# What do Collectors Want?

# The Effect of Aesthetics Versus Functionality on Secondary Market Prices for Collectibles


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## Abstract

*Technology has become ubiquitous across the modern world. Many commonplace objects now serve many functions due to their enhanced technological abilities. These additional features impact people's willingness to buy such products, but how much does it impact the price of these goods? And how can consumers, as investors in these goods, expect to make a return on these items given their technological features? My research focusses on this question by looking at the secondary-market prices of Nintendo's collectible figurine line: Amiibo. Amiibo are an interesting good in that they have both a clear function as collectibles (that is, they are physical models of Nintendo's most popular characters) and as useful pieces of technology in Nintendo's video games. Both functions would likely impact the price. My analysis looks at the impact of the release of new games on the resale value of these Amiibo, taking new games as a proxy for the additional functional capacities of the Amiibo when games are released. I find that while the aesthetic features of Amiibo have a significant impact on the price of an Amiibo in the current period, new game releases only significantly impact price after a lag of two quarters.*

## Introduction and Motivation

Technology has influenced nearly every part of our day-to-day lives. As such, the technological capabilities of goods are now at the forefront of our purchasing considerations. Many objects serve multiple purposes. For instance, watches and timepieces no longer just serve the sole purpose of telling the wearer the time; many of the most popular watches today, such as Apple Watches, Fitbits, and so on can also track the wearer's heart rate, access their phones, music, etc. As such, the premium on these high-tech devices puts them ahead of many of their relatively low-tech counterparts, with only high-end designer brands outpricing them. But how much of the extra cost of these new, high-tech items is due to their added functionality?

My research focuses on the market for Nintendo's collectible figurine line: Amiibo, to parse out the weight of collectability versus functionality's impact on price when it comes to multi-purpose collectible goods. Amiibo provide a unique lens into this dilemma since they have been mass produced and initially sold at a standard price of $12.99 USD, but their price in secondary online markets, like eBay and Amazon, vary drastically, with some Amiibo re-selling for less than $10 and others fetching much higher prices, nearing the $60 mark in some cases, if not more. It seems plausible that an Amiibo could derive value from both its aesthetic nature as a collectible figurine as well as its function within Nintendo's video-games. As physical models of some of Nintendo's most popular video-game characters (ranging from the smash-hit *Pokémon* series to the *Super Mario Bros.* and nearly everything in-between), it is likely that many long-time fans of Nintendo's games would buy Amiibo simply for their design and value as collectibles. However, each Amiibo also has a built-in chip which allows it to interact with the various games which they correspond to, meaning that players can also use the figurines as tools within their games to complete objectives, get unique bonuses, and in some cases, train and fight against them. Moreover, these Amiibo can be used across several of Nintendo's games.[1]

The most popular (and well-known) line of Amiibo are those that were initially released for the *Super Smash Brothers 4* (SSB4) game in late 2014—these were the first wave of Amiibo to be released. Luckily, SSB4 features a host of characters from a variety of Nintendo's games, ranging from their most popular titles (e.g., *Mario, The Legend of Zelda*, and *Pokémon*) to its

[1] See the Appendix for a picture of what an Amiibo is and a brief description of how they work.

lesser-known games (e.g., *Xenoblade* and *Kid Icarus*). This means that the demand for certain characters will almost certainly vary across the type of game to which the Amiibo corresponds, but the reason for variation is not likely due solely to its relative popularity, but also its relative utility. As more games are released, the Amiibo which correspond to those games see an increase in their function, as using them inside of those games can grant the player special bonusses or unique items that cannot be obtained in other ways. This is more likely to occur for games which make use of the Amiibo feature, as well as series of games that use that same Amiibo. That is, added functionality could drive demand. Similarly, the demand for those games could have a direct impact on the price of its corresponding SSB4 Amiibo, since this is a distinct and measurable extension to that Amiibo's functionality (many games which use the Amiibo feature also release a few Amiibo specifically for that game, but I will not consider those in my model since it would be harder to separate the functionality aspect from the popularity/aesthetic aspect of those figurines, as well as just the sheer demand for their corresponding game). Both the abilities of the Amiibo as well as their aesthetic design (or even just their popularity) could influence their secondary-market price; my model will attempt to find out in what proportion. I will explore how the release of a new game affects the price of already existing Amiibo. The main regression used will be a hedonic price function, which will look at the log of the price of each Amiibo regressed against various controls, focusing specifically on the release of additional compatible games across time periods. We will also be controlling for the aesthetic features which would affect the "collectability" of each figurine, namely its popularity and its relative aesthetic quality compared to other Amiibo.

I conclude, however, that while the function of an Amiibo certainly has some effect on the secondary-market price on said Amiibo, the large variation in prices is better explained by the more traditional aspects of collectibles. Moreover, there is a delay to market responses when additional functional features are added. I also provide some intuition as to why this may be the case, considering both consumer behavior as well as the behavior of Nintendo as a company.

**Literature Review**

This paper will mainly draw influence from the research on collectibles and the factors that affect their price. Burton and Jacobsen (1999) outline the framework that I will use. In their paper, they talk about the various ways to model returns to collectibles, with one of the most common ways being a hedonic price function, which regresses the log of the price of a good against various controls, such as its age and the artist (in reference to paintings). Obviously, I will have to update their initial framework to account for the additional aspects of collectibles that I am interested in, in this case added functionality.

Hedonic price functions also are used in estimating housing costs, perhaps there we can draw an analogy to our collectibles. Cebula (2009) uses vectors of the internal, external, spatial and other factors of the house to estimate each one's impact on the price of the house. He also looks at the various amenities offered by the various houses in his sample (e.g., number of bedrooms, number of bathrooms, fireplaces, pool, air conditioning, etc.), estimating each one's effect on the price of the house. Similarly, I separate the aesthetic features of the Amiibo from their functional features to see how each one impacts the price of the Amiibo.

On top of that, since I am considering panel data on a set of products and their value, it will also be prudent to consider time trends and the past value of said items, especially when considering that the data I am using comes from online posts and auction sites like Amazon or eBay. Johnson and Plott (1989) analyzes how consumer behavior shifts depending on the venue that an item is sold in, stating that in cases where a price is posted without much complexity, consumer behavior is generally simple and extrapolative, meaning that time trends and lags would be useful in accounting for the variation in the price of Amiibo. However, since the data source I collected my data from does not indicate whether the price was simply listed as a flat price or whether it was sold in an online auction, additional controls should be added in to account for this, specifically ones relating to the features of the Amiibo themselves, especially ones which consider where Amiibo were sold initially.

In order to incorporate the utility of the Amiibo and its effect on price, I am considering some research done in Sports Economics, specifically looking at NBA player salary determination for inspiration. Berri et al. (2015) and Stanek (2016) both find that individual utility as well as the effectiveness of a player's team and the organization as a whole have an impact on player salary. While, it might be difficult to translate this directly for Amiibo, it is not implausible that there are some aspects of Amiibo which correspond directly to the aforementioned qualities. Regarding individual utility, this is probably the easiest aspect to grasp intuitively, yet the hardest to quantify in a model—in short, every Amiibo is different and has a different in-game effect, so it is almost trivial to state that Amiibo have differing utility. But that being said, it is difficult to measure this difference in quality objectively—it is not as simple as tallying up how many assists, points scored and rebounds any given player had, but rather how the function of each Amiibo enhances a player's subjective experience in a game, and would be incredibly difficult to model objectively. I proxy for this by considering the number and types of games released which make use of an Amiibo. As for the other aspects, those are much simpler to account for; an Amiibo's "team" could be thought of as the series of games from which it originates, and the organization could be thought of as Amiibo-compatible games as a whole.

My hope in this paper is to synthesize the methods used in all of these different branches of economics in order to create a hybridized hedonic price function which takes time trends and utility into account. As I alluded to, one of the main difficulties of this task is translating all of these varying intuitions and theories into a framework which includes Amiibo. And even if the results do not prove to be impactful in an economic sense (i.e., external validity might be a concern—it is not the case that I am observing functionality directly), my hope is that the framework and intuition I provide will be of some use to how we might model the effect of additional functionality via technological augmentation in the future.

## Framework

Taking the literature into account, I will be using a supply and demand style of framework in order to analyze the factors which affect the price of an Amiibo. Both sides will be considered when estimating the price of an Amiibo.

The main variable to be considered on the supply side is time, specifically, the amount of time since the Amiibo's release. Since we are considering secondary market sales, it will be prudent to keep in mind three time periods regarding the supply of Amiibo. When first released, the Amiibo will be available commercially as well as on the secondary market, but it might be reasonable to expect that consumers would prefer to buy Amiibo from official retailers (such as Target, Best Buy and Amazon), rather than seek them out in the secondary market, so the secondary market for an Amiibo would not have as large a supply. Moreover, the fact that the Amiibo are still available at their market suggested retail price would impose a de facto price ceiling on the Amiibo's resale value at around $12.99. However, once the Amiibo have been bought out in the primary market, consumers' only option to get a specific figurine will be through secondary markets (Nintendo does not usually re-release the same Amiibo figurine, except in a few exceptional cases), so one might expect there to be a surge of Amiibo on the secondary market once the primary market has been depleted. And lastly, after this surge, the secondary market will eventually settle at a new equilibrium.

An additional point of interest is the role of demand in determining both the length of these time periods, as well as the price at which the Amiibo eventually settles. The more in demand Amiibo will be bought out more quickly from their primary market sources (in some cases, this happened virtually overnight, especially from online sources and pre-sales) and will most likely have an equilibrium value much higher than their retail price. On the other hand, the less highly demanded Amiibo might not completely exit the first time period at all—retailer stock might not ever be depleted in some cases, until there are put on clearance or disposed of. This, coupled with the fact that they are already unpopular would most likely depress the sales of those Amiibo in the secondary market.

Amiibo demand will be analyzed as a function of three vectors, meant to capture the aesthetic qualities, functional qualities, and price of each figure, respectively. That is, $D_{c,t}=f(aesthetic_{c,t}, function_{c,t}, price_{c,t})$. Included in the aesthetic vector would be features of the amiibo which are correlated with its appearance and general popularity of the character. While this would be mostly expected to remain constant over time, there may be some dynamic aspect to the popularity of the characters, which might be the result of either aesthetic changes to the character (e.g., the character has a new costume or "skin" introduced in a game, thus causing an increase to its popularity for aesthetic rather than functional reasons) or functional ones. The functionality vector considers the additional functions that an Amiibo gets when new games and figurines are released. These are the clearest and most impactful additions to functionality which can be observed. Simply put, each new game that an Amiibo can be used in extends its function. Intuitively speaking, it would make sense that, as more games are released which use an Amiibo, the more in demand that Amiibo will be; thus, functionality should have a positive effect on Amiibo price. But, there are a few possibilities as to why this might not always appear to be the case. As I will discuss in the next sections, other factors regarding the types of games released must be considered as well. The effects that an Amiibo has varies greatly from game to game, and the figurine's relationship to the game released plays a role too (that is, a Mario Amiibo will have a more impactful effect when used in a *Mario* game as opposed to a game from another series, even if the Amiibo is compatible with a wide breadth of games). Furthermore, there may be some substitutability concerns with other Amiibo from the same series that were released at other times. Lastly, the demand side of my framework will also consider the price of the Amiibo (taken from previous quarters). While this measure is likely to retain its standard economic intuition, this effect could be offset by the supply side of the model as well as collector behavior—it might be the case that some collectors would be willing to pay for very high priced Amiibo, even if cheaper substitutes exist, simply because that Amiibo is rare or expensive, or some might treat it as a form of investment, and will be willing to purchase the Amiibo at a high price because they expect prices to rise even more.

That said, this framework attempts to provide a simplified view of how the distinct aesthetic and functional features of Amiibo can affect prices. In the next section, I will discuss how the data which I collected aims to control and account for these features.

## Data

The data I am using is personally scraped. In this section, I outline the various sources from which I obtained my data, as well as my reasoning as to why I collected the data in the manner that I did, starting with my main outcome variable: price.

The variable for the prices of the figurines was collected from the website pricecharting.com, which keeps track of the average prices of video games and video game-related merchandise (like Amiibo) sold online, though websites such as Amazon and eBay, as well as their own website. I have collected quarterly data on the price of each Amiibo figurine in the Super Smash Bros. line of Amiibo. Since the first Amiibo were released in December 2014, this gives us twelve time periods to analyze, ranging between December 2014 and September 2017 (though, not all Amiibo for this game were released at once, which I control for). Note that one possible concern is the reliability of the pricing data that I have acquired. While pricecharting.com purports to have used sound techniques in acquiring and compiling their pricing data, there may still be a few remaining concerns regarding how this average price figure is collected. Most importantly, it does not say exactly how many Amiibo were sold during any given period, so this average price might be the result of very few observations, or a lot of them. In this case, high-valued Amiibo might have their prices because of some outlier cases where the figurine was sold at above the market value, but I do not have a way to control for this possibility, so I am forced to assume that on average, the average price of an Amiibo as reported by pricecharting.com is an accurate figure for the equilibrium price of any given Amiibo of interest.

Compatibility with other games can be accessed directly through Nintendo, since they announce the specific features of all their games, including which Amiibo can be used in any given game. In order to differentiate between the types of effects that different Amiibo will have within games, I decided to use two variables to measure the added utility of new games: one which measures broadly how many games an Amiibo is compatible with that were released during the quarter (many games incorporate a large amount of Amiibo, even ones which are unrelated to the game itself; they usually have minor effects on the character, in the form of small bonuses or in-game items), and another which measures only the number of new games released that correspond to the series to which that specific Amiibo relates (e.g., if a new *Mario* game is released, then the variable for Amiibo figurines which correspond to the *Mario* series, such as Mario and Bowser, will increase by 1 unit for that time period). Collinearity is not a concern here since in every time period there are more games released which are compatible with more games than just those in their specific time period. So, the model that I will be using makes key use of the variables *new_game* and *new_game_in_series*, which tracks the change in the number of games that any particular Amiibo is compatible with between time periods.

**Table 1: Data Description**

| *Variable* | *Obs* | *Mean* | *Std. Dev.* | *Min* | *Max* |
|---|---|---|---|---|---|
| *price* | 520 | 18.74192 | 14.14807 | 0 | 114.5 |
| *new_game* | 462 | 2.077922 | 1.334666 | 1 | 7 |
| *new_game_in_series* | 462 | .4025974 | .7232082 | 0 | 3 |

Of course, it will be prudent to make use of the log of prices, especially since we are trying to estimate the effect of a change in the value of *new_game* and *new_game_in_series* on the price of a figurine, so measuring the percent change in prices will paint a more accurate picture of the effect of a new release. Note also the high variance in the variables here, which could indicate the high volatility of the market for Amiibo. Additionally, these numbers will not line up with the official number of compatible games as given by Nintendo. I did this intentionally to avoid overstating the effect of any particular game on the price of an Amiibo. It is often the case that Nintendo will release the same game on several of its gaming systems, such as the WiiU, the Nintendo 3DS and the Nintendo Switch. "porting" the game from one system to another. The games released these different systems platforms are almost exact copies of each other—that is, the Amiibo will have the same effect in the WiiU version as it would the Switch version, and so on. So, while Nintendo counts each of these games as distinct from each other (and thereby states that the Amiibo has additional utility for each of those games), my data only uses the titles of the games themselves to differentiate between what constitutes a "new game," with the exception of SSB4 itself. Despite having copies on both the WiiU and the Nintendo 3DS, the two games have distinct differences between how they play and incorporate Amiibo, so I decided to keep them as two distinct games.

I measure aesthetics and general using two variables: *fan_art* and *popularity*. The *fan_art* variable is meant to proxy for the aesthetic qualities of the characters that Amiibo represent. It was constructed by taking the total number of fan-made art posts of the various Nintendo characters on the website DeviantArt. Since it is unlikely that the aesthetic value of a character would change over time, I am only including this as a static measure of aesthetics, so it will be constant in every time period. However, both *fan_art* and *price* are likely to be affected by the sheer popularity of the characters themselves, so to control for these endogenous effects, I also include the popularity of that character. Controlling for popularity also has the added benefit of allowing for the possibility of changes to character popularity over time. though related, popularity and aesthetic quality are not necessarily the same measure. The *popularity* variable was constructed by taking data from Google Trends, which gives the relative popularity of a term within a specified time period. I then multiplied the Google Trends data by the average number of monthly searches for that character in order to put this data in comparable terms (though this is not necessarily an accurate representation of the true number of times that a character was searched for in a given quarter, it simply makes it easier to compare between characters). Much like the prices of the Amiibo, these variables have a large range of values (much larger than in the case of price), and high variance as well, so I will be looking at the log of these variables in my papers as well.

One further caveat which concerns the *fan_art* variable is that I expect there to be a lot of noise in virtue of how it was constructed. Firstly, some fanatics might only be interested in drawing one (or a select few) character(s) and artificially inflate the total number of posts for that character. Similarly, some characters have names which strongly resemble another's (e.g., Donkey Kong and Diddy Kong), and some are derivatives of another character's name (e.g., Bowser and Bowser Jr.). Both of these could attribute artwork to the wrong character, or even count a character more often than what should have been the case. Moreover, the way DeviantArt allows users to label their art might place disproportionate weight on the main or titular characters of a series (e.g., even though a piece of art might be of Princess Peach, the fact that she is a character in the *Mario* games might also cause the website to categorize her under the umbrella of the term "Mario" if the artist tagged her as such). That said, this is probably the most objective measure of the aesthetic qualities of Nintendo characters available, but the results should be met with some skepticism.

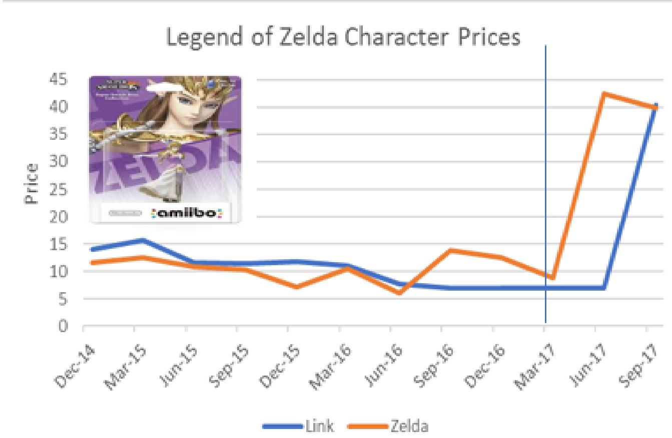
Beyond just these variables, other factors ought to be controlled for in the models that I specify. The variables *amiibo_wave*, *series*, and *store_exclusive* are important to differentiate between the different Amiibo figurines; in addition, they could be useful to measure the popularity and the supply of Amiibo.

*Amiibo_wave* differentiates the different SSB4 figurines based on their date of release. So far there have been ten distinct "waves" of Amiibo releases for the SSB4 figurines. Each wave contains at least 1 new figurine which was made specifically for the SSB4 game (but in every case, is also compatible with other non-SSB4 games). The first wave of Amiibo was released on November 21st, 2014, and the most recent wave was released this past summer in June 2017. There is no set release date for new Amiibo, but they are released intermittently as new games come out, and the *amiibo_wave* variable is a discreet variable which groups Amiibo together by their release dates. The variable *series* is another discreet variable to track the series to which an Amiibo corresponds (note that those with the vale 0 belong to the *Mario* line of Amiibo, so this variable, when regressed against price, will measure the difference between the prices of a series of Amiibo relative to the Amiibo belonging to the *Mario* series). As stated earlier, the relative popularity of a series is likely to have an impact on both the supply of Amiibo and the price of the Amiibo as well. Refer to the series catalogue in the Appendix for how the *series* variable was catalogued. The variable *store_exclusive* is a dummy variable which tracks whether an Amiibo was made exclusive to a specific retailer upon its initial release by Nintendo. In order to generate interest among its fans, some Amiibo were made available in only a few specific venues upon their release, ranging from large retailers like Target and Walmart to the video-game-only chain GameStop, and some were only initially available as purchases online through Amazon. This almost certainly would affect the price of the Amiibo since it limits supply. Controlling for these variables would likely be prudent as well.

From a cursory look at the data, I do see correlation between the release of new games and the price of an Amiibo. It seems plausible that the SSB4 Amiibo act as complements to the additional games that Nintendo releases. This extended functionality would increase the demand for the Amiibo which work inside of the game, and this increased demand would drive resale prices higher. For instance, consider the following graph, which shows how the prices of the Link and Zelda Amiibo (the two main characters of the *Legend of Zelda* series) changed following the release of the game *Legend of Zelda: Breath of the Wild*. I chose this specific series for two reasons: firstly, the game itself was a major success, so this would be an illustrative example of the effects that I want to analyze (i.e., how the demand for and popularity of new games could drive demand for compatible Amiibo), and secondly, the *Legend of Zelda* series does not release games with high frequency—new games are only released once every few years (unlike other popular series, like *Mario*, which releases games consistently throughout the year), so it is unlikely that this example would pick up the effects of multiple games on Amiibo demand. In the graph, we can see that the SSB4 Zelda And Link Amiibo showed large price increases in the quarters following the release of the game *Legend of Zelda: Breath of the Wild*, going from less than $10 each on the secondary market to nearly $40 in the most recent quarters. This could likely be due to the fact that using the SSB4 Zelda Amiibo in the new Zelda game granted the player special items that would be difficult to access otherwise. That is, the SSB4

Zelda served as a complement to the new Zelda game, and the increased demand for that new game spilled over and affected older Amiibo prices, since they served a useful function in said new game. Additionally, it would be plausible to think that the release of the new game greatly increased the popularity of the *Legend of Zelda* characters in general, which might also be another channel through which price is affected.

**Figure 1: Prices of *Zelda* Characters over Time**




Note that in this graph, prices seem to rise in the periods following the release of a game, either one or two periods after its release. As such, my model will look at the effect of releasing games in previous quarters as well as in the current period. Additionally, from this graph, we might also stipulate that there is a time trend effect on these variables, namely that without some additional games released, it appears as though Amiibo will see some decline in their prices. So, my model will also take the time period into account. As noted earlier, there are twelve time periods total, one for each quarter starting from December 2014 through September 2017.

**Model**

In this section, I report two tables which look at the framework that I have discussed. I begin with just a standard hedonic price model, modified to take my aesthetic and functional features into account. I do not initially look at the lagged number of new games released, nor do I look at the lagged log price of the Amiibo, even though both are likely to have an effect. However, the baseline model is just as important, I think, in order to see what would have an effect on Amiibo prices in the current period, though Table 1 does include the lagged price variable as well, since it is more clearly the case that consumers will make price expectations and buying decisions based on the price in previous quarter. I begin by estimating the following hedonic price function:

$$\log(price)_{ti} = \beta_0 + \beta_1 new\_game_{ti} + \beta_2 new\_game\_in\_series_{ti} + \beta_3 \log(fan\ art)_i + \beta_4 \log(popularity_{ti}) + \beta_5 time + \beta_6 controls + \varepsilon_{ti}$$

Running the regression, I get the results seen in the following table. I also include additional models which incorporate the lag of *log(price)* as well as an interaction term which combines the *log(art)* and *log(pop)* variables. In this initial model, I do not observe a significant effect of *new_game* or *new_game_in_series* on *log(price)*, but I do observe significant effects of popularity and the lag of price. Interestingly, the baseline model reports a large and significant negative effect of fan-made art posts. It is likely that popularity affected both the *log(art)* variable as well as Amiibo price, so I control for this potential endogeneity by adding the interaction of *log(pop)* and *log(art).* This addition does a few things: it increases the magnitude of the *log(pop)* variable's effect on price, *log(art)* goes from having a significant coefficient which is negative to having a positive yet insignificant coefficient, and the interaction term has a significant negative effect on price, though it is small in magnitude (especially when considering that it is the interaction of two log terms).

**Table 2: Initial Model**

| | Log(price) | Log(price) | Log(price) |
|---|---|---|---|
| | b/se | b/se | b/se |
| *new_game* | 0.003 | 0.000 | 0.002 |
| | (0.02) | (0.02) | (0.02) |
| *new_game_in_series* | 0.021 | 0.044 | 0.044 |
| | (0.05) | (0.04) | (0.04) |
| *log(art)* | -0.192*** | -0.102*** | 0.038 |
| | (0.03) | (0.03) | (0.07) |
| *log(pop)* | 0.131*** | 0.098*** | 0.353** |
| | (0.03) | (0.03) | (0.11) |
| *time* | -0.004 | 0.021 | 0.021 |
| | (0.01) | (0.01) | (0.01) |
| | (0.03) | (0.03) | (0.03) |
| *L.log(price)* | | 0.519*** | 0.510*** |
| | | (0.05) | (0.05) |
| *log(art) *log(popularity)* | | | -0.024* |
| | | | (0.01) |
| *Series Controls* | Yes | Yes | Yes |
| *Release Date Controls* | Yes | Yes | Yes |
| *Exclusivity Controls* | Yes | Yes | Yes |
| *constant* | 3.918*** | 1.764*** | 0.320 |
| | (0.42) | (0.41) | (0.75) |
| *R-sqr* | 0.379 | 0.541 | 0.548 |
| *dfres* | 375 | 372 | 371 |
| | * p<0.05 | ** p<0.01 | *** p<0.001 |

Unsurprisingly, these initial regressions do not report significant coefficients on the functional variables. They are not significant once I control for the popularity and supply factors. Recall that in the graph shown previously, Amiibo prices only seemed to increase in the quarters following the release of a game. They did not show much change in the concurrent time period as the release of the game. In the next models, I account for both one and two lags of the *new_game* and *new_game_in_series* variables. The results for the one lag model as well as the two lag model are reported in Table 3. For the sake of completeness, I do add in a second lag for the price variable, though it is not significant. That said, one danger of including too many lags would be that it limits the amount of available data, especially considering the fact that some Amiibo were released more recently than others. Every lag taken eliminates some of the data that can be observed, and in some cases, it eliminates entire waves of Amiibo price data. Moreover, the more superfluous terms that I include, the less significant my other results are. As such, I would be apprehensive about including too many additional lags in my regression, since it both eliminates possible findings and muddles the data that I do have. I do not add in lags for the aesthetic variables, since I think it is unlikely that the lag of popularity will be impactful in the current period (the popularity in the current period should be sufficient). Likewise, since the *fan_art* variable is a static measure, there would not be anything additional gained from its inclusion.

**Table 3: 1 and 2 Lag Models**

| | *Log(price)* | *Log(price)* |
|---|---|---|
| | b/se | b/se |
| *L.lprice* | 0.490*** | 0.367*** |
| | (0.06) | (0.07) |
| *L2.lprice* | | 0.184 |
| | | (0.10) |
| *new_game* | 0.009 | 0.013 |
| | (0.02) | (0.02) |
| *L.new_game* | 0.008 | -0.014 |
| | (0.03) | (0.03) |
| *L2.new_game* | | -0.106*** |
| | | (0.03) |
| *new_game_in_series* | 0.042 | 0.052 |
| | (0.04) | (0.05) |
| *L.new_game_in_series* | -0.017 | 0.040 |
| | (0.04) | (0.04) |
| *L2.new_game_in_series* | | 0.202*** |
| | | (0.05) |
| *log(art)* | 0.038 | -0.017 |
| | (0.06) | (0.07) |
| *log(pop)* | 0.383** | 0.261* |
| | (0.12) | (0.13) |
| *log(art) *log(pop)* | -0.026** | -0.016 |
| | (0.01) | (0.01) |
| *time* | 0.022 | 0.046* |
| | (0.01) | (0.02) |
| *store_exclusive* | 0.271** | 0.201 |
| | (0.10) | (0.11) |
| *Series Controls* | Yes | Yes |
| *Wave Controls* | Yes | Yes |
| *constant* | 0.260 | 0.313 |
| | (0.68) | (0.79) |
| *R-sqr* | 0.525 | 0.528 |
| *dfres* | 321 | 271 |

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

This table, while more in line with my initial intuitions, still returns some unexpected results. The only significant lag of *new_game* and *new_game_in_series* in these regressions is second lag. This implies that the prices of the Amiibo are only significantly impacted by new game releases until two quarters after the release of the new game. This seems odd—intuitively speaking, it would not be expected to take this long to observe impacts on the price of the Amiibo. However, this could make sense when we consider that most games are released towards the end of the quarter (especially in March and December) and the fact that it might take time for secondary markets to respond to a change within a game. More interestingly, it seems to also imply that the release of games which are not directly related to the series to which an Amiibo corresponds would actually decrease the price of that Amiibo. Perhaps this could be made sense of if one thinks that the lack of new games in the series which corresponds to the Amiibo signals a lack of relevance of that Amiibo and its series—that is, those Amiibo which do not get new games added into their series are getting less popular overall. In order to stay relevant, more games must be released into the new series, only then will the Amiibo's value increase.

**Discussion**

Regarding the economic conclusions that can be gleaned from the models thus far, it seems that function alone does not have a large impact on the price of the Amiibo, accounting for approximately 10% of the variation in the secondary market price of Amiibo. But considering the high variance among prices, I am not surprised. When we control for more of the traditional aspects of collectibles, more of the variability of the Amiibo prices can be explained. It would seem, *prima facie*, that collectors of Amiibo are still concerned with the aesthetic features of their collectibles over the utility of said Amiibo. The most important factors in determining the price of an Amiibo seem to be its popularity and price in the previous quarter. In some cases, it seems clear that the functionality of the Amiibo does have an impact on the price.

The second lag term of a new release sheds some light on this effect. However, it should also be noted that when *new_game_in_series* increases, *new_game* necessarily increases by the same amount (the two are not perfectly correlated, however, since the opposite is not true—it is not the case that *new_game_in_series* will increase whenever *new_game* increases). But even considering this fact, we can see that the value of an Amiibo will still increase when a new game in its series is released by adding the two terms together. By the second table's regression, we can see that the difference between second lag of *new_game_in_series* and the second lag of *new_game* is 0.096 meaning that increasing *new_game* by 1 unit would increase that Amiibo's price by approximately 10%. Meanwhile, a one percent increase in character popularity seems to be correlated with 0.26% increase to Amiibo prices, and a one percent increase to the price of the Amiibo in the previous quarter is correlated with a 0.37% increase (if these measures were to double, or more than double, like it did in the case of the release of *Breath of the Wild*, then the explanatory power of the *new_game* variables would be smaller than a cursory look at Figure 1 would have suggested).

As I mentioned previously, it might be the case that the release of a new game (or the lack of the release of a new game to a series) might also influence the popularity of the characters in that game, and subsequently the Amiibo in the series. However, controlling for this does not return any significant results.[2] But there may be other reasons why it might be the case that the effect of functionality on price is understated, as well as why the amount of time it takes for market responses to functionality is as long as the data would suggest. Firstly, it is not always clear what the effects of Amiibo are in games—players have to take time to experiment and play with the features of their new games in order to discover the various benefits of those Amiibo. Moreover, not all Amiibo have consistent effects. While sometimes they might produce one and only effect in the game, but other times they might have a randomized effect on the character, giving them one of many possible items or bonuses. And it takes time to discover every effect. This would go hand-in-hand in explaining at least part of the reason why only the second lag term of the *new_game* variables have significant effects. This process of discovery has been expedited, however, by people who can mine into a game's coding to figure out the exact effect(s) that an Amiibo has on the game. But still, there is most likely a delayed between discovery and dissemination of information (probably enough time for enterprising data-miners to buy the best Amiibo for every game). Secondly, it is also generally the case that when Nintendo releases a new, big-ticket game, that they will release a line of Amiibo specifically for that game (i.e., not an SSB4 Amiibo, but rather, one tailored to that specific game). So, instead of trying to figure out how to buy older Amiibo, most players are trying to get their hands on the fancy new Amiibo. Perhaps, the substitution effect here is what depresses the price of the older Amiibo—as demand spikes for the new product, the older ones are left by the wayside. However, this gives well informed collectors an opportunity to make quick returns on the older product—they can take advantage of the lower prices on the older Amiibo and wait for prices to rise back to their previous prices, or even to higher prices and make some extra money as a result.

**Checks and Extensions**

One concern that might remain from my examination of my models is how resale prices are initially determined, especially given the significance of the lag of the price variable. In the following table, I use the log of the initial resale value as my dependent variable, and I regress it against all my independent variables and controls, except for the functional variables, since there would be no new games to speak of in this time period. One major caveat for this is that I am looking at this variable in the current time period, not two periods after release.[3] So, it might not be the case that all Amiibo have moved into the secondary market phase of their supply.

**Table 4: Initial Value Regressions**

| | *Log(initial price)* | *Log(initial price)* |
|---|---|---|
| | b/se | b/se |
| *log(pop)* | -0.028* | -0.160** |
| | (0.01) | (0.06) |
| *log(art)* | -0.077*** | -0.154*** |
| | (0.02) | (0.04) |
| *store_exclusive* | 0.386*** | 0.367*** |
| | (0.06) | (0.06) |
| *Log(pop) * log(art)* | | 0.013* |

[2] This regression is not included in my paper since the results are, for the most part, uninformative. The next section looks at a different case where I examine the effects of my non-functional variables on the initial resale value.
[3] I do not look at the effects two quarters after since that might muddle the initial effects that determine resale value; allowing this to change might not give accurate or interesting results.

| | | |
|---|---|---|
| | | (0.01) |
| *Series and Wave Controls* | Yes | Yes |
| *Constant* | 3.615*** | 4.409*** |
| | (0.19) | (0.47) |
| *R-sqr* | 0.800 | 0.803 |
| *Dfres* | 442 | 441 |
| * p<0.05 | ** p<0.01 | *** p<0.001 |

Notice in this graph that it seems like both fan art and popularity have negative effects. While seems odd, even counter to what would be expected given the results of the previous tables, it might be more sensible when the supply side is considered as well. It stands to reason that Nintendo knows which characters are the most popular (including main characters, fan favorites, and so on), so they will supply more of those characters initially, meaning that they are not bought out as quickly and remain in the primary market for a longer period. It seems to be the case that the supply side plays a larger role in determining the initial value of Amiibo. The exclusivity variable, which states whether or not an Amiibo was only supplied to one store upon release, has a much larger and more significant effect on initial value than it did in my previous table. Likewise, many of my controls returned very large, very significant results, specifically for some of the series, as well as the wave of release. The series control is, for the most part, strongly positive (I am comparing each individual game series with *Super Mario* as the baseline), which might support the claim I made earlier, since Mario is Nintendo's flagship series, more Mario and Mario-related Amiibo were released than any other series of Amiibo. This might indicate that there is a premium for the rarity of an Amiibo that affects its initial resale value (which might be the case for more obscure series, such as *Wii Fit*, or *Bayonetta*). This effect might weaken over time. The wave control seems to get more negative as we get closer to the current period, supporting the notion that they might not have been bought out from primary market retailers. The fully expanded table, along with a series catalogue, is included in the Appendix.[4] Interestingly, however, the initial resale value of the Amiibo does not seem to have a significant effect on resale value in subsequent quarters, indicating that the supply side effects wane over time. this makes sense considering the increased role of demand in the secondary market.

Further extensions of the model which have not been explored could incorporate the subjective qualities of the released games—broadly, are those games enjoyable? I have not controlled for the "enjoyability" of the games to which the different Amiibo correspond, but it seems almost trivially true that the most enjoyable games would be the most valuable from a utility perspective, and thus those games would increase demand for some specific Amiibo which provide the best in-game effects (*The Legend of Zelda: Breath of the Wild* is a good example of this phenomenon). I have not controlled for the quality of the games to which the Amiibo correspond, so one possible extension would be to add in a quality control measure for the games released. However, this would be extremely difficult to implement (not to mention extremely subjective; just because a game receives good ratings does not necessarily mean that everyone enjoys it, or that the use of Amiibo in the game provides players a sufficiently

[4] It is not included here simply due to the sheer number of series being controlled for.

enhanced experience such that they would actually increase their demand for all Amiibo, or some subset of Amiibo).

Likewise, for the substitutability of Amiibo, it is difficult to determine what kind of Amiibo acts as a substitute for another, even though there are likely substitution effects regarding Amiibo prices, especially when new figurines are released. It is not the case that any Amiibo is a perfect substitute for another model (even if they produce the same, or similar, in-game effects, they all have differing aesthetic qualities), but now the question becomes: what constitutes sufficient classification as a substitute? Must they have the exact same in-game qualities? Or is similarity in function enough to determine this? This gets further complicated by the fact that even though two Amiibo from different lines of Amiibo might have the exact same function in one game, such as SSB4 (like with the SSB4 Mario, there are several other Mario figurines that serve the same functions as the SSB4 Mario in SSB4), but they might not have the same function across all compatible games. Amiibo substitutability depends on the game that they are being used for. Furthermore, for games unrelated to the series to which an Amiibo belongs, almost any other compatible, non-series-related Amiibo will produce the same or similar in-game effect. This makes the process of determining what constitutes a substitute for an Amiibo, since at a certain level of abstraction, they are all substitutes for each other (which would make sense to some degree, but would not be in line with what this paper is trying to examine).

**Conclusion**

In this paper, I have examined the various market forces which determine the resale value of Amiibo figurines. I find significant values in the factors that are generally thought to be true of traditional collectibles, namely popularity, and I also find significant values on the functional qualities of the Amiibo, after a delay period.

So, given this knowledge, how might investors (collectors) as well as companies like Nintendo who want to emphasize the utility of their collectibles behave to make use of this information? For investors, investments in Amiibo generally depend on how many games have been released for that series and will be released in the future. Demand increases for already-existing Amiibo seem to have a lagged effect on secondary market prices, so investors should resist the urge to sell their collectibles immediately after the release of a new game and wait for the price to rise in future quarters. On the other hand, companies like Nintendo should also be trying to use the information about the effect of functionality on how they price of their product. While they do not have control over the Amiibo already on the market, they can control what they do with the Amiibo that they plan to release, and the price at which they are released.

Going forward, what more can be done to see if these functional effects hold up in the long run? Three years is a relatively short time horizon, so it would be interesting to see whether these significant effects remain as such as more games and figurines are released. Specifically, as more alternatives are released, will the functional component of the older Amiibo retain any of their significance in determining price, or will the traditional features of the toys (as collectibles) take precedence in determining resale prices? Furthermore, it would be interesting to see if age of the Amiibo becomes a significant factor in driving Amiibo demand (as Burton and Jacobsen would suggest), especially for those released early on. One easily testable hypothesis that could be carried out soon is whether the addition of a new *Smash Brothers* game has a significant effect on the price of SSB4 Amiibo relative to other Amiibo. The fifth installment to the franchise was announced on March 8th, 2018, and will be released later in the year.[5] This would allow me to better test for substitution effects regarding Amiibo. If the demand for the SSB4 Amiibo increases more than other non-SSB4, yet compatible Amiibo, then the worry that some Amiibo might be perfect substitutes for each other would be less likely.

Considering the broader implications of this paper, I do not think that these results can be applied to all collectibles, or even video game paraphernalia in general. It probably is not the case that all collectibles will experience a lagged increase to their price two periods after the extension of their functionality.[6] However, I do hope that this project has been in some way informative of how one could implement a strategy like mine in estimating the effects of functionality on demand for collectible goods.

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## Appendix

Figure 1: What is an Amiibo and what do they do? (with Pictures)

Amiibo (both the singular and plural term) are collectible toys produced by Nintendo for its various video games. Each Amiibo comes packaged in its own display box, as shown below. In order to be scanned into a compatible game, a player must touch the base of the Amiibo to their game controller; the base of the Amiibo figurine contains a small chip which is scanned and loaded into the game, producing whatever effect that game allows for. The systems with Amiibo

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[5] Announcement details can be found at https://www.polygon.com/2018/3/8/17097680/smash-bros-switch-release-date; it almost makes me wish that I had done this project one year later!

[6] Even less likely would be if functionality extensions could be as easily measured in other types of collectibles.

compatibility are the Wii U, Nintendo 3DS, and the Nintendo Switch. The SSB4 Amiibo were the flagship series of Amiibo released. The first wave was released in conjunction with the Wii U's version of the game, and were a massive success upon release. In SSB4, every Amiibo which corresponds to a character in the game (which is most of them, including all SSB4 Amiibo as well as any Amiibo released in a different series of Amiibo whose character appears in SSB4) can be scanned into the game as a "figure player" (FP). The FP can then be trained to fight by the player and can be upgraded using items that the player collects. The FP can be fought against as an adversary, or the player can use it as an ally to help him complete various objectives, or both. The Amiibo stores the data concerning its FP's powers and abilities in its built-in chip and can be used in any version of the game (e.g., I can take one of my Amiibo to a friend's house and load my character into his game and have it fight).



**Series Catalogue**

| Series Name | Number | Series Name | Number |
|---|---|---|---|
| Mario | 0 | Bayonetta | 10 |
| The Legend of Zelda | 1 | Retro (SNES) | 11 |
| Fire Emblem | 2 | Metroid | 12 |
| Pokémon | 3 | Captain Falcon | 13 |
| Star Fox | 4 | Final Fantasy | 14 |
| Kirby | 5 | Mega Man | 15 |
| Kid Icarus | 6 | Sonic | 16 |
| Animal Crossing | 7 | Pikmin | 17 |
| Earthbound | 8 | Xenoblade | 18 |
| Wii Fit | 9 | | |

**Table 4.1: Initial Value Regression, Including Control Values**

| | *Log(initial price)* | *Log(initial price)* |
|---|---|---|

| | | |
|---|---|---|
| | b/se | b/se |
| *lpop* | -0.028* | -0.160** |
| | (0.01) | (0.06) |
| *lart* | -0.077*** | -0.154*** |
| | (0.02) | (0.04) |
| *store_exclusive* | 0.386*** | 0.367*** |
| | (0.06) | (0.06) |
| *series=0* | 0.000 | 0.000 |
| | (.) | (.) |
| *series=1* | 0.185*** | 0.152*** |
| | (0.04) | (0.04) |
| *series=2* | 1.017*** | 1.010*** |
| | (0.06) | (0.07) |
| *series=3* | 0.388*** | 0.410*** |
| | (0.06) | (0.06) |
| *series=4* | 0.315*** | 0.314*** |
| | (0.06) | (0.06) |
| *series=5* | 0.492*** | 0.476*** |
| | (0.06) | (0.06) |
| *series=6* | 1.064*** | 1.039*** |
| | (0.06) | (0.07) |
| *series=7* | 1.149*** | 1.139*** |
| | (0.05) | (0.06) |
| *series=8* | 0.590*** | 0.591*** |
| | (0.09) | (0.09) |
| *series=9* | 0.834*** | 0.793*** |
| | (0.07) | (0.08) |
| *series=10* | 1.221** | 1.235** |
| | (0.40) | (0.40) |
| *series=11* | 0.265* | 0.240* |
| | (0.11) | (0.11) |
| *series=12* | -0.052 | -0.054 |
| | (0.07) | (0.07) |
| *series=13* | 0.727*** | 0.712*** |
| | (0.06) | (0.06) |
| *series=14* | 1.360*** | 1.338*** |
| | (0.34) | (0.35) |
| *series=15* | 0.487*** | 0.441*** |
| | (0.04) | (0.05) |
| *series=16* | 0.170* | 0.160* |
| | (0.08) | (0.08) |
| *series=17* | 0.077 | 0.042 |
| | (0.08) | (0.08) |
| *series=18* | 0.694*** | 0.663*** |
| | (0.07) | (0.07) |
| *amiibo_wave=1* | 0.000 | 0.000 |

| | | |
|---|---|---|
| | (.) | (.) |
| *amiibo_wave=2* | -0.085 | -0.081 |
| | (0.05) | (0.05) |
| *amiibo_wave=3* | -0.125* | -0.091 |
| | (0.06) | (0.06) |
| *amiibo_wave=4* | 0.104 | 0.111 |
| | (0.06) | (0.06) |
| *amiibo_wave=5* | -0.855*** | -0.827*** |
| | (0.10) | (0.10) |
| *amiibo_wave=6* | -0.395*** | -0.385*** |
| | (0.09) | (0.09) |
| *amiibo_wave=7* | -0.903*** | -0.885*** |
| | (0.08) | (0.07) |
| *amiibo_wave=9* | -1.324*** | -1.324** |
| | (0.38) | (0.42) |
| *amiibo_wave=10* | -1.179*** | -1.168*** |
| | (0.31) | (0.31) |
| *lpop # lart* | | 0.013* |
| | | (0.01) |
| *constant* | 3.615*** | 4.409*** |
| | (0.19) | (0.47) |
| *R-sqr* | 0.800 | 0.803 |
| *dfres* | 442 | 441 |
| *bic* | 231.6 | 231.9 |
| * p<0.05 | ** p<0.01 | ***p<0.001 |

* p<0.05, ** p<0.01, *** p<0.001

As mentioned in the paper, the series to which an Amiibo belongs as well as its release date seem to be extremely important in determining the initial resale value of the Amiibo, more so than popularity. So, it seems that the supply side of the Amiibo plays an impactful role in determining resale value initially.