective averages of the prices, total number of titles, total number of AAA titles ranked by the GameSpot.com (with a grade above or equal 9 of 10) and online titles of each platform, given by:

$$P_{avg} = \left(\frac{P_{XBox} + P_{PS} + P_{Wii}}{3} \right)$$

$$N_{avg} = \left(\frac{N_{XBox} + N_{PS} + N_{Wii}}{3} \right)$$

$$NA_{avg} = \left(\frac{NA_{XBox} + NA_{PS} + NA_{Wii}}{3} \right)$$

$$NO_{avg} = \left(\frac{NO_{XBox} + NO_{PS} + NO_{Wii}}{3} \right)$$

Since those variables changes of time, it is expected α_{Xbox} , α_{PS} and α_{Wii} to assume different values over the time, so:

$$\alpha_{XBox}(t) = a_{XBox} + b_{XBox} * \left(\frac{P_{XBox}(t)}{P_{avg}(t)} \right) + c_{XBox} * \left(\frac{N_{XBox}(t)}{N_{avg}(t)} \right) + d_{XBox} * \left(\frac{NA_{XBox}(t)}{NA_{avg}(t)} \right) + e_{XBox} * \left(\frac{NO_{XBox}(t)}{NO_{avg}(t)} \right)$$

$$\alpha_{PS}(t) = a_{PS} + b_{PS} * \left(\frac{P_{PS}(t)}{P_{avg}(t)} \right) + c_{PS} * \left(\frac{N_{PS}(t)}{N_{avg}(t)} \right) + d_{PS} * \left(\frac{NA_{PS}(t)}{NA_{avg}(t)} \right) + e_{PS} * \left(\frac{NO_{PS}(t)}{NO_{avg}(t)} \right)$$

$$\alpha_{Wii}(t) = a_{Wii} + b_{Wii} * \left(\frac{P_{Wii}(t)}{P_{avg}(t)} \right) + c_{Wii} * \left(\frac{N_{Wii}(t)}{N_{avg}(t)} \right) + d_{Wii} * \left(\frac{NA_{Wii}(t)}{NA_{avg}(t)} \right) + e_{Wii} * \left(\frac{NO_{Wii}(t)}{NO_{avg}(t)} \right)$$

The coefficients a, b, c, d and e can be obtained by linear regression.

So, the revenues (R) and the profit (π) each player makes over the time with its own console sales are given by:

$$\begin{aligned}
 R_{XBox}(t) &= Q_{XBox}(t) * (P_{XBox}(t)) \\
 R_{PS}(t) &= Q_{PS}(t) * (P_{PS}(t)) \\
 R_{Wii}(t) &= Q_{Wii}(t) * (P_{Wii}(t)) \\
 \pi_{C_{XBox}}(t) &= Q_{XBox}(t) * (P_{XBox}(t) - MC_{XBox}(t)) \\
 \pi_{C_{PS}}(t) &= Q_{PS}(t) * (P_{PS}(t) - MC_{PS}(t)) \\
 \pi_{C_{Wii}}(t) &= Q_{Wii}(t) * (P_{Wii}(t) - MC_{Wii}(t))
 \end{aligned}$$

A model for the games sales

One important metric in the home console videogame industry is the tie-ratio (also known by attach rate). This metric measure the number of games purchased by the users in the average per unit of console sold as in given by the following expression:

$$TR = \text{Tie Ratio} = \left(\frac{\text{Total Software Unit Sales}}{\text{Total Console Unit Sales}} \right)$$

Resulting in the following expressions for the current platforms, where TR(t) is the Tie Ratio in the period t, S(i) is the total sales of software in the period i and Q(i) is the total sales of consoles in the period i. So, the Tie Ratio changes over the time and it does not consider the net contribution of the console sales to the stock due to the depreciation, since it accounts for the total number of console sales.

$$\begin{aligned}
 TR_{XBox}(t) &= \sum_{i=1}^t \left(\frac{S_{XBox}(i)}{Q_{XBox}(i)} \right) \\
 TR_{PS}(t) &= \sum_{i=1}^t \left(\frac{S_{PS}(i)}{Q_{PS}(i)} \right) \\
 TR_{Wii}(t) &= \sum_{i=1}^t \left(\frac{S_{Wii}(i)}{Q_{Wii}(i)} \right)
 \end{aligned}$$

According to [55], high tie-ratio and software sales are crucial for a console to be successful due to the revenue stream it generates and because it also encourage the software developers and publishers to release more games for the platform.

Although the tie-ratio is not published every month, they are revealed periodically by analysts in specialized videogame media such as Gamasutra or NPD reports. Using this metric, it is possible to estimate the software sales in any given period t by having the console sales. So, it is also possible to estimate the revenue from game sales using the average price of the games as show below:

$$S_{XBox}(t) = Q_{XBox}(t) * TR_{XBox}(t) - S_{XBox}(t - 1)$$

$$S_{PS}(t) = Q_{PS}(t) * TR_{PS}(t) - S_{PS}(t - 1)$$

$$S_{Wii}(t) = Q_{Wii}(t) * TR_{Wii}(t) - S_{Wii}(t - 1)$$

Here, the proposed model for the tie-ratio for a videogame platform will take into account the GDP, the average price of the game titles in a given moment for the platform (Pg), the relative game quality (NA/N) and the number of games that can be played on-line (NO). So, the tie-ratio will be given by:

$$\ln TR(t) = a + b * \ln GDP(t) + c * \ln Pg(t) + d * \ln \left(\frac{NA(t)}{N(t)} \right) + e * \ln NO(t)$$

$$TR(t) = e^{\left[a + b * \ln GDP(t) + c * \ln Pg(t) + d * \ln \left(\frac{NA(t)}{N(t)} \right) + e * \ln NO(t) \right]}$$

Where the coefficients a , b , c , d and e can be obtained by linear regression. The NA is the total number of games available for the platform on t which is ranked with a score of at least 9 of 10 points in the GameSpot raking system and N is the total number of games released until the moment t for the platform.

So, the using the proposed model, the tie-ratio for each platform in any given moment t will be given by:

$$TR_{XBox}(t) = e^{\left[a_{XBox} + b_{XBox} * \ln GDP(t) + c_{XBox} * \ln Pg_{XBox}(t) + d_{XBox} * \ln \left(\frac{NA_{XBox}(t)}{N_{XBox}(t)} \right) + e * \ln NO_{XBox}(t) \right]}$$

$$TR_{PS}(t) = e^{[a_{PS} + b_{PS} \ln GDP(t) + c_{PS} \ln Pg_{PS}(t) + d_{PS} \ln \left(\frac{NA_{PS}(t)}{N_{PS}(t)}\right) + e \ln NO_{PS}(t)]}$$

$$TR_{Wii}(t) = e^{[a_{Wii} + b_{Wii} \ln GDP(t) + c_{Wii} \ln Pg_{Wii}(t) + d_{Wii} \ln \left(\frac{NA_{Wii}(t)}{N_{Wii}(t)}\right) + e \ln NO_{Wii}(t)]}$$

Since there is first party and third party games, or in better words, software developed by the console manufacturer and by software publishers/developers respectively, the analysts in this industry uses to compute two tie-ratios, for given a better sense of the sales and revenues for the console manufacturers. One example of it is show in the Figure 8 and 9. But unfortunately those data is not widely available.

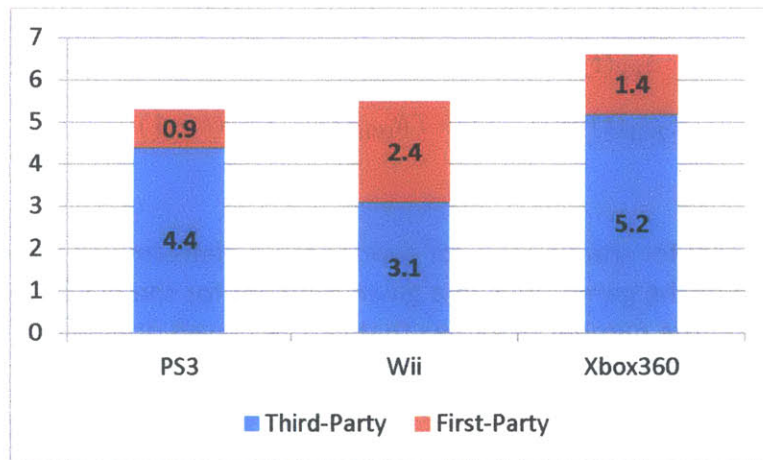


Figure 29 - Tie Ratios after 23 Months on the Market (2005-2007) - First and Third Parties - Source: Gamasutra

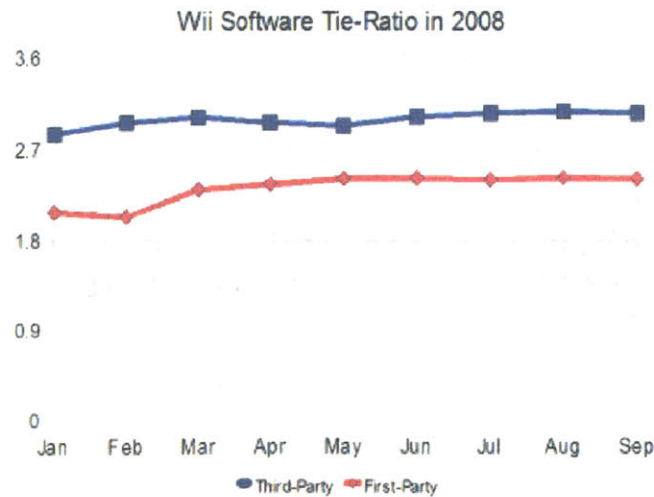


Figure 30 – Wii Tie Ratios in 2008 - First and Third Parties - Source: Gamasutra

Those split tie-ratios can help to estimate the revenue and profit for the console manufacturers, since they receive royalties for each third party game sold while they receive the full revenue for each first party game sold for its own platform, but in this case they have invested a huge amount of money to develop the game what balances the equation. In one hand, third party development seems to be better for the console manufacturers taking into account the risk and the investment, but on the other hand, first party development seems to be the solution for the “chicken-and-egg” problem for the new console introduction into the market since users tend to adopt the console with more games and game developers tend to adopt those with more users and higher initial tie-ratios.

The relationship between the Tie Ratio and the split ones are given by:

$$TR_{XBox}(t) = TR1_{XBox}(t) + TR3_{XBox}(t)$$

$$TR_{PS}(t) = TR1_{PS}(t) + TR3_{PS}(t)$$

$$TR_{Wii}(t) = TR1_{Wii}(t) + TR3_{Wii}(t)$$

Where TR1 is the first party tie-ratio and the TR3 is the third party tie-ratio respectively. By definition, the fraction of the total tie-ratio for first party (f1) and third party (f3) are given respectively by:

$$f1_{XBox}(t) = \frac{TR1_{XBox}(t)}{TR_{XBox}(t)}$$

$$f3_{XBox}(t) = \frac{TR3_{XBox}(t)}{TR_{XBox}(t)}$$

$$f1_{PS}(t) = \frac{TR1_{PS}(t)}{TR_{PS}(t)}$$

$$f3_{PS}(t) = \frac{TR3_{PS}(t)}{TR_{PS}(t)}$$

$$f1_{Wii}(t) = \frac{TR1_{Wii}(t)}{TR_{Wii}(t)}$$

$$f3_{Wii}(t) = \frac{TR3_{Wii}(t)}{TR_{Wii}(t)}$$

Then, because of the difference in the revenue structures for first and third party software, the games sales need to be split into two pockets (S1 and S3) for allowing the correct computation of the revenue from first party titles and royalties from third party.

For any platform,

$$S(t) = S1(t) + S3(t)$$

$$S1 = Q(t) * TR1(t) - S1(t - 1) = Q(t) * f1 * TR(t) - S1(t - 1)$$

$$S3 = Q(t) * TR3(t) - S3(t - 1) = Q(t) * f3 * TR(t) - S3(t - 1)$$

So, for each platform the expressions will be such as:

$$\begin{aligned} S1_{XBox} &= Q_{XBox}(t) * TR1_{XBox}(t) - S1_{XBox}(t - 1) \\ &= Q_{XBox}(t) * f1_{XBox} * TR_{XBox}(t) - S1_{XBox}(t - 1) \end{aligned}$$

$$\begin{aligned} S3_{XBox} &= Q_{XBox}(t) * TR3_{XBox}(t) - S3_{XBox}(t - 1) \\ &= Q_{XBox}(t) * f3_{XBox} * TR_{XBox}(t) - S3_{XBox}(t - 1) \end{aligned}$$

$$S1_{PS} = Q_{PS}(t) * TR1_{PS}(t) - S1_{PS}(t - 1) = Q_{PS}(t) * f1_{PS} * TR_{PS}(t) - S1_{PS}(t - 1)$$

$$S3_{PS} = Q_{PS}(t) * TR3_{PS}(t) - S3_{PS}(t - 1) = Q_{PS}(t) * f3_{PS} * TR_{PS}(t) - S3_{PS}(t - 1)$$

$$S1_{Wii} = Q_{Wii}(t) * TR1_{Wii}(t) - S1_{Wii}(t - 1) = Q_{Wii}(t) * f1_{Wii} * TR_{Wii}(t) - S1_{Wii}(t - 1)$$

$$S3_{Wii} = Q_{Wii}(t) * TR3_{Wii}(t) - S3_{Wii}(t - 1) = Q_{Wii}(t) * f3_{Wii} * TR_{Wii}(t) - S3_{Wii}(t - 1)$$

Considering $Pg(t)$ the average price of the game titles at the moment t and $r(t)$ the average royalties paid to the console manufacturer (in percentage of the price) per third game unit sold, the revenue from game sales ($Rg1$) for the console manufacturers (first party) are given by:

$$\begin{aligned} Rg1_{XBox}(t) &= Pg_{XBox}(t) * (S1_{XBox}(t) + S3_{XBox}(t) * r_{XBox}(t)) \\ &= Pg_{XBox}(t) \\ &\quad * ([Q_{XBox}(t) * f1_{XBox} * TR_{XBox}(t) - S1_{XBox}(t - 1)] \\ &\quad + [Q_{XBox}(t) * f3_{XBox} * TR_{XBox}(t) - S3_{XBox}(t - 1)] * r_{XBox}(t)) \end{aligned}$$

$$\begin{aligned} Rg1_{PS}(t) &= Pg_{PS}(t) * (S1_{PS}(t) + S3_{PS}(t) * r_{PS}(t)) \\ &= Pg_{PS}(t) \\ &\quad * ([Q_{PS}(t) * f1_{PS} * TR_{PS}(t) - S1_{PS}(t - 1)] \\ &\quad + [Q_{PS}(t) * f3_{PS} * TR_{PS}(t) - S3_{PS}(t - 1)] * r_{PS}(t)) \end{aligned}$$

$$\begin{aligned}
Rg1_{wii}(t) &= Pg_{wii}(t) * (S1_{wii}(t) + S3_{wii}(t) * r_{wii}(t)) \\
&= Pg_{wii}(t) \\
&\quad * [(Q_{wii}(t) * f1_{wii} * TR_{wii}(t) - S1_{wii}(t-1))] \\
&\quad + [Q_{wii}(t) * f3_{wii} * TR_{wii}(t) - S3_{wii}(t-1)] * r_{wii}(t)
\end{aligned}$$

On the other hand, the total revenue for third party publishers/developer (Rg3) at any instant t from game sales is given by:

$$\begin{aligned}
Rg3_{XBox}(t) &= Pg_{XBox}(t) * [(Q_{XBox}(t) * f3_{XBox} * TR_{XBox}(t) - S3_{XBox}(t-1)) * (1 - r_{XBox}(t))] \\
Rg3_{PS}(t) &= Pg_{PS}(t) * [(Q_{PS}(t) * f3_{PS} * TR_{PS}(t) - S3_{PS}(t-1)) * (1 - r_{PS}(t))] \\
Rg3_{wii}(t) &= Pg_{wii}(t) * [(Q_{wii}(t) * f3_{wii} * TR_{wii}(t) - S3_{wii}(t-1)) * (1 - r_{wii}(t))]
\end{aligned}$$

Considering Ig the amount of investment made to develop a game title for a platform, Nn1(t) and Nn3(t) the new game titles developed in the period t by first and third party respectively, the total profit for the console manufacturers ($\pi t1(t)$) and third party ($\pi t3(t)$) will be given by:

$$\begin{aligned}
\pi t_{XBox}(t) &= [Q_{XBox}(t) * (P_{XBox}(t) - MC_{XBox}(t))] + (Rg_{XBox}(t) - Nn1_{XBox}(t) * Ig_{XBox}) \\
\pi t_{PS}(t) &= [Q_{PS}(t) * (P_{PS}(t) - MC_{PS}(t))] + (Rg_{PS}(t) - Nn1_{PS}(t) * Ig_{PS}) \\
\pi t_{wii}(t) &= [Q_{wii}(t) * (P_{wii}(t) - MC_{wii}(t))] + (Rg_{wii}(t) - Nn1_{wii}(t) * Ig_{wii})
\end{aligned}$$

$$\begin{aligned}
\pi t_{XBox}(t) &= [Q_{XBox}(t) * (P_{XBox}(t) - MC_{XBox}(t))] \\
&\quad + \{Pg_{XBox}(t) \\
&\quad * [(Q_{XBox}(t) * f1_{XBox} * TR_{XBox}(t) - S1_{XBox}(t-1)) \\
&\quad + (Q_{XBox}(t) * f3_{XBox} * TR_{XBox}(t) - S3_{XBox}(t-1)) * r_{XBox}(t)] - Nn1_{XBox}(t) \\
&\quad * Ig_{XBox}\}
\end{aligned}$$

$$\begin{aligned}
\pi t_{XBox}(t) &= [Q_{XBox}(t) * (P_{XBox}(t) - MC_{XBox}(t))] \\
&\quad + \{Pg_{XBox}(t) \\
&\quad * [(Q_{XBox}(t) * f1_{XBox} * TR_{XBox}(t) - S1_{XBox}(t-1)) \\
&\quad + (Q_{XBox}(t) * f3_{XBox} * TR_{XBox}(t) - S3_{XBox}(t-1)) * r_{XBox}(t)] - Nn1_{XBox}(t) \\
&\quad * Ig_{XBox}\}
\end{aligned}$$

$$\begin{aligned} \pi_{Wii}(t) = & [Q_{Wii}(t) * (P_{Wii}(t) - MC_{Wii}(t))] \\ & + \{Pg_{Wii}(t) \\ & * [(Q_{Wii}(t) * f1_{Wii} * TR_{Wii}(t) - S1_{Wii}(t - 1)) \\ & + (Q_{Wii}(t) * f3_{Wii} * TR_{Wii}(t) - S3_{Wii}(t - 1)) * r_{Wii}(t)] - Nn1_{Wii}(t) * Ig_{Wii}\} \end{aligned}$$

Nonetheless, there is no reason to consider Ig constant over time since there must be a learning effect in the game development as well as an economy of scale, since after some numbers of games have been developed, the producers have built a software library that can be reused to develop new games faster and cheaper. So, considering the learning effect, the cost of developing a new game can be given by the following exponential expression:

$$Ig_{XBox}(t) = a_{XBox} * [t]^{-b_{XBox}}$$

$$Ig_{PS}(t) = a_{PS} * [t]^{-b_{PS}}$$

$$Ig_{Wii}(t) = a_{Wii} * [t]^{-b_{Wii}}$$

The Console Sales Model Parameters

All console sales data was collected from the website VGchartz.com (Table 5).

Table 5 - Consoles Sales in the U.S. (Units) - Source: VGchartz.com

Year	Units Sold		
	XBox360	PS3	Wii
2005	563,282.00	-	-
2006	3,832,778.00	667,762.00	1,075,329.00
2007	4,356,599.00	2,474,435.00	6,444,409.00
2008	4,784,134.00	3,547,363.00	9,826,502.00
2009	4,691,537.00	4,255,949.00	8,989,309.00
2010	6,999,773.00	4,737,437.00	7,398,500.00
2011	7,693,050.00	4,486,935.00	4,878,060.00
2012	5,566,035.00	3,433,720.00	2,042,064.00

The number of game titles released per platform per year the number of AAA games (ranked as at least 9 of 10 in the GameSpot Raking) released per platform per year and also the number of on-line games released per platform per year were collected from the Gamespot.com website. An excel macro for computing the totals per year and per platform was used (Table 6).

Table 6 - Game Titles Units - Source: Gamespot.com

Year	PS3			Wii			Xbox360		
	Total	On-line	AAA (>9)	Total	On-line	AAA (>9)	Total	On-line	AAA (>9)
2005	2	-	-	3	-	-	38	7	1
2006	28	-	-	39	1	-	99	24	4
2007	127	4	7	199	1	3	166	18	6
2008	196	7	9	411	39	7	307	48	8
2009	307	9	15	542	48	9	832	96	12
2010	381	16	10	454	52	11	1,085	161	15
2011	545	27	13	266	5	11	1,093	160	11
2012	646	36	7	96	7	13	903	197	7

From those data, the cumulative number of games (N), number of online games (NO) and AAA games (NA), per platform and per year could be computed (Table 7).

Table 7 - Cumulative Game Titles (Total, On-line and AAA) - Adapted from Gamespot.com

Year	PS3			Wii			Xbox360		
	N	NO	NA	N	NO	NA	N	NO	NA
2005	2	-	-	3	-	-	38	7	1
2006	30	-	-	42	1	-	137	31	5
2007	157	4	7	241	2	3	303	49	11
2008	353	11	16	652	41	10	610	97	19
2009	660	20	31	1,194	89	19	1,442	193	31
2010	1,041	36	41	1,648	141	30	2,527	354	46
2011	1,586	63	54	1,914	146	41	3,620	514	57
2012	2,232	99	61	2,010	153	54	4,523	711	64

For the calculation of the sales coefficients (α 's), the real sales data were used and a depreciation rate of 5% (δ) was adopted, so the real contribution for the stock level of the consoles was 95% of all the console sales in one year. The following expression derived from expression X was used for computing the stock ($x(t)$) from the real sales data (Q).

$$x(t) = Q(t) + x(t - 1) * (1 - \delta)$$

That resulted on the following stocks for each platform (Table 8):

Table 8 - Stocks per Platform

Year	Xxbox	Xps	Xwii
2005	563,282	-	-
2006	4,367,896	667,762	1,075,329
2007	8,506,100	3,108,809	7,465,972
2008	12,864,929	6,500,731	16,919,175
2009	16,913,220	10,431,644	25,062,525
2010	23,067,332	14,647,499	31,207,899
2011	29,607,015	18,402,059	34,525,564
2012	33,692,699	20,915,676	34,841,350

The historical prices of the console were got from the websites (56). Since the prices were dropped in any month during a year, the prices used per console were weighted by the number of unit sold in each price level for each year, as it can be seen in Table 9.

Table 9 - Consoles Prices - Source: (56)

Year	XBox360	PS3	Wii
2005	\$ 299.00	\$ -	\$ -
2006	\$ 299.00	\$ 499.00	\$ 249.00
2007	\$ 285.18	\$ 451.47	\$ 249.00
2008	\$ 229.75	\$ 399.00	\$ 249.00
2009	\$ 199.00	\$ 329.37	\$ 219.47
2010	\$ 199.00	\$ 299.00	\$ 199.00
2011	\$ 199.00	\$ 299.00	\$ 163.08
2012	\$ 199.00	\$ 299.00	\$ 139.99

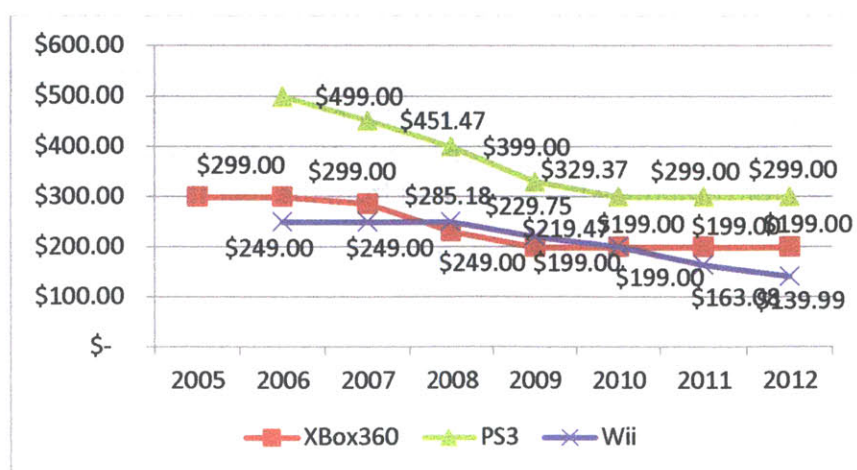


Figure 31 - Consoles Prices reduction along the generation life cycle

The coefficients of the expression $X + 1$ for the desired saturation level in the year t was assumed to be reasonable values ($a_0 = 2$, $a_1 = -1.5$ and $a_2 = 0.8$). Using the GDP per year and the price got by weighting each console price per its previous period sales and plugging in the expression $X + 1$, the saturation levels were computed (Table 10).

Table 10 - Desired Saturation Level

Year	GDP (in Trillions)	Weighted Prices	Desired Stock ($X^*(t)$)
2005	\$12.564	\$ 299.00	43,091,619.80
2006	\$13.315	\$ 299.00	45,137,974.92
2007	\$13.962	\$ 298.12	47,093,283.64
2008	\$14.219	\$ 270.64	55,245,608.77
2009	\$13.898	\$ 235.55	66,809,703.16
2010	\$14.419	\$ 222.73	74,831,769.98
2011	\$14.991	\$ 209.87	84,400,158.06
2012	\$15.685	\$ 208.43	88,417,187.56

Then the following expressions derived from $x+2$, $x+3$ and $x+4$ were used to determine the sales coefficients (α 's) values.

$$\alpha_{XBox}(t) = \frac{\Delta x_{XBox}(t)}{x_{XBox}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]}$$

$$\alpha_{PS}(t) = \frac{\Delta x_{PS}(t)}{x_{PS}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]}$$

$$\alpha_{Wii}(t) = \frac{\Delta x_{Wii}(t)}{x_{Wii}(t-1) * [x^*(t) - x_{XBox}(t-1) - x_{PS}(t-1) - x_{Wii}(t-1)]}$$

From those expressions and the values of the stocks of each platform and the desired stock saturation level, the sales coefficients values in Table 11 were calculated.

Table 11 - Sales Coefficients (x 10⁻⁹)

Year	Alpha_Xbox	Alpha_PS3	Alpha_Wii
2005	-	-	-
2006	152.0	-	-
2007	21.0	82.0	133.0
2008	11.0	24.0	28.0
2009	7.0	14.0	11.0
2010	8.0	9.0	6.0
2011	6.0	6.0	2.0
2012	3.0	3.0	0.2

Then, using a linear regression and the data from the 7th generation competition, the sales coefficients (α 's) parameters (a,b,c,d and e) of the expressions X+13, x+14 and x+15 could be determined as shown in Table 12. Note that the sales coefficients (α 's) are multiplied by 1,000,000,000, so they need to be divided by 1,000,000,000 to be used in the model.

Table 12 - Sales Coefficients' linear regression coefficients

Sales Coef. (Alpha)	PS3	Wii	Xbox
(x1,000,000,000)	Coefficients	Coefficients	Coefficients
a	4759.82 (0) R ² = 1	-124.17 (21.00) R ² = .99	-48.66 (22.40) R ² = .99
b	19834.27(0) R ² = 1	217.38 (52.48) R ² = .99	-68.32 (52.90) R ² = .99
c	-54085.89(0) R ² = 1	106.47 (43.90) R ² = .99	-1.34 (16.86) R ² = .99
d	-6200.33(0) R ² = 1	11.20 (6.07) R ² = .99	91.74 (7.99) R ² = .99
e	48619.95(0) R ² = 1	-201.41 (64.64) R ² = .99	-4.82 (9.84) R ² = .99

The Marginal Cost Estimation

Another data required for the estimative of the profits of the manufacturers from the console sales is the marginal cost. Although this is not available for each year, since the manufacturers use to lose money at least in the introduction of each console, the specialized media used to publish some estimative of the their cost for manufacturing and shipping an unit of each console. After a deep search, the marginal cost information shown in Table 13 were got.

Table 13 - Consoles Marginal Costs³

Year	Xbox	PS3	Wii
2005	?	?	?
2006	\$ 323.30	\$ 823.10	\$ 158.30
2007	?	?	?
2008	?	?	?
2009	?	\$ 365.37	?
2010	\$ 124.00	\$ 317.00	?
2011	?	?	?
2012	?	?	\$ 133.99

Because of the learning effect, the economy of scale and the fact the electronic components costs tend to be reduced over time, the expected shape of the Marginal Cost along the time for each platform is an exponential. Using the interpolations shown in Figures 33, 34 and 35, the expressions could be estimated.

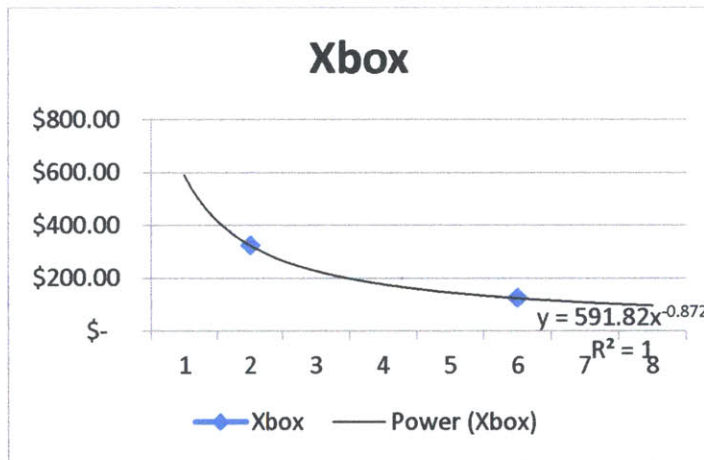


Figure 32- Xbox Marginal Cost expression estimative

³ <http://www.digitimes.com/systems/a20070507PD200.html>
http://en.wikipedia.org/wiki/PlayStation_3_launch
<http://www.neowin.net/news/wii-costs-nintendo-158-to-make>
<http://www.digitrends.com/gaming/playstation-3-finally-turning-a-profit-on-each-console-sold/>
<http://techland.time.com/2010/07/01/ps3-finally-making-a-profit-for-sony/>

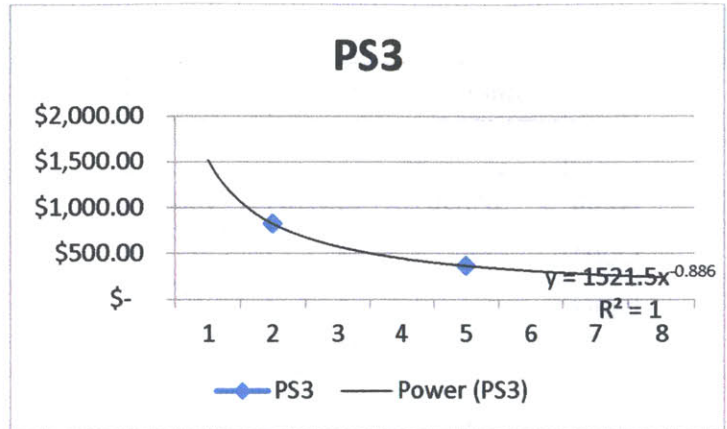


Figure 33 - PS3 Marginal Cost expression estimative

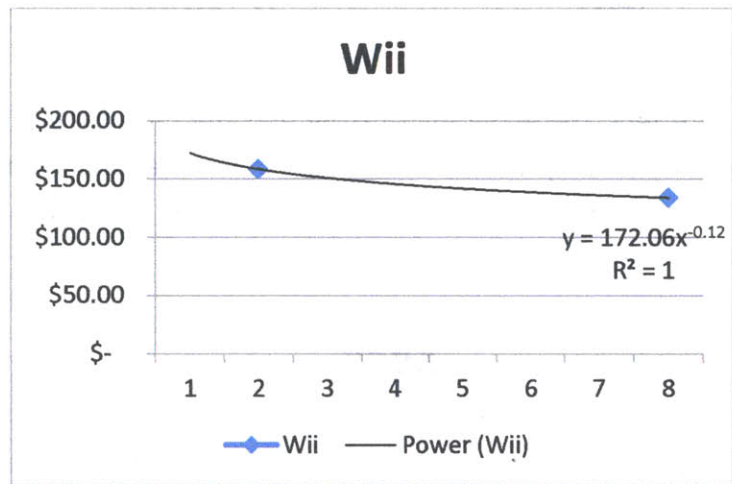


Figure 34 - Wii Marginal Cost expression estimative

So, from the interpolation, the Marginal Costs per platform per year could be estimated as shown in Table 14.

Table 14 - Estimated Consoles Marginal Costs

Year	Xbox	PS3	Wii
2005	\$ 591.82	\$ 1,506.50	\$ 172.06
2006	\$ 323.36	\$ 821.99	\$ 158.33
2007	\$ 227.06	\$ 576.72	\$ 150.81
2008	\$ 176.68	\$ 448.51	\$ 145.69
2009	\$ 145.44	\$ 369.04	\$ 141.84
2010	\$ 124.06	\$ 314.68	\$ 138.77
2011	\$ 108.46	\$ 275.01	\$ 136.23
2012	\$ 96.54	\$ 244.72	\$ 134.06

The Game Titles Sales Model Parameters

The game titles average prices for each platform were got from the Pricecharting.com database [66]. Since all the data being used is annually, and the game prices are a monthly average, the average price per year was used per platform. Ideally, it would be better to use the weighted price per sales volume, but since the monthly game sales volume per platform could not be found, the average price per year was used. Table 15 shows the values of the games average price per year.

Table 15 - Average Game Prices – Source: (57)

Year	PS3	Wii	Xbox
2008	\$ 26.43	\$ 21.25	\$ 18.70
2009	\$ 21.45	\$ 17.38	\$ 16.02
2010	\$ 18.47	\$ 15.07	\$ 14.27
2011	\$ 17.07	\$ 12.31	\$ 14.15
2012	\$ 15.31	\$ 10.05	\$ 13.69

It is important to emphasize two limitations from this database: there is no data before 2008 and also the data includes the new and used games. But, since there was no other source of data available, this one was used. A work around for the first problem was applied by finding the best fit curve and from that the missing values from the previous years were estimated as it is shown in Figure 36.

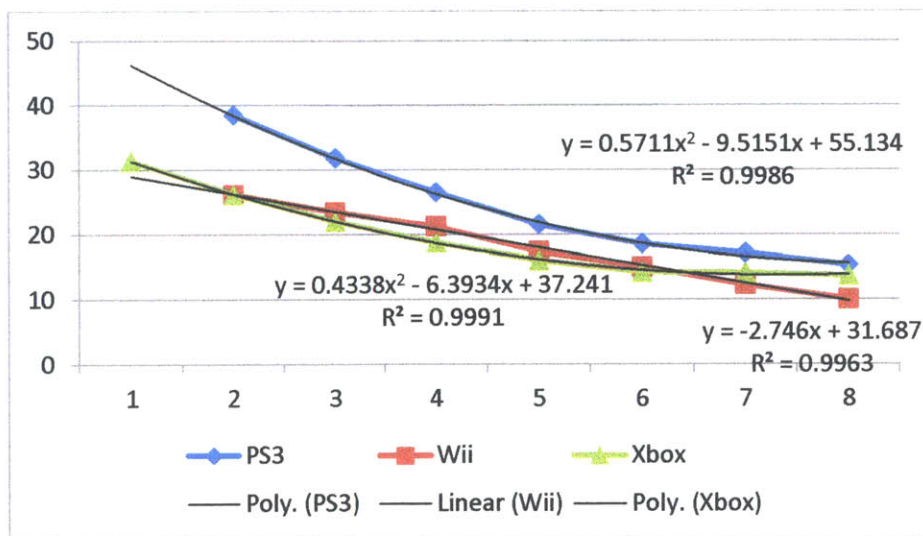


Figure 35 - Average prices best fit expressions

From the best fit curves and the original data set, the average game prices are shown in Table 16.

Table 16 - Estimated Average Game Prices

Year	PS3	Wii	Xbox
2005			\$ 31.28
2006	\$ 38.39	\$ 26.20	\$ 26.19
2007	\$ 31.73	\$ 23.45	\$ 21.97
2008	\$ 26.43	\$ 21.25	\$ 18.70
2009	\$ 21.45	\$ 17.38	\$ 16.02
2010	\$ 18.47	\$ 15.07	\$ 14.27
2011	\$ 17.07	\$ 12.31	\$ 14.15
2012	\$ 15.31	\$ 10.05	\$ 13.69

For estimating the game sales volumes per platform, the tie-ratios collected from VGSales and Gamasutra.com were used (Table 17), except those market with * which have been estimated by the best fit curve (Figure 37) from the monthly tie-ratios got from Gamasutra.com

Table 17 - Tie Ratios - Source: Gamasutra.com and VGSales

Year	Xbox	PS3	Wii
2005	4	0	0
2006	5	1.1	2
2007	7	4.2	4.8
2008	8.1	6	6
2009	8.8	6.8*	7.1*
2010	9*	7.8*	7.5
2011	9.1	8.3	7.7
2012	9.7	8.9	8.2

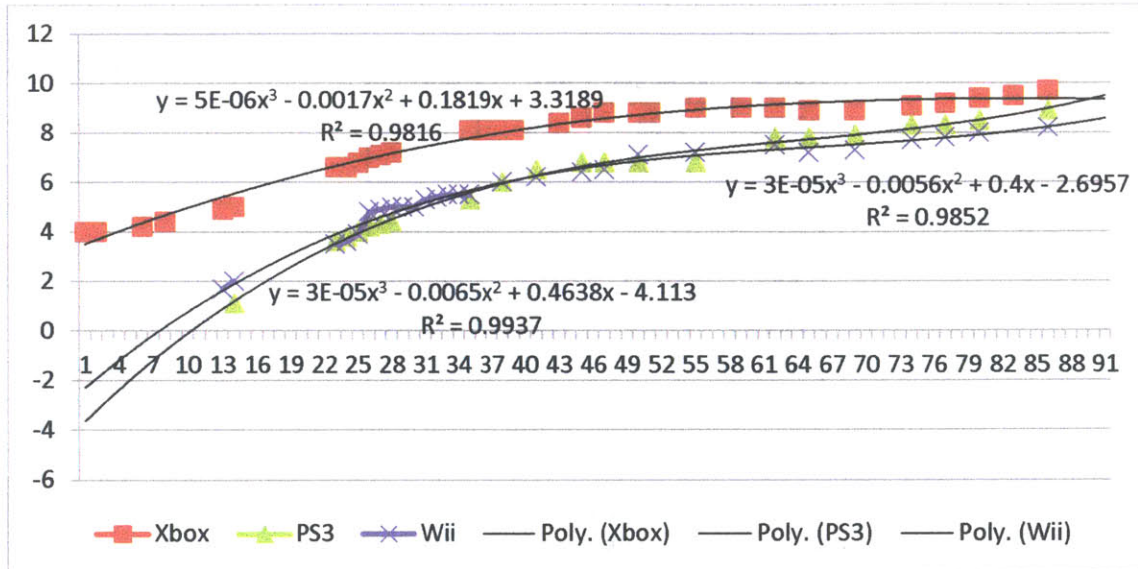


Figure 36- Tie Ratio Best Fit Expressions

Using a linear regression it is possible to get the coefficients of expression (Table 18) $\ln TR(t) = a + b * \ln GDP(t) + c * \ln Pg(t) + d * \ln \left(\frac{NA(t)}{N(t)} \right) + e * \ln NO(t)$ that estimates the Tie Ratio using the GDP, the average price of the games, the ratio between the total number of AAA games and total number of titles for the platform and the total number of on-line games from the platform.

Table 18 - Regression Coefficients

	PS3 R ² = .99	Wii R ² = .99	Xbox R ² = .99
a	-108.655 (2.90)	16.95565 (2.40)	-5.85069 (6.67)
b	13.6426 (0.07)	-1.41924 (0.01)	1.595819 (0.07)
c	-2.94464 (0.02)	-0.51612 (0.01)	-1.88712 (0.09)
d	2.982577 (0.36)	0.059671 (0.24)	0.262703 (0.77)
e	-0.47506 (0.09)	0.069064 (0.04)	-0.19052 (0.37)

Using the console sales from VGChartz and the Tie Ratios collected from VGSales and Gamasutra.com, it is possible to estimate the real game sales volume per year from the expression $S_{XBox}(t) = Q_{XBox}(t) * TR_{XBox}(t) - S_{XBox}(t - 1)$ since this number is not easily available and it will be used as a benchmark for the model (Table 19).

Table 19 - Estimated Game Unit Sales (in Millions) per year

Year	XBox360	PS3	Wii
2005	2.25	0	0
2006	21.98	0.73	2.15
2007	61.27	13.20	36.09
2008	109.65	40.14	104.08
2009	160.41	74.43	186.98
2010	27.05	122.33	253.01
2011	99.58	167.41	297.31
2012	373.33	210.07	333.36

Another important element is the cost to develop a game title. Although some sources used point out the cost of developing a game for Xbox 360 or a PlayStation 3 to be between \$20-30 million and for Wii to be between \$5-10 million, others point out those respective costs to be lower such as \$10 Million on average for PS3 and Xbox 360 and \$3 Million for Wii (45) (44). It makes sense to consider the average cost of developing a new game drops down over the years due to the learning effect, since in the beginning, the developer have low productivity since there is no piece of code to be re-used, no objects previously done and they need to learn how to develop on the new platform and how to use the new software development kit. So, after some games are released, the team has an increase on the productivity due to the re-use of code and objects and the familiarity with the software development kit and the platform.

So, according to Pindyck (58) it is expected to have a learning curve due to the increasing in the productivity leading to the reduction of the number of hours needed to produce the same output given by the following type of expression:

$$L = A + BN^{-\beta}$$

Where “N is the cumulative units of output produced and L the labor input per unit of output. A, B, and β , are constants, with A and B positive, and β , between 0 and 1. When N is equal to 1, L is equal to A + B, so that A + B measures the labor input required to produce the first unit of output. When β , equals 0, labor input per unit of output remains the same as the cumulative level of output increases; there is no learning. When β , is positive and N gets larger and larger, L becomes Arbitrarily close to A. A, therefore, represents the minimum labor input per unit of output after all learning has taken place.” (58)

Using that expression, the costs higher costs found for each platform as the starting point, and the lower ones as the minimum when all learning has taken place, the proposed learning expressions for each platform is as follows, where C is the cost for develop a game and the N is the number of games developed until the date:

$$C_{PS} = 10 + 60N^{-0.4}$$

$$C_{wii} = 3 + 20N^{-0.4}$$

$$C_{xbox} = 10 + 60N^{-0.4}$$

The proposed expressions results on the curves shown in Figure 38 for each platform's game development cost as a function of the total number of games developed until each year. As it can be seen, there is a considerable difference of costs level between the Wii platform and the others (Table 20). This can be explained by the Nintendo strategy of invest in a hardware platform less sophisticated that can generate profits since the introduction, so the costs of developing games for a less sophisticated platform is much less, since the developer don't need to invest a lot of resources in artistic finishing for push the hardware capabilities to its limit as it happens in the case of PlayStation 3 and Xbox 360 case.

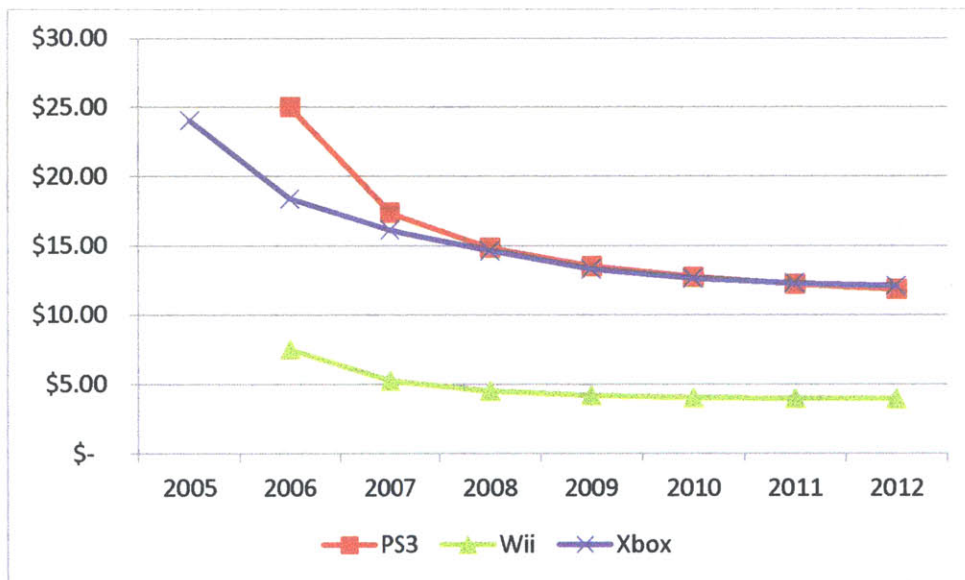


Figure 37- Estimated costs of a game development (in millions of dollars)

Table 20- Estimated costs of a game development (in millions of dollars)

Year	PS3	Wii	Xbox
2005			\$ 24.00
2006	\$ 25.00	\$ 7.48	\$ 18.38
2007	\$ 17.37	\$ 5.23	\$ 16.10
2008	\$ 14.84	\$ 4.50	\$ 14.61
2009	\$ 13.52	\$ 4.18	\$ 13.27
2010	\$ 12.74	\$ 4.03	\$ 12.61
2011	\$ 12.21	\$ 3.97	\$ 12.26
2012	\$ 11.84	\$ 3.95	\$ 12.07

The Model Results

Using the proposed model, a simulation of the current generation of home videogame console competition was done (seventh generation) from the console and game perspective. The results of the simulation are presented in this section and a comparison is made using the real data as a benchmark in order to validate the model.

As input, some real information per year and per platform were used such as: the console prices (weighted by the real sales volume at each price level inside each year), total number of games released LTD (launch to the date) (N), total number of AAA games released LTD (launch to the date) (NA), total number of on-line games playable games released LTD (launch to the date) (NO) and finally the average price of the games (Tables 21, 22 and 23).

Table 21 - Input information to estimate PS3 console sales

PS3						
Year	Titles Released	N (LTD)	Network Titles Released	NO (LTD)	AAA Titles Released	NA (LTD)
2005	2	2	-	-	-	-
2006	28	30	-	-	-	-
2007	127	157	4	4	7	7
2008	196	353	7	11	9	16
2009	307	660	9	20	15	31
2010	381	1,041	16	36	10	41
2011	545	1,586	27	63	13	54
2012	646	2,232	36	99	7	61

Table 22 - Input information to estimate Wii console sales

Wii						
Year	Titles Released	N (LTD)	Network Titles Released	NO (LTD)	AAA Titles Released	NA (LTD)
2005	3	3	0	0	0	-
2006	39	42	1	1	0	0
2007	199	241	1	2	3	3
2008	411	652	39	41	4	7
2009	542	1194	48	89	2	9
2010	454	1648	52	141	2	11
2011	266	1914	5	146	0	11
2012	96	2010	7	153	2	13

Table 23 - Input information to estimate Xbox console sales

Xbox						
Year	Titles Released	N (LTD)	Network Titles Released	NO (LTD)	AAA Titles Released	NA (LTD)
2005	38	38	7	7	1	1
2006	99	137	24	31	4	5
2007	166	303	18	49	6	11
2008	307	610	48	97	8	19
2009	832	1442	96	193	12	31
2010	1085	2527	161	354	15	46
2011	1093	3620	160	514	11	57
2012	903	4523	197	711	7	64

Figures 39, 40 and 41 give a sense of the how each platform performed developing their game library.

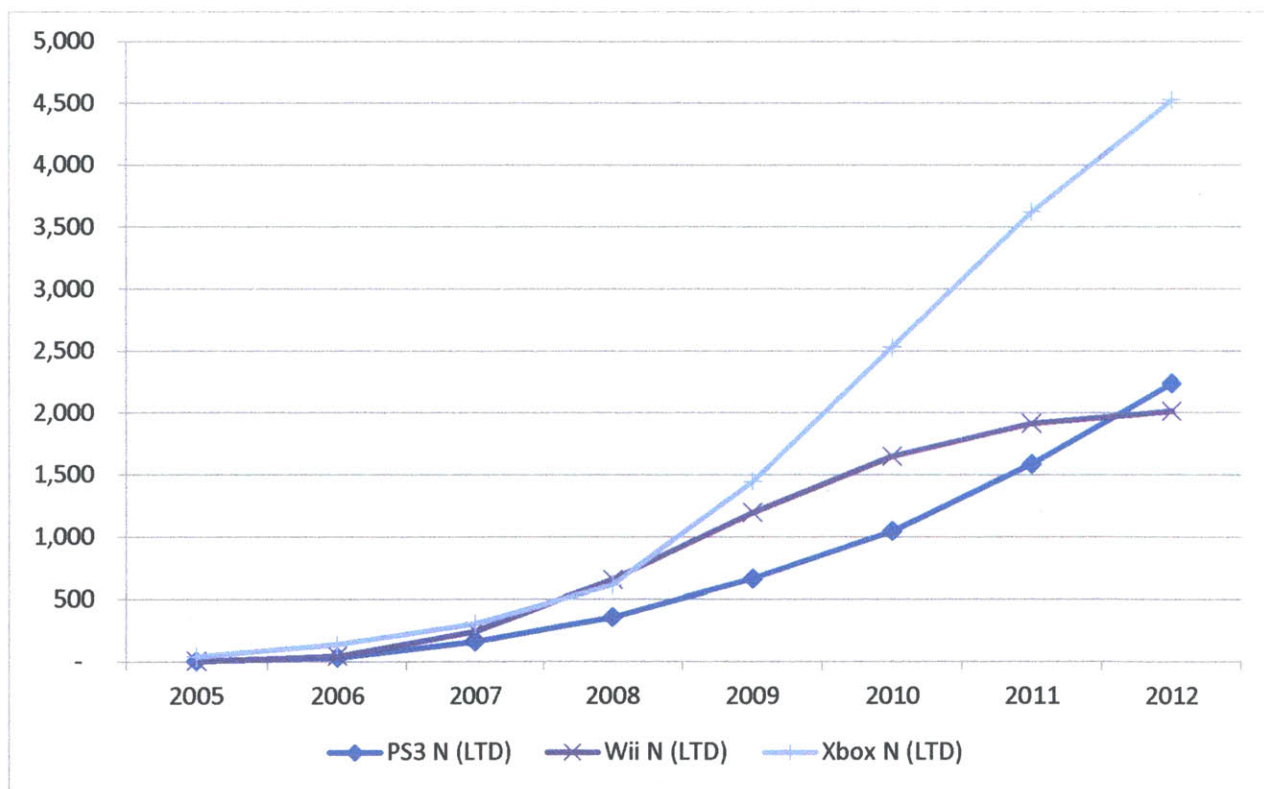


Figure 38 - Evolution of the Game Library per Platform in total number of titles released LTD (Launch to Date)

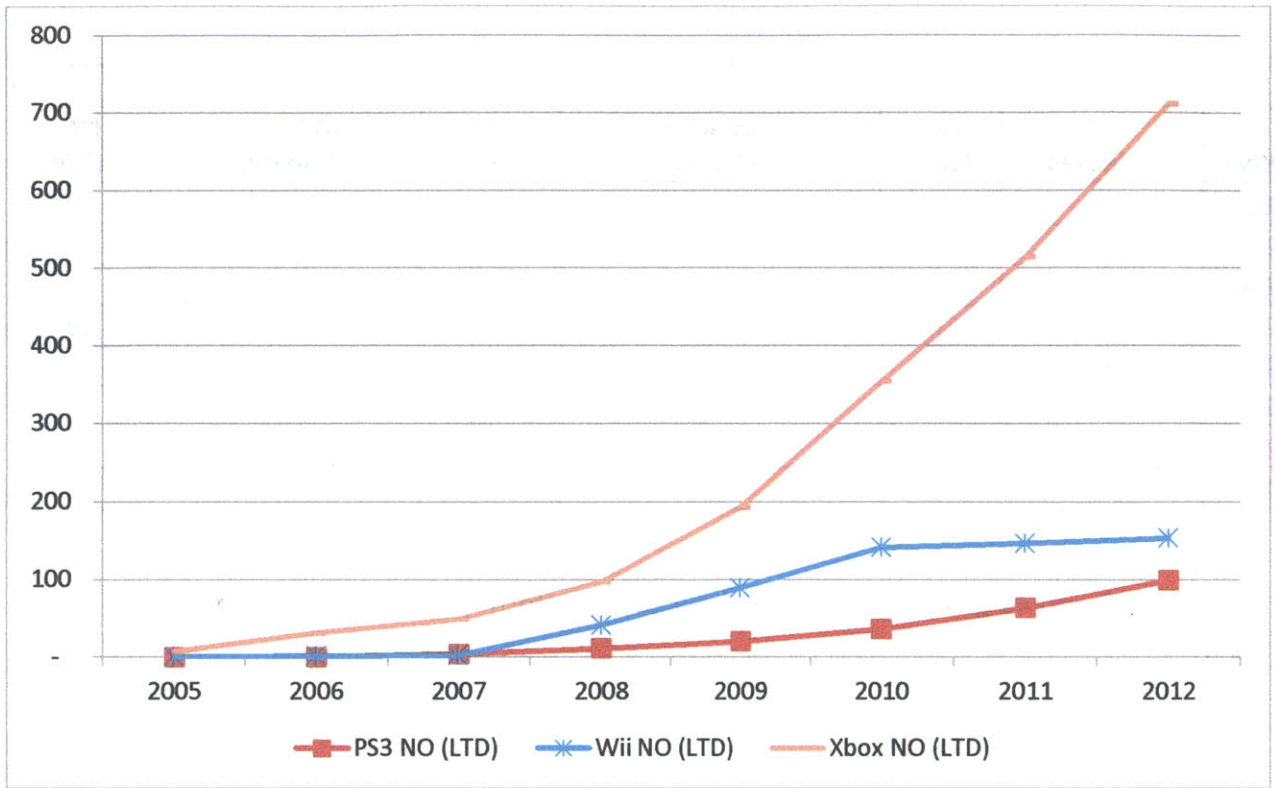


Figure 39- Evolution of the On-Line Game Library per Platform in total number of titles released LTD (Launch to Date)

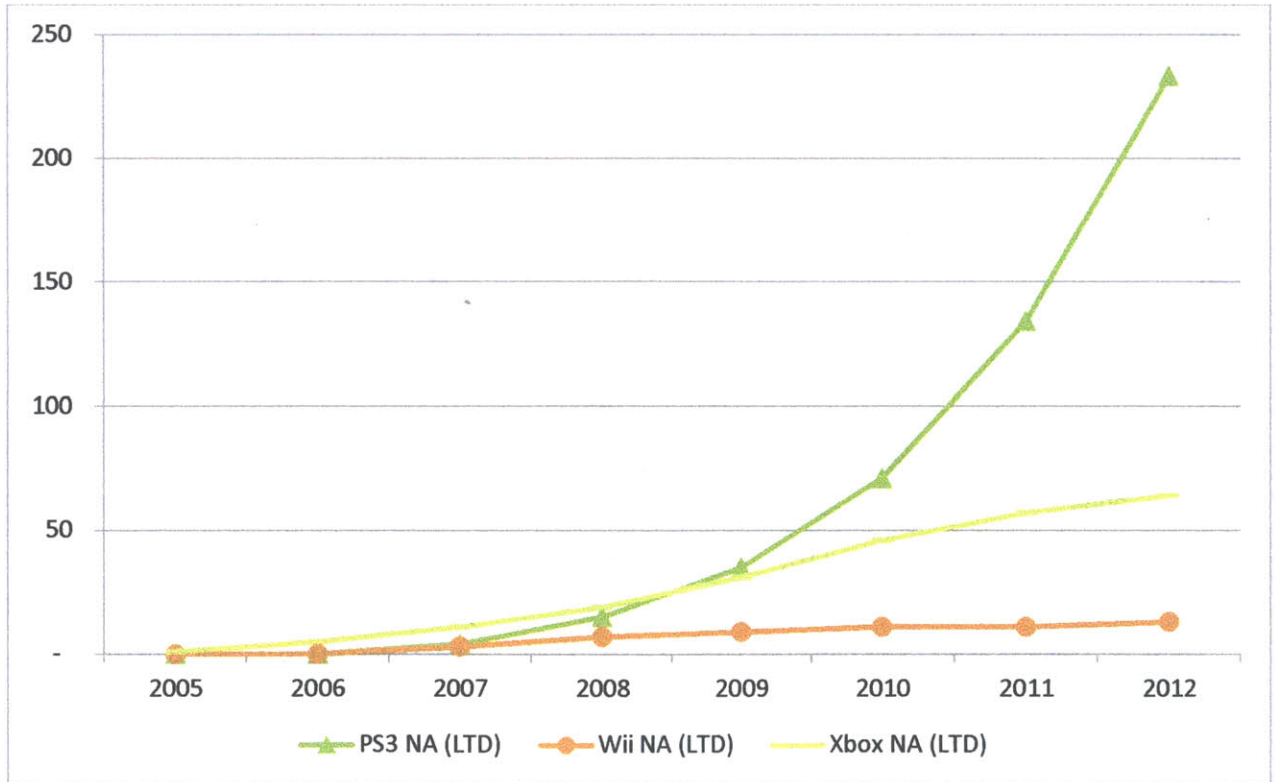


Figure 40 - Evolution of the AAA Game Library per Platform in total number of titles released LTD (Launch to Date)

The first information generated using the model was the stock levels and the sales of consoles per platform per year (Table 25).

Table 24- Estimated Stocks and Console Sales

Year	PS3		Wii		Xbox	
	X(t)	Q	X(t)	Q	X(t)	Q
2005	-	-	-	-	563,282	563,282
2006	667,762	667,762	1,075,329	1,075,329	4,987,918	4,480,964
2007	3,329,275	2,728,289	8,037,315	7,069,519	10,224,568	5,735,442
2008	7,029,598	4,033,251	18,662,322	11,428,739	15,461,904	6,259,793
2009	10,749,119	4,422,480	25,296,778	8,500,688	19,071,170	5,155,457
2010	14,097,675	4,423,468	30,741,337	7,974,237	25,910,979	8,746,925
2011	16,698,867	4,010,960	34,268,496	6,601,292	30,836,460	7,516,579
2012	17,232,936	2,203,956	35,364,482	4,522,836	33,122,600	5,369,786

Figure 42 and 43 give a sense of how each platform performed according to the model in building their stocks in the market and how was the sales performance.

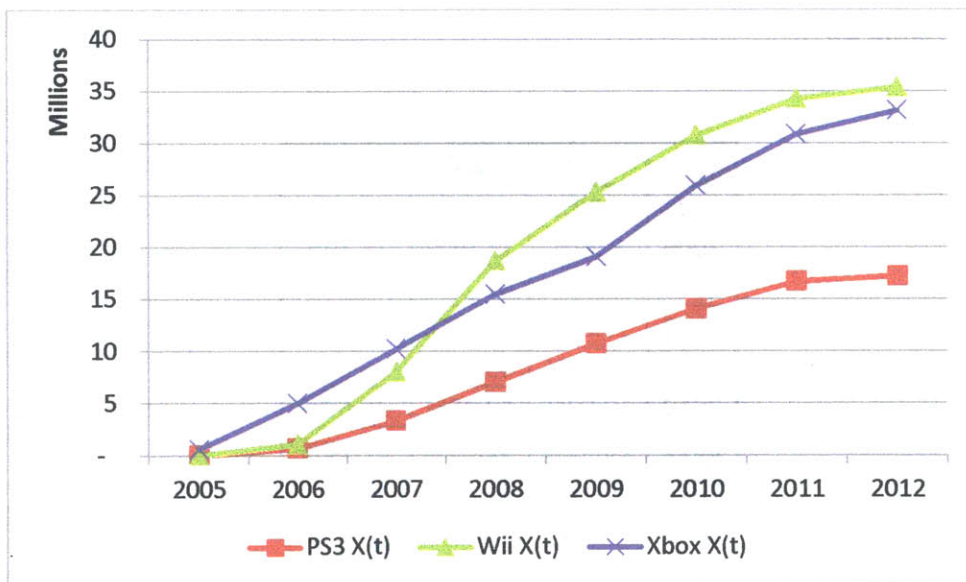


Figure 41 - Evolution of the stock per platform

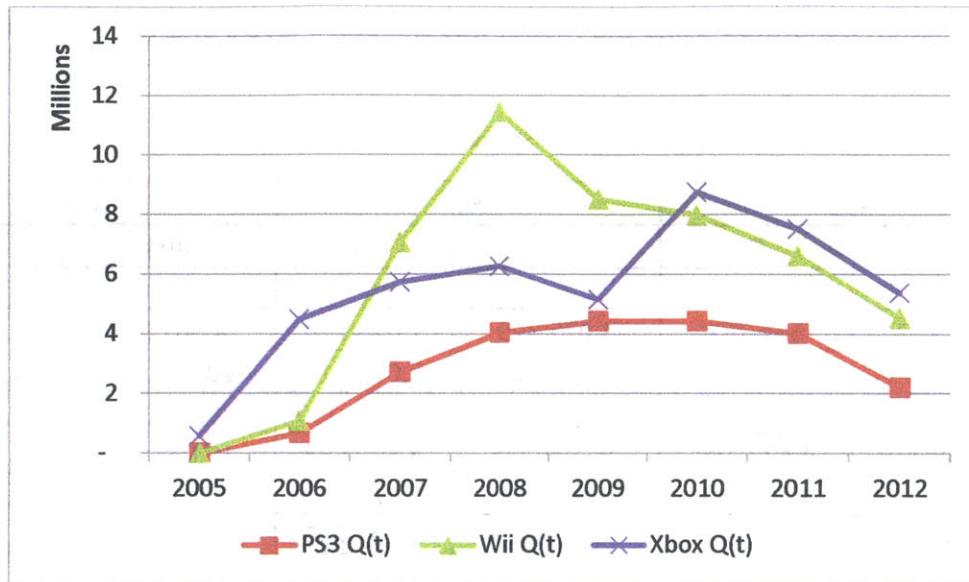


Figure 42 - Estimated Sales per Platform

The model results can give an estimate of the market-share LTD per platform listed in Table 26 and plotted in Figure 44.

Table 25 - Market-share per platform LTD

Year	PS3	Wii	Xbox
2005	0.00%	0.00%	100.00%
2006	9.92%	15.98%	74.10%
2007	15.42%	37.23%	47.36%
2008	17.08%	45.35%	37.57%
2009	19.50%	45.90%	34.60%
2010	19.93%	43.45%	36.62%
2011	20.41%	41.89%	37.70%
2012	20.10%	41.26%	38.64%

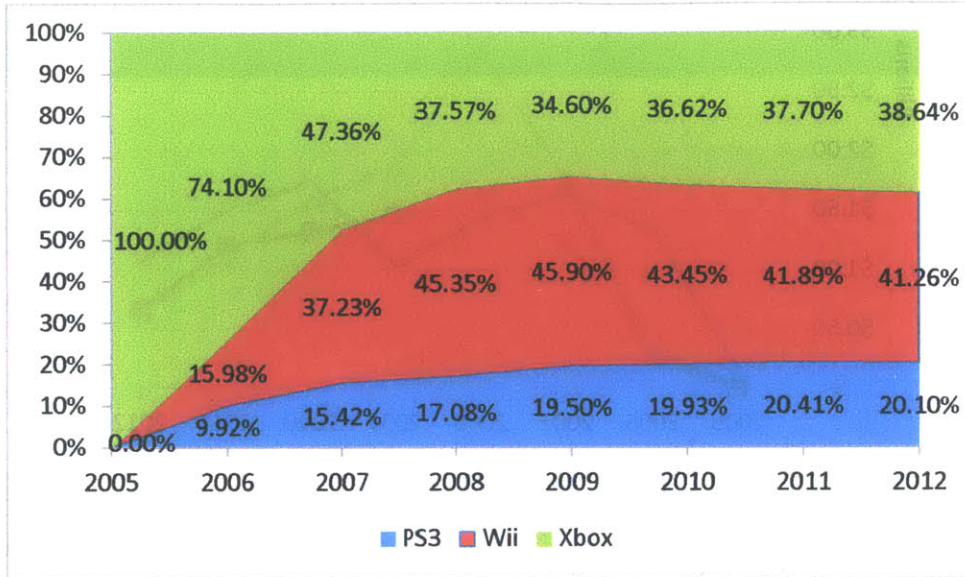


Figure 43 - Platforms Market-Share Evolution

From the sales and average price of the consoles per year it is possible to estimate the revenue each manufacturer had per year as well as the cumulative one. Tables 27 and 28 show these data while Figure 45 and 46 allow an easy visualization and comparison.

Table 26 – Manufacturers' Revenues from Console Sales

Year	PS3 R(t)	Wii R(t)	Xbox R(t)
2005	\$ -	\$ -	\$ 168,421,318.00
2006	\$ 333,213,238.00	\$ 267,756,921.00	\$ 1,339,808,205.26
2007	\$ 1,231,733,649.41	\$ 1,760,310,168.01	\$ 1,635,644,680.23
2008	\$ 1,609,267,246.84	\$ 2,845,755,966.38	\$ 1,438,204,492.36
2009	\$ 1,456,630,195.53	\$ 1,865,662,946.34	\$ 1,025,935,908.95
2010	\$ 1,322,616,853.06	\$ 1,586,873,218.34	\$ 1,740,638,118.73
2011	\$ 1,199,277,052.77	\$ 1,076,506,463.52	\$ 1,495,799,301.03
2012	\$ 658,982,699.35	\$ 633,166,377.81	\$ 1,068,587,403.29

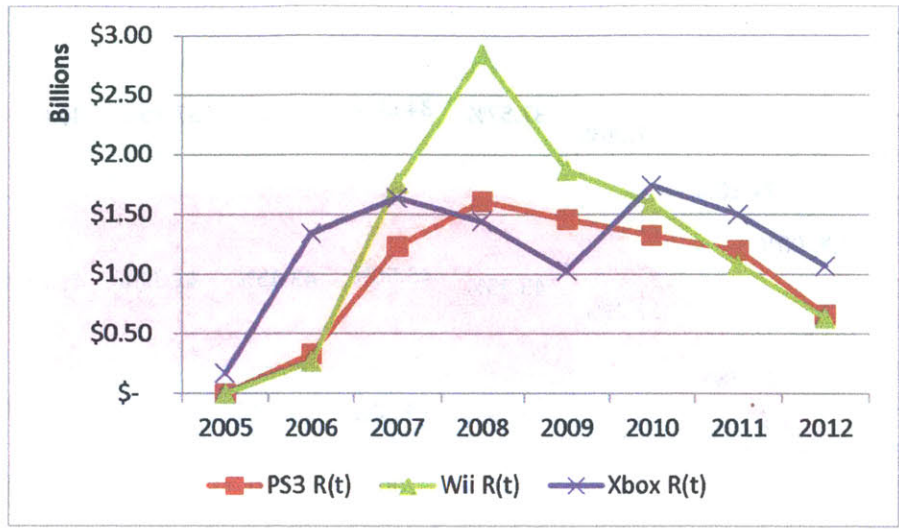


Figure 44 –Manufacturers’ Revenues from Console Sales

Table 27 - Manufacturers’ Cumulative Revenues from Console Sales

Year	PS3 Cumulative R(t)	Wii Cumulative R(t)	Xbox Cumulative R(t)
2005	\$ -	\$ -	\$ 168,421,318.00
2006	\$ 333,213,238.00	\$ 267,756,921.00	\$ 1,508,229,523.26
2007	\$ 1,564,946,887.41	\$ 2,028,067,089.01	\$ 3,143,874,203.49
2008	\$ 3,174,214,134.26	\$ 4,873,823,055.38	\$ 4,582,078,695.84
2009	\$ 4,630,844,329.79	\$ 6,739,486,001.73	\$ 5,608,014,604.79
2010	\$ 5,953,461,182.85	\$ 8,326,359,220.06	\$ 7,348,652,723.53
2011	\$ 7,152,738,235.62	\$ 9,402,865,683.58	\$ 8,844,452,024.56
2012	\$ 7,811,720,934.97	\$ 10,036,032,061.39	\$ 9,913,039,427.85

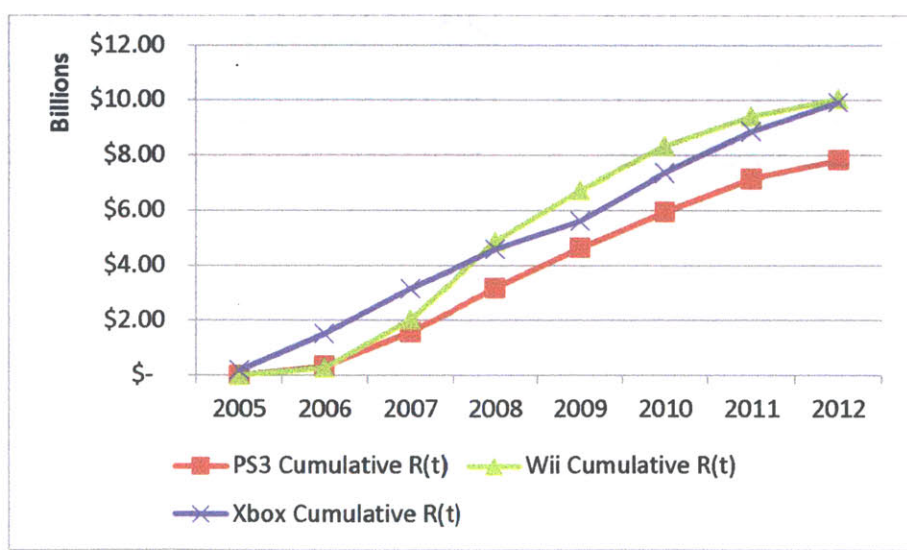


Figure 45 - Manufacturers’ Cumulative Revenues from Console Sales

Using the estimated marginal costs, the annual profits and the cumulative ones from the console sales could be estimated as shown in the Tables 29 and 30 and Figures 47 and 48.

Table 28 - Profits from console sales

Year	PS3 Profit	Wii Profit	Xbox Profit
2005			\$ (164,940,235.24)
2006	\$ (215,683,463.59)	\$ 97,502,782.55	\$ (109,173,580.54)
2007	\$ (341,725,671.10)	\$ 694,167,760.41	\$ 333,357,504.57
2008	\$ (199,671,995.04)	\$ 1,180,691,596.61	\$ 332,209,119.97
2009	\$ (175,426,579.27)	\$ 659,912,089.11	\$ 276,119,486.05
2010	\$ (69,346,517.93)	\$ 480,272,563.89	\$ 655,469,663.08
2011	\$ 96,210,326.03	\$ 177,221,917.67	\$ 680,561,335.91
2012	\$ 119,631,918.26	\$ 26,821,137.47	\$ 550,202,741.54

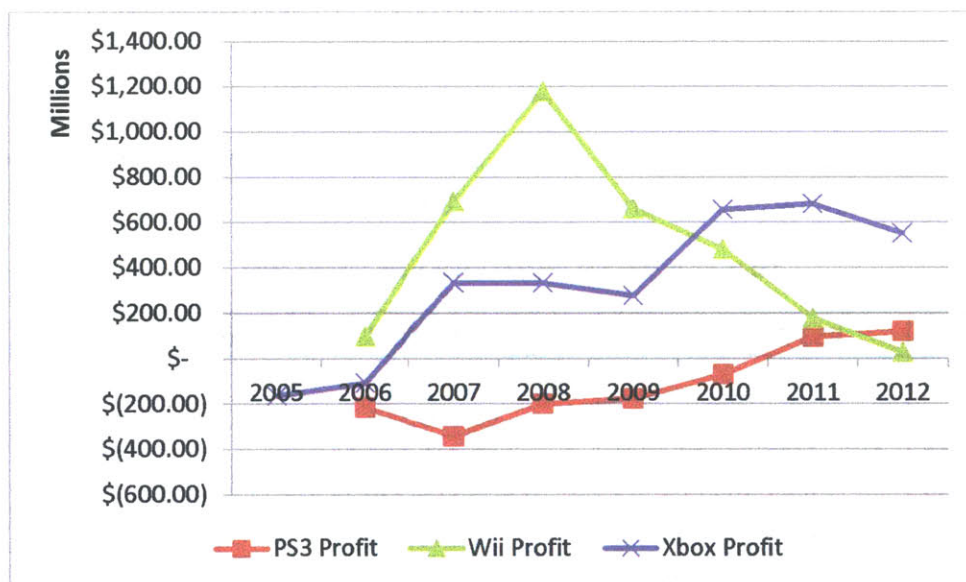


Figure 46 - Profits from console sales

Table 29 - Cumulative Profits from console sales

Year	PS3 Cumul. Profit	Wii Cumul. Profit	Xbox Cumul. Profit
2005	\$ -	\$ -	\$ (164,940,235.24)
2006	\$ (215,683,463.59)	\$ 97,502,782.55	\$ (274,113,815.78)
2007	\$ (557,409,134.69)	\$ 791,670,542.97	\$ 59,243,688.79
2008	\$ (757,081,129.73)	\$ 1,972,362,139.57	\$ 391,452,808.75
2009	\$ (932,507,709.00)	\$ 2,632,274,228.69	\$ 667,572,294.81
2010	\$ (1,001,854,226.93)	\$ 3,112,546,792.57	\$ 1,323,041,957.89
2011	\$ (905,643,900.90)	\$ 3,289,768,710.25	\$ 2,003,603,293.80
2012	\$ (786,011,982.64)	\$ 3,316,589,847.72	\$ 2,553,806,035.34

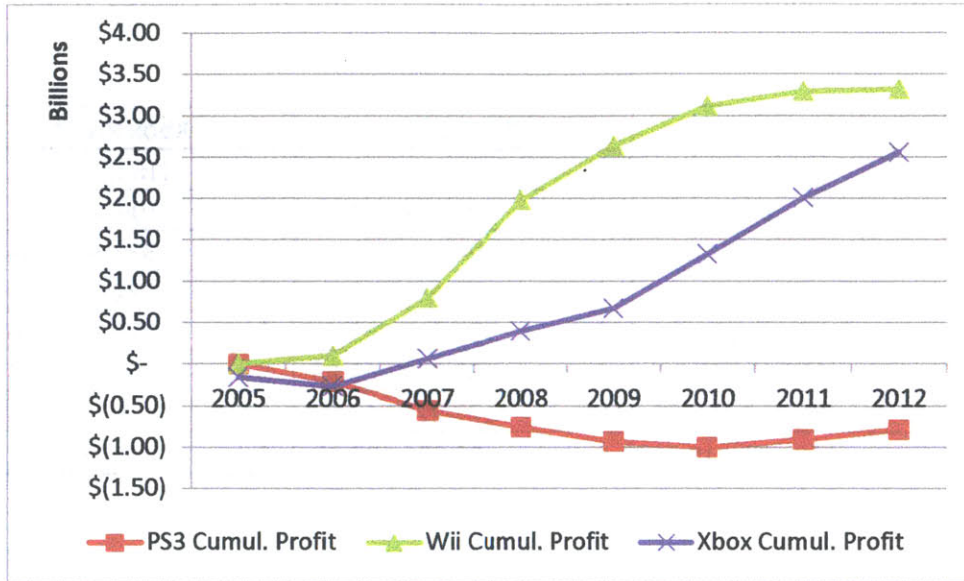


Figure 47- Cumulative Profits from console sales

Using an 8% discount rate for the profits of each platform it is possible to get a better sense of the net present value of the console profits (Table 31 and Figure 48).

Table 30- Profits Net Present Value from console sales

Year	PS3 Profit NPV	Wii Profit NPV	Xbox Profit NPV
2005	\$ -	\$ -	\$ (164,940,235.24)
2006	\$ (199,706,910.73)	\$ 90,280,354.22	\$ (266,026,883.89)
2007	\$ (492,681,594.46)	\$ 685,417,323.02	\$ 19,773,445.82
2008	\$ (651,187,661.75)	\$ 1,622,688,379.11	\$ 283,491,756.01
2009	\$ (780,131,434.49)	\$ 2,107,743,464.83	\$ 486,447,821.20
2010	\$ (827,327,509.37)	\$ 2,434,608,901.81	\$ 932,549,460.05
2011	\$ (766,698,684.11)	\$ 2,546,288,771.54	\$ 1,361,418,543.18
2012	\$ (696,894,608.84)	\$ 2,561,938,647.65	\$ 1,682,456,558.31

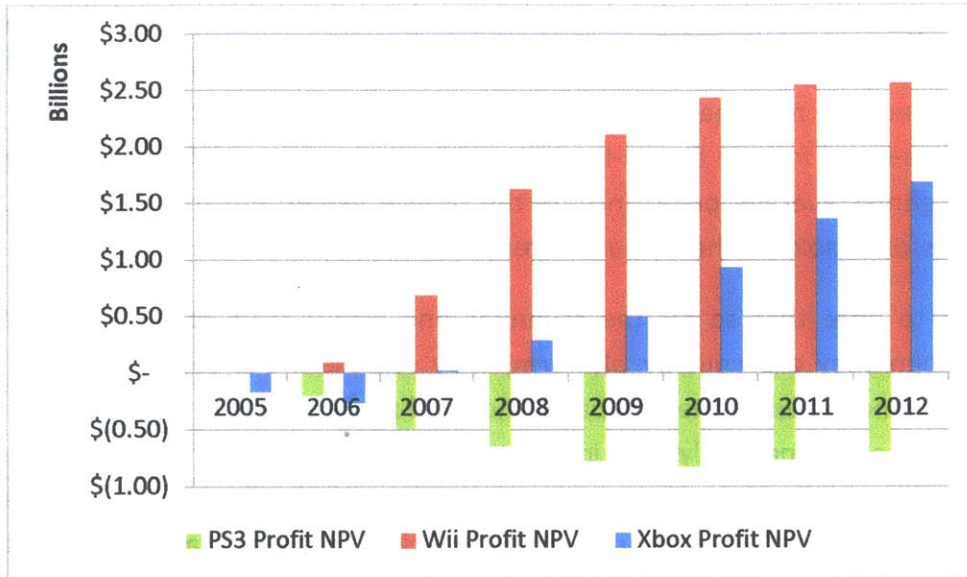


Figure 48- Profits Net Present Value from console sales

Then, from the modeled expression for the tie-ratios and the console sales, we could get the games sales volume per platform per year.

Using the game sales volume and the average prices, it is possible to estimate the total revenue made in the game sales per platform.

Using the development cost estimative and some assumptions on the distribution costs advertising costs, the industry profit from game sales per platform can be estimate. The assumptions made were:

1. The marketing costs for advertising the games have been considered in the average to be equal the cost of the development, although (45) points out it can be even double the development cost.
2. The distribution costs including the costs of getting the goods to the wholesalers, any co-op advertising or marketing the return of good contingencies to be fixed 23.5% of the game price paid by the consumer. This was estimated by the example pointed out in (45), where from the \$30 typically paid by the wholesaler to the game, \$14 is spend to the described expenses related to the distribution costs and the remaining \$16 goes to the publisher. Since the \$30 in the example paid by the wholesaler is 50% of the typical price of a game in the launch (\$60), the distribution cost is around 47% of the price paid by the wholesaler of 23.5% by the price paid by the consumer.

3. The games distribution on the manufacturers' on-line networks makes the distribution cost to be virtually zero. So, all the on-line games have no distribution cost since the marginal cost of hosting them on a server is technically zero.
4. The tie-ratios include the on-line game sales under the manufacturers' networks.
5. The games average prices include the on-line games and the all the virtual games accessories sold on the manufacturer's networks.

It is important to note that so far the revenues and profits from games are totals of the industry. Although they are split by platform, they represent the total profit all the game publishers have done including the first party and third party players (manufacturers and other publishers/developers respectively). So, in order to estimate how much profit from games the manufacturers made, what is relevant due to their razor/blade business model, it was necessary to establish some assumptions due to the lack of massive data and information in the media and internet. Based on some information from IGN.com (45) and Gamasutra.com (59), the following assumptions have been made:

1. Fixed license rate of \$6.5 paid by the publisher to the console manufacturer per unit sold (from the average of the \$3 and \$10) (45).
2. The games published by the manufacturers (first-party game) don't accrue the license rate (45).
3. Royalties paid to the outside development company developing games outsourced by any publisher will be fixed in 15%, the average of the typical range (10% - 20%) pointed out by (45). That is additionally to the cost of the game development, which usually is paid upfront by the publisher tied to development milestones (45).
4. The fraction of the games released per platform from first-party will be constant and equal to the derived ones from the Gamasutra.com tie-ratios from first and third party games in the first 23 months (59). Those fractions of first-party titles for PS3, Xbox 360 and Wii will be considered respectively 17%, 21.2% and 43.6%; and were considered constant all over the generation lifetime because of the lack of more information, although it could be considered varying since it is reasonable to assume those fractions to be higher in the beginning of the lifecycle of the consoles where the manufacturers develop titles to get users and third-party developers/publishers on board.
5. The fraction of the total game sales is equal to the fraction of total number of 1st party games over the total number of 3rd party games.
6. The fraction of total games sales made by the manufacturers' networks will be equal to the ratio of on-line games over total games for each platform.
7. The third party publishers are assumed to be a single entity, although actually they are many companies. The same assumption was made for the game developers.

8. The first party publishers outsource 80% of the games development to game developers while the third party ones outsource around 50%.

Table 31- Fractions First Party Tie Ratios of the Total Ones - Source: derived from data of (59)

Platform	Fractions=TR1/(TR1 + TR3)	TR1	TR3
PS3	17.0%	0.90	4.4
Wii	43.6%	2.40	3.1
Xbox	21.2%	1.40	5.2

So, considering all those assumptions, the total annual and cumulative revenues for the console manufacturers and third-party (considered as a single entity) could be estimated as shown Tables 33, 34, 35 and 36 and Figures 50, 51, 52 and 53.

Table 32- Third Party Publishers Annual Revenue

Year	PS3	Wii	Xbox
2005	\$ -	\$ -	\$ 55,618,987.06
2006	\$ 21,281,428.79	\$ 31,751,733.44	\$ 478,394,765.33
2007	\$ 358,175,011.94	\$ 488,077,966.00	\$ 854,277,540.48
2008	\$ 664,845,132.33	\$ 940,108,561.08	\$ 981,317,909.01
2009	\$ 640,502,347.53	\$ 803,527,989.87	\$ 564,399,316.26
2010	\$ 712,695,105.13	\$ 583,650,881.60	\$ 1,190,595,821.23
2011	\$ 588,131,021.44	\$ 437,082,362.54	\$ 665,968,563.84
2012	\$ 400,588,747.39	\$ 306,660,556.27	\$ 724,929,415.34

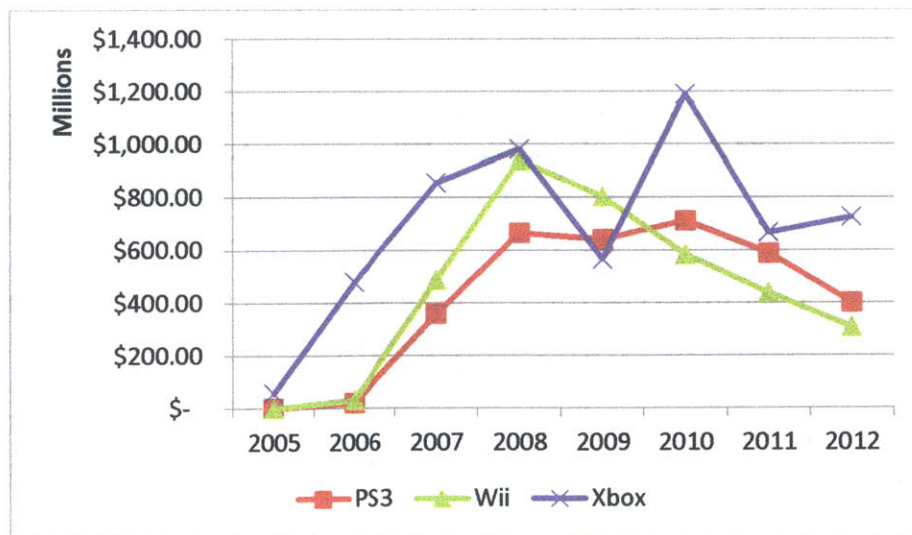


Figure 49- Third Party Publishers Annual Revenue

Table 33 - Console Manufacturers Annual Revenues from Game Sales

Year	PS3	Wii	Xbox
2005	\$ -	\$ -	\$ 23,242,140.46
2006	\$ 7,956,414.47	\$ 32,460,769.07	\$ 222,006,694.79
2007	\$ 150,241,702.81	\$ 521,037,768.41	\$ 504,056,828.29
2008	\$ 376,518,566.13	\$ 1,158,582,113.18	\$ 774,064,144.79
2009	\$ 565,590,004.00	\$ 1,353,413,883.39	\$ 833,899,879.33
2010	\$ 831,158,500.95	\$ 1,434,940,958.73	\$ 1,390,524,928.80
2011	\$ 1,029,609,092.70	\$ 1,552,306,286.43	\$ 1,468,143,878.50
2012	\$ 1,161,368,074.44	\$ 1,649,606,476.83	\$ 1,730,190,430.63

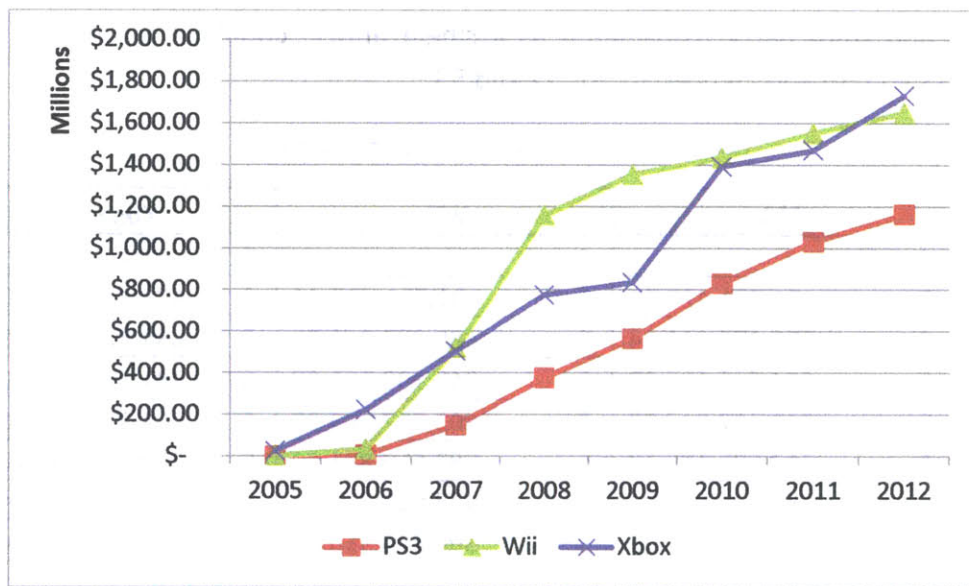


Figure 50 - Console Manufacturers Annual Revenues from Game Sales

Table 34 - Third Party Publishers Cumulated Game Sales Revenue

Year	PS3	Wii	Xbox
2005	\$ -	\$ -	\$ 55,618,987.06
2006	\$ 21,281,428.79	\$ 31,751,733.44	\$ 534,013,752.38
2007	\$ 379,456,440.73	\$ 519,829,699.44	\$ 1,388,291,292.86
2008	\$ 1,044,301,573.06	\$ 1,459,938,260.52	\$ 2,369,609,201.88
2009	\$ 1,684,803,920.59	\$ 2,263,466,250.38	\$ 2,934,008,518.14
2010	\$ 2,397,499,025.73	\$ 2,847,117,131.99	\$ 4,124,604,339.36
2011	\$ 2,985,630,047.17	\$ 3,284,199,494.52	\$ 4,790,572,903.21
2012	\$ 3,386,218,794.56	\$ 3,590,860,050.79	\$ 5,515,502,318.54

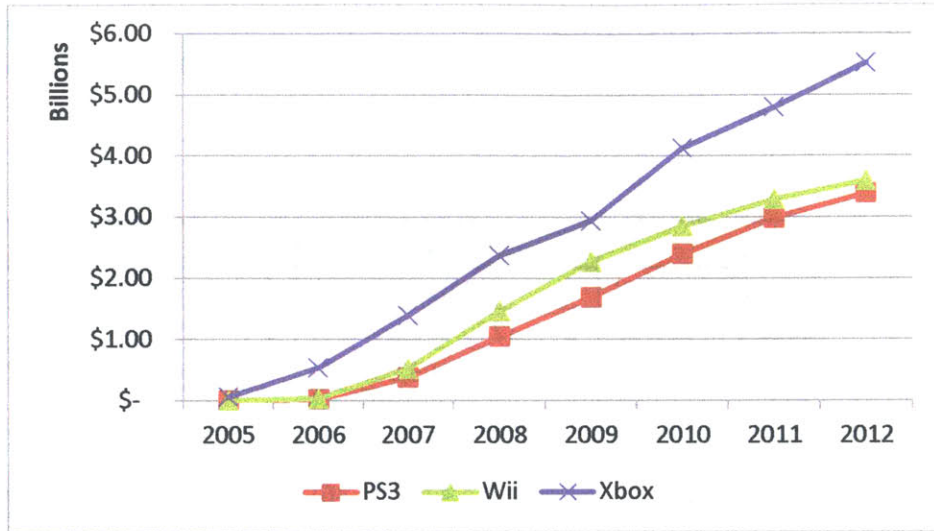


Figure 51 - Third Party Publishers Cumulated Game Sales Revenue

Table 35 - Manufacturers Cumulated Game Sales Revenue

Year	PS3	Wii	Xbox
2005	\$ -	\$ -	\$ 23,242,140.46
2006	\$ 7,956,414.47	\$ 32,460,769.07	\$ 245,248,835.25
2007	\$ 158,198,117.28	\$ 553,498,537.49	\$ 749,305,663.54
2008	\$ 534,716,683.42	\$ 1,712,080,650.66	\$ 1,523,369,808.32
2009	\$ 1,100,306,687.42	\$ 3,065,494,534.06	\$ 2,357,269,687.65
2010	\$ 1,931,465,188.37	\$ 4,500,435,492.79	\$ 3,747,794,616.45
2011	\$ 2,961,074,281.07	\$ 6,052,741,779.21	\$ 5,215,938,494.95
2012	\$ 4,122,442,355.50	\$ 7,702,348,256.04	\$ 6,946,128,925.58

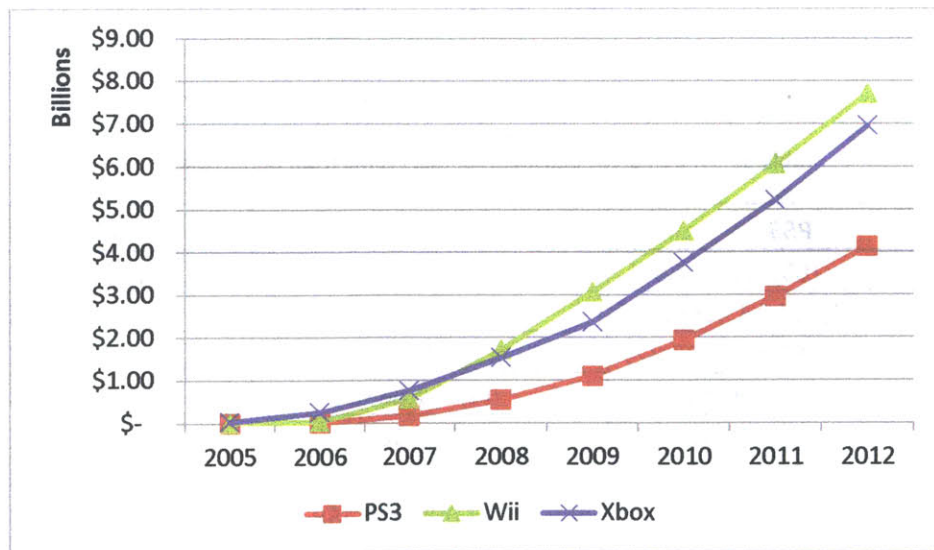


Figure 52 - Manufacturers Cumulated Game Sales Revenue

Finally, under the same assumptions, the model could give a sense of all the profits each manufacturer player and the third party game publishers could possibly have had annually from game sales (Tables 37 and 38 and Figures 54 and 55).

Table 36 - Manufacturers Annual Profits from Game Sales

Year	PS3	Wii	Xbox
2005	\$ (16,981,132.08)	\$ (19,596,221.18)	\$ (366,652,189.66)
2006	\$ (231,324,756.52)	\$ (230,879,169.64)	\$ (574,197,215.41)
2007	\$ (624,604,694.64)	\$ (520,603,558.20)	\$ (677,228,198.09)
2008	\$ (658,384,501.57)	\$ (702,208,580.64)	\$ (1,184,974,829.93)
2009	\$ (889,339,200.19)	\$ (831,624,412.37)	\$ (3,885,722,050.47)
2010	\$ (867,972,409.80)	\$ (314,470,030.46)	\$ (4,487,403,097.30)
2011	\$ (1,272,470,785.78)	\$ 515,858,067.44	\$ (4,263,238,955.17)
2012	\$ (1,464,810,945.74)	\$ 1,238,260,457.67	\$ (2,943,056,518.33)

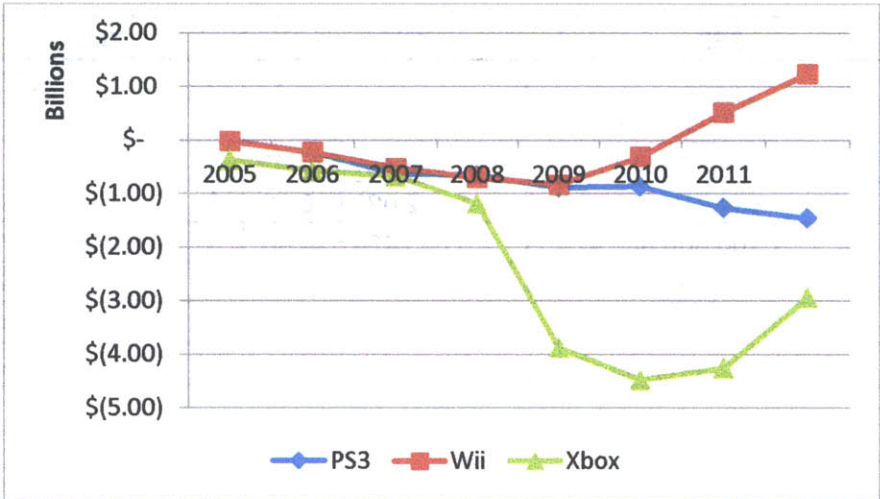


Figure 53 - Manufacturers Annual Profits from Game Sales

Table 37 - Third Party Publishers Annual Profits from Game Sales

Year	PS3	Wii	Xbox
2005	\$ (83,018,867.92)	\$ (25,311,785.69)	\$ (1,400,747,740.25)
2006	\$ (1,151,183,360.02)	\$ (314,845,641.28)	\$ (2,571,240,134.23)
2007	\$ (3,490,823,687.82)	\$ (978,582,861.76)	\$ (3,804,759,402.26)
2008	\$ (4,605,290,461.85)	\$ (1,851,863,996.94)	\$ (6,800,041,578.09)
2009	\$ (6,878,240,427.51)	\$ (2,713,982,080.31)	\$ (17,640,971,732.13)
2010	\$ (8,247,475,802.16)	\$ (2,632,822,901.44)	\$ (21,701,333,531.53)
2011	\$ (11,549,325,387.40)	\$ (2,095,914,488.57)	\$ (21,898,396,777.96)
2012	\$ (13,499,911,657.97)	\$ (1,623,053,512.73)	\$ (18,153,007,088.57)

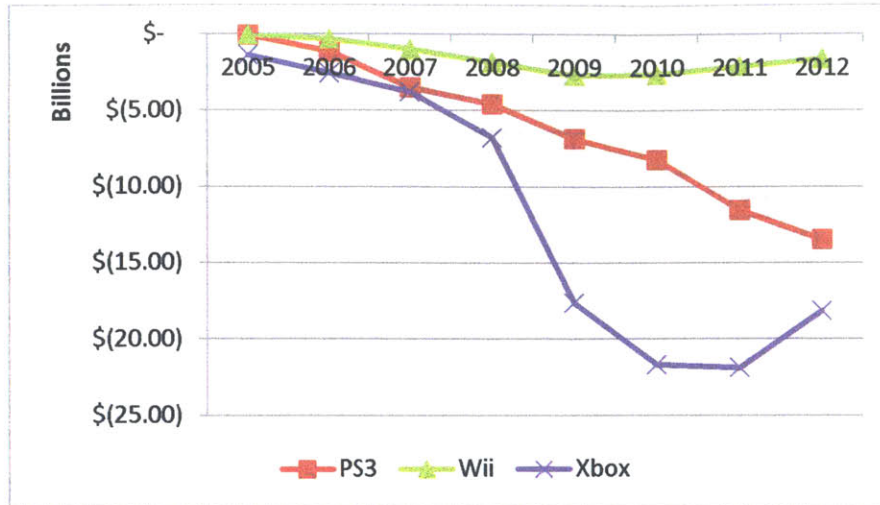


Figure 54 - Third Party Publishers Annual Profits from Game Sales

The cumulative profits are shown in Tables 39 and 40 and Figures 56 and 57.

Table 38 - Manufacturers Cumulative Profits from Game Sales

Year	PS3	Wii	Xbox
2005	\$ (16,981,132.08)	\$ (19,596,221.18)	\$ (366,652,189.66)
2006	\$ (248,305,888.60)	\$ (250,475,390.82)	\$ (940,849,405.08)
2007	\$ (872,910,583.24)	\$ (771,078,949.01)	\$ (1,618,077,603.17)
2008	\$ (1,531,295,084.81)	\$ (1,473,287,529.66)	\$ (2,803,052,433.10)
2009	\$ (2,420,634,285.00)	\$ (2,304,911,942.03)	\$ (6,688,774,483.57)
2010	\$ (3,288,606,694.79)	\$ (2,619,381,972.49)	\$ (11,176,177,580.86)
2011	\$ (4,561,077,480.57)	\$ (2,103,523,905.05)	\$ (15,439,416,536.03)
2012	\$ (6,025,888,426.31)	\$ (865,263,447.38)	\$ (18,382,473,054.36)

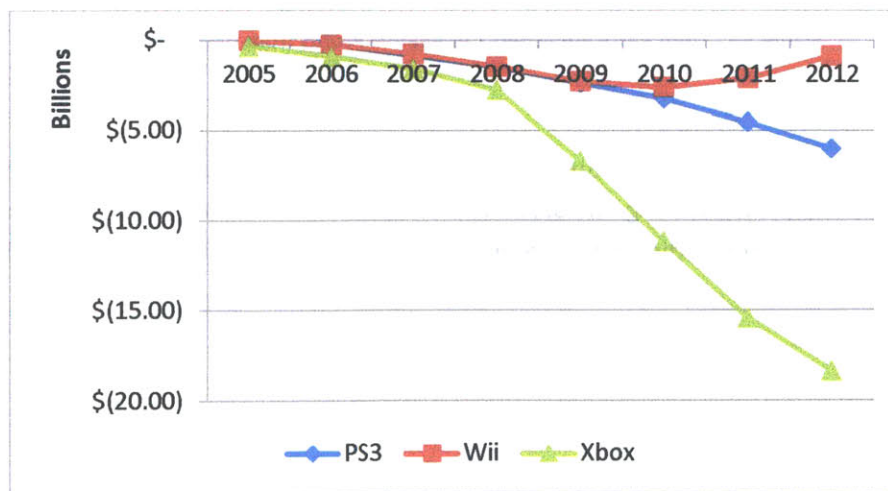


Figure 55 - Manufacturers Cumulative Profits from Game Sales

Table 39 - Third Party Publishers Cumulative Profits from Game Sales

Year	PS3	Wii	Xbox
2005	\$ (83,018,867.92)	\$ (25,311,785.69)	\$ (1,400,747,740.25)
2006	\$ (1,234,202,227.95)	\$ (340,157,426.97)	\$ (3,971,987,874.47)
2007	\$ (4,725,025,915.76)	\$ (1,318,740,288.73)	\$ (7,776,747,276.74)
2008	\$ (9,330,316,377.62)	\$ (3,170,604,285.67)	\$ (14,576,788,854.83)
2009	\$ (16,208,556,805.12)	\$ (5,884,586,365.98)	\$ (32,217,760,586.96)
2010	\$ (24,456,032,607.28)	\$ (8,517,409,267.42)	\$ (53,919,094,118.48)
2011	\$ (36,005,357,994.68)	\$ (10,613,323,755.99)	\$ (75,817,490,896.44)
2012	\$ (49,505,269,652.66)	\$ (12,236,377,268.73)	\$ (93,970,497,985.01)

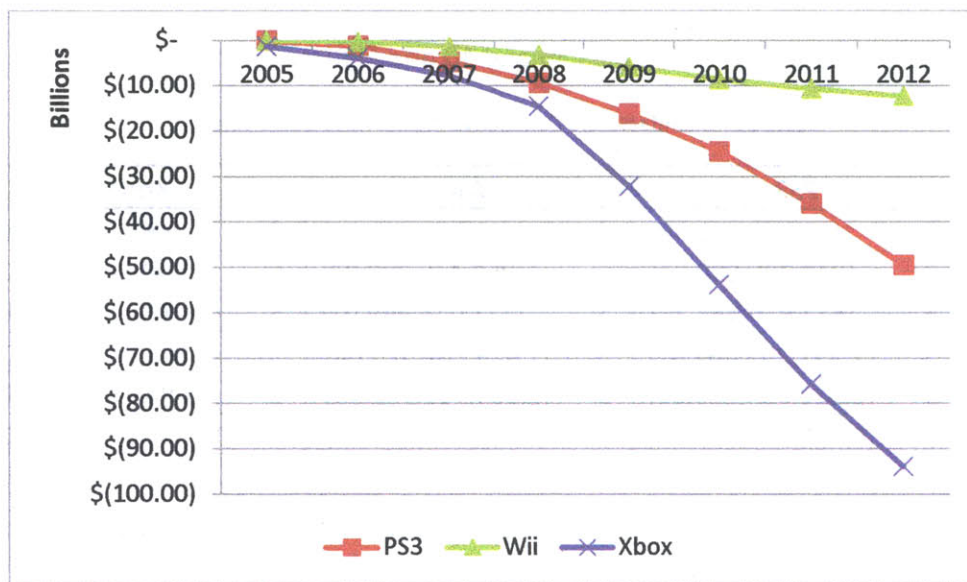


Figure 56 - Third Party Publishers Cumulative Profits from Game Sales

Finally, the total profits for the manufacturers could be estimated where the profits from the console sales are summed to the profits from game sales. Also, the cumulative total profits and the net present value of the annual profits using a discount rate of 8% were calculated (Tables 41, 42 and 43 and Figures 58, 59 and 60).

Table 40 - Manufacturers Annual Total Profits

Year	PS3	Wii	Xbox
2005	\$ (16,981,132.08)	\$ (19,596,221.18)	\$ (531,592,424.90)
2006	\$ (447,008,220.11)	\$ (133,376,387.09)	\$ (683,370,795.95)
2007	\$ (966,330,365.74)	\$ 173,564,202.22	\$ (343,870,693.52)
2008	\$ (858,056,496.61)	\$ 478,483,015.96	\$ (852,765,709.97)
2009	\$ (1,064,765,779.46)	\$ (171,712,323.26)	\$ (3,609,602,564.41)
2010	\$ (937,318,927.73)	\$ 165,802,533.43	\$ (3,831,933,434.21)
2011	\$ (1,176,260,459.75)	\$ 693,079,985.12	\$ (3,582,677,619.26)
2012	\$ (1,345,179,027.48)	\$ 1,265,081,595.14	\$ (2,392,853,776.79)

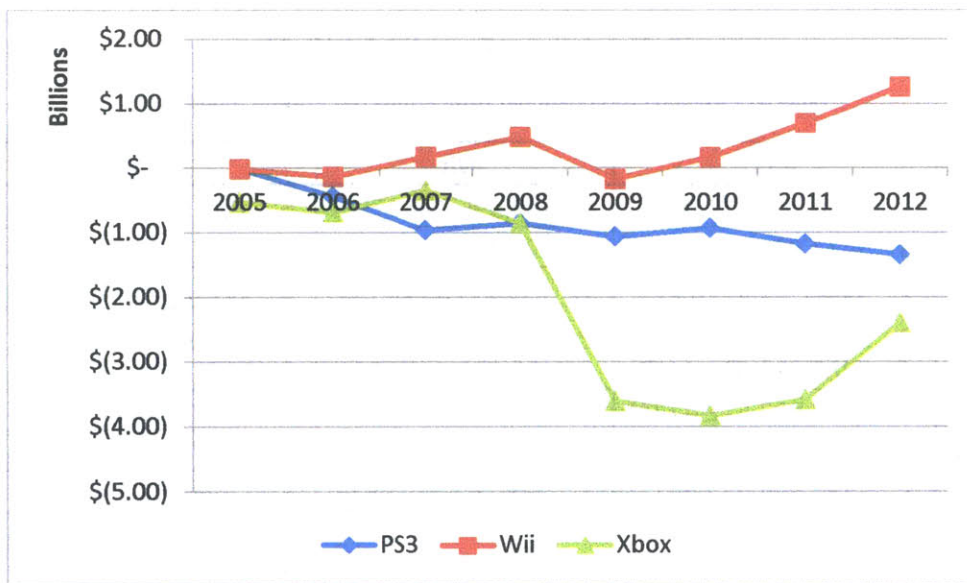


Figure 57 - Manufacturers Annual Total Profits

Table 41 - Manufacturers Cumulative Total Profits

Year	PS3	Wii	Xbox
2005	\$ (16,981,132.08)	\$ (19,596,221.18)	\$ (531,592,424.90)
2006	\$ (463,989,352.18)	\$ (152,972,608.27)	\$ (1,214,963,220.86)
2007	\$ (1,430,319,717.92)	\$ 20,591,593.95	\$ (1,558,833,914.38)
2008	\$ (2,288,376,214.54)	\$ 499,074,609.91	\$ (2,411,599,624.35)
2009	\$ (3,353,141,994.00)	\$ 327,362,286.66	\$ (6,021,202,188.76)
2010	\$ (4,290,460,921.73)	\$ 493,164,820.08	\$ (9,853,135,622.97)
2011	\$ (5,466,721,381.48)	\$ 1,186,244,805.20	\$ (13,435,813,242.23)
2012	\$ (6,811,900,408.95)	\$ 2,451,326,400.34	\$ (15,828,667,019.02)

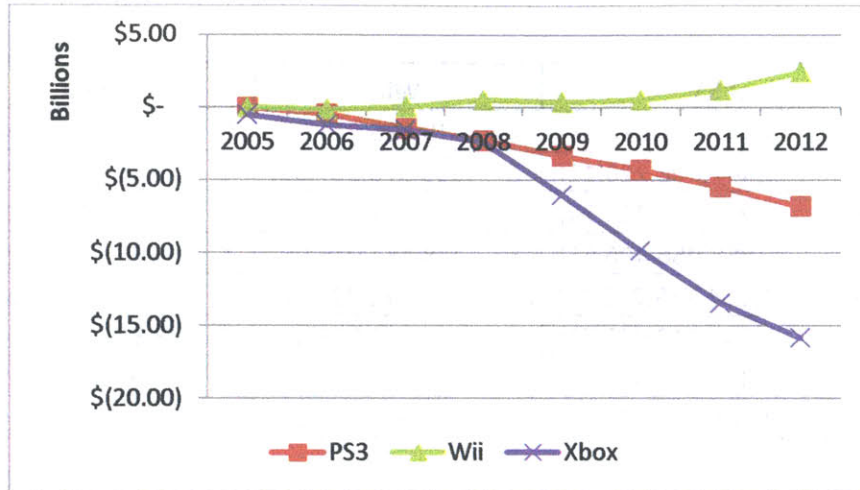


Figure 58 - Manufacturers Cumulative Total Profits

Table 42 - Manufacturers Annual Total Profits Net Present Value

Year	PS3	Wii	Xbox
2005	\$ (16,981,132.0755)	\$ (19,596,221.1795)	\$ (531,592,424.9037)
2006	\$ (413,896,500.0987)	\$ (123,496,654.7095)	\$ (632,750,736.9940)
2007	\$ (828,472,535.7876)	\$ 148,803,328.3760	\$ (294,813,694.7183)
2008	\$ (681,152,911.6289)	\$ 379,835,244.8519	\$ (676,952,914.6095)
2009	\$ (782,634,634.1417)	\$ (126,213,683.6862)	\$ (2,653,165,641.5753)
2010	\$ (637,923,512.4724)	\$ 112,842,418.2750	\$ (2,607,949,507.4782)
2011	\$ (741,243,615.0370)	\$ 436,757,955.6216	\$ (2,257,694,618.5686)
2012	\$ (784,899,042.4412)	\$ 738,162,959.9876	\$ (1,396,207,196.0257)

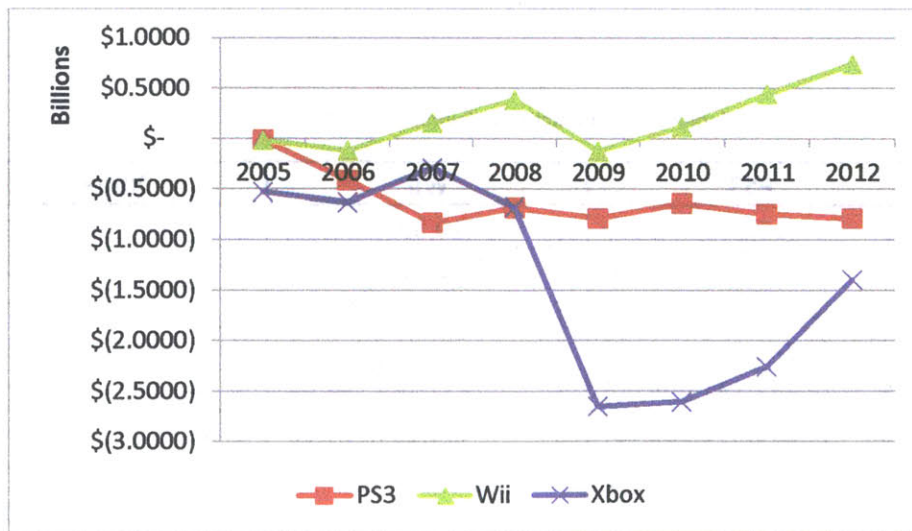


Figure 59 - Manufacturers Annual Total Profits Net Present Value

Analysis of the Results

A comparison between the actual console sales and the estimated console sales of PlayStation 3, Wii and Xbox 360 can be seen in the Figures 64, 65 and 66, respectively. First, a qualitative analysis gives a sense of the model reasonable accuracy since the shapes of the curves are very similar. Second, a quantitative analysis reinforces the model reasonable accuracy because the sales order of magnitudes of the estimative and the real sales are very similar for each console. Finally, considering the Wii Platform, it is important to note Nintendo launched in 2012 the Wii-U platform and sold almost 1 million units in the U.S. according to VGChartz.com, which is not considered by the model. In fact, the model estimated the Wii sales in 2012 to be almost 2.5 million above the real sales, but considering the Wii-U sales, this difference would be around 1.5 million.

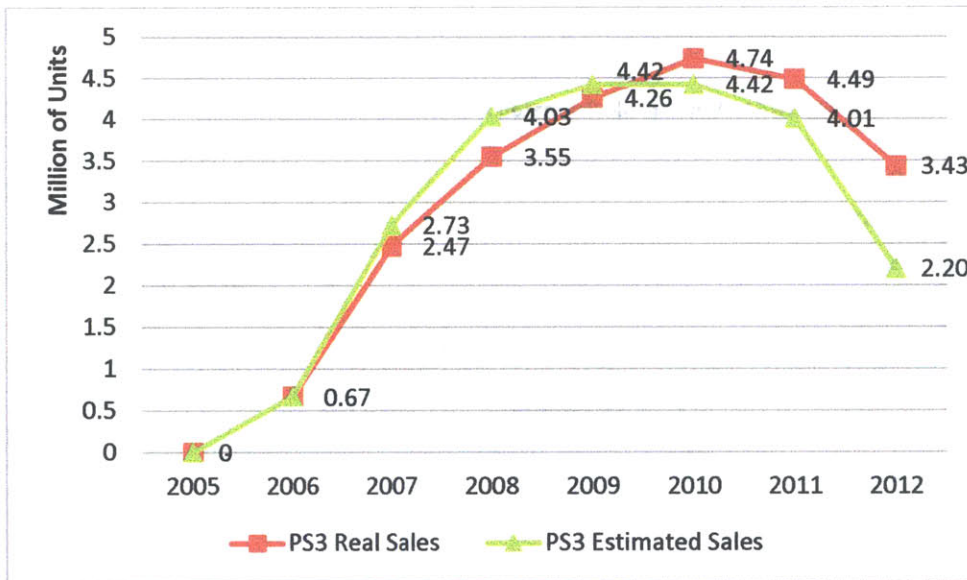


Figure 60 - PS3 Console Estimated x Real Sales from 2005 to 2012

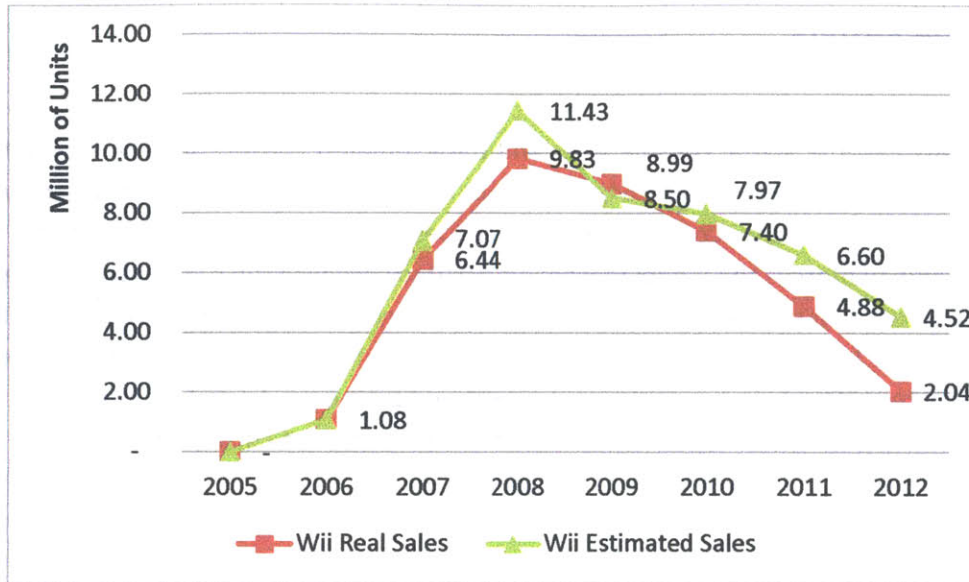


Figure 61 - Wii Console Estimated x Real Sales from 2005 to 2012

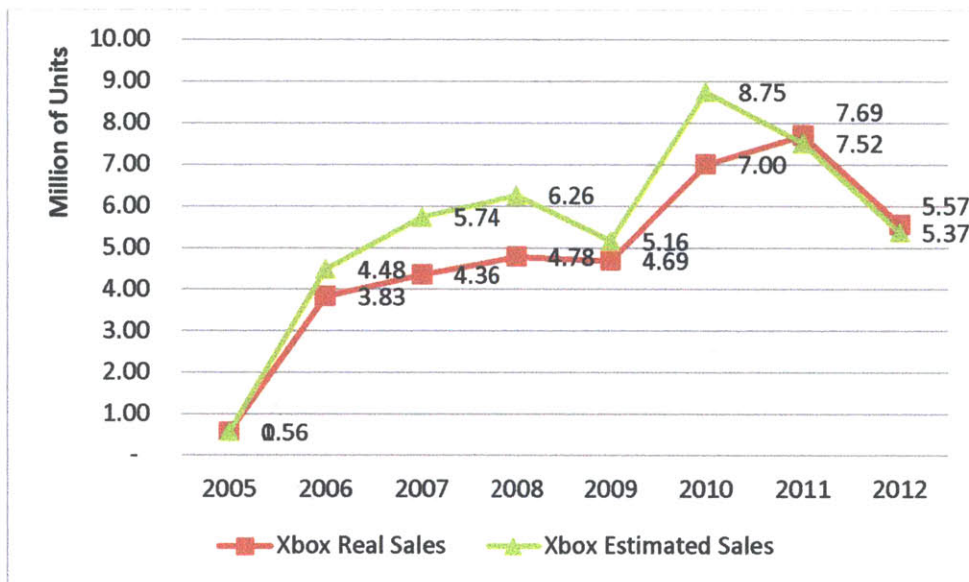


Figure 62 - Xbox Console Estimated x Real Sales from 2005 to 2012

Additionally, a comparison between the evolution of the real and the estimated market-shares of the PlayStation 3, Wii and Xbox 360 can be seen in the Figures 67, 68 and 69. Again, a qualitative analysis gives a sense of the model reasonable accuracy because the shapes of the curves are very similar. Finally, a quantitative analysis reinforces the model reasonable accuracy because the market-shares of the estimative and the real sales are very similar for each console over the years. Finally, Figure 70 shows the comparison between the real and the estimated market-shares for each console in just one picture.

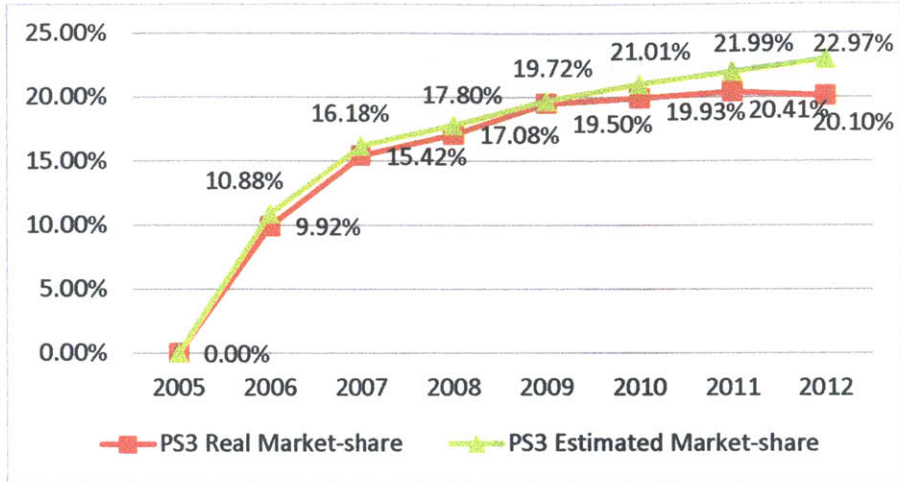


Figure 63 - PS3 Console Estimated x Real Market-shares from 2005 to 2012

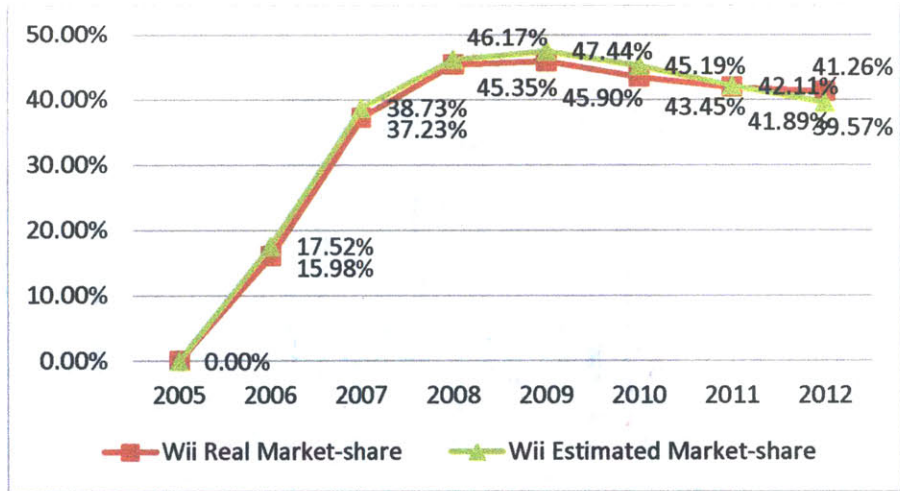


Figure 64 - Wii Console Estimated x Real Market-shares from 2005 to 2012

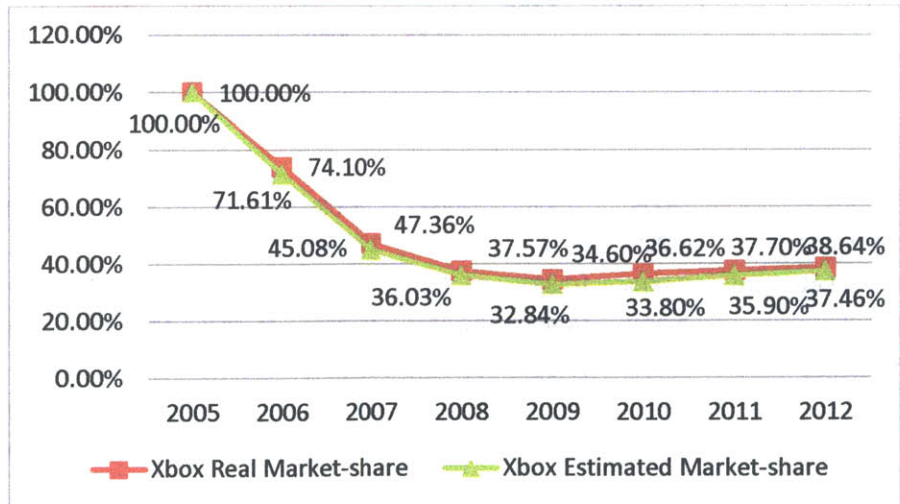
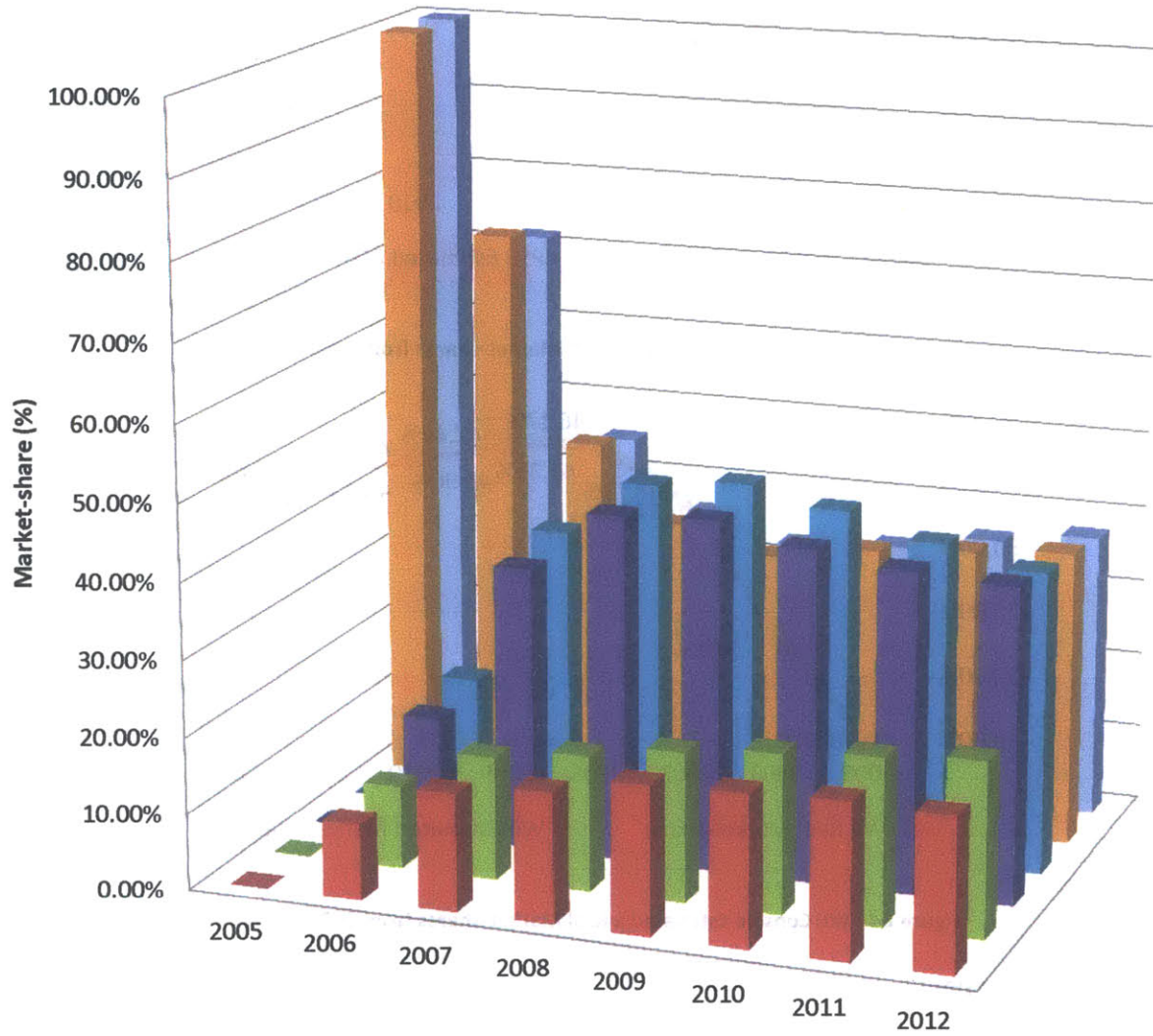


Figure 65 - Xbox Console Estimated x Real Market-shares from 2005 to 2012

Real vs Estimated Market-shares



	2005	2006	2007	2008	2009	2010	2011	2012
■ PS3 Real Market-share	0.00%	9.92%	15.42%	17.08%	19.50%	19.93%	20.41%	20.10%
■ PS3 Estimated Market-share	0.00%	10.88%	16.18%	17.80%	19.72%	21.01%	21.99%	22.97%
■ Wii Real Market-share	0.00%	15.98%	37.23%	45.35%	45.90%	43.45%	41.89%	41.26%
■ Wii Estimated Market-share	0.00%	17.52%	38.73%	46.17%	47.44%	45.19%	42.11%	39.57%
■ Xbox Real Market-share	100.00%	74.10%	47.36%	37.57%	34.60%	36.62%	37.70%	38.64%
■ Xbox Estimated Market-share	100.00%	71.61%	45.08%	36.03%	32.84%	33.80%	35.90%	37.46%

Figure 66 - PS3, Xbox and Wii Consoles - Estimated x Real Market-shares from 2005 to 2012

Now, from the software perspective, a comparison between the evolution of the real and the estimated tie-ratios of the PlayStation 3, Wii and Xbox 360 can be seen in the Figures 71, 72 and 73. Again, a qualitative analysis gives a sense of the model reasonable accuracy because the shapes of the curves are very similar and, in fact, there is considerable overlap between the estimated and the real curves. Additionally, a quantitative analysis reinforces the model accuracy because the estimative and the real sales are very similar for each console over the years.

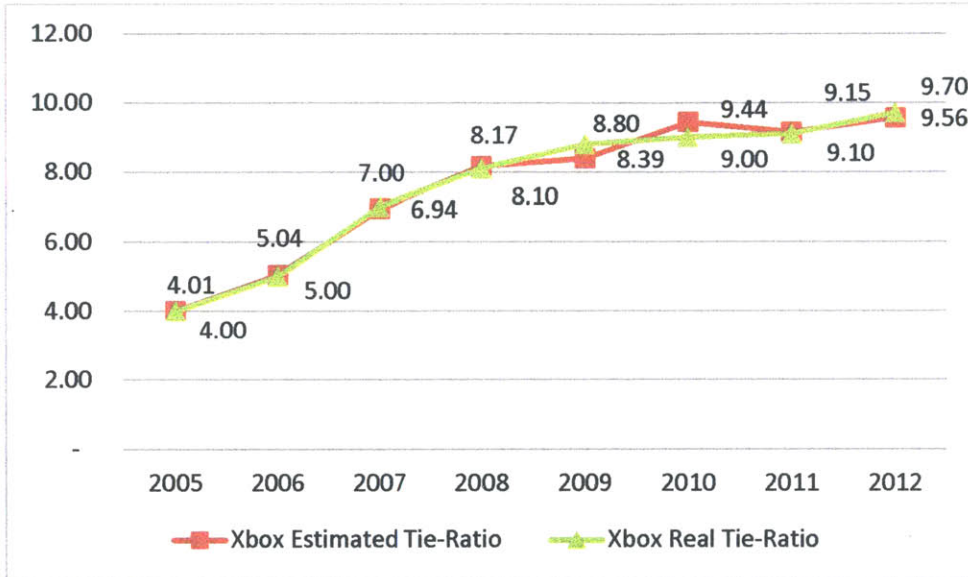


Figure 67 - Xbox Estimated x Real Tie-Ratios from 2005 to 2012

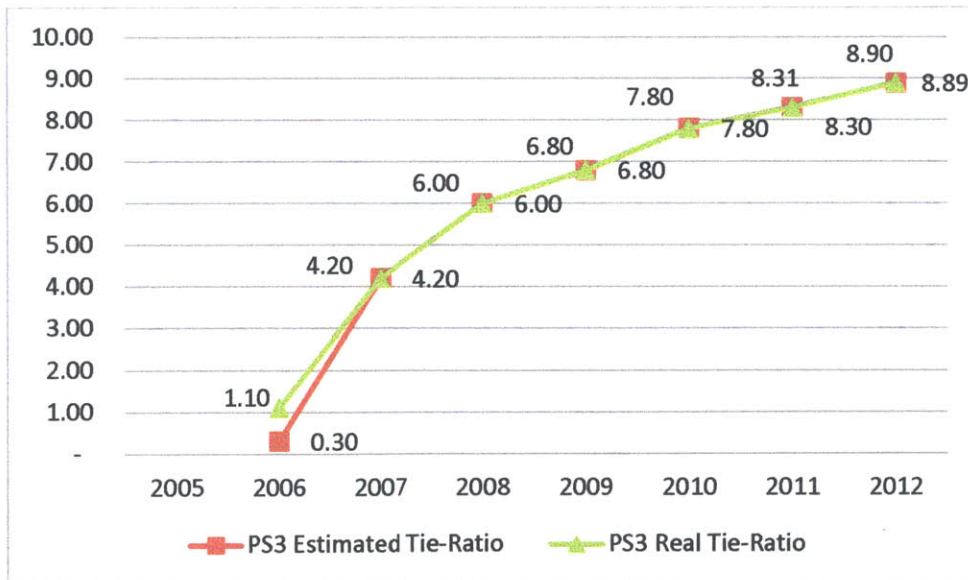


Figure 68 - PS3 Estimated x Real Tie-Ratios from 2005 to 2012

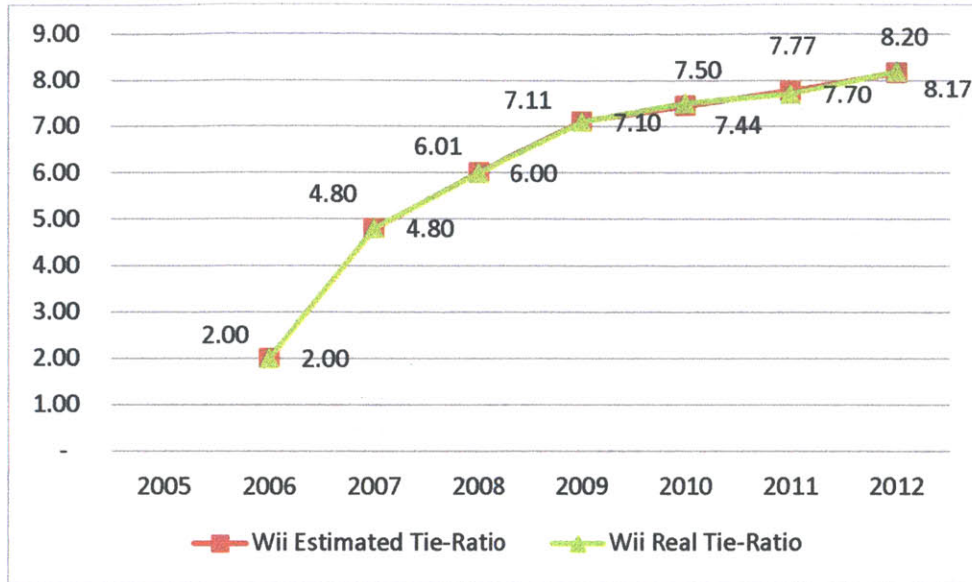


Figure 69 - Wii Estimated x Real Tie-Ratios from 2005 to 2012

Although there is no official data available about the game sales for all the years considered in this work, a good approach to get the real numbers is to do the product between the real console sales and the real tie-ratios which results in the total game sales LTD. So, doing it, it could get the total game sales LTD from 2005 to 2012 for each platform as it can be seen in Figures 74, 75 and 76. Again, there is a significant similarity between the shapes of the estimated and the real curves. However, a quantitative analysis shows there is a significant difference between the estimated and the real numbers for the Wii and PS3 platforms.

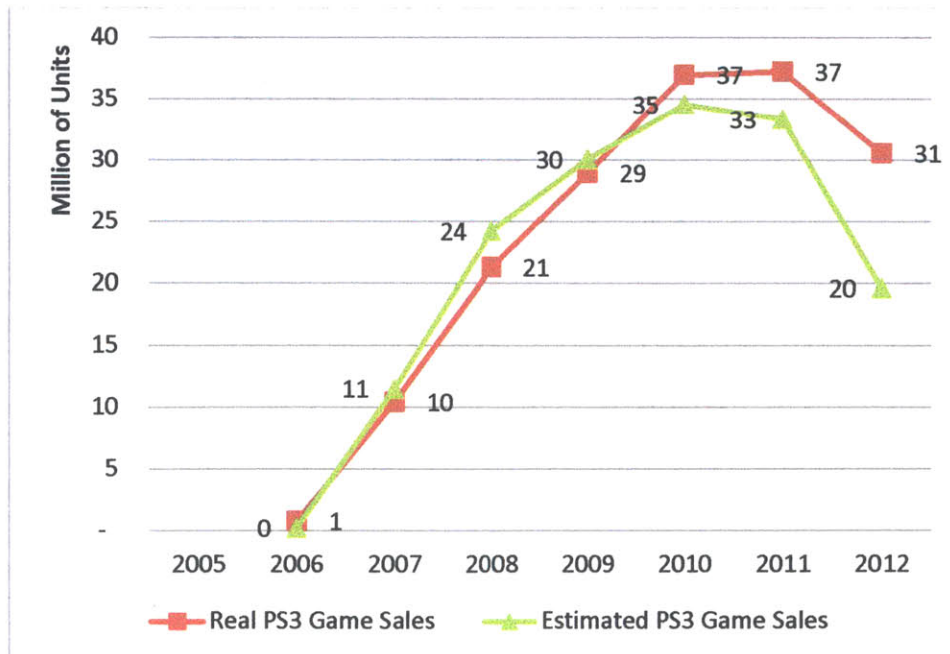


Figure 70 - PS3 Estimated x Real Games Sold LTD from 2005 to 2012

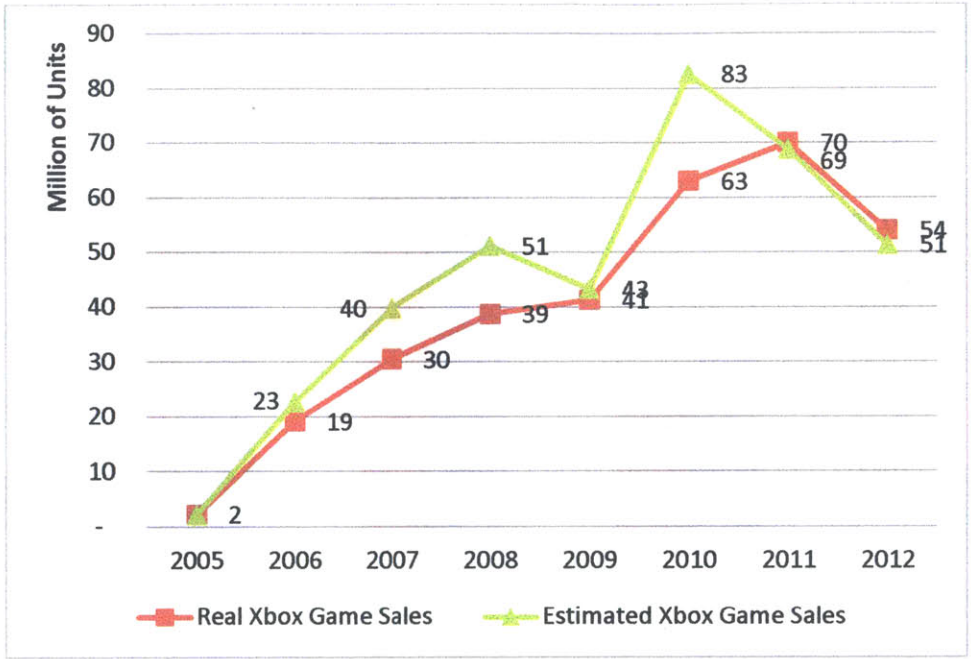


Figure 71 - Xbox Estimated x Real Games Sold LTD from 2005 to 2012

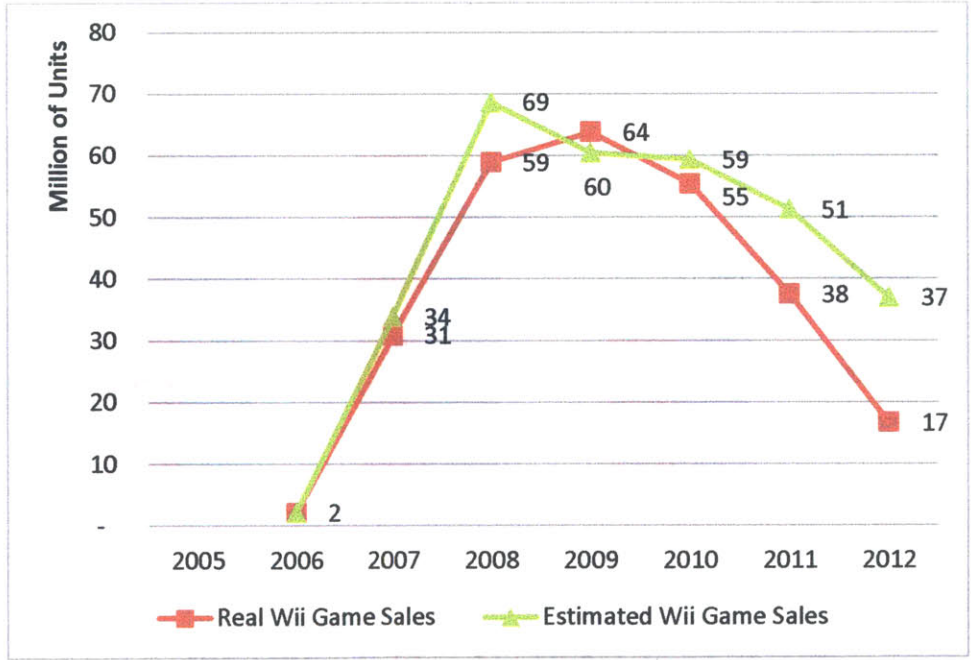


Figure 72 - Wii Estimated x Real Games Sold LTD from 2005 to 2012

Another comparison was done for both the console and game total sales until the end of 2012 and they are shown in the Figures 77 and 78. Considering the console total sales until the end of 2012, the estimative is good, although there is a difference of around 5.5 million between the estimated and the

real sales for Wii and Xbox. The same can be described about the game total sales, where the biggest gaps area also for Wii and Xbox.

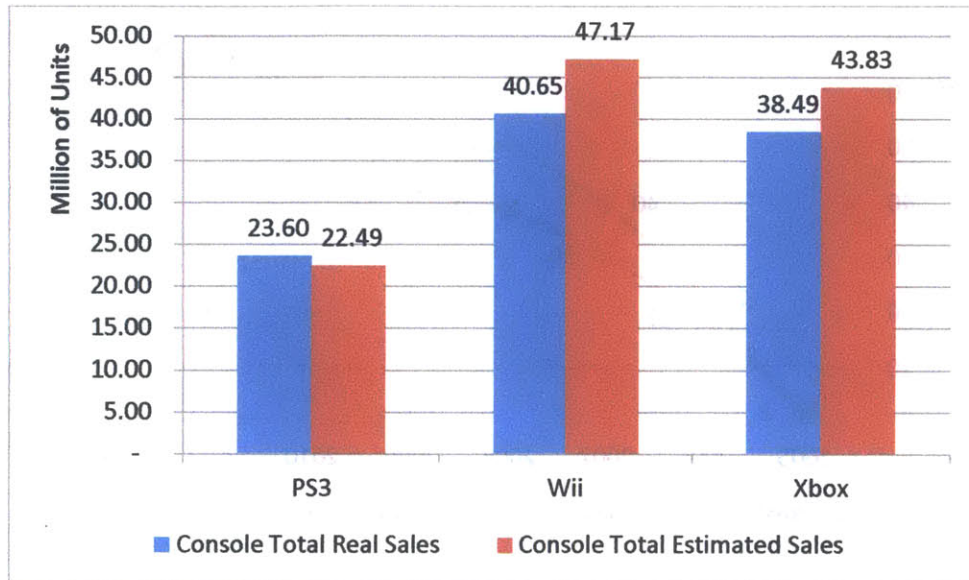


Figure 73 - Estimated x Real Total Console Sales from 2005 to 2012

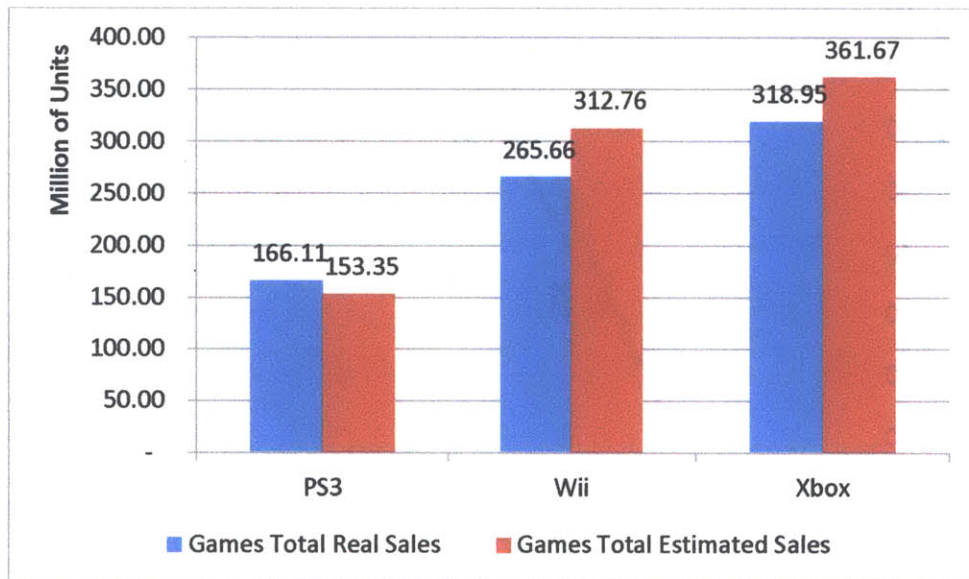


Figure 74 - Estimated x Real Total Game Sales from 2005 to 2012

Counterfactual Analysis

In this session, some possible scenarios are analyzed using the model to explore possible outcomes from different strategies.

Scenario 1 - Nintendo prices Wii equals its Marginal Cost

The first possible scenario considered was “Wii’s price equals to its marginal cost”. The reason Nintendo was selected is because it is the only player pricing consistently the console above the marginal cost. Figure 79 shows Nintendo’s profits would grow aggressively in 2010, then drop in 2011 and have some small growth in 2012. However, the profits’ order of magnitude are not reasonable since they are in 1000 x Billions of Dollars, indicating some lack of accuracy in the model, possible because of the big errors in the regressions to get the consoles sales’ coefficients. Figure 80 just shows the Profits Net Present Value discounted at an 8% annual rate. Finally, according to the model, the proposed strategy would result in 97.71% of market-share to Nintendo, while only 0.19% to Xbox and 2.11% to PlayStation3. However, it is important to note there is probably a considerable discrepancy in the model which could be generating this dominant market-share to Nintendo.

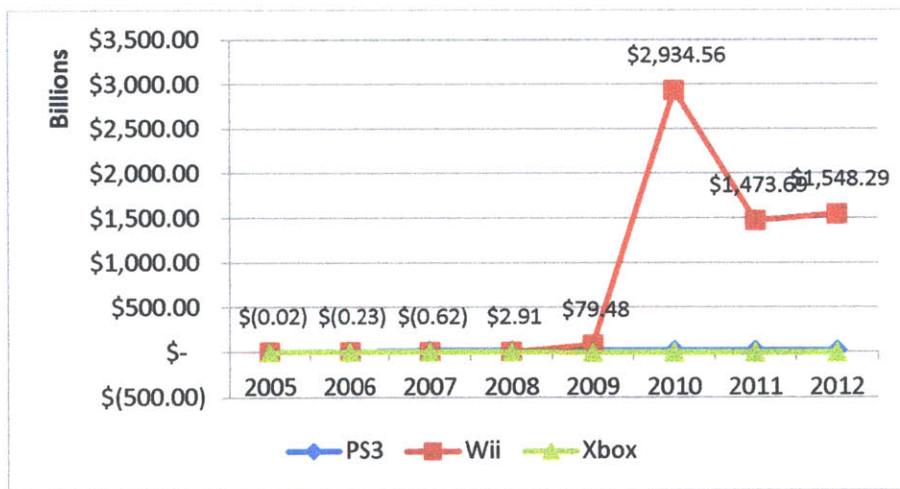


Figure 75 - Console Manufacturers Total Profits

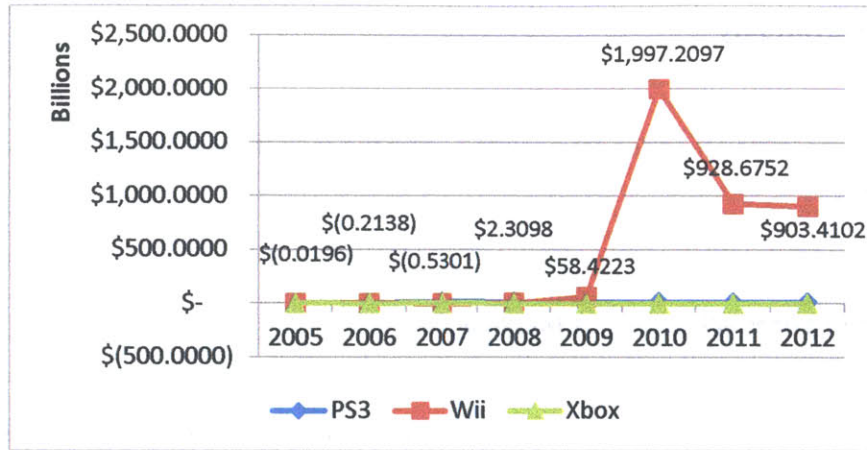


Figure 76 - Console Manufacturers NPV of Total Profits

Scenario 2 - Sony prices PlayStation 3 equals its Marginal Cost

The second possible scenario considered was “PlayStation’s price equals to its marginal cost”. Figure 81 shows Sony’s profits would grow aggressively in 2011 reaching \$164 Billion. Additionally, Figure 82 just shows the Profits Net Present Value discounted at an 8% annual rate. Finally, according to the model, the proposed strategy would result in 96.43% of market-share to Nintendo, while only 0.18% to Wii and 3.39% to Xbox. However, it is important to note again there is probably a considerable discrepancy in the model which could be generating this dominant market-share to Nintendo.

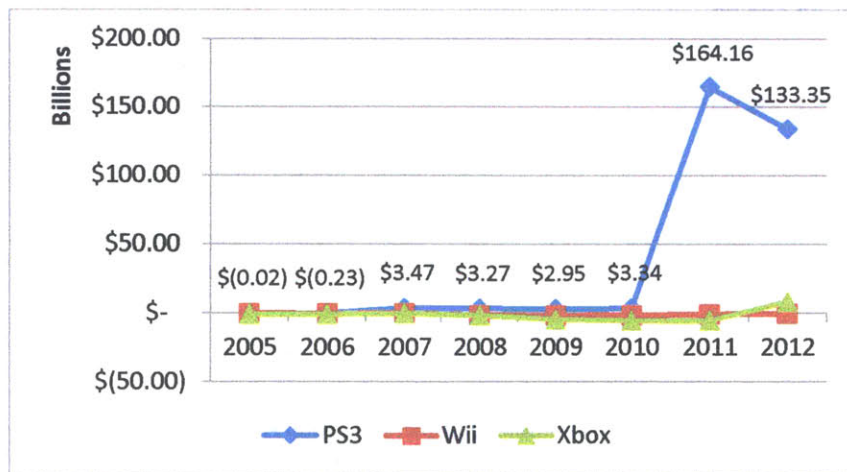


Figure 77 - Console Manufacturers Total Profits

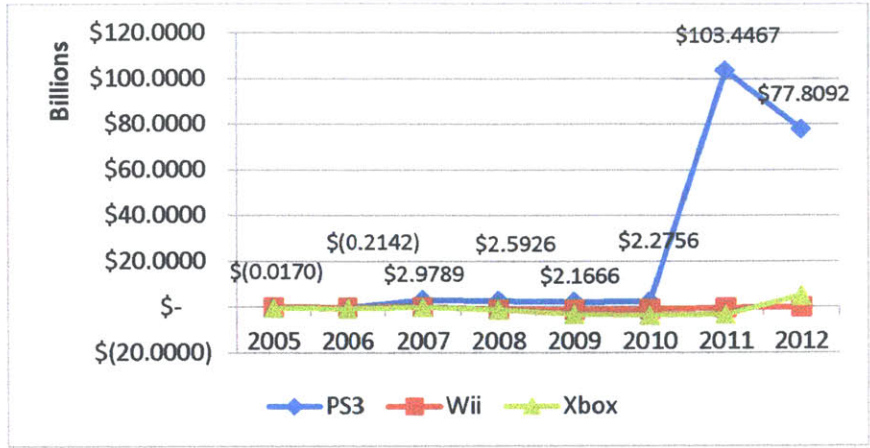


Figure 78 - Console Manufacturers NPV of Total Profits

Scenario 3 - Microsoft prices Xbox 360 equals its Marginal Cost

The third possible scenario considered was “Xbox’s price equals to its marginal cost”. Surprisingly, Figure 83 shows Sony’s profits (instead of Microsoft’s) would grow aggressively in 2012 reaching \$203.89 Billion (which seems to be unrealistic given the total market size). Additionally, Figure 84 just shows the Profits Net Present Value discounted at an 8% annual rate. Finally, according to the model, the proposed strategy would result in 98.75% of market-share to PlayStation 3, while only 0.53% to Wii and 0.72% to Xbox. Although it is important to note again there is probably a considerable discrepancy in the model which could be generating this dominant market-share to Sony, this result makes some sense considering this scenario implies Microsoft’s would raise Xbox’s prices since it had been pricing the console below its marginal cost to get installed base. Finally, considering the estimated market-share distribution in 2011, PlayStation 3 would have 74.18%, while Wii would account 11.08% and Xbox would take 14.73%. So, this market-share distribution seems to be more reasonable.

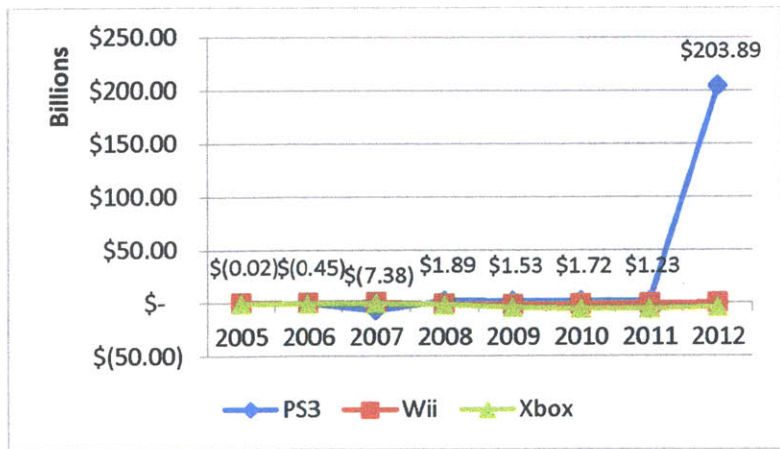


Figure 79 - Console Manufacturers Total Profits

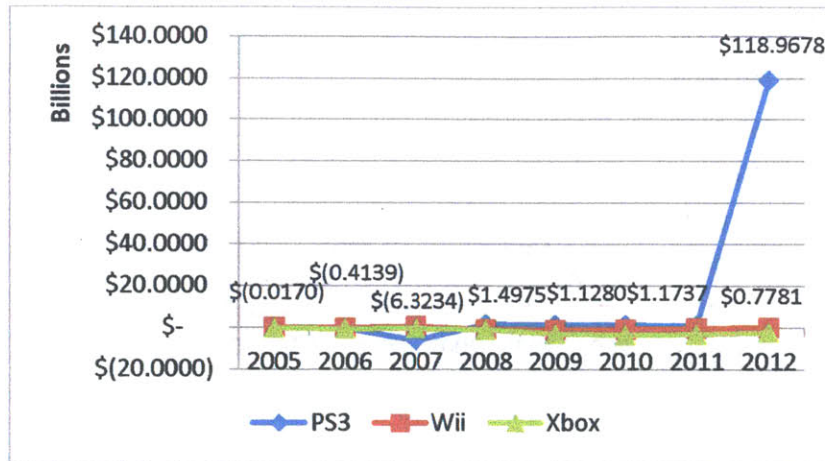


Figure 80 - Console Manufacturers NPV of Total Profits

Scenario 4 – All Console Manufacturers price their Consoles equals their Marginal Costs

Another possible scenario considered was “All consoles priced equal to their marginal costs”. Surprisingly, Figure 83 shows Sony’s profits (instead of Microsoft’s) would grow aggressively in 2010 reaching an unrealistic profitability given the total market size and the order of magnitude of the profits, which may sign some problem in the model. Additionally, Figure 84 just shows the Profits Net Present Value discounted at an 8% annual rate. Finally, according to the model, the proposed strategy would result in 99.42% of market-share to Wii, while only 0.56% to PlayStation 3 and 0.02% to Xbox. Although it is important to note again there is probably a considerable discrepancy in the model, the Nintendo’s dominance makes some sense considering this scenario implies Microsoft’s and Sony’s would raise their console’s prices since they had been pricing them below their marginal costs to get installed base.

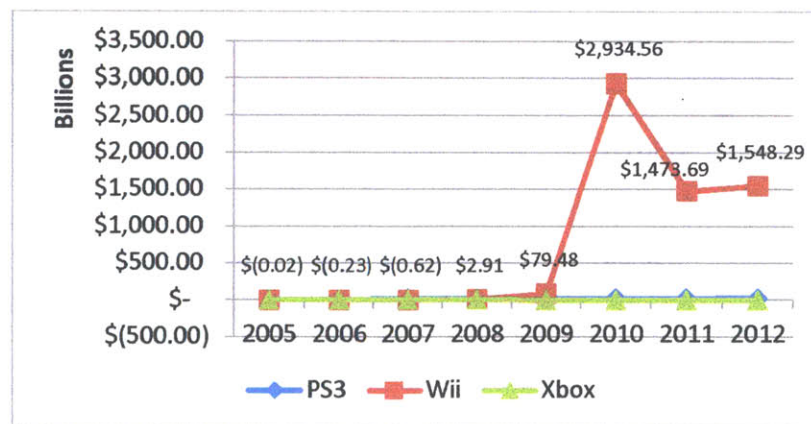


Figure 81 - Console Manufacturers Total Profits

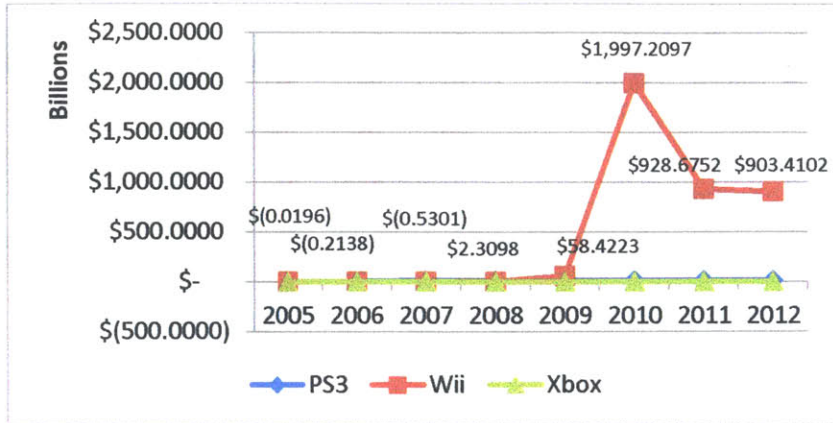


Figure 82 - Console Manufacturers NPV of Total Profits

Scenario 5 – Royalties paid to Console Providers dropped to \$3

Another possible scenario considered was “Royalties paid to the Console Manufacturers dropped to \$3”. So, Figures 87, 88 and 89 show a comparison between the 3rd party Publishers’ Profits (as one single entity) with the Royalty rate of \$6.5 and \$3.0. As it can be seen, the biggest difference in the profitability was for the Wii’s Third-Party Publishers. On the other hand, Figure 90 shows the Manufacturers’ Profits with Royalties at \$3.0.

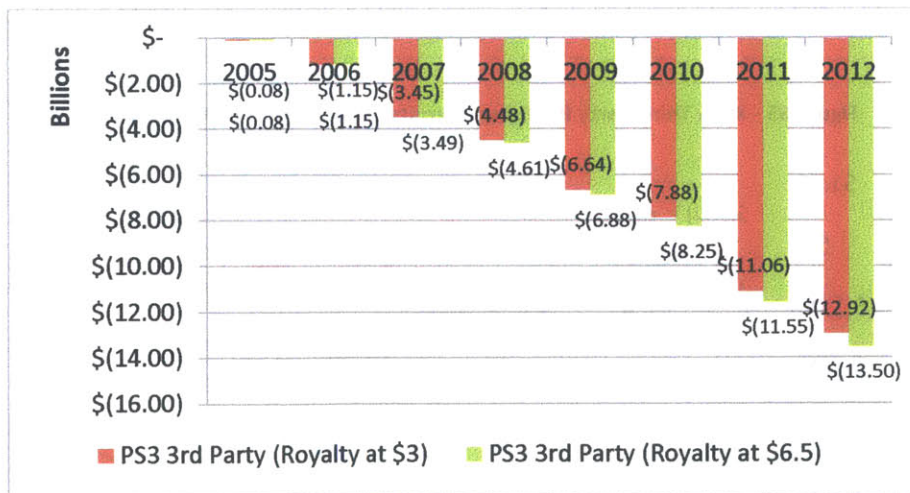


Figure 83 – PS3 Third-party Publishers’ Profits with different Royalty Rates

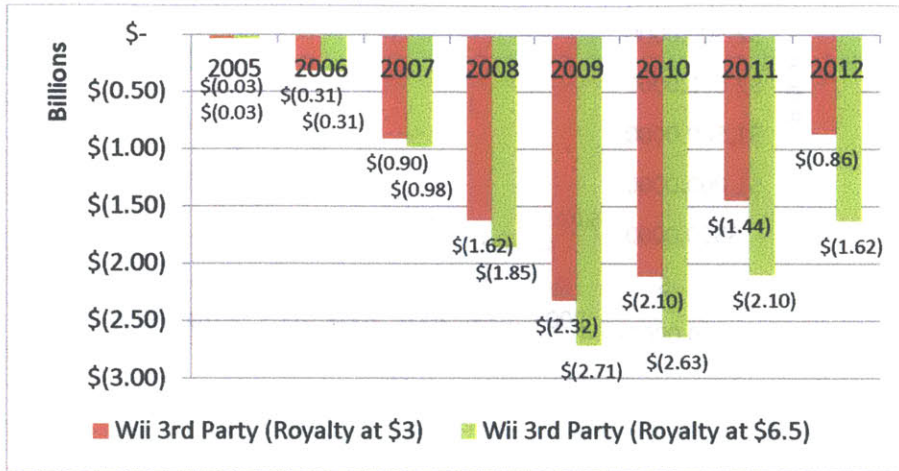


Figure 84 - Wii Third-party Publishers' Profits with different Royalty Rates

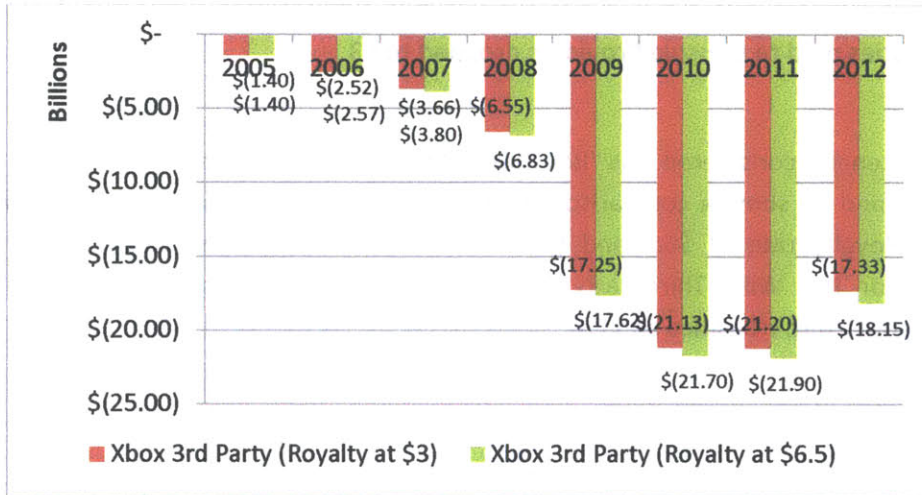


Figure 85 - Xbox Third-party Publishers' Profits with different Royalty Rates

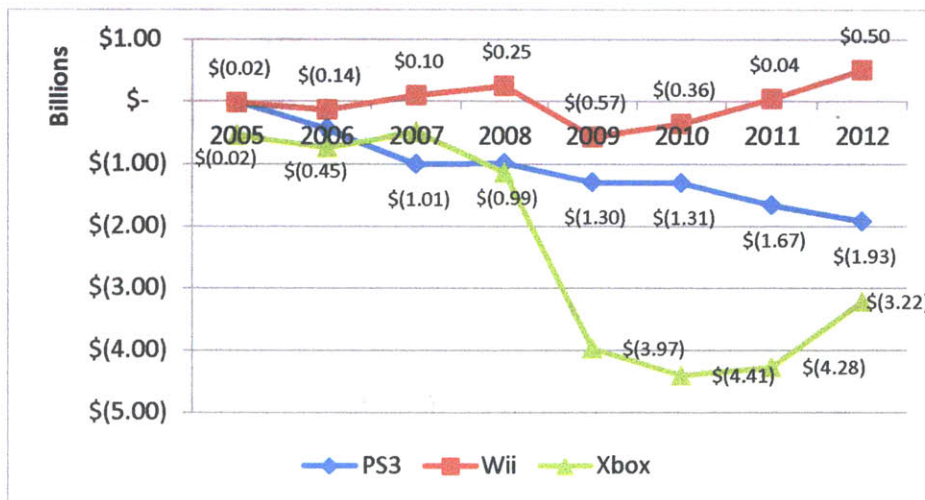


Figure 86 - Manufacturers Profits with Royalties at \$3.0

Scenario 6 – Manufacturers produce all the Games in-House

Atari initially imagined it would be the only one to develop games for its Atari 2600 platform. However, some employees left the company and founded Activision, the first third-party publisher and after being sued by Atari, they started to pay royalties per game unit sold, establishing the current business model. So, this scenario considers all the games developed by the console manufacturers as Atari initially imagined. Figure 91 shows the manufacturer profits from 2005 to 2012 while Figure 92 shows the NPV of Profits in the same time range. Finally, Figures 93, 94 and 95 show a comparison between the profits of each console manufacturer developing all their games in-house and the real scenario. As it can be seen, there is a huge difference in their console videogame business profitability, so, it is fundamental to any console manufacturer to attract third-party developers for its platform to succeed.

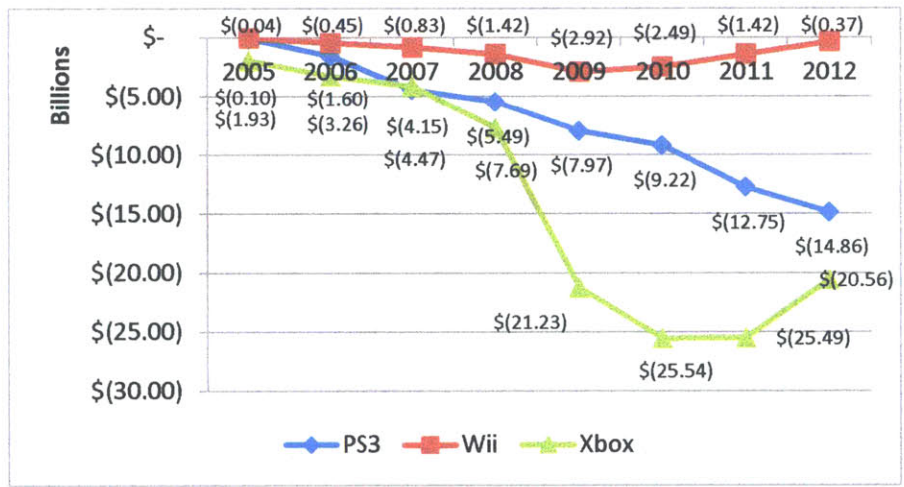


Figure 87 – Console Manufacturers Profits when They Developing all the their Games

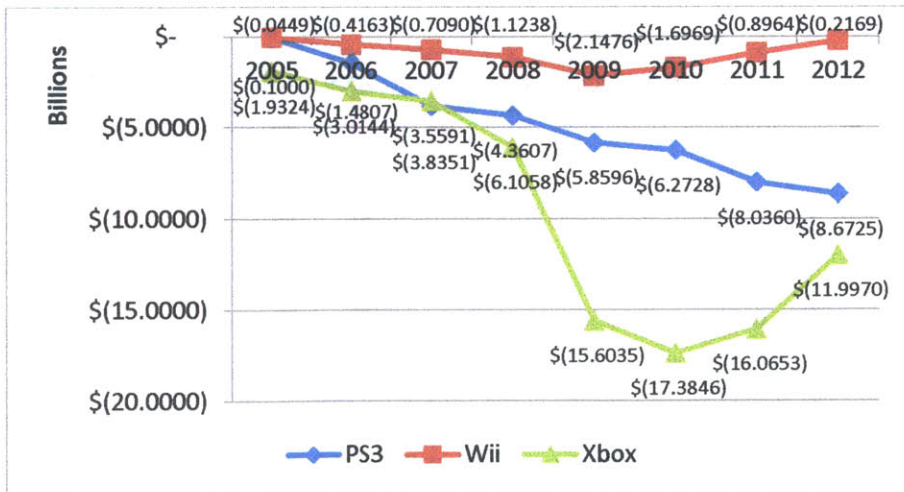


Figure 88 - Console Manufacturers' NPV of Profits when They Developing all the their Games

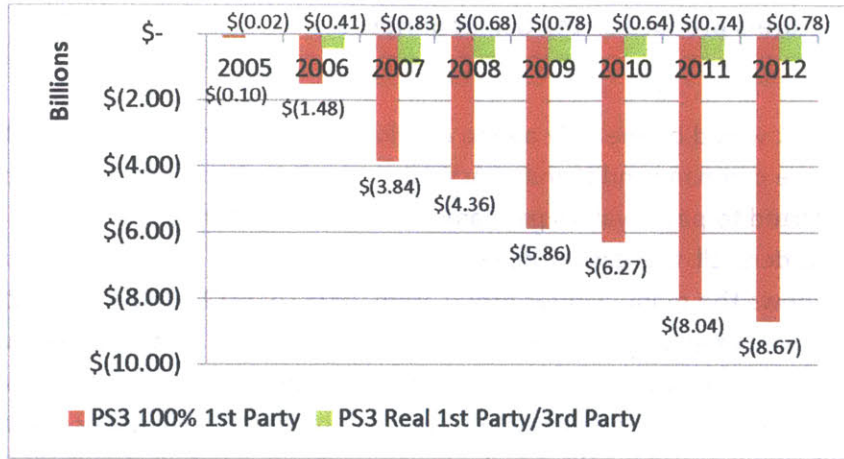


Figure 89 – PlayStation 3’s Profits comparison between the Real Scenario and all the games produced in-house

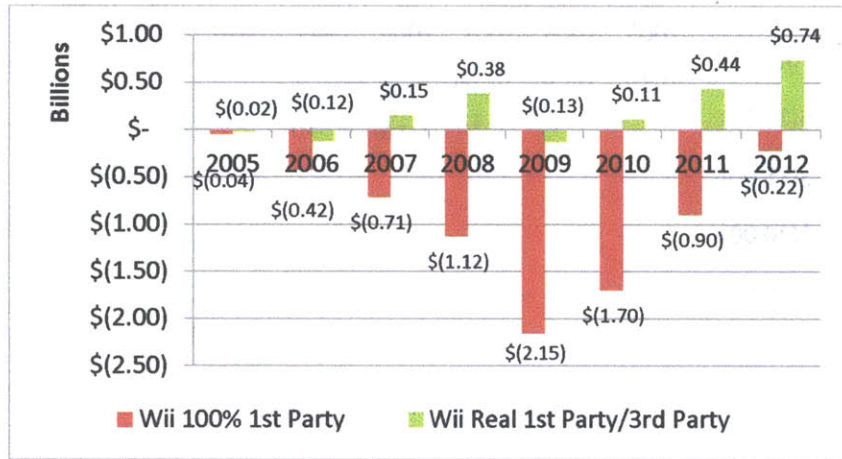


Figure 90 – Wii’s Profits comparison between the Real Scenario and all the games produced in-house

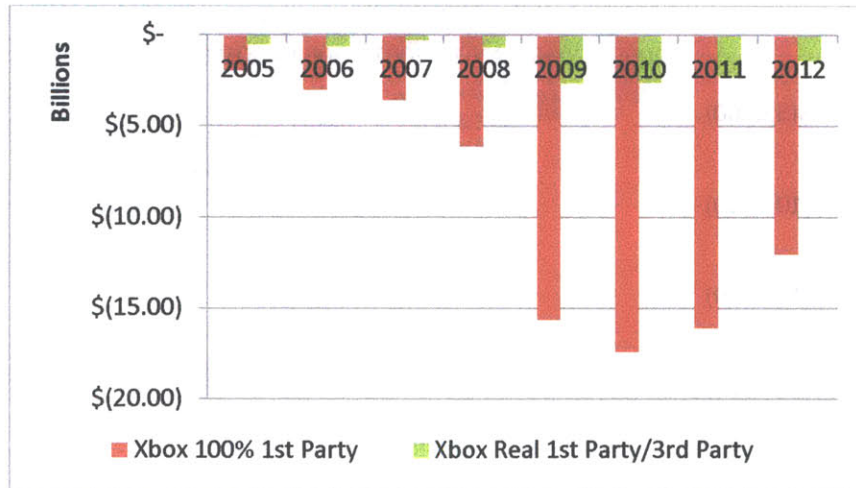


Figure 91 – Xbox’s Profits comparison between the Real Scenario and all the games produced in-house

Scenario 7 – Manufacturers produce no Games in-House

This scenario is the opposite than the previous one. So, the third-party developers would have produced all the game titles for the consoles. Consequently, as it can be seen in Figure 96 and 97, this completely changes the game for the console manufacturers, turning their operations in a very profitable business. However, the third-party developers have no positive profits from 2005 to 2012 since they pay all the development, marketing and distributions costs as shown in Figure 98. Finally, it is important to note there is a big difference between the third-party publishers for each console. In fact, Wii's game publishers have the smaller losses, while the other two consoles' publishers have huge losses, because of the considerable difference in the game development cost between Wii and others.

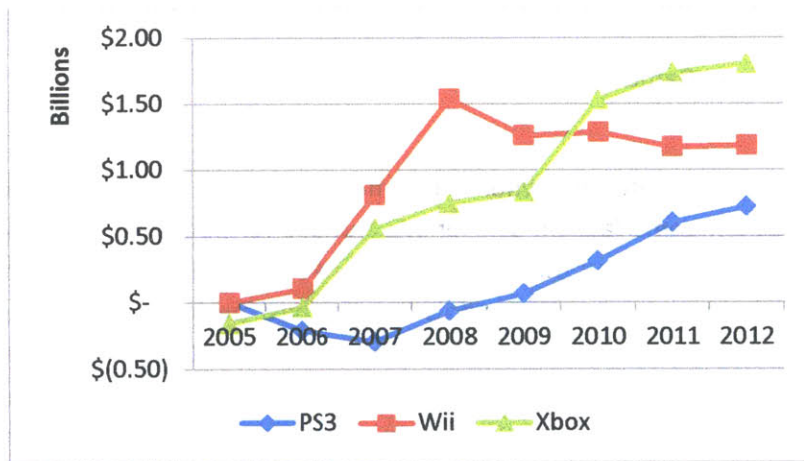


Figure 92 – Consoles Manufacturers' Profits

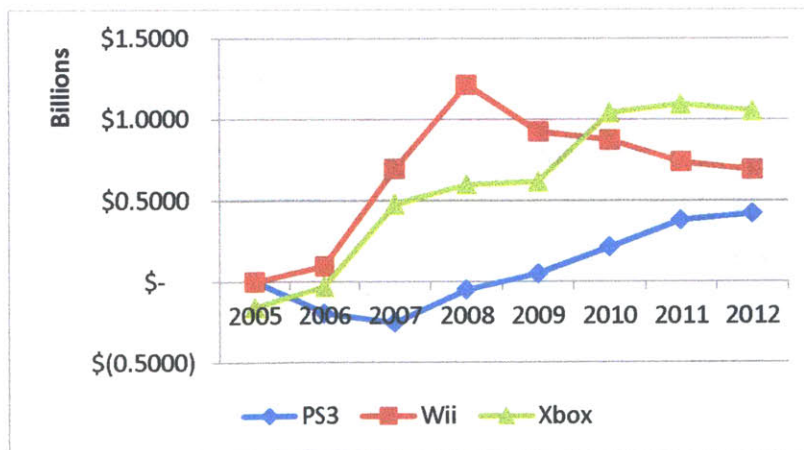


Figure 93 – Consoles Manufacturers' NPV of Profits

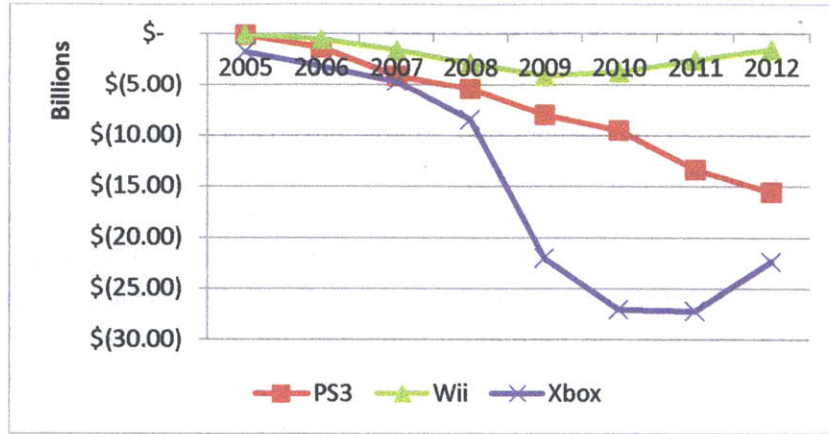


Figure 94 – Third-Party Publishers' Profits

Scenario 8 – No price cuts on Games

This scenario explores a possible situation when the games price would stay permanently at the current prices practiced today at any game launch: \$50 for Wii and \$60 for both PlayStation 3 and Xbox 360 in the average. Figures 99 and 100 show the Manufacturer's Profits and NPV of the Profits respectively from 2005 to 2012. As it can be seen, Nintendo's has the best performance among manufacturers, although it cannot be considered profitable. Additionally, Figures 101, 102 and 103 show a comparison between the profitability of PlayStation 3, Wii and Xbox 360 respectively with game price cuts and no price cuts. As it can be seen, Nintendo is much more impacted negatively with the game price cuts than the other competitors, probably due to higher first-party ratio among the consoles.

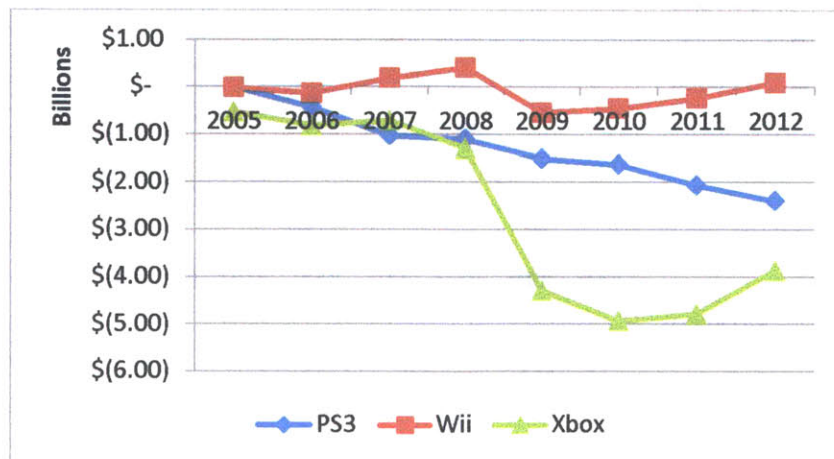


Figure 95 – Console Manufacturers' Total Profits

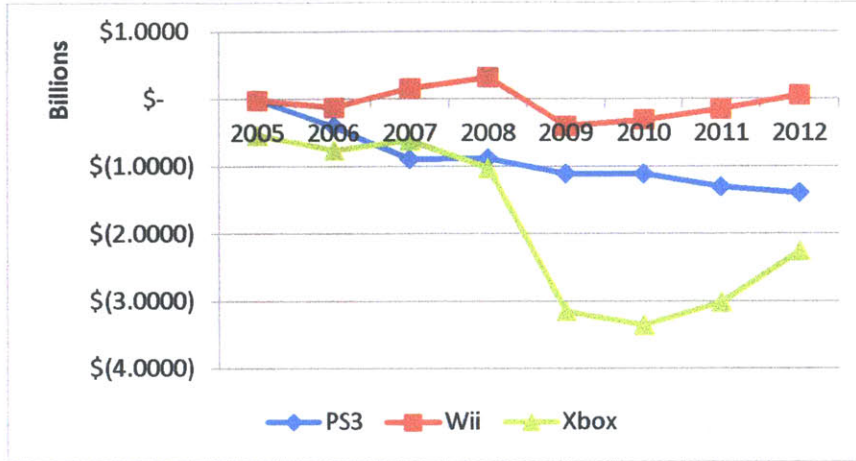


Figure 96 - Console Manufacturers' NPV of Total Profits

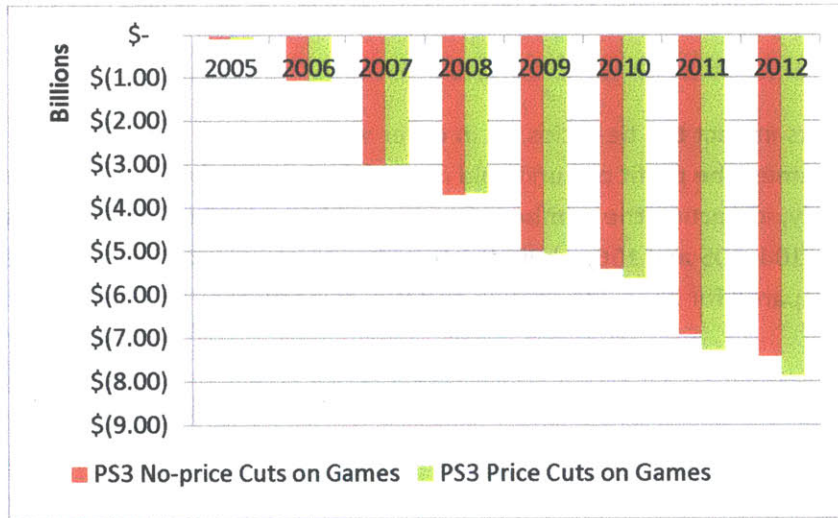


Figure 97 – Comparison between PlayStation 3's Total Profits with Price Cuts and no Price Cuts on Games

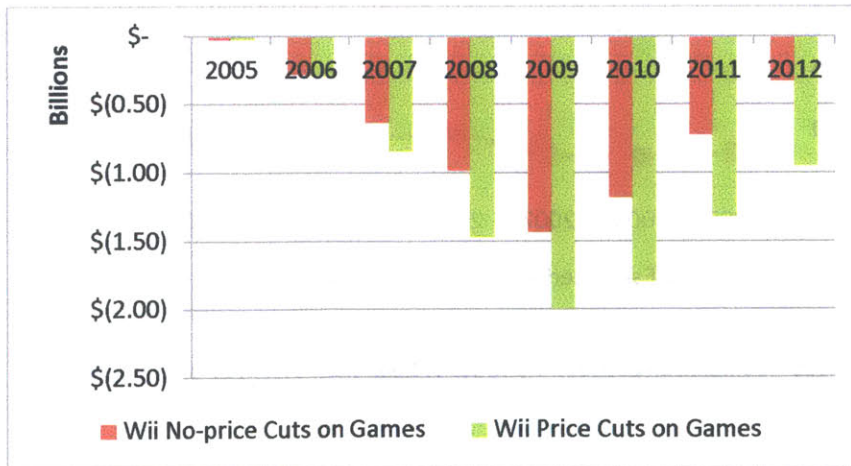


Figure 98 - Comparison between Wii's Total Profits with Price Cuts and no Price Cuts on Games

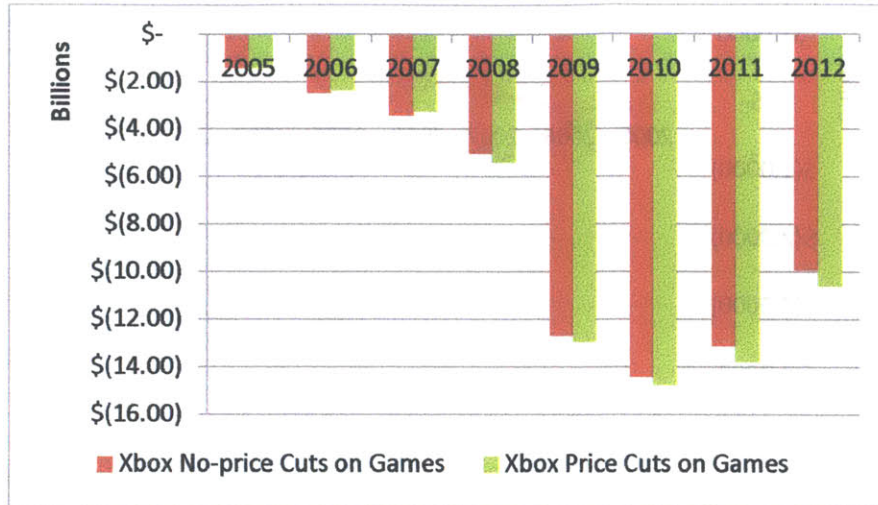


Figure 99 - Comparison between Xbox's Total Profits with Price Cuts and no Price Cuts on Games

However, the price cuts impact the tie-ratios, or in other words the demand for games. So, when there are no price cuts on games, the profit per unit sold is much higher. On the other, the demand for games is reduced considerably, impacting the number of games sold per number of consoles sold. In fact, this can be seen in Figures 104, 105 and 106, where the tie-ratios for the real and the estimated for "no price cut" scenarios are compared for Xbox, PlayStation and Wii, respectively.

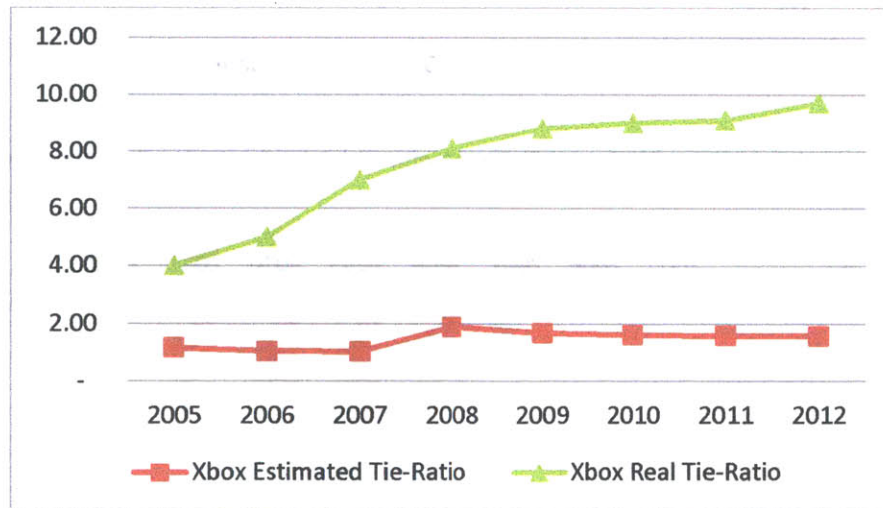


Figure 100 - Comparison between Tie-ratios of Xbox with "Price Cut" and "No Price Cut"

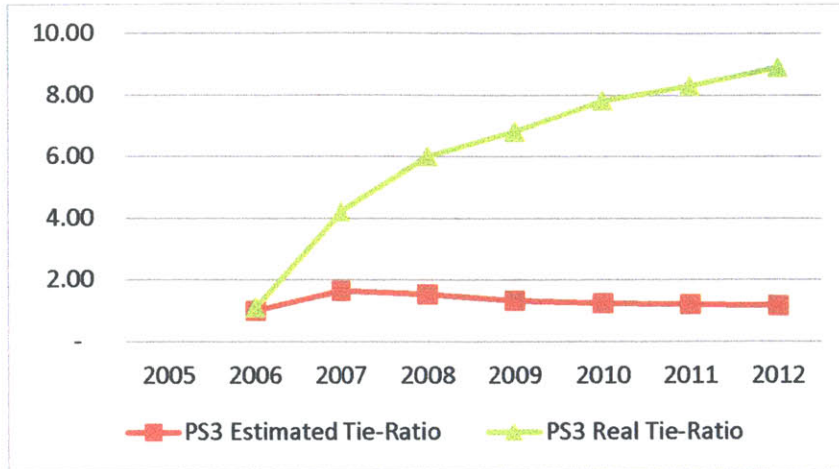


Figure 101 - Comparison between Tie-ratios of PlayStation 3 with "Price Cut" and "No Price Cut"

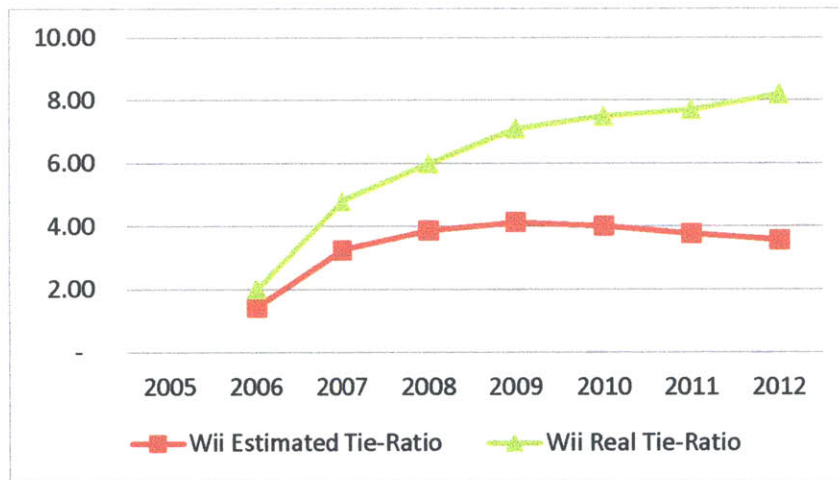


Figure 102 - Comparison between Tie-ratios of Wii with "Price Cut" and "No Price Cut"

In Fact, the impact on the games sales can be better notice in the Figures 107, 108 and 109, where the real game units sold from 2005 to 2012 for each console platform is shown in comparison to the estimated ones for the "no price cut" scenario. So, a qualitative analysis shows the PlayStation 3 has the biggest impact on the game sales if there is no price drops. Additionally, Xbox has also a considerable impact on the game sales while Nintendo has the smallest but considerable impact on the total game units sold. Consequently, there is also an impact on the third-party publisher's profits as it can be seen in Figures 110, 111 and 112, where the profits with and without price cut are compared. However, it is important to note that Nintendo has the biggest impact on the third-party publishers' profitability. Finally, the total profitability of the third-party publishers as a single entity is shown in Figure 113.

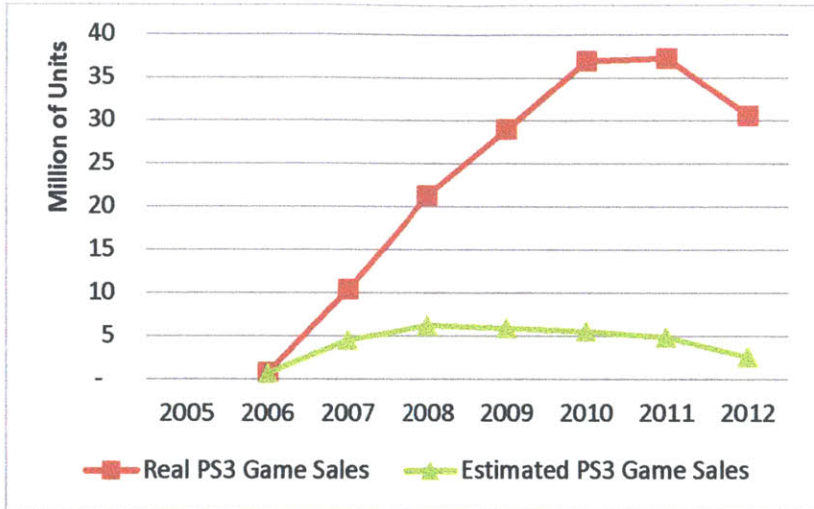


Figure 103 - Comparison between Total Game Sales of PlayStation 3 with "Price Cut" and "No Price Cut"

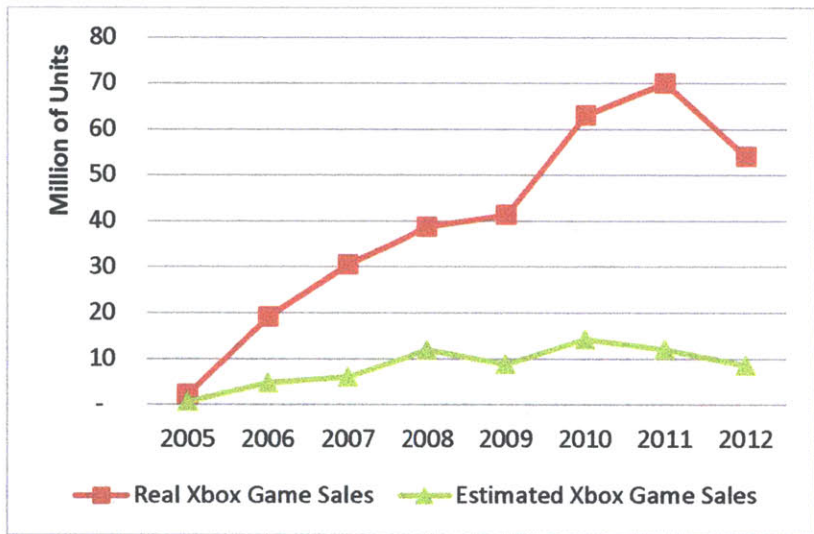


Figure 104 - Comparison between Total Game Sales of Xbox with "Price Cut" and "No Price Cut"

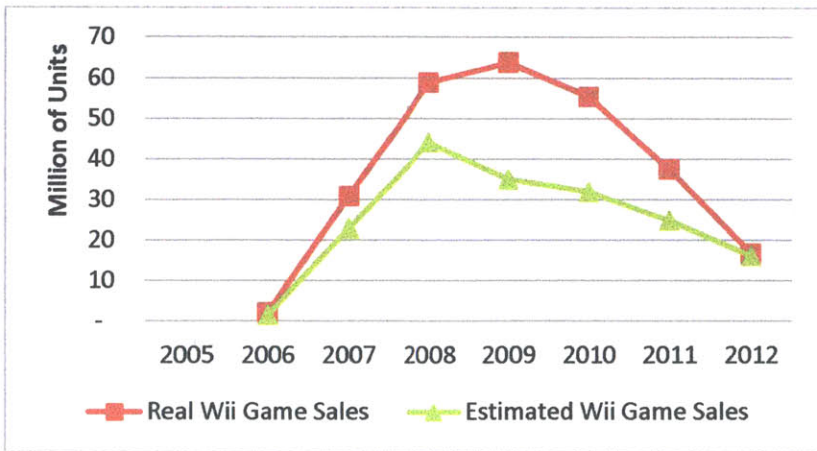


Figure 105 - Comparison between Total Game Sales of Wii with "Price Cut" and "No Price Cut"

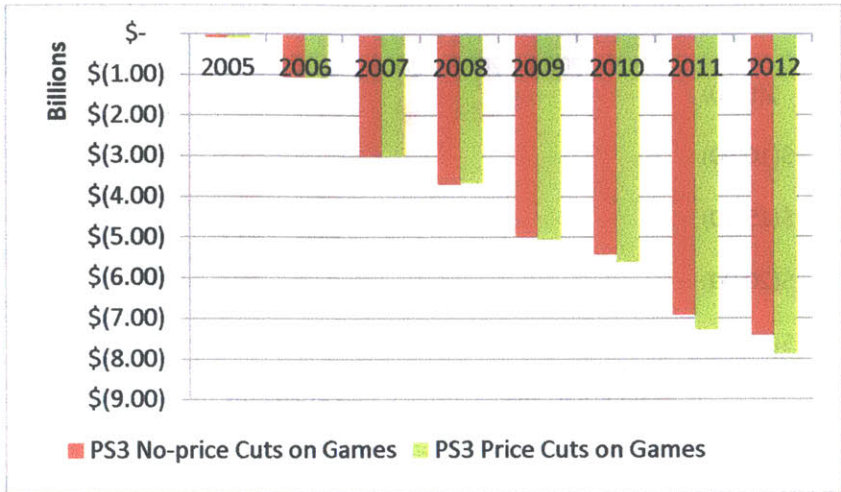


Figure 106 – Impact on profitability of PlayStation 3’s Third-party Publishers without price cut on Games

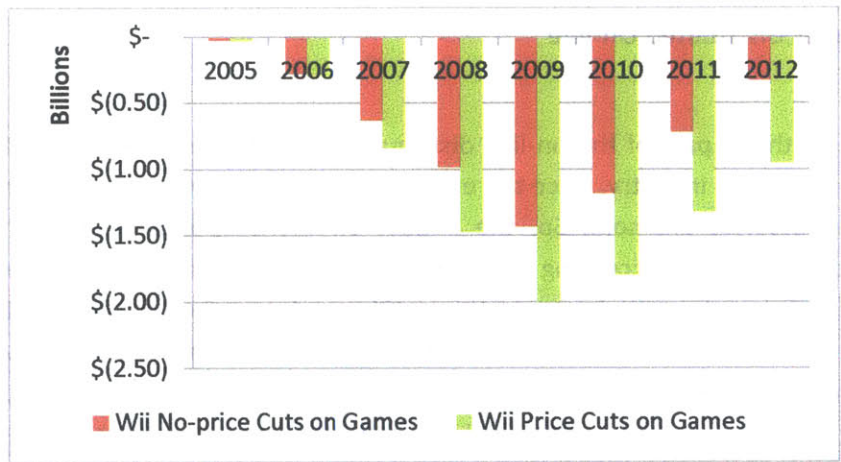


Figure 107 - Impact on profitability of Wii’s Third-party Publishers without price cut on Games

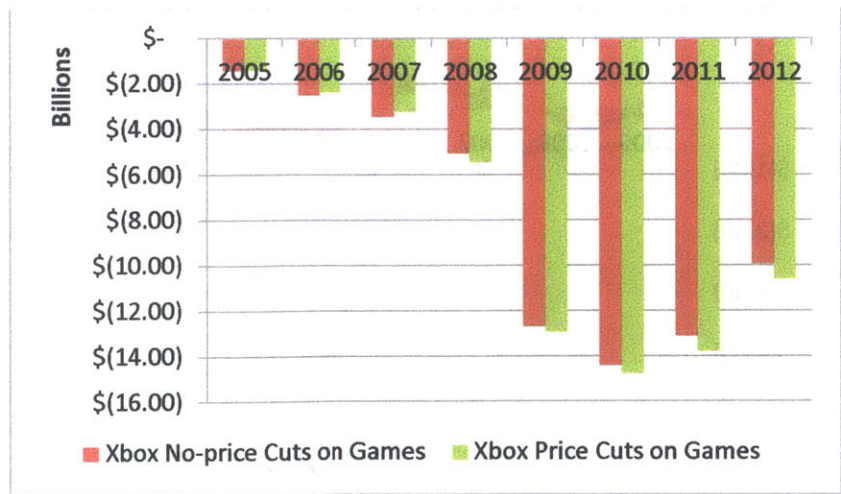


Figure 108 - Impact on profitability of Xbox’s Third-party Publishers without price cut on Games

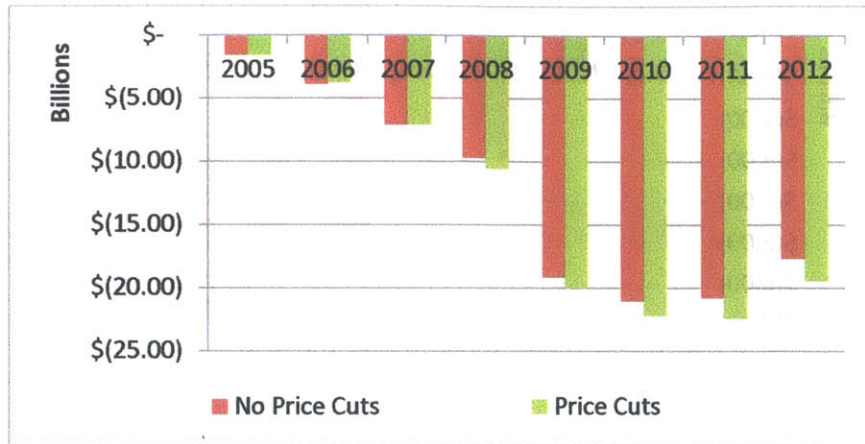


Figure 109 - Impact on profitability of Third-party Publishers without price cut on Games

Scenario 9 – All Games Distributed On-line

This scenario analyses the impact of the on-line distribution of all game titles. In fact, this is a trend in the home console videogame industry, since the each platform has its own on-line network where some games as virtual accessories are sold. So, the impact on the proposed model is to consider the distribution cost equals to zero. According to Figures 114 and 115, Wii's can reach profitability after 2011 with no distribution costs while its competitors still have losses, but are also positively impacted. Figures 116, 117 and 118 show a comparison between the conventional operations with distribution costs for the games and an on-line (with no distribution costs) for PlayStation3, Wii and Xbox respectively, while the Figures 119, 120 and 121 show the same comparison for the third-party publishers considering each console respectively. Finally, Figure 122 shows the same comparison, but considering the third-party publishers as a single entity.

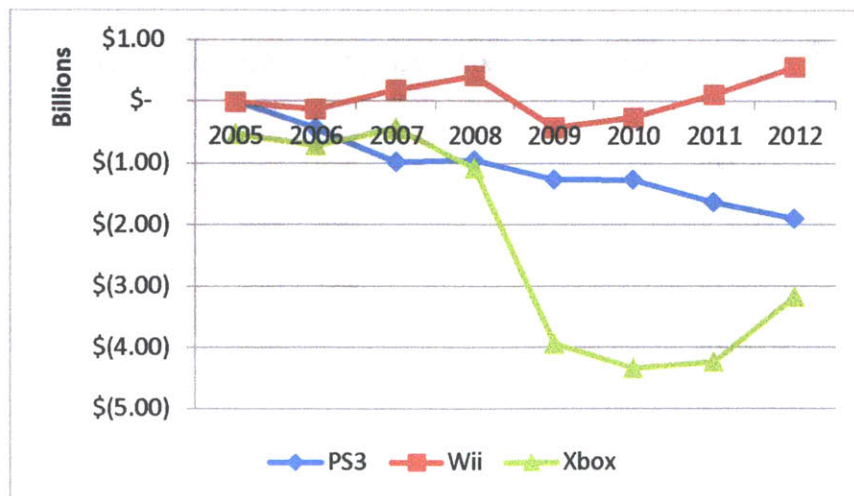


Figure 110 – Console Manufacturers' Profits with no Distribution Costs for the Games

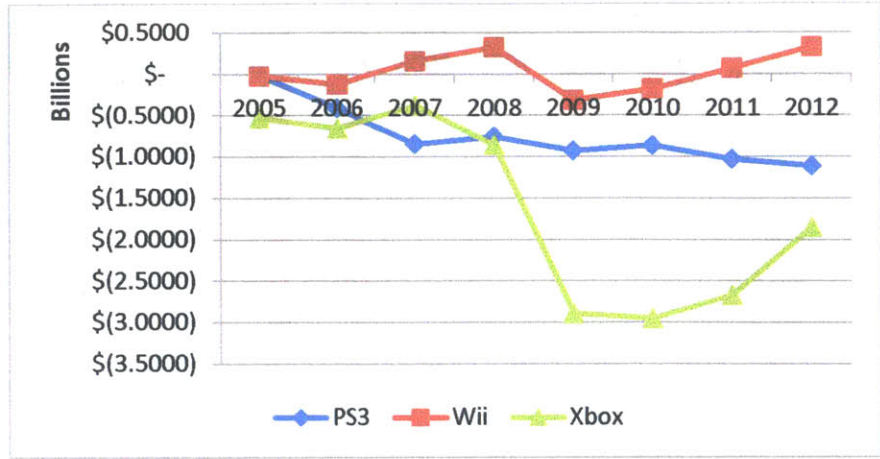


Figure 111 - Console Manufacturers' NPV of Profits with no Distribution Costs for the Games

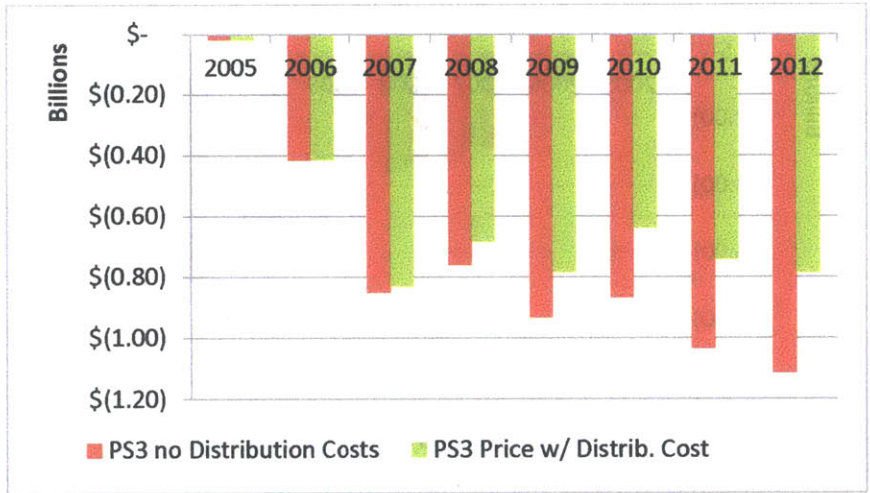


Figure 112 – Profits comparison between Operations with and without Games Distribution Costs for Sony

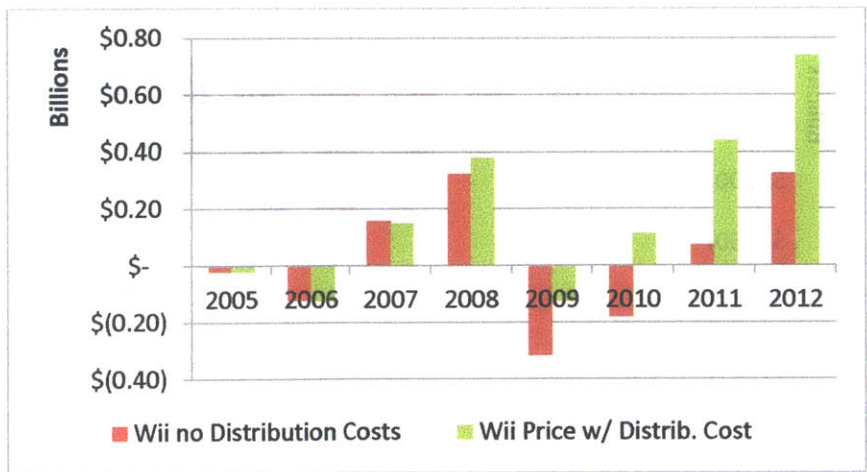


Figure 113 - Profits comparison between Operations with and without Games Distribution Costs for Nintendo

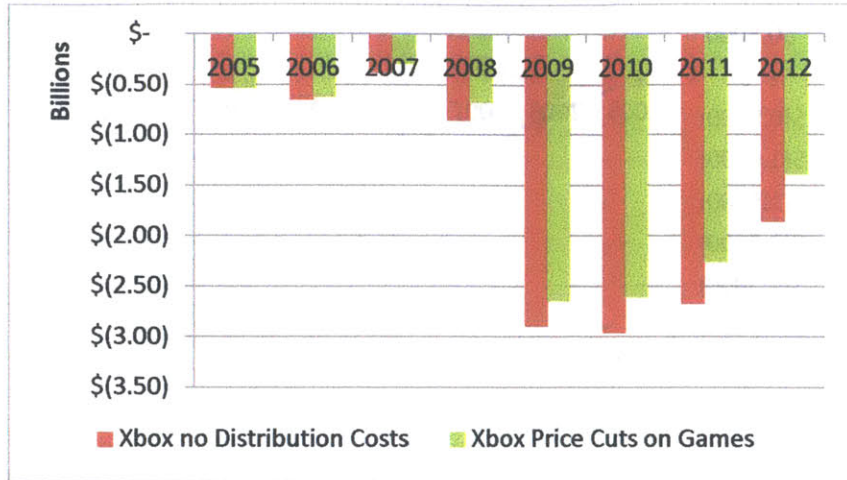


Figure 114 - Profits comparison between Operations with and without Games Distribution Costs for Microsoft

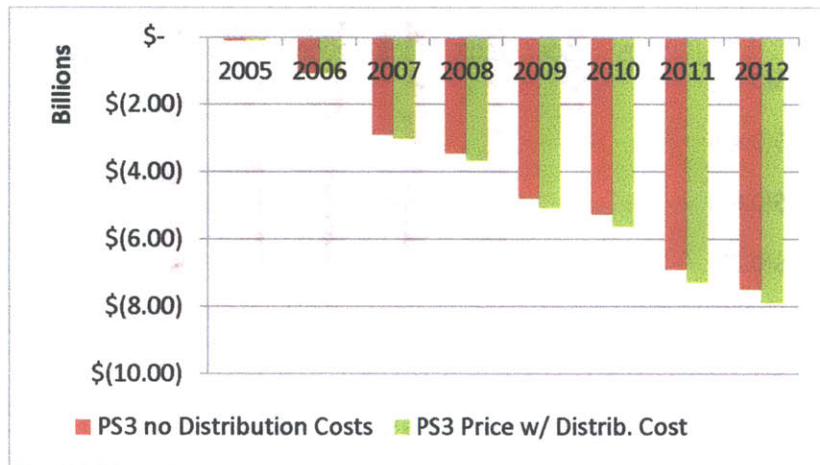


Figure 115 - Profits comparison between Operations with and without Games Distribution Costs for PlayStation 3's Third-party Publishers

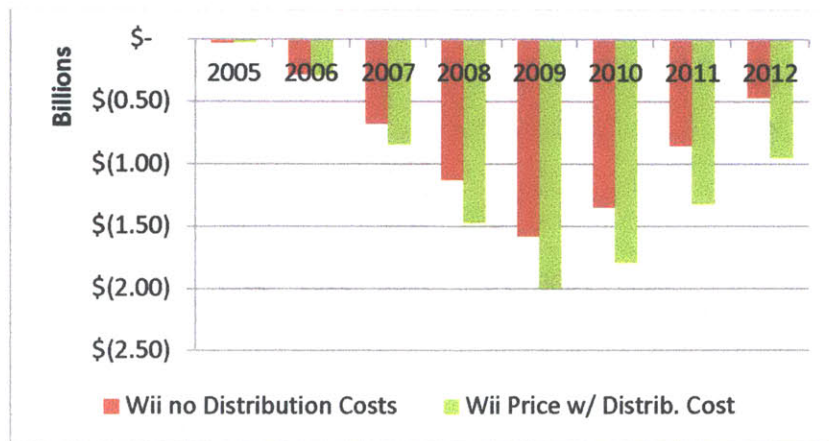


Figure 116 - Profits comparison between Operations with and without Games Distribution Costs for Wii's Third-party Publishers

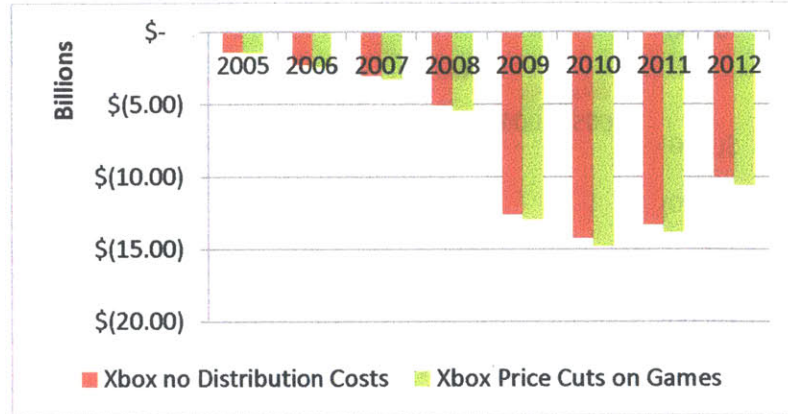


Figure 117 - Profits comparison between Operations with and without Games Distribution Costs for Xbox's Third-party Publishers

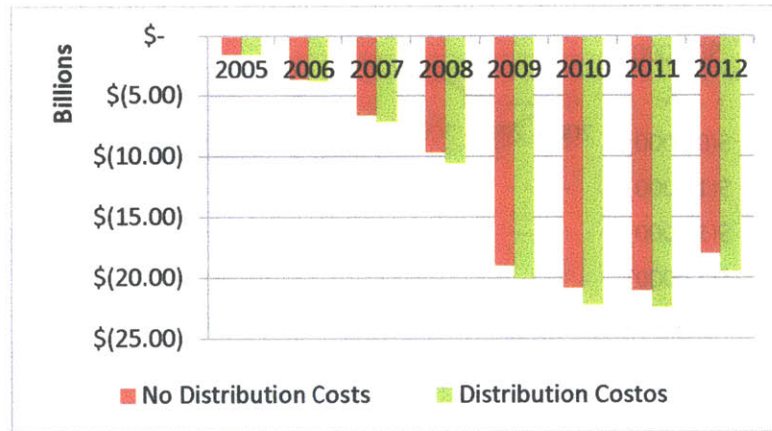


Figure 118 - Profits comparison between Operations with and without Games Distribution Costs for Third-party Publishers as a single entity

Scenario 10 – All Games Distributed On-line

Although the model does not consider the impact of the marketing investment on the demand, it considers the impact of the marketing costs in the manufacturers' and publishers' profits. So, this scenario analyses the impact of a 50% reduction of the games marketing costs on the manufacturers' and publishers' results. The Manufacturer's profits and the NPV of profits can be seen in the Figures 123 and 124 respectively. However, profitability comparisons between the scenarios with full and half investment for each manufacturer are shown in Figures 125, 126 and 127, while the same profitability comparisons for each manufacturer's third-party are shown in Figures 128, 129 and 130. Finally, a last comparison of the same type is done considering the third-party publishers as a single entity in the Figure 131.

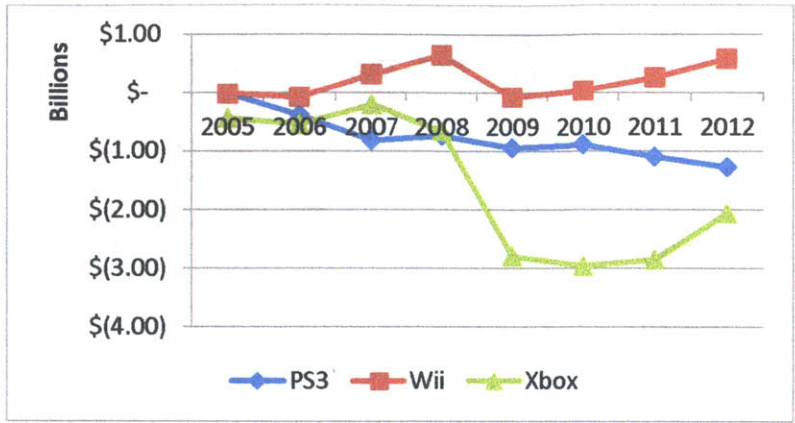


Figure 119 – Manufacturers' Profits with 50% of the Real Marketing Costs

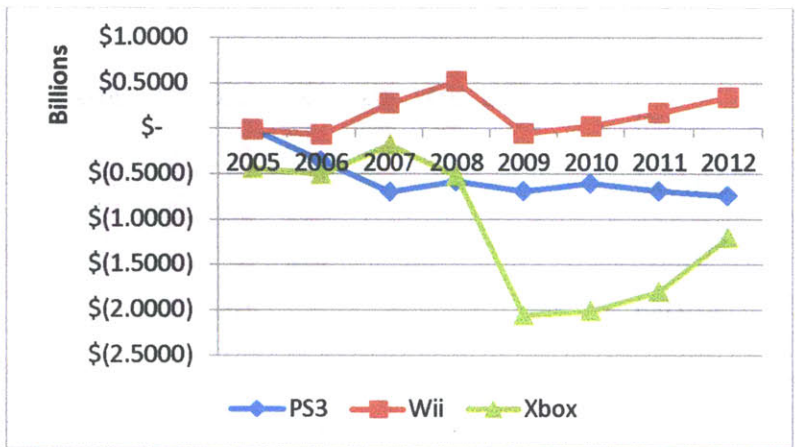


Figure 120 - Manufacturers' NPV of Profits with 50% of the Real Marketing Costs

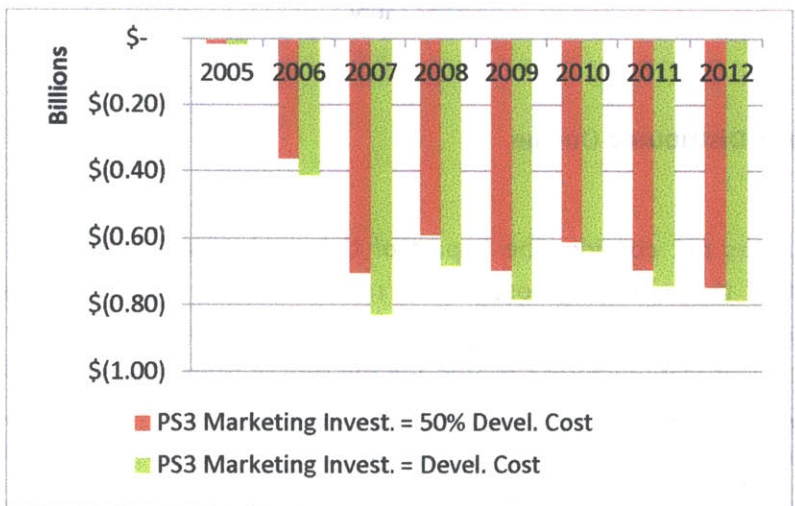


Figure 121 – PlayStation 3's Profits comparing two Marketing Costs Scenarios

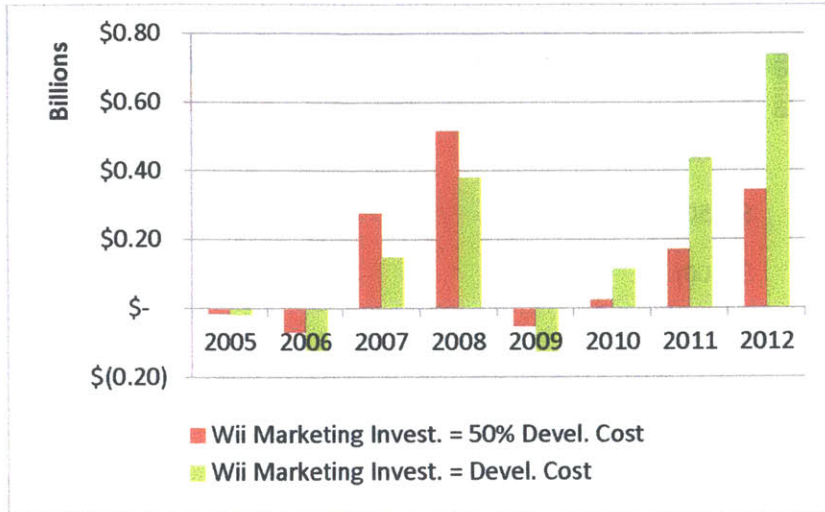


Figure 122 - Wii's Profits comparing two Marketing Costs Scenarios

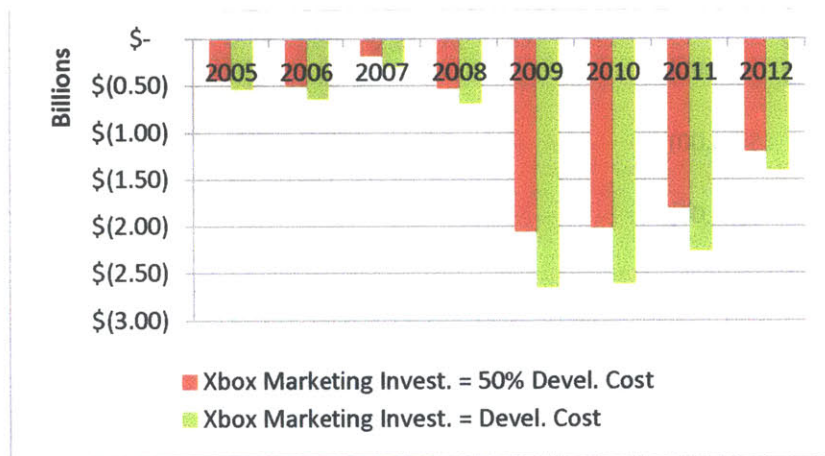


Figure 123 - Xbox's Profits comparing two Marketing Costs Scenarios

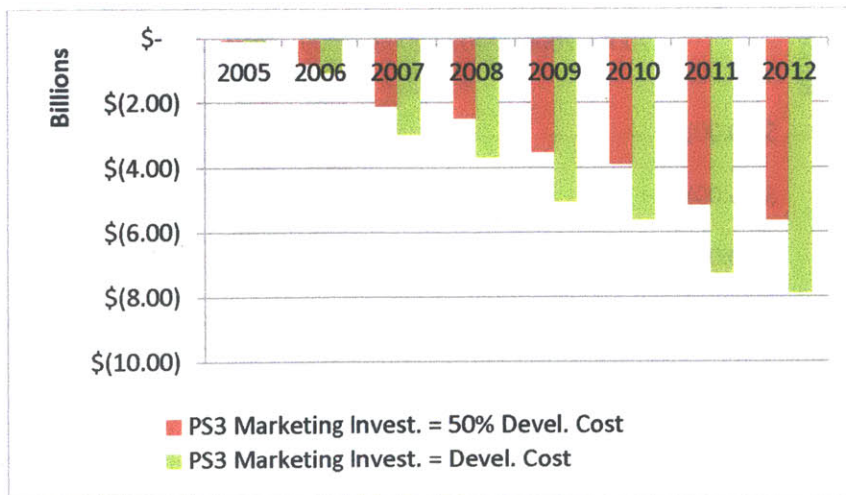


Figure 124 - PlayStation 3 Third-Party's Profits comparing two Marketing Costs Scenarios

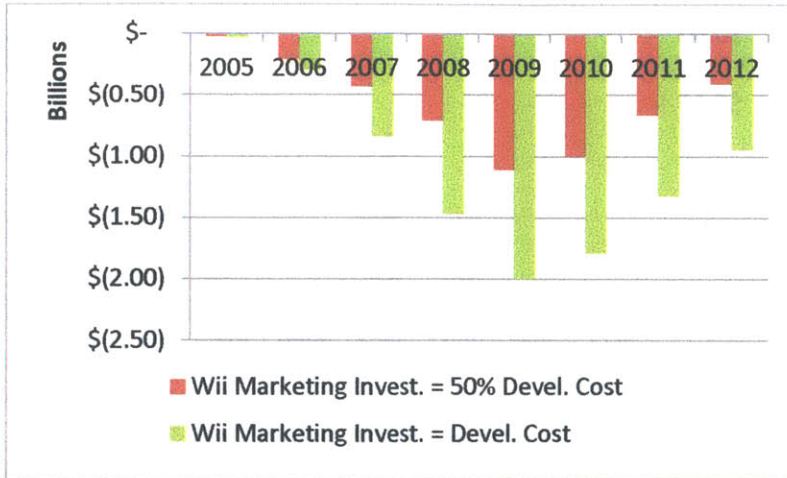


Figure 125 – Wii Third-Party's Profits comparing two Marketing Costs Scenarios

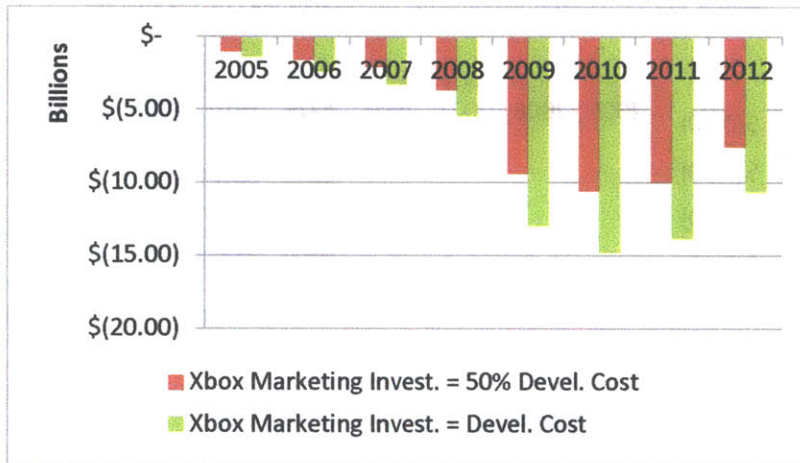


Figure 126 - Xbox Third-Party's Profits comparing two Marketing Costs Scenarios

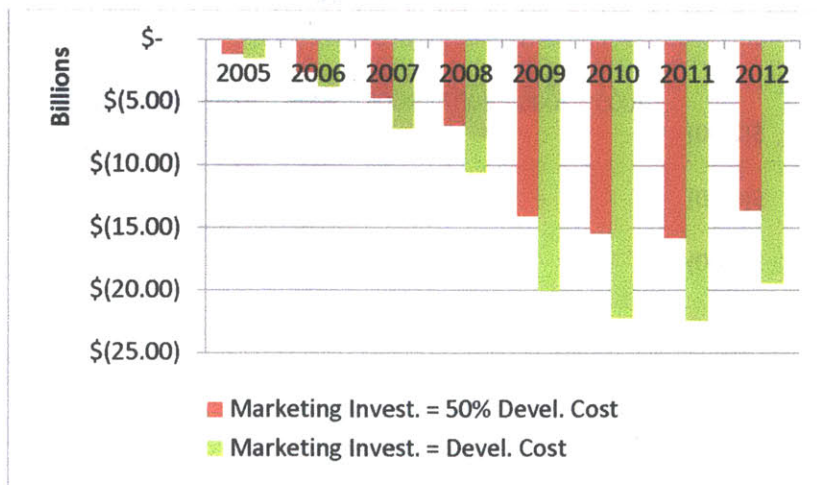


Figure 127 - Third-Party's Total Profits comparing two Marketing Costs Scenarios

Scenario 11 – Game Prices 50% Higher on Average

This scenario analyses the impact the game prices 50% higher than the real average. In fact, a motivation for it would be imagine GameStop does not exist in the market, so it has no impact on the game prices, which by assumption would result in game prices 50% higher. The Manufacturer's profits and the NPV of profits can be seen in the Figures 132 and 133 respectively. However, profitability comparisons between the scenarios with original and higher prices for each manufacturer are shown in Figures 134, 135 and 136, while the same profitability comparisons for each manufacturer's third-party are shown in Figures 137, 138 and 139. Finally, a last comparison of the same type is done considering the third-party publishers as a single entity in the Figure 140.

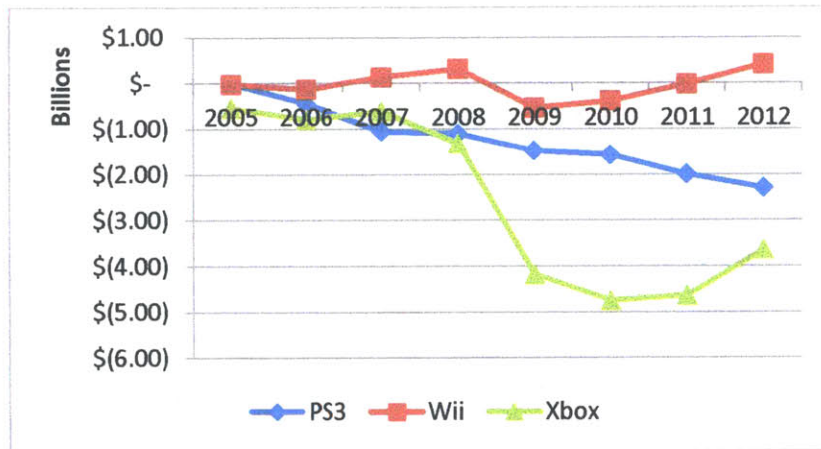


Figure 128 – Manufacturers' Profits comparing two Game Price Levels

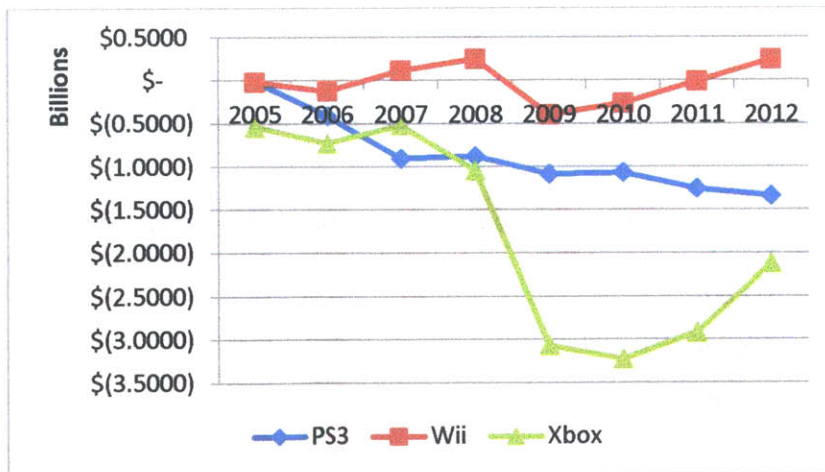


Figure 129 - Manufacturers' NPV of Profits comparing two Game Price Levels

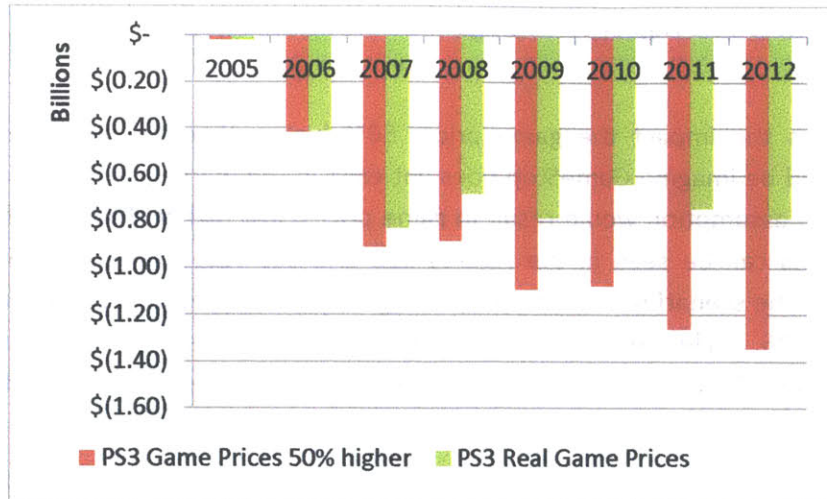


Figure 130 – PlayStation 3 Manufacturer’s Profits comparing two Game Price Levels

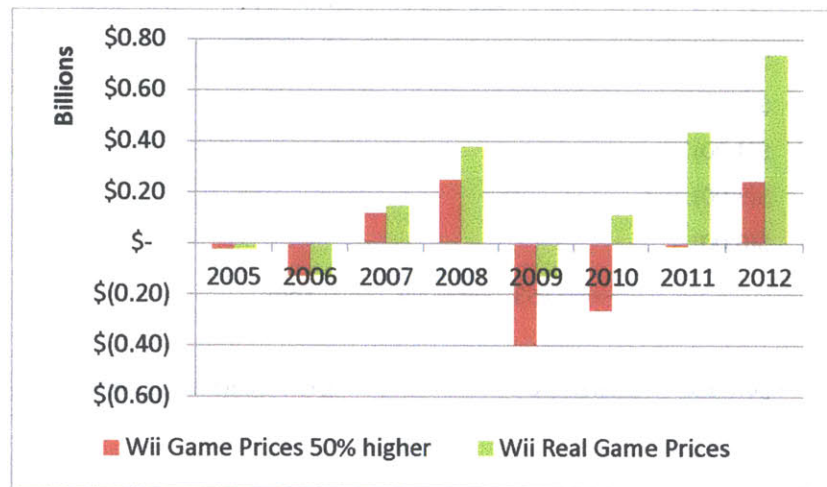


Figure 131 - Wii Manufacturer’s Profits comparing two Game Price Levels

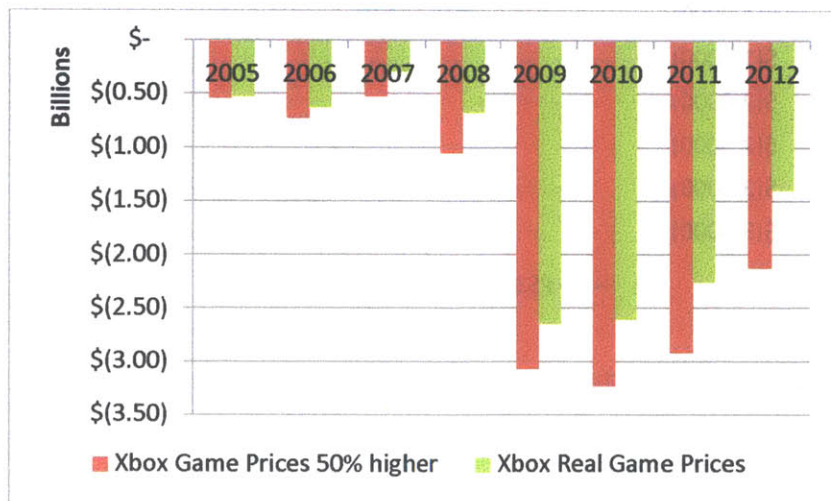


Figure 132 - Xbox Manufacturer’s Profits comparing two Game Price Levels

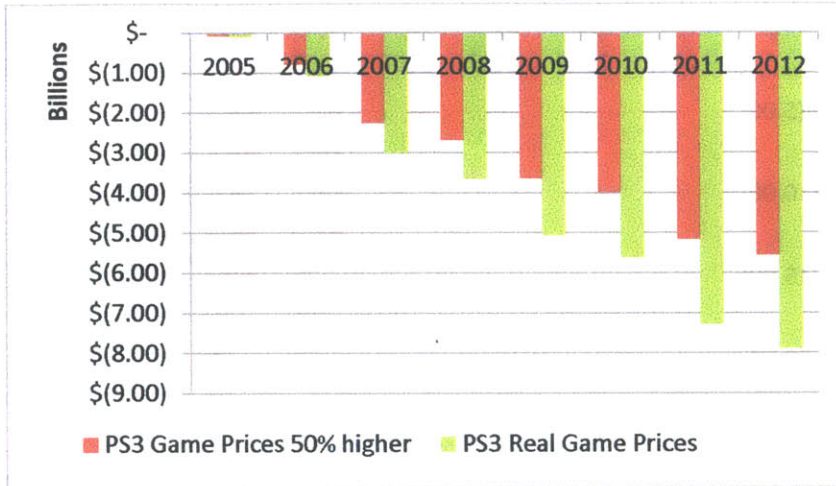


Figure 133 – PS3 Third-Party's Profits comparing two Game Price Levels

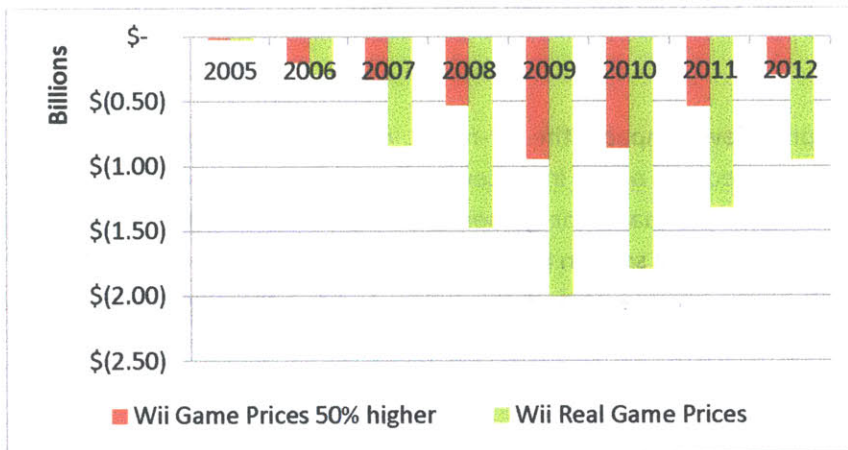


Figure 134 – Wii Third-Party's Profits comparing two Game Price Levels

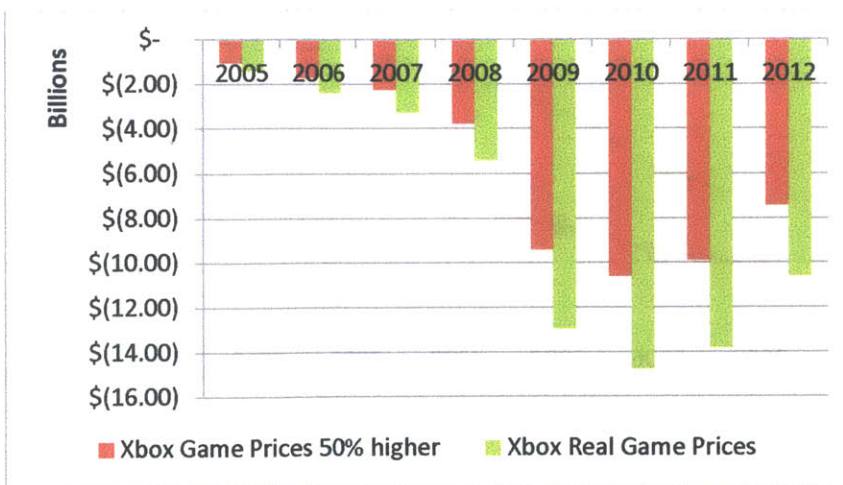


Figure 135 - Xbox Third-Party's Profits comparing two Game Price Levels

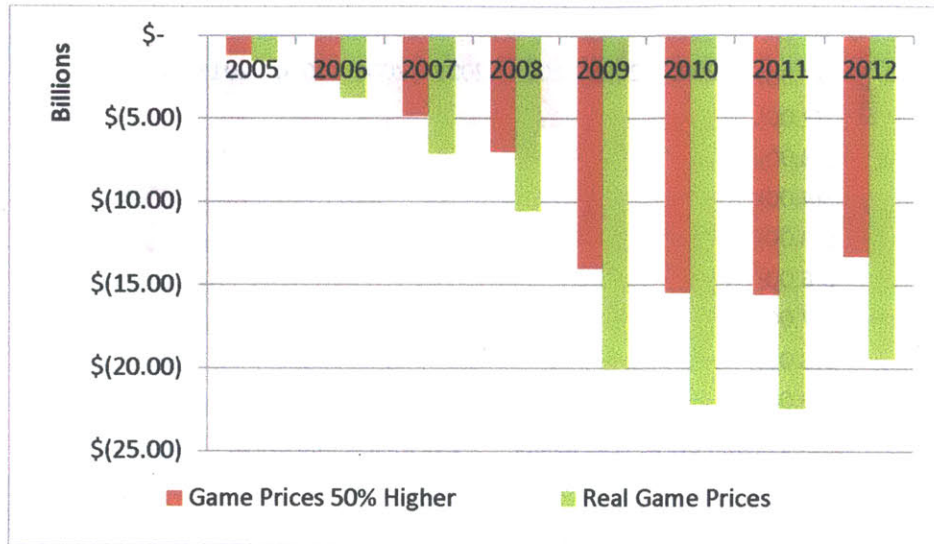


Figure 136 - Third-Party's Total Profits comparing two Game Price Levels

However, the higher price level impacts the tie-ratios, or in other words the demand for games. So, when the prices are higher because of the inexistence of GameStop, for example, the profit per unit sold is much higher, however, the demand for games is reduced considerably, impacting the number of games sold per number of consoles sold. In fact, this can be seen in Figures 141, 142 and 143, where the tie-ratios for the real game price level and the estimated for the higher price level scenarios are compared for Xbox, PlayStation and Wii, respectively.

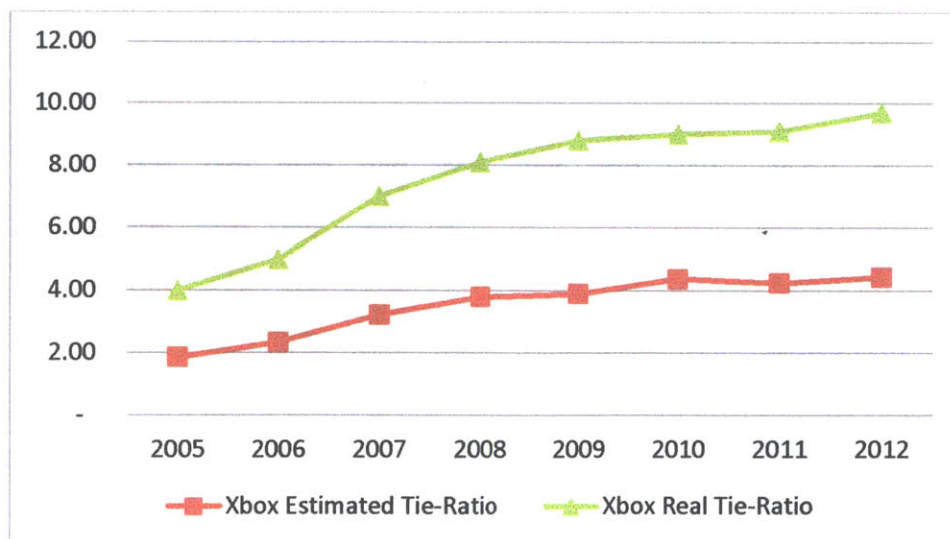


Figure 137 - Comparison between Tie-ratios of Xbox for two Different Game Price Levels

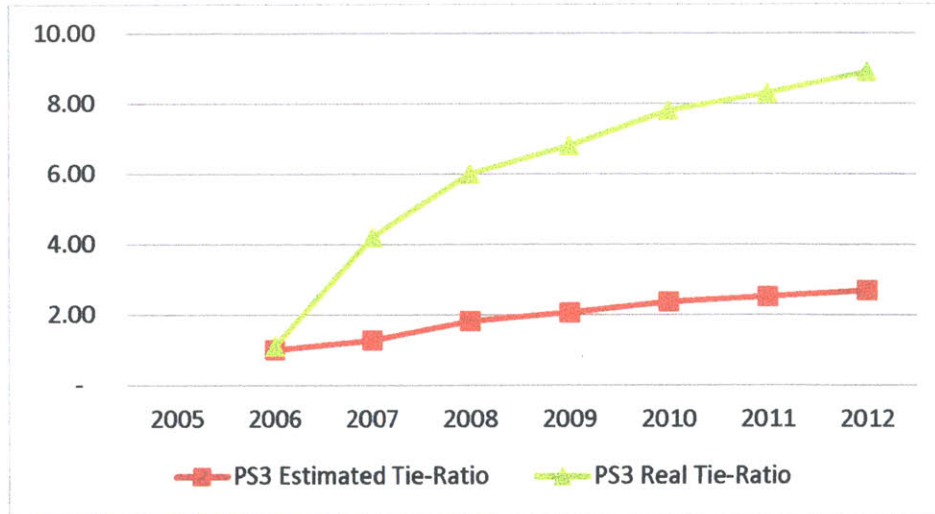


Figure 138 - Comparison between Tie-ratios of PS3 for two Different Game Price Levels

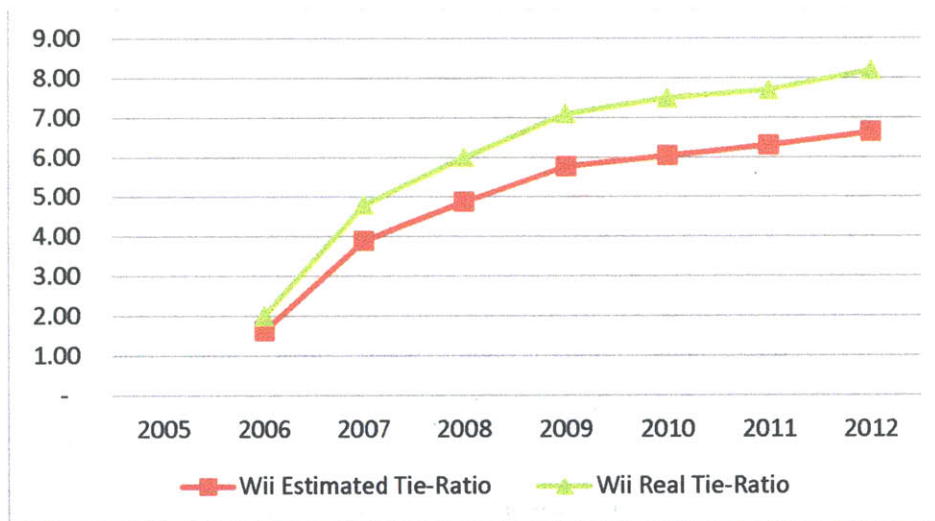


Figure 139 - Comparison between Tie-ratios of Wii for two Different Game Price Levels

In Fact, the impact on the games sales can be better notice in the Figures 144, 145 and 146, where the game units sold with the real price levels from 2005 to 2012 for each console platform is shown in comparison to the estimated ones for the higher-price scenario. So, a qualitative analysis shows the PlayStation 3 has the biggest impact on the game sales the games price level is higher. Additionally, Xbox has also a considerable impact on the game sales while Nintendo has the smallest impact on the total game units sold. Consequently, this explains the impact on the third-party publisher's profits as it could be seen in Figures 137, 138 and 139, where the profits with the regular price levels and the higher ones are compared.

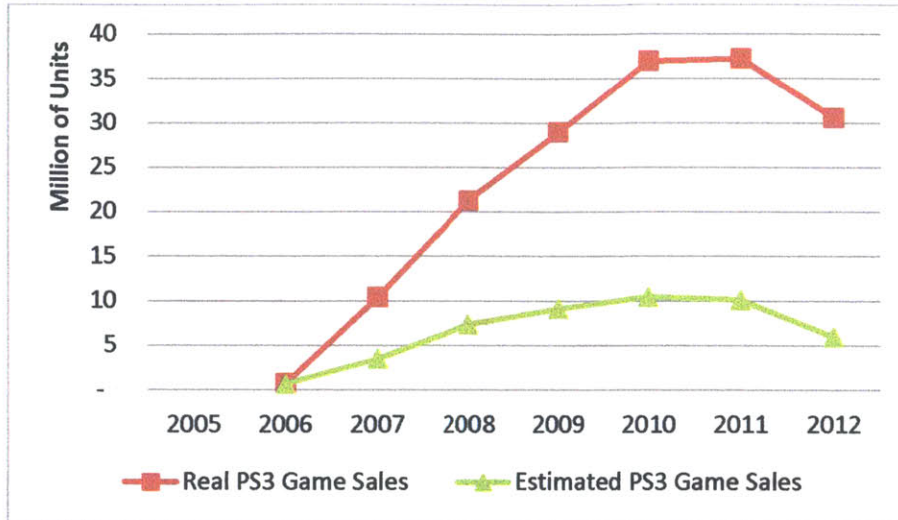


Figure 140 - Comparison of Total Game Sales of PlayStation 3 between two Scenarios of Game Price Levels

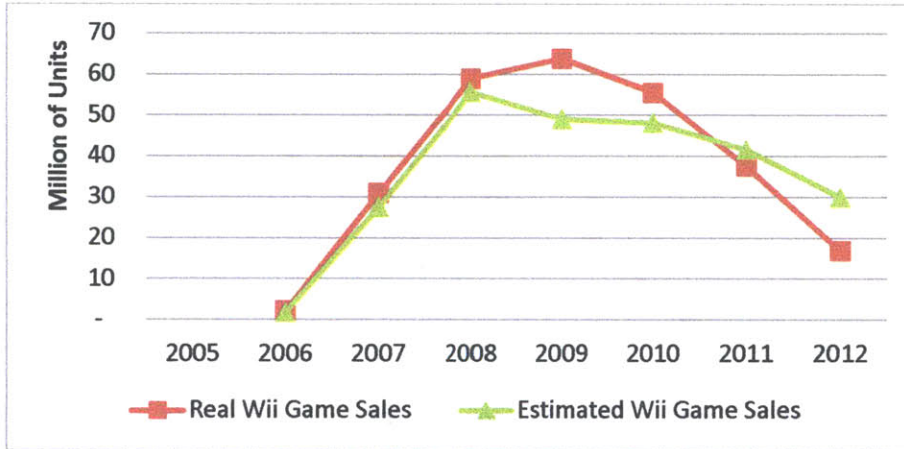


Figure 141 - Comparison of Total Game Sales of Wii between two Scenarios of Game Price Levels

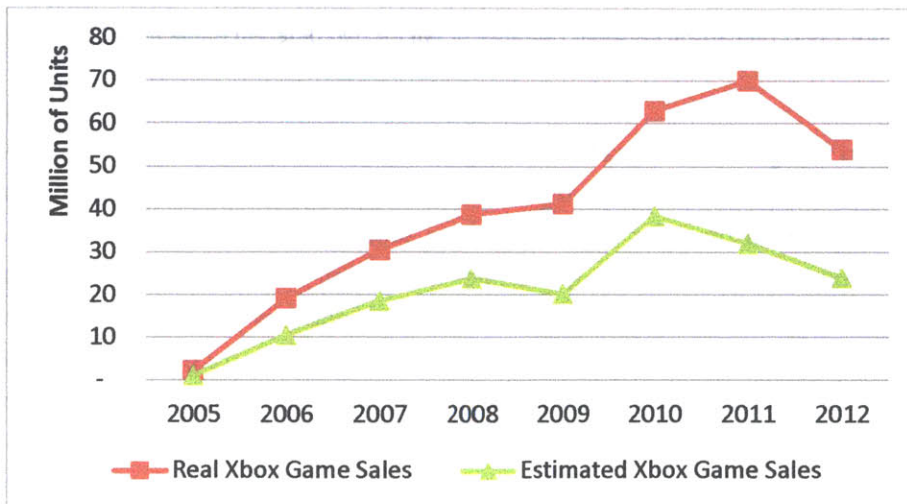


Figure 142 - Comparison of Total Game Sales of Xbox between two Scenarios of Game Price Levels

Profit Maximization Scenarios

This session presents the results of some results from the usage of a GRG non-linear optimization algorithm for different hypothetical scenarios. The Parameters used for the GRG non-linear optimization algorithm is show in the figure 147.

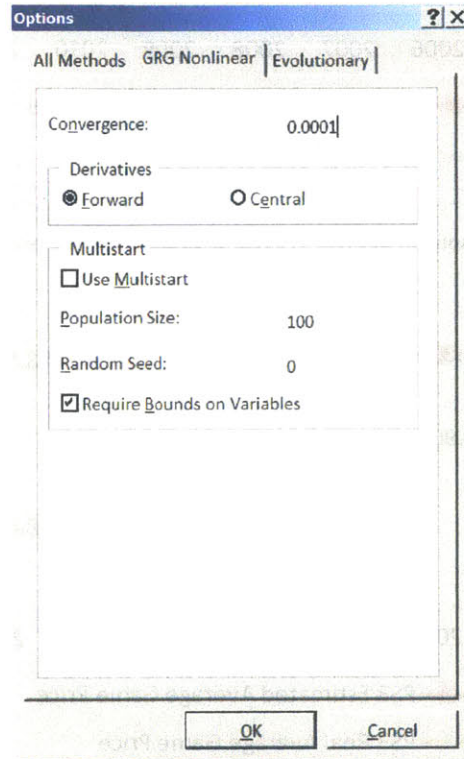


Figure 143 – Parameters

Scenario 1 – Maximize the total Manufacturers Profit as a Single Entity by Changing the Game Prices

The first scenario is the result of a simulation using the non-linear optimization for maximizing the total profits of all the consoles manufacturers together as a unique entity. For doing it, the algorithm was set-up to find the optimal prices for the games. So, Figures 148, 149 and 150 show the original and the optimized game prices found by the non-linear optimization algorithm, making possible a comparison. Additionally, Figures 151,152 and 153 show the comparison between the tie-ratios of the regular and the optimized scenarios. Then, Figures 154, 155 and 156 show the Manufacturers' profits, NPV of profits and total profits of all manufacturers together respectively. Right after, Figures 157, 158 and 159 show a comparison between the profits of each manufacturer for the regular and optimized scenarios. Finally, Figures 160,161 and 162 show the same comparison between the regular and optimized scenarios for the game sales in units of each platform.



Figure 144 – Comparison between the real and optimized price level of Xbox’s games

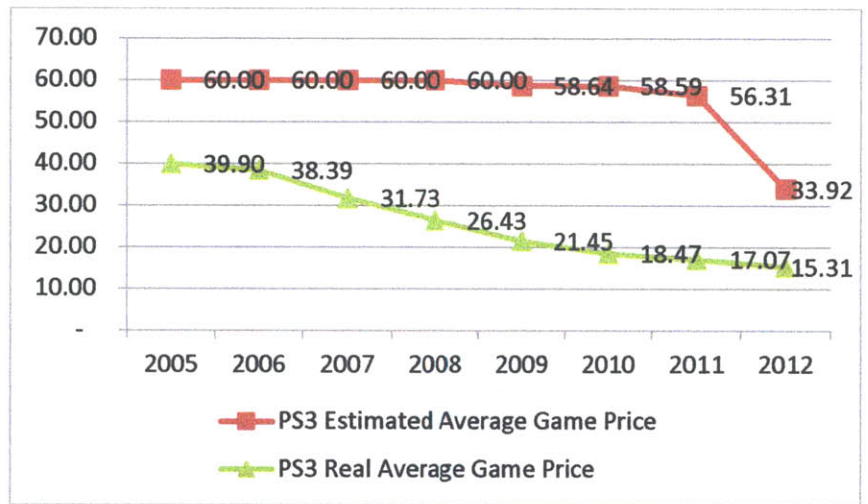


Figure 145 - Comparison between the real and optimized price level of PS3’s games



Figure 146 - Comparison between the real and optimized price level of Wii’s games

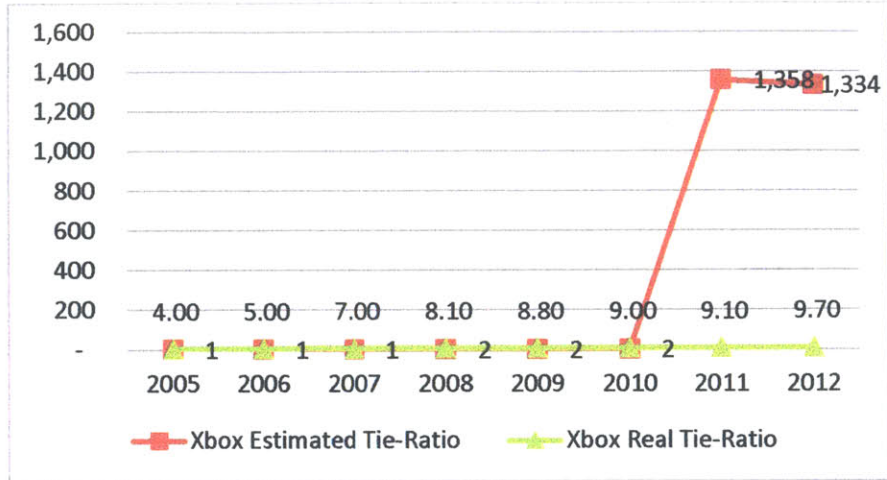


Figure 147 - Comparison between the tie-ratios of the real and optimized price level of Xbox's games

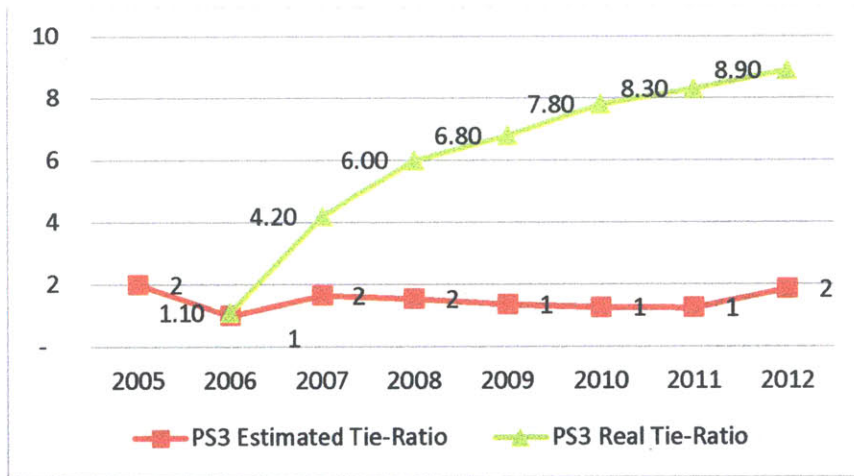


Figure 148 - Comparison between the tie-ratios of the real and optimized price level of PS3's games

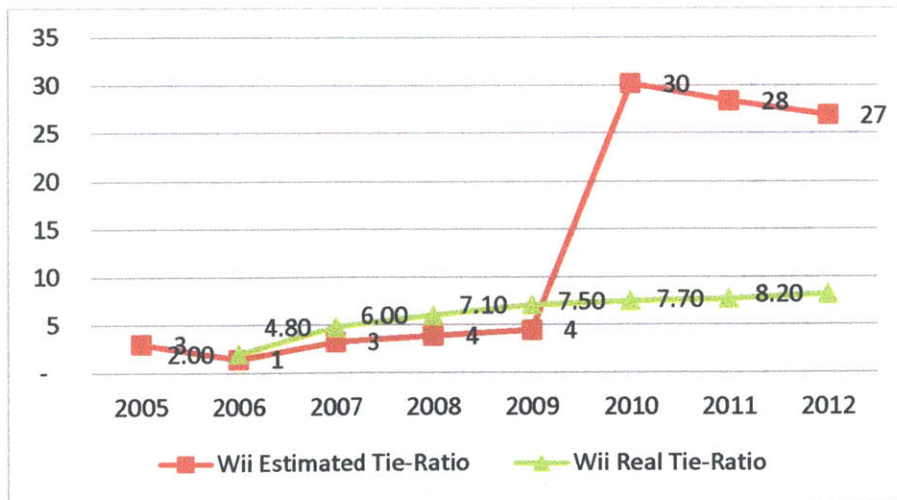


Figure 149 - Comparison between the tie-ratios of the real and optimized price level of Wii's games

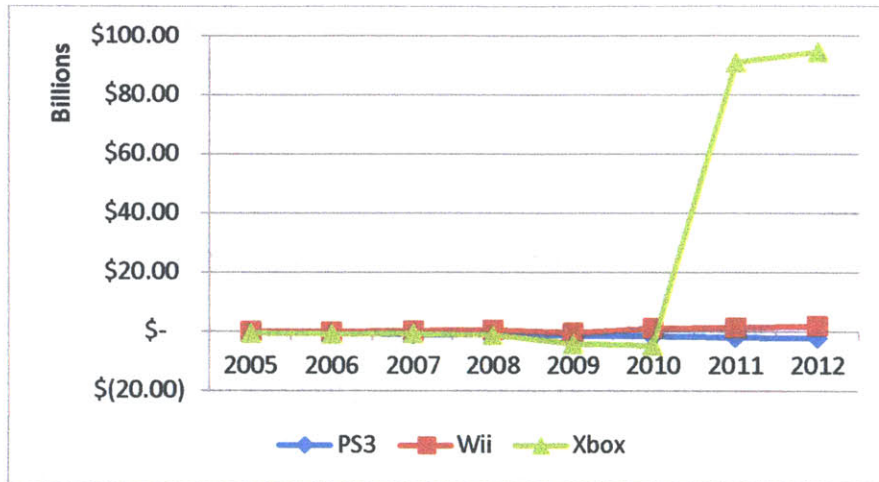


Figure 150 – Manufacturers' profits for the optimized price level of games

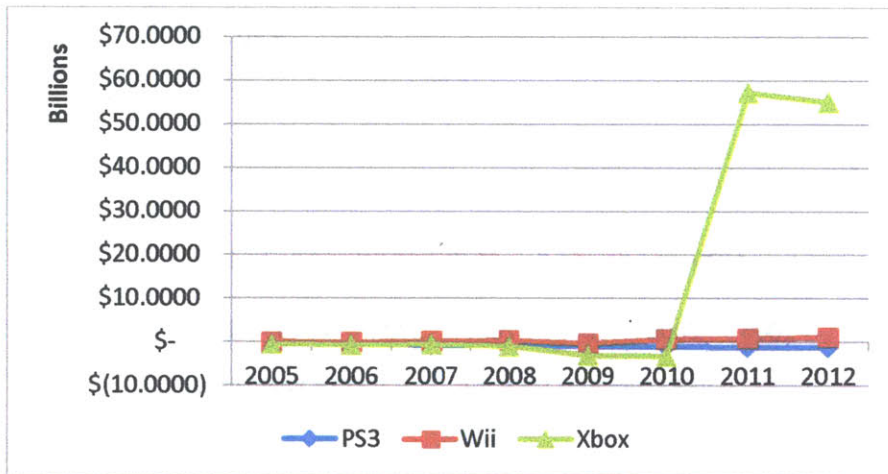


Figure 151 - Manufacturers' NPV of profits for the optimized price level of games

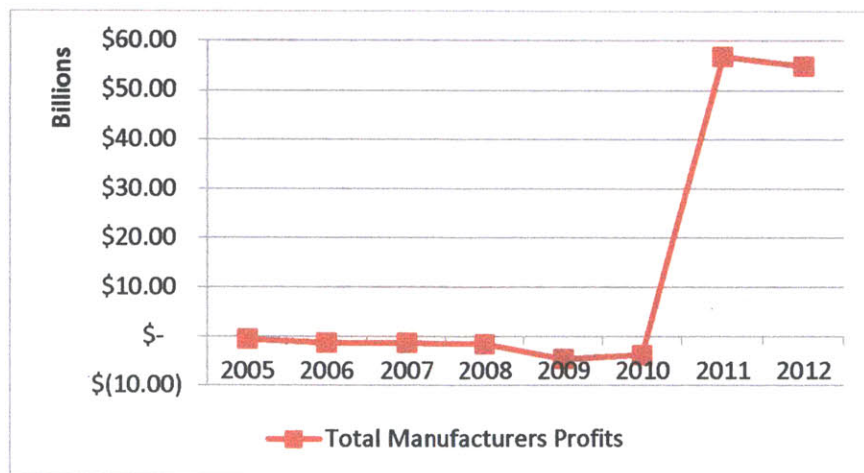


Figure 152 – Total Manufacturers' profits for the optimized price level of games

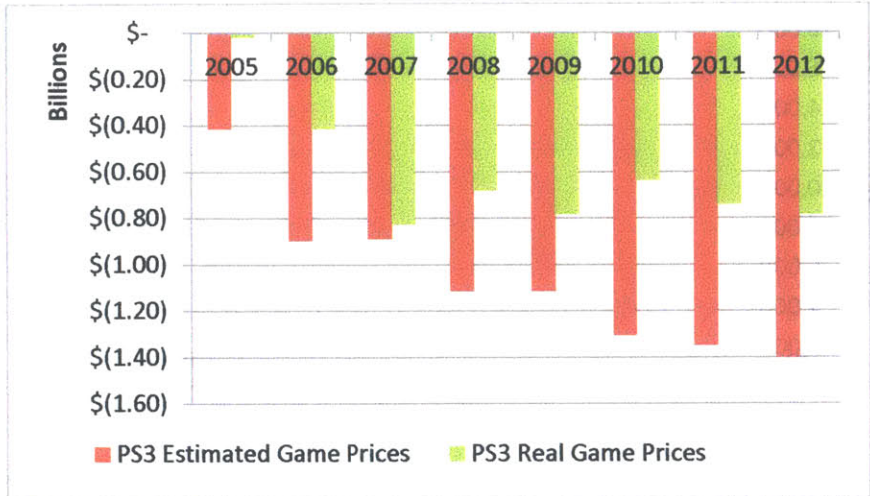


Figure 153 - Comparison between the PS3's profits from real and optimized price level of games

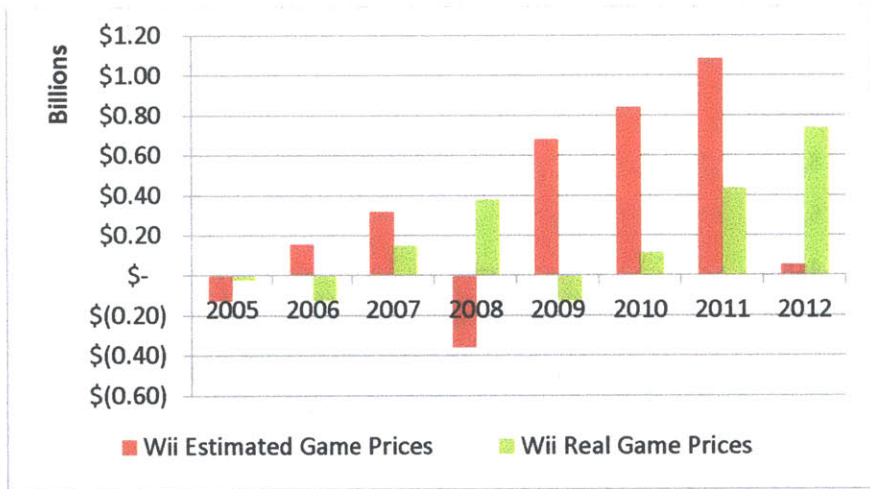


Figure 154 - Comparison between the Wii's profits from real and optimized price level of games



Figure 155 - Comparison between the Xbox's profits from real and optimized price level of games

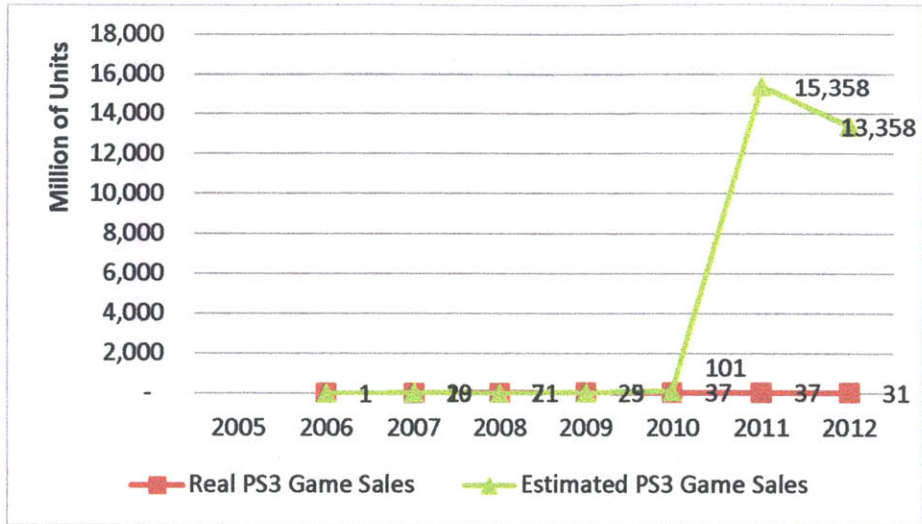


Figure 156 - Comparison between the PS3's game unit sales from real and optimized price level of games

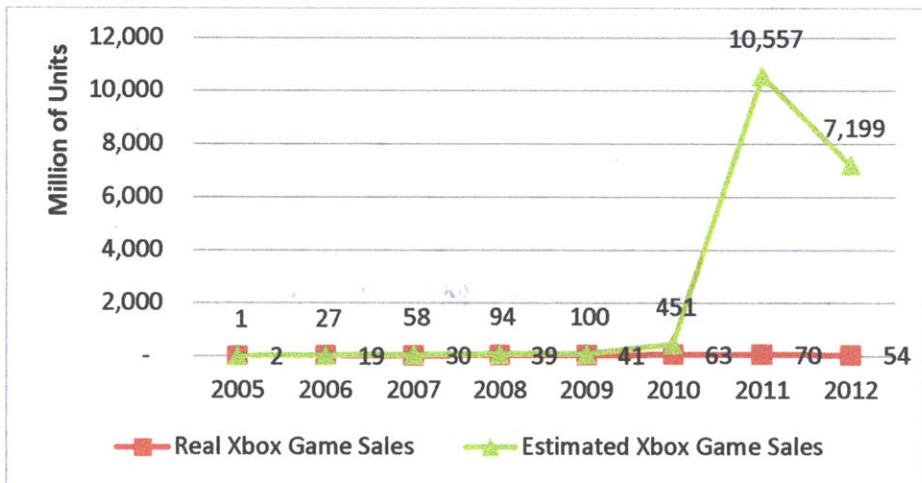


Figure 157 - Comparison between the Xbox's game unit sales from real and optimized price level of games

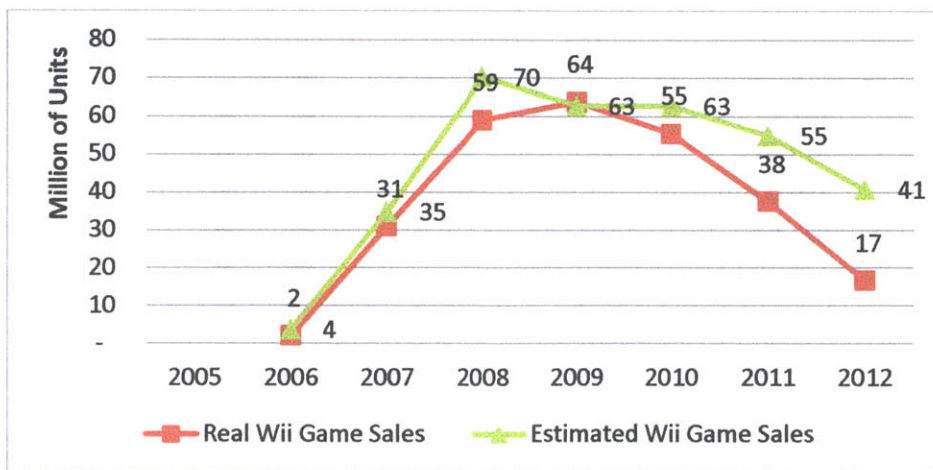


Figure 158 - Comparison between the Wii's game unit sales from real and optimized price level of games

Scenario 2 – Maximize the total Manufacturers Profit as a Single Entity by Changing the Game Prices and the First-Party/Third-Party Ratio.

The second scenario is also the result of a simulation using the non-linear optimization for maximizing the total profits of all the consoles manufacturers together as a unique entity. For doing it, the algorithm was set-up to find the optimal prices for the games and also for the ratio between the number of games developed in-house and by the publishers. While Figure 163 shows the total profits for all manufacturers together, Figures 164, 165 and 166 show a comparison between the profits of each manufacturer for the regular and optimized scenarios. Additionally, it is important to note the total profits for the manufacturers have a non-reasonable magnitude order. Finally, the algorithm found as an optimal solution the consoles manufacturers develop no game for their platforms.

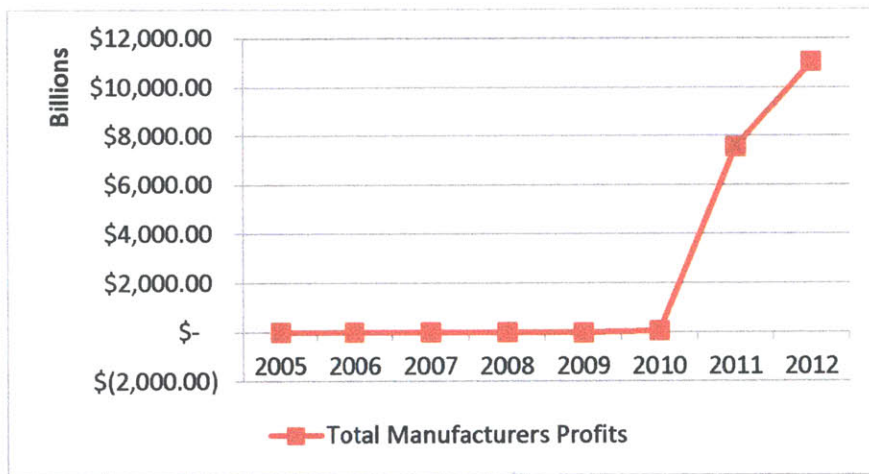


Figure 159 – Total Profits of All Console Manufacturers for the Optimized Scenario

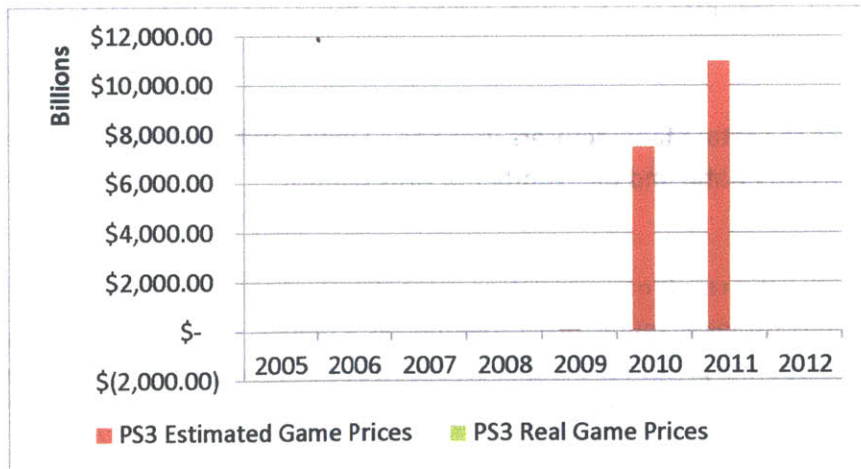


Figure 160 – Comparison of PS3’s Profits between the Regular and the Optimized Scenario



Figure 161 - Comparison of Wii's Profits between the Regular and the Optimized Scenario

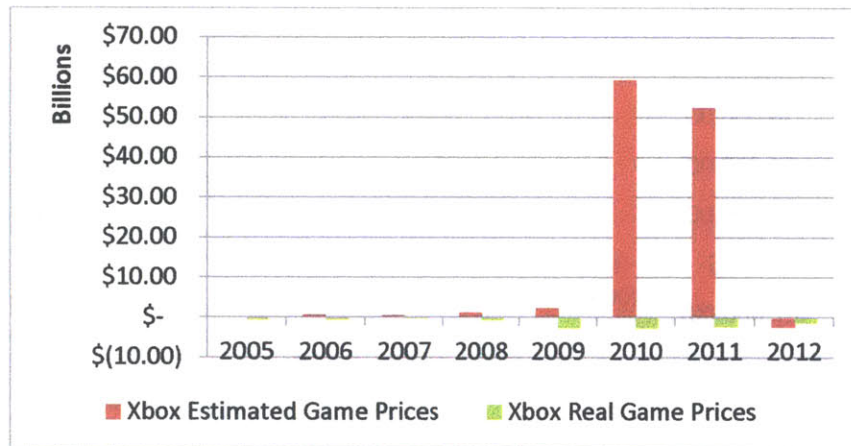


Figure 162 - Comparison of Xbox's Profits between the Regular and the Optimized Scenario

Scenario 3 – Maximize the total Manufacturers Profit as a Single Entity by Changing the Game Prices, the First-Party/Third-Party Ratio and the Number of AAA Games.

The third scenario is also the result of a simulation using the non-linear optimization for maximizing the total profits of all the consoles manufacturers together as a unique entity. For doing it, the algorithm was set-up to find the optimal prices for the games, the ratio between the number of games developed in-house and by the publishers and the optimal number of AAA games. While Figure 167, 168 and 169 shows the comparison between the regular and optimized game prices for each platform, Figures 170, 171 and 172 show the comparison between the tie-ratios of each manufacturer for the regular and optimized scenarios. Additionally, Figures 173, 174 and 175 show the comparison between the game sales (in units) for the regular and optimized scenarios. Then, Figures 176, 177 and 178 show the manufacturers' profits and NPV of profits per platform and the total profits of the manufacturers

together respectively. In the sequence, Figures 179, 180 and 181 show the comparison between the profits of each manufacturer for the regular and optimized scenarios. Finally, Figures 182, 183 and 184 show the comparison between the number of AAA games released per year of each platform for the regular and optimized scenarios

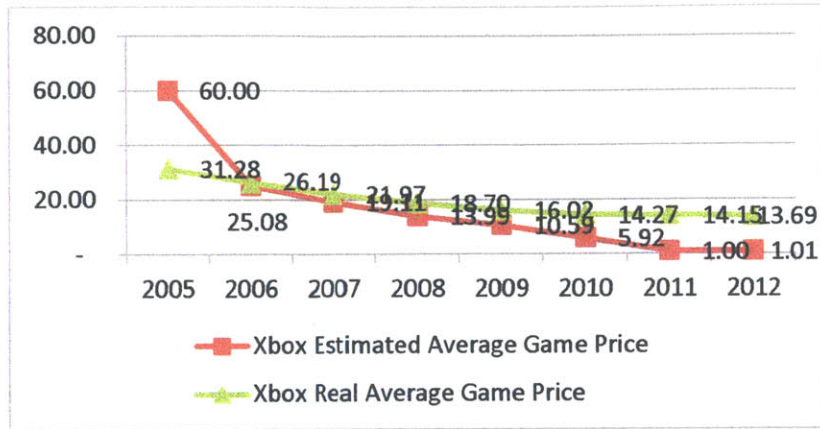


Figure 163 – Comparison of Xbox’s Game Prices between regular and optimized scenarios

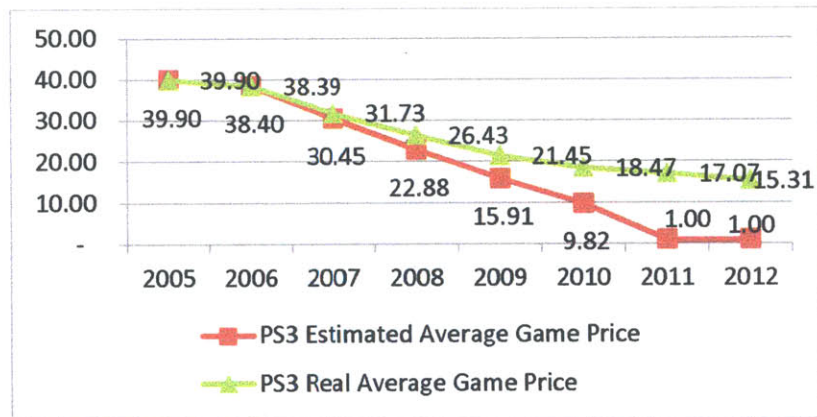


Figure 164 - Comparison of PS3’s Game Prices between regular and optimized scenarios

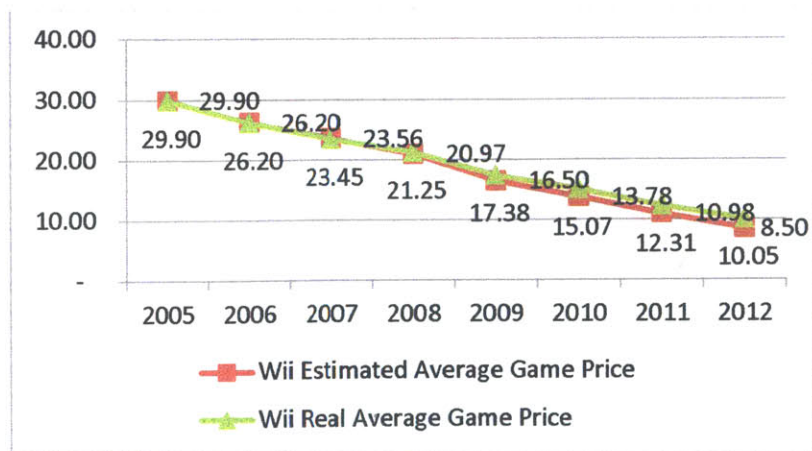


Figure 165 - Comparison of Wii’s Game Prices between regular and optimized scenarios

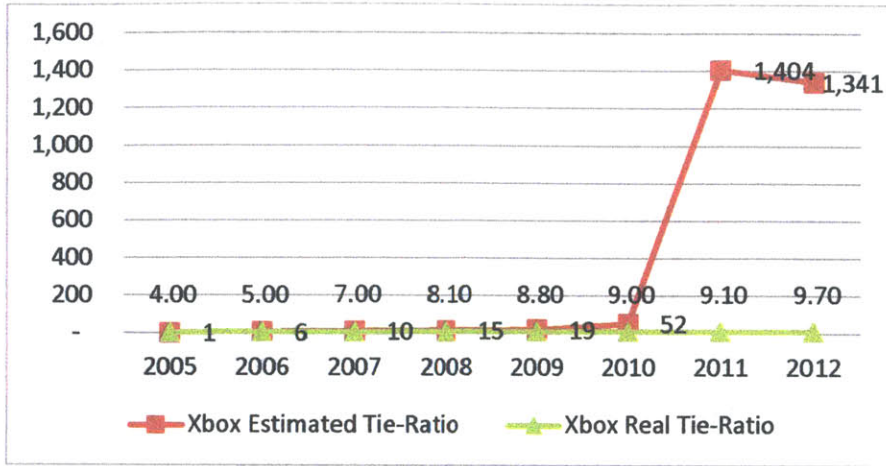


Figure 166 - Comparison of Xbox's Tie-ratios between regular and optimized scenarios

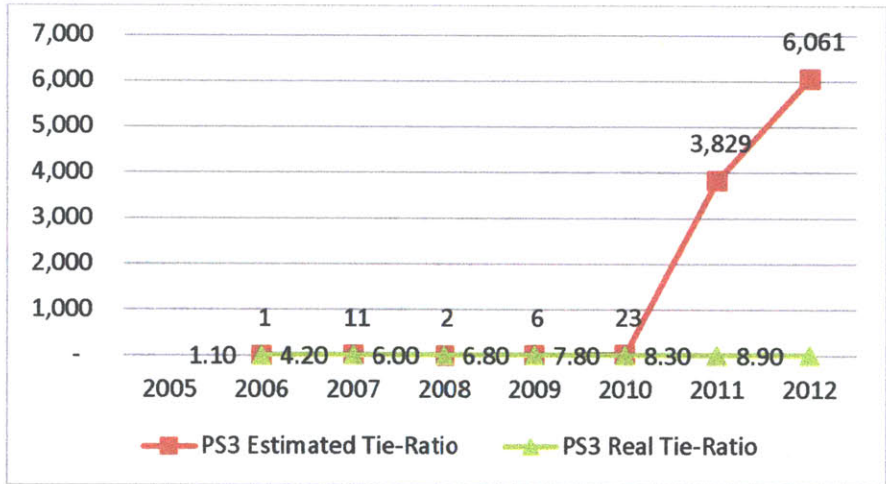


Figure 167 - Comparison of PS3's Tie-ratios between regular and optimized scenarios

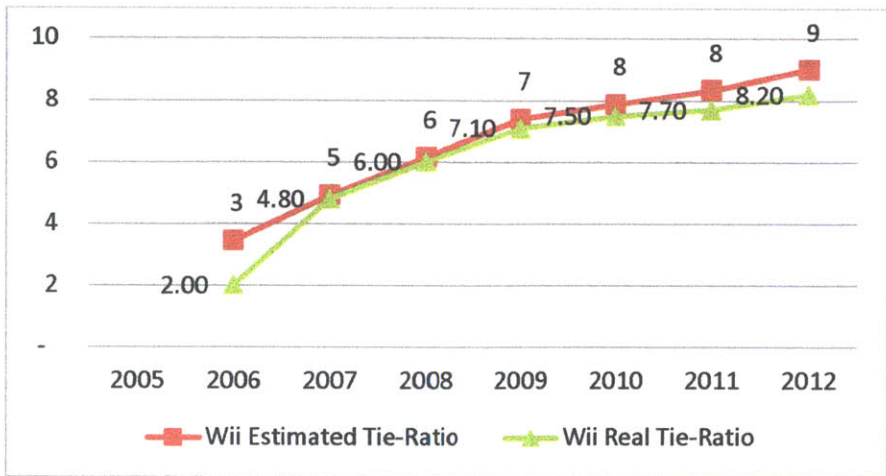


Figure 168 - Comparison of Wii's Tie-ratios between regular and optimized scenarios

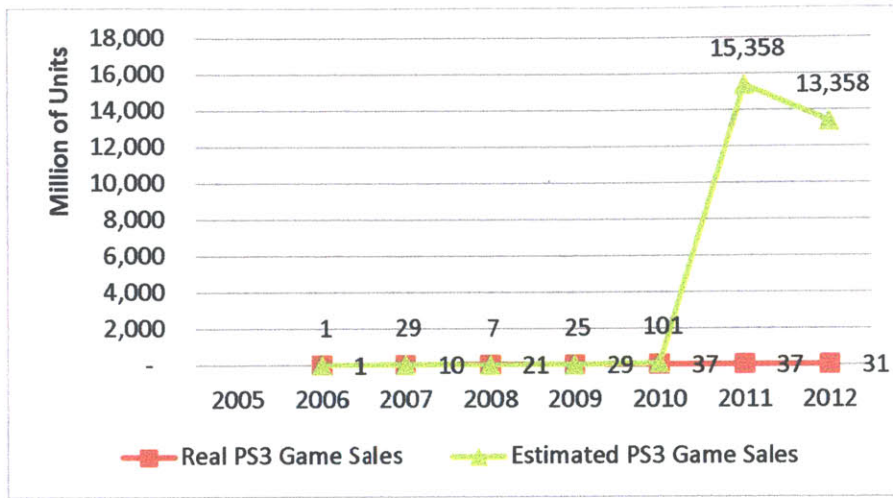


Figure 169 - Comparison of PS3's Game Sales (in units) between regular and optimized scenarios

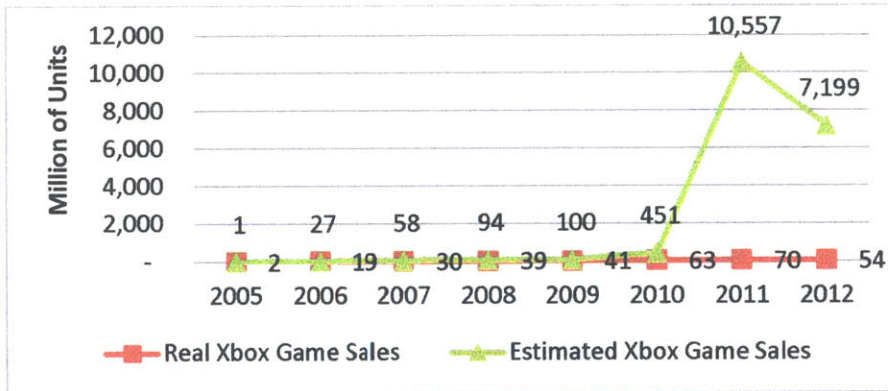


Figure 170 - Comparison of Xbox's Game Sales (in units) between regular and optimized scenarios

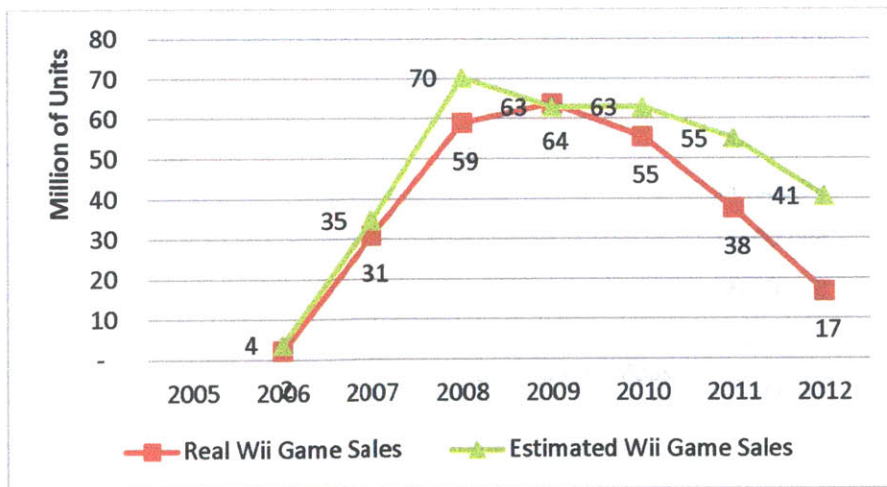


Figure 171 - Comparison of Wii's Game Sales (in units) between regular and optimized scenarios

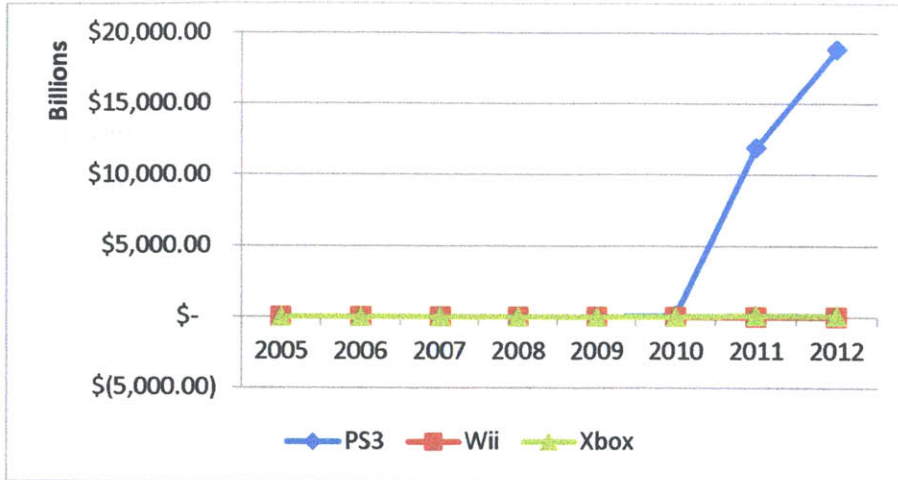


Figure 172 – Manufacturers' Profits for the Optimized Scenario

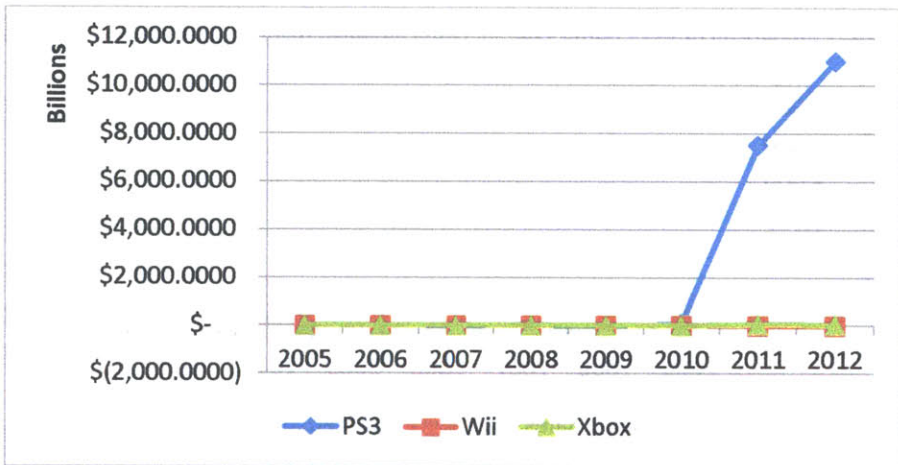


Figure 173 - Manufacturers' NPV of Profits for the Optimized Scenario

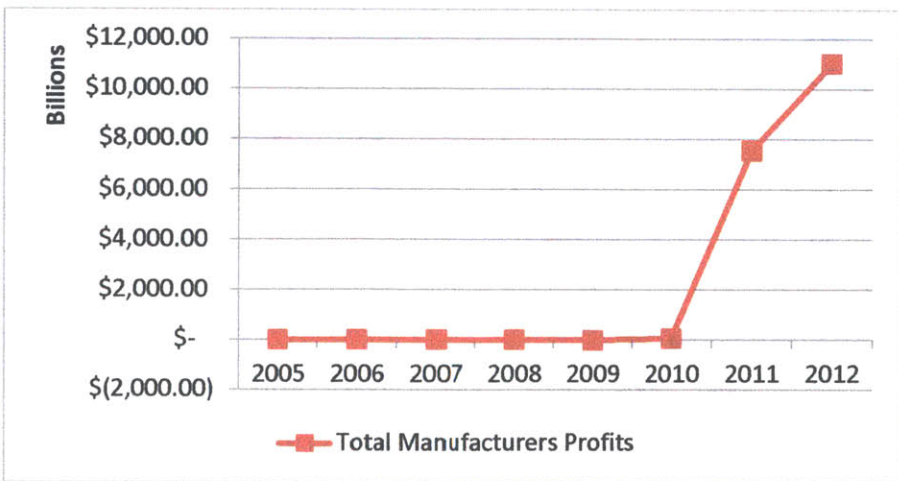


Figure 174 – Manufacturers Total Profits for the Optimized Scenario

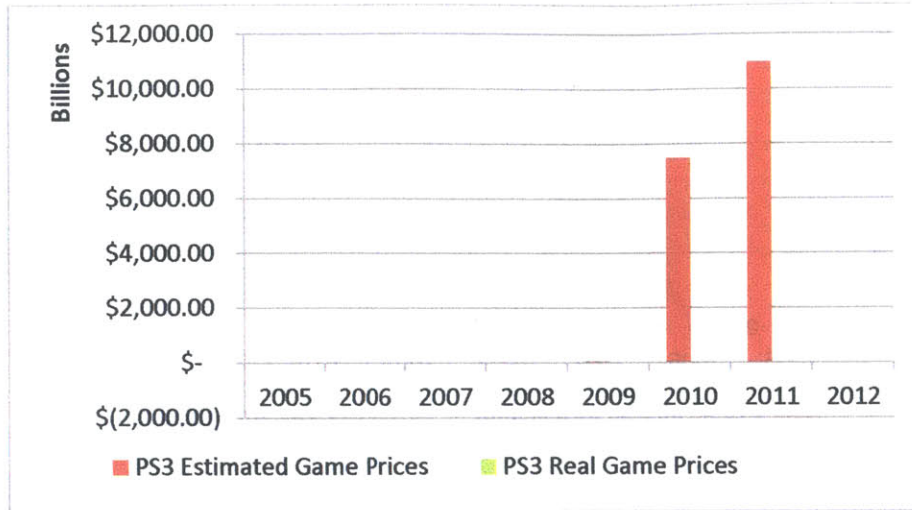


Figure 175 - Comparison of PS3 Manufacturer's Profits between regular and optimized scenarios

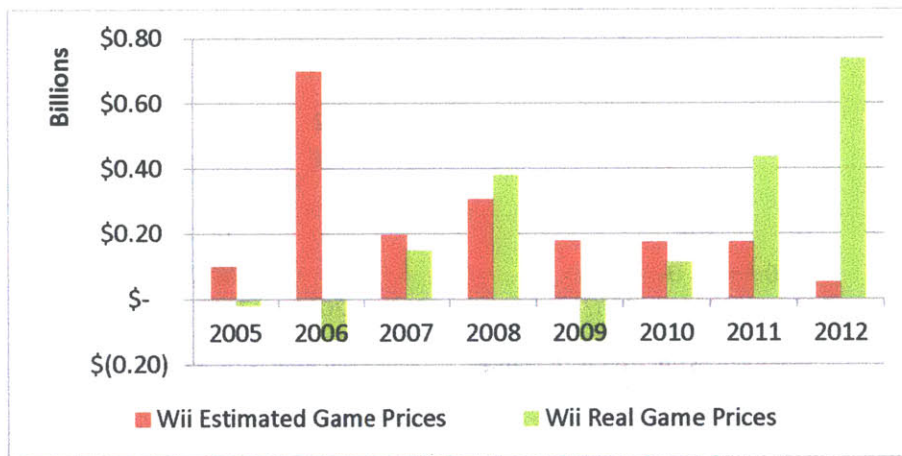


Figure 176 - Comparison of Wii Manufacturer's Profits between regular and optimized scenarios



Figure 177 - Comparison of Xbox Manufacturer's Profits between regular and optimized scenarios

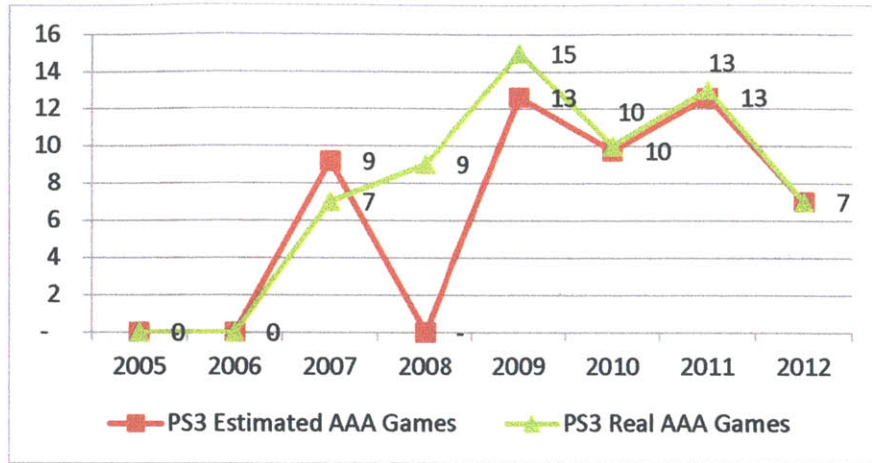


Figure 178 - Comparison between the real number of AAA releases and the optimized number of releases for PS3

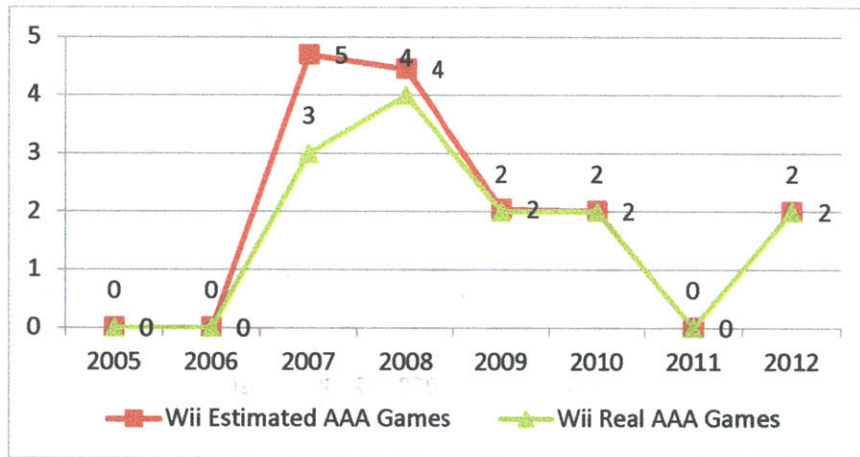


Figure 179 - Comparison between the real number of AAA releases and the optimized number of releases for Wii

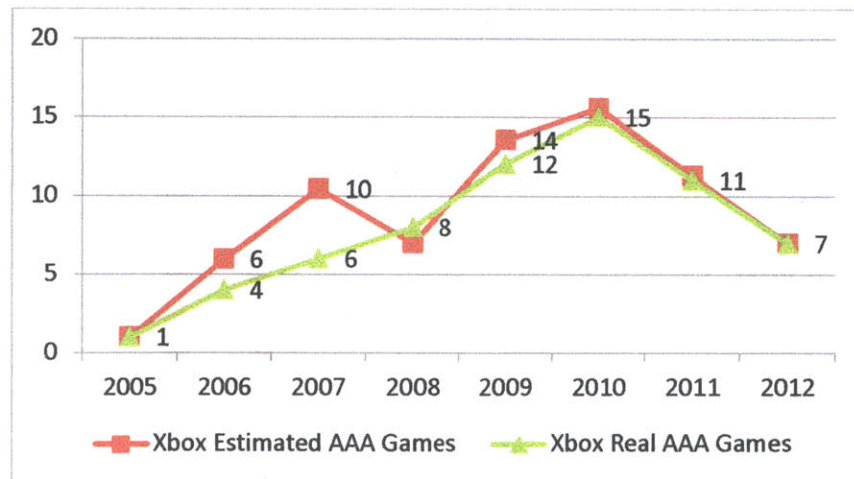


Figure 180 - Comparison between the real number of AAA releases and the optimized number of releases for Xbox

Conclusions

The \$70 billion and 40 years old [83] traditional videogame industry is a fascinating example of intense and dynamic competition, where over eight generations new players could enter the market and reach the leadership while old leaders were pushed out of the market. The fierce competition has been pushing all the manufacturers and game developers to the constant cutting-edge innovation to keep themselves in the market even sometimes literally paying to be there.

In 1983, the competitive landscape created a big crash in the videogame industry making some analysts to declare the end of the industry. Now, although it is not clear if a new crash is going to happen, it seems this industry's structure is going to change deeply because of some important factors: on-line game distribution cutting the middleman and new revenue models based on monetizing game's virtual accessories, open source consoles, powerful mobile platforms and used games retailers.

Although the applied WTAoM framework and the proposed model can somehow explain about why three home console videogame platforms co-exist today, the geometrically growing costs for all the players seems to be raising the bar by requiring really deep pockets and challenging the current razor/blade business model in this industry. That draws a worrying current question in the home console videogame industry is: Who are going to develop the games, especially for the new generations? In fact, according to (60), 58% of the North American developers are planning their next games only for smartphones and tablets. Cliff (60) points out also that from 2,500 game developers inquired in a San Francisco Game Developers Conference, just 11% expect to work for Sony or Microsoft, while just 6.4% expect to produce games for the new Nintendo's 8th generation console (Wii-U). And this makes sense. Why is someone going to develop games for home console platforms since they can spend much less to develop for mobile phones and reach a much higher consumer base without paying royalties?

It is important to note that one of the limitations of this study is proposing a model ignoring the videogame industry in a broader sense, especially because of the substitutability. The videogame industry broader definition includes not only the videogame consoles, but also the portable videogames, computers, tablets and smartphones. In fact, the market specialists analyzing the time users spend playing games on a platform, known by "screen time", say that the main platform for games will be the mobile, since it is most convenient and allows anyone to play whenever there is time available and anywhere (60).

However, the proposed model demonstrated a good accuracy in explaining the competitors' market-shares, tie-ratios and units sold of consoles and games in the seventh generation. Although the model presented some problems in some scenarios, probably because of the questionable quality of the regressions for the sales coefficients, this work could demonstrate a diffusion model can be used to explain the competition between platforms.

An extension of this work could be done for enhancing the proposed model to support the mobile, PCs and portable consoles to provide a better understanding of the industry's dynamics. Finally, as a suggestion, this model could be applied to answers the following questions: what will be the impact an open source console in this market, using an open-source operational system which would make the game development cheaper and a royalty-free policy? And what if someone creates an open on-line network with open APIs (Application Program Interface) for allowing anyone on any platform to connect and play multi-players competitive or cooperative games cross-platforms?

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