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Abstract

Much significant research has been done to shed light on discrimination of females in, for example, labor markets. Less is known, in contrast, about the amount of discrimination in the virtual world of online gaming. In an early study, Castronova (2004) finds that female avatars receive about 10% lower prices in online auctions. In this research note, we re-examine the pricing of avatars sold in the Fortnite game. We cannot reject the null hypothesis that female and male avatars are sold at the same prices. We also account for the impact of a Fortnite sex scandal on the price differential between female and male avatars.

Keywords: Gender discrimination, Fortnite, gaming, Freemium, product differentiation, market segmentation

JEL Codes: J16, L11, M31

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1 Introduction

A large and significant literature has developed in recent years that studies whether females are discriminated in the workplace, as witnessed by the large and growing gender-gap literature. Discrimination of females, however, may not only prevail in the real world but also in the virtual world of online gaming. Such discrimination may show up, for example, in a tendency of online gamers to opt for a male rather than a female virtual character (avatar). In fact, Castronova (2004) has documented that male users are more prone to selecting their main character as male instead of female. Moreover, he reports that the auction price of female avatars is about 10% lower than the auction price of male ones. Castronova (2004) has concluded that female avatars are traded by a primarily male player base at a discount, and that the difference between the prices of avatars of different gender is statistically significant.

In this research note, we re-examine the role of gender for the pricing of avatars in online gaming and test whether there exists a price difference between female and male avatars. To this end, we build on the research by Castronova (2004) and study data taken from an online gaming platform. Specifically, we study data for Fortnite, an online survival game produced by Epic Games and People Can Fly. Our data are taken from the website of Skin-Tracker and consist of the name, definition, and the prices of all listed outfits (that is, avatars). Moreover, with the help of photos provided for each outfit, we can control for physical appearances of avatars such as gender. Additionally, we can observe the prices labeled for each outfit in V-Bucks, the virtual currency allowing gamers to buy the equipment or costumes in the in-game shop.

In contrast to the results of Castronova (2004), we do not find a statistically significant price difference between male and female avatars. Based on the outfit data, we find the difference between the average prices for male and female avatars to be rather small. Taken together, our empirical results

show that, while the prices for female avatars are lower than the prices of male avatars, this difference is not statistically significant.

The virtual currencies used in online-gaming platforms and the main determinants of prices in in-game shops, where avatars are bought or auctioned by online gamers, have become under scrutiny in recent empirical research (see, e.g., Cerulo 2011, Nagy and Koles 2014, Xu et al. 2017). For this reason, we also study the pricing of fantasy outfits (that is, non-human outfits) and observe a significant positive price difference relative to male outfits. Moreover, we show that the time of the outfit release has a significant effect on its price, which is in line with the findings of Castronova (2004).

2 Empirical analysis

2.1 The data

We collected the data set from the website Skin-Tracker in June 2020. This website lists a total of 717 avatars, where newly released avatars are depicted at the top of the older ones. All avatars have a name and are accompanied by a description attached to the photos also shown on the website. Figure 1 presents some of these Fortnite avatars.

-- Please insert Figure 1 about here. --

Although most avatars appear as "Item Shop" (they have a price denominated in terms of V-Bucks), some appear as "Leaked Skins" (new and unreleased cosmetics, see Hamstead 2020, Pro Game Guides 2020) or "Promotional" (cosmetic items that are awarded as a result of a promotion, see Fortnite Wiki). Cosmetic items do not have a price labeled with them and, hence, are not sold in the in-game shop. Therefore, we exclude "Leaked Skins" and "Promotional" from our data and focus on the avatars that have a price determined in V-Bucks.

Although there are various types of avatars in the in-game shop, their V-Bucks prices do not differ much. We observe mainly six different prices in our data: 800, 1200, 1500, 1600, 1800, and 2000 V-Bucks. Because avatars with a price of 1600 and 1800 V-Bucks are sold only in one season, we do not include them in our empirical analysis. The final version of our data set comprises 548 avatars along with their names, descriptions, and prices.

We categorize avatars according to their gender based on the photos depicted on the web page: We define three categories: male, female, and fantasy. We sort avatars that we cannot subsume under the male or female categories into the fantasy category. In total, there are 145 male, 185 female, and 218 fantasy characters (Table 1).

-- Please insert Table 1 about here. --

The average prices for males, females, and fantasy avatars are approximately 1199, 1181, and 1472 V-Bucks. While the average price of fantasy avatars is higher than the average prices of female and male avatars, there is no substantial difference between the average prices of male and female avatars. Hence, the descriptive statistics do not lend support to the view that online gamers discriminate between female and male avatars.

2.2 Regression models

In order to study our data in more detail, we estimate the following regression equation by the ordinary-least-squares technique:

$$Price_i = \alpha + \beta_1 female_i + \beta_2 fantasy_i + \epsilon_i. \quad (1)$$

The dependent variable is the price of an avatar, i , denominated in V-Bucks. The dummy variable “female” is one for females, and zero otherwise. Similarly, the dummy variable “fantasy” is one for fantasy avatars, and zero otherwise. Estimation results (Table 2) show that the price of female avatars is 18 V-Bucks lower than the price of male avatars. This price difference, however, is not statistically significant. In contrast, the price of fantasy

avatars is 273 V-Bucks higher compared to the price of male avatars, and this difference is statistically significant.

-- Please insert Table 2 about here. --

Next, we test whether newly released avatars are sold at a discount (as found by Castronova 2004). To this end, we extend our regression equation to include a variable that captures the release time of an avatar:

$$Price_i = \alpha + \beta_1 female_i + \beta_2 fantasy_i + \beta_3 time_i + \epsilon_i, \quad (2)$$

where the variable “time” assigns consecutive numerical values to every observation according to the time an avatar was released by Fortnite. We sort the observations such that the older releases appear before the newer ones and the assigned “time” value increase for every newly released avatar. Estimation results show that older avatars are sold at a higher price in the in-game shop, that is, the price of avatars has decreased over time. While female avatars are sold at a lower price of roughly 7.6 V-Bucks compared to male ones, this outcome again is not statistically significant. Fantasy avatars are priced that are approximately 287 V-Bucks higher than the prices of male avatars.

When interpreting the results for the variable “time”, it is important to note that Fortnite (unlike the online platform analyzed by Castronova 2004) does not use auctions to sell-off avatars. Rather, it sells all avatars at a pre-determined prices, that is, it lists all prices in V-Bucks and players buy an avatar at these prices in the in-game shops. The decline of prices of avatars over time, thus, can be interpreted as evidence that Fortnite applies a quasi-skimming strategy. A skimming strategy implies that a product is sold at a high initial price, and that its price declines over time due to customer satisfaction and intensifying competition. The pricing of avatars by Fortnite can be viewed as a quasi-skimming strategy because, while the price of a single avatar stays constant, the prices of newly released avatars decrease over time, that is, new outfits are sorted into lower price categories.

It also is worth noticing that, in Fortnite, players do not have to choose an avatar once and for all. In EverQuest, the game that Castronova (2004) has analyzed, choices of characters, in contrast, are permanent. The potentially temporary choice of an avatar in Fortnite may imply that players, even in case the player base is mainly male experiment with avatars and switch back and forth between genders, so that there eventually the data we analyze do not show signs of a significant gender-price gap.

Like Castronova (2004), we next re-estimate our regression model with the dependent variable being measured in terms of logs. Estimation results corroborate that there is no statistically significant price discrimination between female and male avatars, and that new avatars are sold at a discount relative to older avatars. Furthermore, fantasy avatars receive higher in-game shop prices relative to male avatars. To be more specific, in the model where we take into account the release time of an avatar, female avatars are sold at a discount of only -0.5% relative to male avatars, the price of newly released outfits is seen to be lower relative to the price of older outfits.

2.3 Fortnite scandal

With Fortnite being a popular online-gaming platform, an incidence concerning the design of avatars has received much public attention. Specifically after the release of Season 6, some players noticed a change: "*Epic added boob jiggle physics*" (Wilhelm 2018) to some of their female characters.¹ Epic reacted fast and patched the problem. However, Wilhelm (2018) regards Epics' communication policy as strange, because Epic apologized by arguing that the addition of the bonus physics was careless and *accidental*. He argues that it took time and effort to create the jiggle and that this surely did not happen accidentally.

¹For a short video sequence, see SMGxPrincess (2018).

When such an incidence takes place, a company might set up a task force and cross-check several of its procedures. This might affect subsequent pricing decisions in an attempt to avoid further incidences and scandals. Hence, in order to inspect whether the Fortnite scandal have had a significant impact on price differentiation between female and male avatars, we separate the avatars released before Season 6 from the ones released after Season 6.

-- Please insert Table 3 about here. --

Results (Table 3) show that, before the scandal occurred, the price difference between male and female avatars was larger than in the full sample ($+34.8 > +18.1$ V-Bucks). After the scandal had taken place, male skins were sold at a lower price compared to female skins and the price difference took on a value of -16.2 . Moreover, before the scandal occurred, the total numbers of females, males, and fantasy avatars were 73, 70 and 78. After the scandal had gathered steam, the number of female avatars increased to 112 whereas the number of male avatars increased only slightly to 75. In sum, Fortnite reduced the price of male skins more strongly than the price of female skins, so that the price difference has become negative. The subsequent increase in the number of female skins may even further helped to even out the price difference that existed before the scandal broke out.

-- Please insert Table 4 about here. --

In order to analyze more formally whether the impact of being a female avatar on the in-game shop prices relative to the prices of male avatars has changed after the scandal in Season 6, we create new dummy variables for the two genders that capture the average price differences among every gender before and after Season 6. Estimation results (Table 4) confirm that the price of male avatars were lowered to a larger extent than that the female avatars. The price difference between genders is not statistically different. Hence, we do not find evidence of price discrimination between female and male avatars.

When we specify our regression model in terms of logs of the dependent variable, the estimation results are consistent with the results for the anti-log specification.

3 Concluding remarks

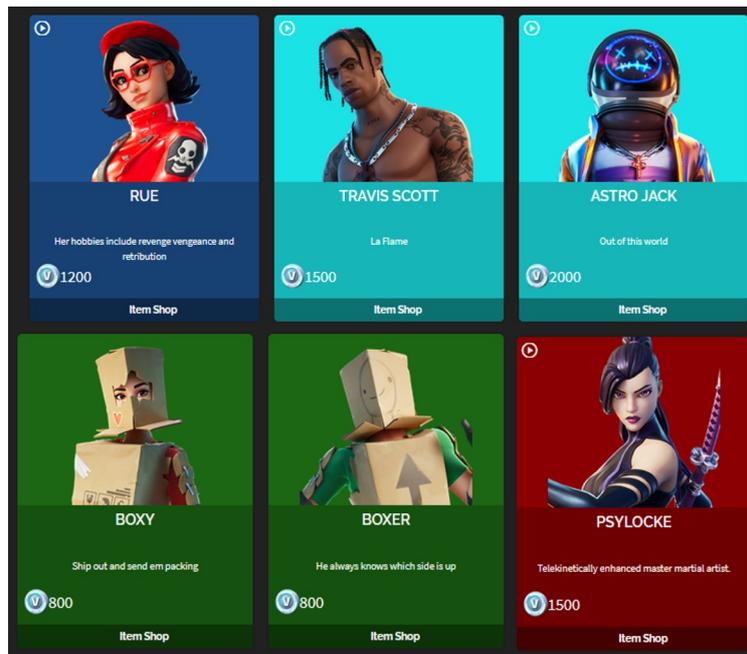
This research note contributes to the relatively scarce literature that studies whether real-world discrimination extends to the virtual world of online gaming. In earlier research, Castronova (2004) has found that gender of avatars matters for the auction pricing of avatars, and that female avatars are sold for significantly lower prices than male avatars. Upon analyzing data for the online game Fortnite, we also have found that female avatars are sold at lower prices relative to male avatars, but this price difference is small and statistically not significant. In contrast, the release timing of avatars and whether avatars are released “fantasy” outfits have a significant impact on the pricing of avatars. In sum, our results suggest that real-world discrimination does not necessarily extend to the virtual world of online gaming. However, before definite conclusions can be drawn in this regard, more empirical research needs to be done.

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Figure

Figure 1: Fortnite outfits



Note: The first row contains examples for female, male and fantasy avatars. It is not always easy to classify avatars unambiguously. For example “Boxer” could be classified as fantasy. But since, “Boxy” can be classified as female, we classified ”Boxer” as a male. Source: <https://skin-tracker.com/>

Tables

Table 1: Descriptive statistics

| | No. of observations | Average price | Standard deviation |
|---------|---------------------|---------------|--------------------|
| Female | 185 | 1180.5 | 306.9 |
| Male | 145 | 1198.6 | 320.4 |
| Fantasy | 218 | 1472.0 | 294.8 |
| Total | 548 | 1301.3 | 335.4 |

Table 2: Regression results

| | (1) | (2) | (3) | (4) |
|------------|----------------------|----------------------|----------------------|-------------------------|
| | Price | Price | ln(Price) | ln(Price) |
| Female | -18.08 (-0.53) | -7.556 (-0.23) | -0.0132 (-0.49) | -0.00550 (-0.21) |
| Fantasy | 273.4*** (8.34) | 286.9*** (8.99) | 0.221*** (8.39) | 0.231*** (8.96) |
| Time | | -0.351*** (-5.81) | | -0.000258*** (-5.30) |
| Constant | 1198.6*** (47.20) | 1314.9*** (41.40) | 7.053*** (346.35) | 7.138*** (278.95) |
| N | 548 | 548 | 548 | 548 |
| adj. R^2 | 0.169 | 0.216 | 0.170 | 0.209 |

t statistics in parentheses

* 10%, ** 5%, *** 1%

Note: The second and fourth column summarize the results after adding the time of the outfit releases as a new variable to the main regression model. The last two columns summarize the results based on the logarithm of the dependent variable.

Table 3: Descriptive statistics of the data before and after Season 6

| | (Before) | (Before) | (Before) | (After) | (After) | (After) |
|---------|-------------|----------|-------------|----------|---------|-------------|
| | No. of obs. | Average | Stand. dev. | No. Obs. | Average | Stand. Dev. |
| Female | 73 | 1246.6 | 331.3 | 112 | 1137.5 | 283.2 |
| Male | 70 | 1281.4 | 337.2 | 75 | 1121.3 | 284.9 |
| Fantasy | 78 | 1605.1 | 273.5 | 140 | 1397.9 | 280.7 |
| Total | 221 | 1384.2 | 353.1 | 327 | 1245.3 | 311.2 |

Table 4: Regression results: Fortnite scandal

| | (1) | (2) | (3) | (4) |
|---------------|----------------------|----------------------|----------------------|-----------------------|
| | Price | Price | ln(Price) | ln(Price) |
| Female | -34.85 (-0.70) | -34.93 (-0.71) | -0.0280 (-0.70) | -0.0280 (-0.70) |
| Fantasy | 323.7*** (6.65) | 323.8*** (6.65) | 0.246*** (6.27) | 0.246*** (6.27) |
| Male after | -160.1** (-3.26) | -114.3 (-1.76) | -0.130** (-3.29) | -0.104* (-1.98) |
| Female after | -109.1* (-2.45) | -63.73 (-1.04) | -0.0869* (-2.42) | -0.0609 (-1.23) |
| Fantasy after | -207.3*** (-4.96) | -163.1** (-2.79) | -0.144*** (-4.29) | -0.119* (-2.52) |
| Time | | -0.123 (-1.08) | | -0.0000704 (-0.76) |
| Constant | 1281.4*** (36.27) | 1298.5*** (33.54) | 7.120*** (249.99) | 7.130*** (228.36) |
| N | 548 | 548 | 548 | 548 |
| adj. R^2 | 0.223 | 0.224 | 0.216 | 0.215 |

t statistics in parentheses

* 10%, ** 5%, *** 1%

Note: This table summarizes the regression results we obtain when we account for the Fortnite sex scandal in Season 6 on price differences. The dummy variables created for each gender after Season 6 are labeled “Male after”, “Female after”, and “Fantasy after”. The second and fourth columns summarize the results we obtain when we add the variable “time” of release of an avatar.