TRADING VIRTUAL IDENTITY:

A MODEL OF AVATAR PRICING IN ONLINE AUCTIONS

A THESIS

Presented to

The Faculty of the Department of Economics and Business

The Colorado College

In Partial Fulfillment of the Requirement for the Degree

Bachelor of Arts

By

Tae Yon Kim

December 2015

TRADING VIRTUAL IDENTITY:

A MODEL OF AVATAR PRICING IN ONLINE AUCTIONS

Tae Yon Kim

December 2015

Economics

Abstract

Since 2004, online videogame industry has grown significantly. Players use 3D-generated figures called 'avatars' in cyberspace. High-leveled, stronger avatars are often traded in online auction sites such as Ebay or PlayerAuctions by online among players with real money. This paper studies the online avatar auction market. Among hundreds or even thousands of avatars listed online, only few deals are made every day. I collected data on successful deals (N=173), categorized avatar depending on attributes, and used Hedonic Regression model to examine which attributes affect the avatar prices the most. As a result, I discover that attributes indicate avatar power and previous owner's dedication to game are significant in determining avatar price.

KEYWORDS: Videogame, Avatar, Accounts, Online Auction, Virtual Economy, Virtual World

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED UNAUTHORIZED AID ON THE THESIS

_____

Signature

TABLE OF CONTENTS

FIGURES AND TABLES

I. Introduction

Since the early 21st century, the online gaming market, especially Massively Multiplayer Online Role Playing Games (MMORPG) has grown rapidly. The revenue from online games, despite the economic recession in 2004, grew over 1.5 billion dollars, and over 60,000 people played a single online game, EverQuest (Castronova, 2001). In 2010, the revenue of a single company, Blizzard.inc, was over 1.3 billion dollars, and a single online game, World of Warcraft had more than 10 million players (Statista.com).

Since the early 2000s, the virtual world, especially created by online gaming, has become an intriguing field for scholars. MMORPGs have become so popular that living a part of one's life in cyberspace may eventually become a common practice for many players (Castronova, 2003). Many economists study the virtual world because it sets up a simplified model for the complex real world economy (Morrison and Fontenla, 2013).

This paper explores the economy of virtual world. I primarily focus on the pricing of 'avatars,' a 3D generated figure that represents each player in virtual world. Here, what I define as avatars are either a single or multiple avatars that is bundled into a single 'account.' Avatars and accounts are goods and services that exist solely in a game, but they add real money value to many players (Castronova, 2004). Currently, avatars are widely traded in online auctions and within the market. Herein are my questions: Why do buyers put premium price for the specific types of avatars? What are their unique features? Are there any gender-based preferences for avatars? Are avatars considered cyber assets, actual assets, or both? To answer these questions, I have gathered avatar auction data from the online game World of Warcraft for four weeks, categorized avatar attributes, and used Hedonic Regression model for analysis.

My research would not have been possible without Edward Castronova's seminal work in 2004. In "The Price of Bodies: A Hedonic Pricing Model of Avatar Attributes in a Synthetic World,"

Castronova (2004) collected avatar price of the game EverQuest from online auction sites including Ebay and PlayerAucssion.com, for four months, and used Hedonic Regression model to determine which attributes affect avatar price. For determining x variables in the function P=f(x), he put many variables such as Month, Level, Sex, Class or Race of the avatars. He ascribes avatar power, avatar sex, avatar class, and auction time as the key attributes that impact price of avatars. I believe that Castronova's (2004) results are groundbreaking, yet they still need to be re-tested in different games. In addition, because nine years have passed from the time of the research, there have been many changes and developments in the virtual world.

I divided my research into four sections: Background provides key information on the online game World of Warcraft, specifically in terms of avatar, avatar markets, and virtual world; Methodology & Data describes my methods and statistical summary of data; Results gives regression outcomes; and Conclusion offers the closing analyses and remarks.

II. Background

A. *Avatars and Avatar Market*

Players enter and inhabit cyberspace through their avatars. Each avatar represents one player and communicates with other avatars and, hence, other players. A group of avatars form a society, thereby creating the virtual world. Avatars are not only what characterizes each player but also how one can differentiate oneself from the others. For example, in World of Warcraft, hundreds of avatars form a 'guild,' a user-made group with minimum of ten and maximum of two hundred avatars. Guild is a useful social tool for many players in any in-game activities that require collaboration, such as fighting epic monsters and battling against other players. For online gamers, guilds are very similar to social networks in the real world.

Each avatar has its own unique features, such as race, class, appearance, level, and items.

For most games, race, class and appearance are determined by each player during the process of avatar creation. However, other features, including items, levels, and achievements, are determined throughout the process of game-playing. In order to attain specific attributes, players have to fight either large monsters or other players, and this is where many players spend much of their time in game. Strong avatars are more capable than weak avatars in most cases. For example, a player with Level-60 Avatar cannot beat another player with Level-100 Avatar due to the power differential between the two avatars. Such differences in strength also determine whether or not an avatar can gain access to specific 'zones' and 'contents.' Therefore, the player with Level-60 Avatar must devote more time and energy into becoming as good or as well-equipped as the player with Level-100 Avatar.

In the virtual world, power is not just the means, but its own end. Many players want to empower their avatars so that they can get access to higher-level contents of the game. With limited time and effort, some players choose to purchase someone else's avatar for real money in order to gain power more easily and quickly. Among players, this practice is called Real-Money-Trade (RMT). At the early stage of online gaming industry in the late 1990s, RMT was done among only a small group of players through phone calls. Today, most of the RMTs are done through the large online auction sites, such as Ebay and PlayerAuctions. Hundreds of sellers put their avatars on sale to online auction sites with prices of avatars varying from $10 to a few thousand dollars. Even those priced over $2,000 are sold quickly due to their unique, rare, and highly-coveted attributes. As people increasingly spend more time online, they are willing to allocate a significant sum of their wealth in the real world on their representative identity in the virtual world (Castronova, 2004).

The risk for avatar trade is that a majority of online gaming firms view avatar trade or any other type of RMT as detrimental not only to their business model but also to the gaming

community. Firms discourage RMT and define it as a "negative externality" that affects the experience of both players and developers (Castronova, 2006). Therefore, many firms prohibit the practice of RMT via their user agreements. If any RMT activities are to be found, many firms reserve the right to punish both buyers and sellers by sanctioning their access to the game for either a certain period or perpetuity. For example, the user agreement of Blizzard Inc. clearly states that all avatars and in-game properties clearly belong to the firm. The following is the user agreement of Blizzard Inc:

> "All Accounts. Note that Blizzard owns all Accounts, and that all use of an Account shall inure to Blizzard's benefit. Blizzard does not recognize the transfer of Accounts. You may not purchase, sell, gift or trade any Account, or offer to purchase, sell, gift, or trade any Account, and any such attempt shall be null and void and may result in the forfeiture of the Account." (Blizzard User License Agreement, 2015)

As shown above, many firms note that any transfer or sale of the accounts is illicit even though there is not any US law against such activities. Hence, in the avatar market, all buyers and sellers are bearing the risk of repercussions in the virtual world through their real, economic transactions.

B. *Gaming in World of Warcraft*

The data for this paper is collected from the online avatar auction data of World of Warcraft. This online game was released in November 2004 by Blizzard Inc. Since then, it has been one of the top MMORPG in the world, and, by the second quarter of 2015, the number of subscribers, who pay from ten to $15 every month, reached 5.6 million worldwide (Statista.com). The game takes place in Azeroth, a virtual, fantasy world, and the players fight monsters, demons, and each other. The game is serviced in seven regions worldwide, including US, Latin America, Europe, Oceania, China, Taiwan, and South Korea. The US region, where the data for this paper was collected, is divided into 226 realms or servers.

In the virtual world of Azeroth, the players are divided into two factions: Alliance and Horde. The players of one faction compete with those of the other faction. Competition between

two factions is one of the biggest objectives of the game, but not all players share the same objectives. Some play the game simply to explore the larger-than-life fantasy world, to achieve high levels of difficulties, or to accumulate cyber wealth and collect rare items. Whereas, others enjoy cooperating with a group of players against a large monster in a 'Raid,' or competing against other players in 'Player vs. Player' (PvP). The game offers a wide range of content in order to fulfill the various demands of players around the world.

Within game, all players are free to design their own avatars. At first, the players decide on which faction their avatars are to join. Then they decide on race, sex, appearance and class. There are twelve avatar races in the game: Human, Night Elf, Dwarf, Gnome, Worgen, and Draenei for alliance; Orc, Troll, Tauren, Undead, Blood Elf, and Goblin for horde; and Pandaren for both factions. When the game was released in 2004, each race had special attributes; however, the different races eventually lost their distinctions because of the players' varying preferences..

In addition, there are twelve classes of avatars: Warrior, Paladin, Death Knight, Hunter, Shaman, Rogue, Monk, Druid, Priest, Mage, and Warlock. Classes are classified with distinct capabilities: 'Melee,' which specializes in close combat and tanking; 'Range,' which specializes in utilizing ranged weaponry; 'Magic User,' which specializes in casting magic spells; 'Healer,' which specializes in healing other players; and 'Hybrid,' which can exercise multiple roles. Because not many players choose to be either Tankers or Healers, in recent years, an avatar in the other classes can now take on healing and tanking roles in addition to the original role of its class. Within this range of options, all players can customize their avatars freely. They can later pay for changes to race, faction, and appearance. However, none of the players can ever change their avatars' class.

Avatars can attain strength through two options: 'Level' and 'Item Level.' Each avatar can increase its Level by exploring the game world and finishing diverse 'Quests' – as determined by

Non-Playing Characters (NPCs). Currently, the maximum ceiling is Level 100. Depending on each player's time commitment and gaming prowess, going from Level One to Level 100 takes between one week and one year. Hence, Level is the most visible gauge of avatar's strength. With increasing Levels, new abilities are granted to individual avatars. Such bonus attributes are so large that Level 99 Avatar cannot defeat Level 100 Avatar in a Duel – which is a PvP activity. After reaching Level 100, players cannot increase their avatars' level, but rather must wait until the release of new game expansion.

Thus, after reaching Level 100, players opt to spend their time on increasing their 'Item Level.' Each Item Level dictates the average level of gear with which an avatar can be equipped. For instance, if an avatar is only wearing Level 660 Weapon and Level 300 Armor, the Item Level of the avatar is 480. Because there are 17 different 'Slots' in which an avatar can equip itself with specific items, many players spend a lot of their time on increasing their avatars' Item Level. High-end items can only be attained by cooperating with other players and defeating large monsters in Raids, or fight other players and increasing individual ranking in PvPs. Consequently, players often covet avatars with far higher item level than their own. Item Level does not affect an avatar's strength as much as Level does, but Item Level is much more difficult to increase than Level. Avatars, thus, with a higher Item Level are much more valued than those with low Item Level. Some items are classified as 'Legendary,' because they require exorbitant input of time and 'Gold,' a cyber currency in the World of Warcraft. Such items are elevated in not only Item Level ranking but also in-game power.

Besides these attributes, many different areas of 'Achievements' can be accrued, thereby that differentiating one avatar from the others. In the world of Azeroth, there are many unique 'Mounts' – a ridable creature or machine for avatars - or items that are very difficult to obtain. Some even require numerous fights with the same monster due to very low obtainability - usually

with less than 1% chance; meanwhile, others require a lot of 'Gold' for players to craft. If an avatar attained unique Mounts or items, or completed certain tasks such as slaying a unique monster and completing 500 Quests, the avatar will gain 'Achievement Points.' Between 10 and 50 Achievement Points will be granted to the avatar for each Mount. Because it takes a very long time to accrue the different Mounts, Achievement Points signifies players' commitment to the game. As a result, the avatars with more than 20,000 Achievement Points or many unique Mounts post the highest prices in online auctions.

Attributes mentioned in this section are important factors in determining avatar prices. Some are directly related to the avatars' strength; whereas, others show the players' devotion to the game.

III. Methodology and Data

The data for my research is collected from online auction sites, including Ebay, PlayerAuctions, VirtualBarrak, and TheGameSupply. Castronova (2004) has noted that online auction data is a useful source in the study of economics because it stores the price of goods in an "economically meaningful way". Hence, I have obtained the data from these websites from September 29 to November 11, 2015.

In the online auction sites, virtual assets are divided into four categories: currency, items, codes, and avatars. People trade currency of the virtual world for real money. Specifically, in World of Warcraft, the price of 'Gold' changes almost every day. Some people profit from purchasing Gold at low prices and selling it off at high prices - as they would do with stocks in the stock market. People also trade codes for rare Mounts and items that can be obtained in real world, such as codes from game festivals. In World of Warcraft, most items are 'soul bound,' which means that, once a specific item is obtained by an avatar, it can no longer be traded with others. The item

section of World of Warcraft has much smaller number of tradable goods than that of the other online games. Therefore, most people trade avatars in order to play at higher levels or with higher-leveled items.

Most players - except for those who purchase someone else's account - log onto World of Warcraft and create accounts with their email address. Then they pay about 15-dollar subscription fee to Blizzard Inc. every month to play the game. After paying the subscription fee, the players can enter 'Create New Character' section and then choose name, faction, race, sex, and class. *Table 1* shows and describes all options for race and class that players can choose.

Table 1: The Races and Classes in the World of Warcraft

Races		**Classes**	
Human	Human as a Race		
		Warrior	Fighers who uses large weapons
Night Elf	Purple-skinned elves.		Can tank or deal damage.
	Tall and agile. Live in forests.	Hunter	Tame animals and use bows and guns
Dwarf	Short and beared.		Pure damage dealing class
	Skilled blacksmiths.	Shaman	Use totems and nature magic
Gnome	Small, farily cute humanoids.		Can heal or deal damage
	Talented in engineering.	Monk	Use fists and kicks
Worgen	Werewolves.		Can heal, tank and deal damage
	Humans who are able to transform into wolves.	Mage	Magic users using arcane magic
Draenei	Aliens from other planet.		Pure damage dealing class
	Males are large and buff, females are tall and skinny	Rogue	Use daggers and sneak skills
Orc	Green-skinned and buff.		Pure damage dealing class
	Known as warriors	Death Knight	Fighters who uses large weapon and necomancy
Troll	Blue-skinned, tall and skinny.		Can tank or deal damage.
	Specialized in Voodoo skills.	Druid	Transforms into animals and use nature magic
Tauren	Humanized Buffalos		Can heal, tank and deal damage
	Nature-loving huge race.	Warlock	Magic users using demonic power
Undead	Reanimated Humans.		Pure damage dealing class
	Torn, rotten and skinny	Priest	Magic users using holy forces
Blood Elf	White skinned elves.		Can heal or deal damage
	Specialized in arcane magic	Paladin	Divine fighters
Goblin	Small, green skinned race.		Can hael, tank and deal damage.
	Specialized in engineering.		
Pandaren	Human-like pandas.		
	Can both join alliance or horde		
Note:	The race and classes were available ones between September 29 and November 11		

After the players choose the specific attributes, their avatars can take up character slots and are ready to be played. For each account, a single player can create up to 11 avatars in one realm, and for all realms, they can create up to 50 avatars.

Once an avatar is created, it can gain more powers by entering Azeroth, completing quests, defeating enemies, and cooperating or competing with other avatars. These processes are designed to be fun and competitive for all players as they seek to attain higher Levels and Item Levels. Strengthening their avatar in the virtual world is akin to raising social status in the real world. Players with higher-level avatars are especially welcomed by many other players because they have the extra powers necessary to defeat the monsters in cooperative Raids. Thus, most players have a 'main avatar' on which they spend most time. They often create 'sub-avatars' within their account to play in a different class, race, gender, or faction.

As mentioned earlier, a high-level avatar is associated with high social status for players in the virtual world. Some players don't have enough time or want to spend so much time on elevating their status. Many are willing to purchase high-leveled avatars with their money. Hence, online auction sites are where real-world asset – specifically money - is traded for virtual-world advantages.

The process of avatar trade is as follows. First, once a deal is made over the online auction site, a seller provides a buyer with a specific account name and password. Then the buyer logs onto the game with the seller's account and verifies all the avatar information that are noted in the product description section of the auction site. If any information is wrong, the buyer has the right to cancel the deal. Or, if correct, the seller discloses the remaining account information, such as an email account and its password bound to the account and closes the deal. For most of the time, payment is made through Paypal or credit card. The buyer then changes the profile information and the password in order to prevent the seller from hacking into the account.

In World of Warcraft, avatar trading involves exchanging Battle.net account for money. Blizzard Inc. utilizes Battle.net as an all-inclusive account management system so that its users can sign up just once and then gain access to the other Blizzard games. Because of this system, World of Warcraft players cannot trade avatars without exchanging the entire Battle.net account for money or paying Blizzard for 'Character Transfer.' To obtain avatars, most players are more likely to spend their money on a loaded account than a transfer service.

I used the hedonic price model to estimate avatar prices. From determining prices of housing (Zabel, 2015) or agricultural land (Kostov, 2009) to examining price variability of yogurt Market (Carlucci, Stasi, Nardone & Seccia, 2013), hedonic price model is widely used among economists in determination of price of assets that are greatly impacted by externalities. Avatars are assets that have actual real money value in auctions, and the price of avatars are determined by their attributes, in this case, externalities. The avatar price is the Y variable of my regression, and X variables are the attributes that define the avatar price and represented as xi. Thus, my primary functions are:

$$
\begin{aligned}
Price = {} & \beta_0 + \beta_1 Level + \ \beta_2 Item\ Level + \ \beta_3\ Achievements + \ \beta_4 Speciality \\
& + \ \beta_5 Legendary + \ \beta_6 Wealthy + \ \beta_7 PvP\ Account + \ \beta_8 Female \qquad (1) \\
& + \ \beta_9 Alliance + \ \beta_{10} Humanoid + \ \beta_{11} Short + \ \beta_{12} Elf + \ \beta_{13} Monster \\
& + \ \beta_{14} Panda + \ \beta_{15} Plate + \ \beta_{16} Chian + \ \beta_{17} Leather + \ \beta_{18} Cloths + \ \epsilon_i
\end{aligned}
$$

$$
\begin{aligned}
\ln Price = {} & \beta_0 + \beta_1 Level + \ \beta_2 Item\ Level + \ \beta_3\ Achievements + \ \beta_4 Speciality \\
& + \ \beta_5 Legendary + \ \beta_6 Wealthy + \ \beta_7 PvP\ Account + \ \beta_8 Female \qquad (2) \\
& + \ \beta_9 Alliance + \ \beta_{10} Humanoid + \ \beta_{11} Short + \ \beta_{12} Elf + \ \beta_{13} Monster \\
& + \ \beta_{14} Panda + \ \beta_{15} Plate + \ \beta_{16} Chian + \ \beta_{17} Leather + \ \beta_{18} Cloths + \ \epsilon_i
\end{aligned}
$$

$$\ln Price = \beta_0 + \beta_1 \ln Level + \ \beta_2 \ln Item\ Level + \ \beta_3\ \ln Achievements + \ \beta_4 Speciality$$

$$+ \ \beta_5 Legendary + \ \beta_6 Wealthy + \ \beta_7 PvP\ Account + \ \beta_8 Female \qquad (3)$$

$$+ \ \beta_9 Alliance + \ \beta_{10} Humanoid + \ \beta_{11} Short + \ \beta_{12} Elf + \ \beta_{13} Monster$$

$$+ \ \beta_{14} Panda + \ \beta_{15} Plate + \ \beta_{16} Chian + \ \beta_{17} Leather + \ \beta_{18} Cloths + \ \epsilon_i$$

$$Price = \beta_0 + \beta_1 Item\ Level + \ \beta_2 Achievements + \ \beta_3\ Specialty + \ \beta_4 Legendary$$

$$+ \ \beta_5 Wealthy + \ \epsilon_i \qquad (4)$$

I also collected and organized the following statistically-significant information in *Table 2*. *Table 2* shows the statistical information on all X and Y variables. According to *Table 2*, the average price of avatars is \$346.614, and median price is \$410.2148. However, it should be noted that price data are driven by online auction prices, and price determination process mostly involves the competing objectives of buyers and sellers. Price varies highly from \$9 to \$3,750. Also the Level and Item Level of avatars vary from Level 80 to 100, and from Item Level 205 to 731. The median price is \$262.49, median Level is 100, and median Item Level is 687. The statistical results in *Table 2* show that avatars with higher level or item level certainly have premium in the market.

Table 2: Definition and Summary Statistics

Variable	Mean	Std. Dev	Descriptions
Price	346.614	410.2148	Price of the Account. Collected if the auction was made or there is a reasonable fixed price
Level	98.41	3.941	Level of the avatar
Lvl100	0.849	-	1 = Avatar is level 100 (Maximum Level), 0 otherwise
Item Level	658.769	73.48	Mean Item level of the Avatar
Achievement	8219.532	5698.825	Achievement points of the Avatar
Gold	21513.879	109639.861	Amount of gold that Avatar possesses. Collected only if Gold was above 10,000
PvP Account	2.486	-	1 = Avatar specializes in PvP, 0 otherwise
Speciality	0.156	-	1 = Avatar has speciality, such as rare items, rare achievements, etc, 0 otherwise
Legendary	0.138	-	1 = Avatar possesses legendary item
Entier Account	0.878	-	1 = Seller is selling entier Battle.net account, 0 otherwise
Avatar Num	2.844	2.879	Number of Avatars in the Battle.net account.
Other Games	0.08	-	Number of other games in the Battle.net account.
Female	0.405	-	1 = Avatar is female, 0 otherwise
Faction	0.532	-	1 = Avatar's faction is Alliance, 0 = Avatar's faction is Horde
Human	0.22	-	1 = Avatar is Human, 0 otherwise
Night Elf	0.11	-	1 = Avatar is Night Elf, 0 otherwise
Dwarf	0.023	-	1 = Avatar is Dwarf, 0 otherwise
Gnome	0.064	-	1 = Avatar is Gnome, 0 otherwise
Worgen	0.064	-	1 = Avatar is Worgen, 0 otherwise
Draenei	0.035	-	1 = Avatar is Draenei, 0 otherwise
Pandaren (A)	0.017	-	1 = Avatar is Pandaren and joined Alliance, 0 otherwise
Orc	0.11	-	1 = Avatar is Orc, 0 otherwise
Troll	0.046	-	1 = Avatar is Troll, 0 otherwise
Tauren	0.046	-	1 = Avatar is Tauren, 0 otherwise
Undead	0.081	-	1 = Avatar is Undead, 0 otherwise
Blood Elf	0.139	-	1 = Avatar is Blood Elf, 0 otherwise
Goblin	0.012	-	1 = Avatar is Goblin, 0 otherwise
Pandaren (H)	0.023	-	1 = Avatar is Pandaren and joined Horde, 0 otherwise
Warrior	0.104	-	1 = Avatar is Warrior, 0 otherwise
Hunter	0.133	-	1 = Avatar is Hunter, 0 otherwise
Shaman	0.052	-	1 = Avatar is Shaman, 0 otherwise
Monk	0.075	-	1 = Avatar is Monk, 0 otherwise
Mage	0.098	-	1 = Avatar is Mage, 0 otherwise
Rogue	0.058	-	1 = Avatar is Rogue, 0 otherwise
Death Knigh	0.104	-	1 = Avatar is Death Knigh, 0 otherwise
Druid	0.133	-	1 = Avatar is Druid, 0 otherwise
Warlock	0.046	-	1 = Avatar is Warlock, 0 otherwise
Priest	0.075	-	1 = Avatar is Priest, 0 otherwise
Paladin	0.11	-	1 = Avatar is Paladin, 0 otherwise

Note: N = 173

Source: Data are collected from online auction data from Ebay.com, PlayerAuctions.com VirtualBarrak.com and TheGameSupply.net from September 29 to November 11, 2015.

All avatars are in a Level of at least 80. Currently, Blizzard Inc. offers a service that 'boosts' avatars into Level 90 for $60. However, most characters that are in Level 90 were sold for less than $60 via the online auction sites. The differences between avatar price and Boost price shows that purchasing other people's avatar carries a certain amount of risk associated with the firm's sanction.

Average Achievement Points of avatars is 8219.532, median is 6832.5, 25000 maximum and 300 minimum. An avatar with 25,000 Achievement Points is sold for $1,500 while it has 727 Item Level and no sub-avatar. In contrast, the other avatars in the same price range have not only comparable Item Levels but also Legendary status and multiple sub-avatars. In fact, only 13.9% of avatars possess legendary item and only 15.6% are specialty avatars.

Although a majority of World of Warcraft players is male, 40% of avatars available in the auction are female. It is interesting to note that many players still create avatars that do not align with their own gender. In World of Warcraft, there are more Alliance players than Horde players; however, in auction sites, there isn't any noticeable discrepancy in the number of Alliance and Horde avatars..

For races and classes, Human has the highest number of auction deals, taking almost 22% of the sales; whereas, Blood Elf, Orc, and Night Elf take around 10~13%. This shows that players prefer human or human-like races more than humanoid or monster races. Among all classes, Hunters take about 13.3% of auction deals and other classes take about 10% each. Warlocks and Shamans have the smallest portion in the auction, both 4.6% and 5.2% range.

Because there are so many classes, I have reclassified the avatars and divided them into four distinct armor groups: Plate, Chain, Leather and Cloth. In the melee classes, Warrior, Death Knight and Paladin wear plate armor. In range and hybrid classes, Hunter and Shaman wear chainmail. In agility classes, Rogue, Monk, and Druid wear leather armor. Finally, in magic classes,

Mage, Warlock, and Priests wear cloth armor. Hence, by tallying the results, Plate takes 31.8% of avatars on sale, Chain takes 18.5%, Leather takes 26.6% and Cloth take 22.2%. The avatars of the Plate group are the most popular among buyers, and those of the Cloth group are the least popular.

In sum, statistical data shows that the market puts a high premium on avatars that possess greater power or high Achievement points. However, it still remains uncertain whether other factors such as race, faction or class affects the price.

IV. Results

Table 3 describes the results of my research. Castronova (2004) noted that hedonic pricing model has three specifications (log, semi-log, and log-log) of the base regression. Therefore, I also have made three specifications in my model so that I can test the effects of avatar attributes on price. In order to simplify the variables, I combine classes and regrouped them under four armor categories – as I previously noted. Furthermore, I combine races into four race categories: Humanoid, Short, Elf, Monster, and Panda. Humanoid includes Human, Worgen and Orc, Short includes Dwarf, Gnome, and Goblin. Elf includes Night Elf, Blood Elf, and Troll. Monster includes Draenei, Undead, and Trauren. Last but not least, Panda includes the two types of Pandarens belonging to Alliance and Horde. Hence, I set my independent variables as shown in the *Table 3*. For the model, robust Huber-White standard was calculated. R square values vary from 0.566 to 0.774, and shows that the regression explains the variations well.

Table 3: Hedonic Regression Model of Avatar Price and Avatar Attributes

Independent Var.	Dependent Variables			
	1. Price	2. Ln(Price)	3. Ln(Price)	4. Price
Level	-9.133	0.073	-	-
	(6.663)	(0.030)	-	-
Ln(Level)	-	-	2.270	-
	-	-	(3.294)	-
Item Level	1.367	0.004	-	0.789
	(0.472)	(0.002)	-	(0.255)
Ln(Item Level)	-	-	2.076	-
	-	-	1.248	-
Achievements	0.018	0.000	-	0.019
	(0.006)	(0.000)	-	(0.007)
Ln(Achievements)	-	-	0.288	-
	-	-	(0.068)	-
Speciality	388.504	0.664	0.755	391.037
	(86.491)	(0.144)	(0.111)	(91.485)
Legendary	275.353	0.417	0.541	311.134
	(93.343)	(0.141)	(0.126)	(108.156)
Wealthy	79.944	0.420	0.367	31.597
	(95.898)	(0.144)	(0.115)	(105.043)
PvP Account	22.224	-0.080	0.182	-
	(42.830)	(0.125)	(0.133)	-
Female	58.622	0.073	0.041	-
	(47.314)	(0.097)	(0.089)	-
Alliance	74.464	0.307	0.101	-
	(75.932)	(0.111)	(0.123)	-
Humanoid	-361.183	-0.076	-0.935	-
	(228.905)	(0.207)	(0.162)	-
Short	-480.637	-0.284	-1.135	-
	(223.438)	(0.236)	(0.193)	-
Elf	-328.694	0.082	-0.800	-
	(235.498)	(0.196)	(0.173)	-
Monster	-320.150	-0.607	-1.158	-
	(299.038)	(0.221)	(0.208)	-
Panda	-394.908	-0.234	-0.982	-
	(242.337)	(0.206)	(0.197)	-
Plate	188.578	-0.160	-0.105	-
	(209.549)	(0.215)	(0.144)	-
Chain	273.640	-0.074	-0.122	-
	(204.911)	(0.191)	(0.127)	-
Leather	142.495	-0.193	-0.214	-
	(211.084)	(0.157)	(0.105)	-
Cloths	220.246	-0.079	-0.057	-
	(214.034)	(0.182)	(0.150)	-
Constant	189.100	-5.161	-20.205	-426.249
	(414.067)	(1.995)	(9.062)	(139.881)
R^2	0.774	0.774	0.699	0.566
F-Statistics	32.980	32.980	-	16.640
N	173	173	173	173

(Standard errors in parenthesis)

As noted earlier, Castronova (2004) concluded that there are specific attributes that impact the avatar prices. The important attributes discussed by Castronova are: Month (time of the auction), Level (avatar level), Sex (avatar gender), Class (avatar class) and Race (avatar race). Most of the attributes tested by Castronova (2004) are also tested in my research, and they all appear to impact the price. The one attribute that I am not able to test is the time of the auction due to the limitation of my research period.

By using regression analysis, I find that female characters in the World of Warcraft are generally valued higher than those in Everquest (Castronova, 2004). Still, with regards to race and class attributes, my findings are similar to those of Castronova. Humanoids and elves are valued higher than the other races, and Chain and Cloth are valued slightly higher than other classes. Clearly, there is a direct correlation between the attributes that indicate avatar's strength and the avatar's price that are listed and transactional in the auction. Achievement Points and Specialty avatars are the two new variables added to my research, and they add premiums in prices. In this regression, I noted another factor in that PvP-specialized avatars have small price premiums over regular accounts.

The overall regression results show that attributes related to avatar's strength have the greatest impact on the avatar's price. The constant for the possession of Legendary Item is 275.33. High-end avatars usually equip items around Item Level 715; whereas, the level of one Legendary item is from 725 to 795. Although any given Legendary item is correlated with a specific Item Level, it still carries a premium and affects the final price.

Another notable factor is that Level has a negative constant, perhaps because more than 90% of avatars in the auction market are in Level 100, which is the maximum level that players can reach. Especially for World of Warcraft, Item Level can measure an avatar's strength more accurately than Level.

However, not all high-value attributes are associated solely with avatar's strength. Some attributes, such as Achievements and Specialty, have no relationship with avatars' strength, but they still have relatively high constants of 0.018 and 388.504. Even though the constant in *Table 3* is fairly small, Achievement Points of avatars vary from 300 to 25,000. Such special attributes, thus, are important indicators of price determination. Yet, because avatars tend to have both high Item Level and high Achievement points, it is impossible to tell whether or not there is correlation between the two variables.

Through the data collection process, I have noticed that buyers and sellers do not always set appropriate prices for avatars. Because buyers and sellers create email aliases and remain anonymous in online auction, traders - mostly sellers - are not always honest. And because avatar trade usually is not officially authorized by the gaming firms, no specific standards are set for the valuation of avatars. Online auction sites, in fact, evaluate and price avatars differently. Hence, many sellers often exaggerate their avatars' attributes and deemphasize their weaknesses in order to get the higher price in the auction. One of my suggestions is for players to set up a standard method of avatar valuation.

I have fulfilled my objective of extending Castronova's work (2004), but I still face a number of weaknesses in my own research. The first and foremost weakness is the limitations of time, so I can only collect a relatively small number of observations. Most studies on online auctions and videogaming are conducted over time frame of several months or even years, and they usually have N of at least 500 due to market inconsistencies. If a further research is to be done on this subject, it should be conducted over a longer period of time, and the number of observations must be at least twice as high as mine.

Another weakness in my research was the oversimplification of avatar attributes. Online games always include a complex set of variables, especially because each avatar has its unique

characteristics. Hence, categorizing avatar attributes is one of the most challenging tasks in my analyses. Throughout my research, I keep on discovering new variables, such as the number of other games in the accounts, the number of sub-avatars, or the number of Feat of Strengths (Special Achievements that can no longer be achieved) that might impact the regression. I have decided to cast aside these attributes because they are not mentioned in the product description of the auction. If there are other ways to categorize all avatar attributes and measure all the variables, my research can be much more accurate.

V. Conclusion

For the duration of my research, I have noticed that the virtual world has become much more complex since 2004 - when the Castronova's research on Everquest was done. While avatars in Everquest only had Level as its power indicator, those in World of Warcraft have more variables, such as Item Level or Legendary status. Furthermore, the games in 2015 offer special services that alter certain attributes, including Race and Gender, with real money. These variables, consequently, are much less significant than the other attributes. The players also consider the variables that indicate avatar powers, such as Level and Item Level, as significant. As observed by Castronova (2004), my first finding is the easiest to understand even by non-players: "more power means more fun playing the game and higher social status" in the virtual world.

For the past decade, online games have become accessible for everyone. Not only have the games become easier and less time-consuming, but dedicated players also have had a hard time differentiating their avatars from those who haven't spent so much time and energy on the game. Compared to EverQuest, the World of Warcraft requires less time – and, therefore, devotion - to reach the maximum level. Item Level is the new variable that indicates avatar power, but there are not many differences (658 and 731) between maximum Item Level and mean Item Level in my

data. As a result, Achievements and Specialty are the two variables on which I focused the most. These variables do not exist in Castronova's research (2004) because 'Achievements' is the system that was first introduced in the World of Warcraft. Regression results show that avatars with higher Achievement Points and some Rare Items are the alternate ways to specialize the dedicated players' avatars from all of the others.

I believe that differentiation is a very important concept in analyzing virtual world. My research shows that, just as people invest their assets on more expensive vehicles and better houses in the real world, players are willing to make the same investments for higher level and more achievement point avatars in the virtual world. Therefore, the online avatar market is a worthy subject of study because it shows how people's real world desires are infiltrating into virtual world.

VI. References

Castronova, Edward (2001), *Virtual Worlds: A First-Hand Account of Market and Society on the Cyberian Frontier*.
CESinfo Working Paper Series, No. 618

Castronova, Edward (2003). *On Virtual Economies*.
The International Journal of Computer Game Research volume 3, issue 2.
Retrieved from: http://www.gamestudies.org/0302/castronova/

Castronova, Edward (2004). *The Price of Bodies: A Hedonoic Pricing Model of Avatar Attributes in a Synthetic World*.
KYKLOS, volume 57, Frasc. 2, pp 173-196

Castronova, Edward (2006). *A Cost-Benefit Analysis of Real-Money Trade in the Product of Synthetic Economies*.
Forthcoming in Info, Vol. 8, No 6

Morrison Michael and Fontenla Matias (2013). *Price Convergence in an Online Virtual World*.
Empir Econ 44; pp 1053-1064

Zabel, Jeffery (2015). *The Hedonic Model and the Housing Cycle*.
Regional Science and Urban Economics, 54, pp.74-86

Kostov, Philip (March 2009). *A Spatial Quantile Regression Hedonic Model of Agricultural Land Prices*.
Spatial Economic Analysis, Vol. 4, No. 1

Carlucci Domenico, Stasi Antonio, Nardone Gianluca, Seccia Antonio (2013). *Explaining Price Variability in the Italian Yogurt Market: A Hedonic Analysis*.
Agribusiness, vol. 29, no. 2, pp. 194-206

Blizzard. Inc (2015, February, 28). Battle.net End User License Agreement.
Retrieved from: http://us.blizzard.com/en-us/company/legal/eula.html

Blizzard.inc (2012, August 22). World of Warcraft Term of Use.
Retrieved from: http://us.blizzard.com/en-us/company/legal/wow_tou.html

Statista. Number of World of Warcraft subscribers from 1st quarter 2005 to 2nd quarter 2015 (in millions)
Retrieved from: http://www.statista.com/statistics/276601/number-of-world-of-warcraft-subscribers-by-quarter/