

# Videogame Attributes as Alternative Investments

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## Abstract

We study financial returns on videogame attributes as alternative investments, using CS:GO skins as an example. Using an extensive dataset of monthly returns on 4,565 skins for 2013-2024, we find that these niche investments outperform most traditional and alternative assets with the average return about 40% pa and provide diversification benefits. The time-series analysis indicates independence of their returns from equity market risk factors, as well as other financial markets, however, the returns exhibit strong seasonality patterns with peaks observed in January and April. The cross-sectional analysis reveals that items from direct drops and of better quality sell for higher prices and generate higher returns, whereas the presence of premium features and higher rarity are associated with significantly higher prices, but lower average returns. We observe strong ‘penny stock effect’ that cheaper items yield higher percentage returns. Lower financial returns on expensive skins are likely compensated by the “emotional dividend” of gamers.

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# 1. Introduction

Diversification is of the utmost importance when it comes to protecting wealth. That is why high net worth individuals see alternative assets as a useful addition to their portfolios. Alternative investments can come in different forms: private equity, hedge funds, real estate, commodities, precious metal and stones, cryptocurrencies and NFTs, art and other collectibles. The latter are also called “emotional assets” or “hobby investments”. This paper investigated a relatively new class of “emotional assets” – videogame skins<sup>1</sup>, which have existed and been traded for a decade already, but which have never been studied from an investment perspective in the academic finance literature.

Using a unique dataset of prices of 4,565 CS:GO skins, traded on the secondary market during 2013-2024, we delve into determinants of skin prices and returns, their time-series and cross-sectional patterns, financial risk exposure and diversification potential. We find that the market portfolio of skins outperforms gold, real estate and equities with the average annualized return above 40%, modest volatility, Sharpe ratio of 0.34 and positive skewness.<sup>2</sup> The returns are not exposed to traditional financial markets (except a small but significantly negative exposure to Bitcoin) and equity risk factors, providing attractive diversification opportunities, but they exhibit strong seasonality patterns with peaks occurring in January and April.

Our cross-sectional analysis indicates that factory new skins generate higher returns than comparable battle-scarred ones, skins from direct drops are much more valuable than skins from cases, however availability of premium features (a StatTrack) does not increase the returns. Also, we do not find evidence that skin rarity is associated with higher returns, although it is associated with higher prices. On the contrary, we observe a penny stock effect that cheaper skins yield higher percentage returns than expensive ones, *ceteris paribus*. The same effect is observed in the cross-section by weapon type: the highest returns are observed on cheaper skins for less popular weapon types, such as machineguns (120% pa), shotguns (84% pa) and SMGs (69% pa), whereas returns on gloves, pistols and rifles, which are sought after and highly priced, are insignificantly different from zero.<sup>3</sup>

This study contributes to the strand of literature which explores returns and diversification potential of collectible assets. The most popular and traditional collectible asset – art – has been

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<sup>1</sup> A skin in a videogame represents the way how your character looks in the game (see figure 1 for examples).

<sup>2</sup> For comparison, the Sharpe ratios of traditional financial markets during the studied period are the following: CRSP – 0.25, REITS – 0.14, gold – 0.12, Bitcoin – 0.21.

<sup>3</sup> However, the lowest average return, observed on rifle skins (10% pa) is still comparable to the average return on CRSP (13.6% pa).

thoroughly researched for decades already (e.g. Goetzman, 1993; Pesando, 1993; Mei and Moses, 2002; Rennebood and Spaenjers, 2013, Dimson and Spaenjers, 2014). Other studied collectibles include precious metals and stones (Baur and Lucey, 2010; Renneboog and Spaenjers, 2012; Low et al., 2016), automobiles (Martin, 2016), postage stamps (Dimson and Spaenjers, 2011 and 2014), violins (Graddy and Margolis, 2014; Dimson and Spaenjers, 2014), fine wines (Kourtis et al., 2012; Lucey and Devine, 2015; Dimson et al., 2015), LEGOs (Dobrynskaya and Kishilova, 2022), Baseball cards (Ghazi and Schneider, 2023), Hot Wheel cars (Hunsander et al., 2025). These studies document that collectible assets generally outperform gold and bonds, but underperform equities. Their returns do not correlate with traditional financial market risk factors, providing diversification opportunities and sometimes possessing ‘safe haven’ properties. The high demand for collectible assets can also be explained by “emotional dividend”, which investors receive in addition to financial returns and which compensates for potential financial underperformance (Kleine et al., 2024).

Compared to the above studies, we find that videogame skins, in addition to the aesthetic utility, provide superior financial returns and Sharpe ratios, than in the equity market. Being digital assets, they fall into the broader category of digital alternative investments (cryptocurrencies, tokens, NFTs), which typically yield outrageous financial returns. Our paper contributes to the quickly growing literature, which analyzes determinants of returns on digital assets and their connectedness with traditional financial markets (e.g. Liu and Tsyvinski, 2021; Borri et al., 2022; Umar et al., 2022; Dobrynskaya and Dubrovskiy, 2023).

Similarly to NFTs, high videogame attributes’ returns may be affected by “keeping up with the Joneses” and “fear of missing out” psychological biases because gamers use skins for self-expression and standing out in internet communities. There are numerous instances of an item from an online game being sold for a record-breaking price. For instance, a CS:GO skin was sold for \$1 million in June 2024 (D’Anastasio, 2025), other skins from the same game were sold earlier in 2003 for \$500K (Bernardo, 2023a), \$210K (Bernardo, 2023b), \$150K (Taylor-Hill, 2023), \$160K (Li, 2023). Despite the attention of media, videogame attributes are overlooked in the academic finance literature.

Unlike NFTs, which are still at their early stages<sup>4</sup> and their returns may be driven by temporary hype, videogames have been around for decades. The earliest arcade games appeared in the 1950’s, then they started appearing on personal computers in the 1980’s, and have started

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<sup>4</sup> The first big NFT collections on Ethereum blockchain, CryptoPunks and CryptoKitties, appeared in 2017.

growing exponentially in quality and quantity since early 2000's due to computers appearing in every household and exponential growth in computing powers. Videogame skins have been actively traded on the secondary markets since early 2010's. Our analysis of videogame attributes' returns benefits from availability of more than 10-year history of data.

Our paper also contributes to the strand of literature, which explores the role of rarity for pricing of physical and digital collectibles. More rare items or features are associated with higher prices in secondary markets for coins (Dickie et al., 1994; Koford and Tschoegl, 1998), vinyl music records (Cameron and Sonnabend, 2020), LEGOs (Dobrynskaya and Kishilova, 2022), baseball cards (Ghazi and Schneider, 2023), Hot Wheel cars (Hunsander et al., 2025), video NFTs (Lee, 2022), generative art collections of NFTs (Mekacher et al., 2022; Bianchi and Dobrynskaya, 2023; Kong and Lin, 2023; Lommers and Baioumy, 2024; Lee et al, 2024). We also document, that rare or exclusive videogame skins are traded at significantly higher prices, however the percentage returns on them are lower compared to cheap common skins. For example, common consumer grade skins with the average price of \$2.25 generate the average return of 18.8% per month, whereas rare extraordinary and contraband skins with the average prices of \$771 and \$1719, respectively, generate the average returns of 2.9% and 2.7% per month, respectively.

This paper considers in-game attributes as alternative hobby investments. The literature that exists is mostly concerned with psychological aspects, how games affect human behavior (e.g. violence, addiction issues) or the legal side of it (gambling). We are aware of only one paper, Yamamoto and McArthur (2015), which provides a general overview of a CS:GO economy, describes ways how a trade can occur in the game, and concludes that the most important factors that influence skins' monetary values are supply and demand, as well as aesthetics. However, the paper is mostly descriptive, the authors do not explore the investment potential of these assets and do not provide any quantitative estimates.

The paper proceeds as follows. Section 2 is devoted to a brief overview of the gaming industry, while section 3 describes the CS:GO game, the in-game economy and motivates why it was chosen for the analysis. Section 4 presents the description of data and the main statistics. Section 5 reports the main empirical results, and section 6 concludes the paper.

## 2. Gaming industry

Among entertainment industries, the gaming industry is bigger than the movie and music industries combined, with the total revenue of \$282.3 billion in 2023 and the expected annual growth rate of 7.8% in 2025-2027 and no signs of slowing down (Statista, 2024).<sup>5</sup>

A part of that growth can be attributed to games becoming more widespread. Nowadays, games attract people from around the world, they are no longer exclusive to one specific age group, nationality or gender, and instead cater to everyone's interests. In 2023, there were 3.26 billion gamers, and that number is projected to grow to 3.8 billion by 2027. Clement (2024) estimates that 83.1% of all internet users around the globe play videogames. Surprisingly, videogames actively attract adult audience: 24% of gamers are 18 or younger, 36% are 18-34 years old, and 40% are 35 or older (Elad, 2022). 55% of players are male and 45% are female (Elad, 2022).

Interestingly, a large number of people enjoy watching someone playing a game rather than playing it by themselves. In 2019, 600 million people watched a "League of Legends" Championship on Twitch and YouTube. For comparison, the Super Bowl championship in arguably the most popular sport in the USA, football, attracts about 100 million viewers every year (Pei, 2019). This demonstrates how large the gaming community can be.

ESport has become another driver of popularity of gaming. ESport audience is projected to reach 640 million in 2025 (Newzoo, 2022).

The growth can also be attributed to the way games are distributed and purchased. Purchasing and obtaining a game has never been easier thanks to digitalization of distribution channels. Most people no longer buy physical copies of games, instead they use a faster and more convenient way of downloading them from digital stores. Digital sales are responsible for 95% of revenue in the videogame industry in 2023 (Newzoo, 2024). Moreover, gaming becomes more mobile rather than stationary. In 2023, mobile games accounted for 49% of total revenue, PC games - for 21%, console games - for 29%, and browser PC games - for 1% (Batchelor, 2023).

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<sup>5</sup> For comparison, the movie and music industries' revenues were \$28.6 and \$38 billion, respectively (Statista, 2024, <https://www.statista.com/outlook/dmo/digital-media/video-games/worldwide>).

### 3. Why CS:GO?

Numerous videogame companies have published millions of games. This paper focuses on game Counter-Strike: Global Offensive (CS:GO)<sup>6</sup> as a representative example of games with well-developed secondary markets for in-game attributes. CS:GO is a multiplayer first-person shooter game developed by Valve. The game has a 25-year history. It was launched in 1999 as a modification of Valve's another game and instantly became a hit. The reasons behind its tremendous popularity were simplicity of rules, low system requirements, the competitive nature and perfect fit for sports. It did not take long for colleges to host championships by organizing them over forums. Given the popularity of the game among hardcore gamers, it could be argued that CS:GO was at the start of the eSports movement.

Nowadays, CS:GO is one of the most popular online games in the world. According to a ranking by Statista (2024)<sup>7</sup>, CS:GO belongs to top 5 most played online games by monthly active users (MAU) and competes with giants such as Fortnite, Roblox, Minecraft and Call of Duty. The number of CS:GO concurrent players reached 1.5 million in 2024.<sup>8</sup> Counter Strike is also among the top 5 global eSports games with the largest cumulative prize pools in tournaments (Gough, 2024).

Most importantly, what distinguishes CS:GO is a huge in-game economy. Adding an in-game economy is beneficial for the long-term prospects of the game, it increases playtime, retention and attracts new players. Players can obtain different game attributes through multiple channels. They can receive random drops or case (chest) drops while playing the game. Alternatively, they have an option to go to a marketplace and purchase these items from other players. Counter Strike was the first game that allowed every item to be placed on the secondary market. And what makes Counter Strike unique is that Valve does not sell items directly to players, so the only way to obtain a particular attribute or skin is to buy it on the secondary market. The supply is created by players, who get random item drops and can list these items on the market for any price. The demand comes from players who decide what price they are willing to pay. The market is highly competitive, so the equilibrium prices are set fairly. This is in stark contrast to many modern games, where the only way to obtain items is

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<sup>6</sup> The game was updated to Counter-Strike 2 in September 2023.

<sup>7</sup> <https://www.statista.com/statistics/1227532/top-pc-games-monthly-active-users/>

<sup>8</sup> <https://www.statista.com/statistics/808630/csgo-number-players-steam/>

through direct purchase from developers, so there is no market economy and prices are set by developers and supply is unlimited.

Since CS:GO is a first-person shooter game where players can only see their hands and weapons, a CS:GO skin represents a variety of prints and features that can be applied to a weapon (figure 1). Several thousand skins are traded round the clock on the global secondary market on Steam. The market capitalization reached \$4.3 billion in March 2025 (D’Anastasio, 2025). A skin is traded 800 times a month, on average, and the monthly prices published by Steam represent the average prices of completed transactions during a month. Availability of such an extensive dataset of skin prices allows us to study the market for videogame attributes thoroughly, track their returns over time and analyze cross-sectional patterns.

Why do players buy skins? The main reason why players value these cosmetic items is for display of status. Counter Strike, being an online game, is like a social media platform, with large following, strong and devoted fan base. In real life, people show off by buying luxury goods, whereas gamers achieve the same goal by having rare, expensive skins on their weapons. Given the recent trend that online activities occupy more and more time in people’s lives, online attributes such as skins or NFTs gain popularity, attract demand from physical items and tend to generate high financial returns.

CS:GO in-game market has been growing for the past 10 years and is forecast to grow in the future. CS:GO is the most popular game of Valve and it is in Valve’s interest to expand the in-game economy and develop the secondary market. Despite the fact that Valve does not sell skins directly to players, the game is a significant source of Valve’s revenue, since when players get random case drops, they need to purchase keys from Valve to open the cases to collect new skins. For instance, 400 million cases were opened in 2023, which amounted to \$980 million in revenue to Valve. Moreover, Valve takes a fee of 17.25% from each transaction on Steam marketplace, which brings hundreds of millions dollars. Hence, it is Valve’s business to grow the community and stimulate the trading activity on the secondary market.

To summarize, Counter Strike: Global Offensive was chosen for the analysis of financial returns on videogame attributes because it is highly popular globally, it has a long history and a developed active in-game secondary market where players trade skins and set prices by themselves, which represent their valuations. Furthermore, an extensive dataset of skin historical prices is publicly available.

## 4. Data and descriptive statistics

The historical prices of CS:GO skins are collected from Steam marketplace. Steam was launched in 2003 and it was designed to provide automatic updates for Valve's games. It became a distribution platform for games of other developers in 2005. Currently, it is the most popular distribution platform for PC games in the world. In 2012, a Community Market was launched on Steam to allow players "to buy and sell in-game items with other players for Steam Wallet funds" (Steam, 2012). Nowadays, as of January 2025, Steam boasts 75% market share with over 132 million monthly active users<sup>9</sup>, there are 46 million items listed and the total yearly revenue of the platform hit \$10.8 billion in 2024 (Kumar, 2025). CS:GO is currently the most popular game on Steam, with a peak of 1,818,773 players (Kumar, 2025).

Skin trading is very active and frequent, a skin is traded 800 times a month, on average, while the most popular skins are traded 100 thousand times a month. So, the prices in the dataset represent the average prices of completed transactions for a respective skin during a month.

The initial sample of 370 901 observations includes prices in USD of all skins available in the game except gloves, equipment (Zeus x27), stickers and cases. The sample period covers the entire period of existence of the in-game market from August 2013 (Arms Deal Update, which added skins to the game) to May 2024 (130 months). Skins which were traded less than twice are excluded. The skin returns have been winsorized by excluding 0.005% of outliers. The final sample consists of 4,565 skins.

There are approximately one thousand original skins in the game, and each skin has multiple variants. There are 5 degrees of quality of skins (float), but we only consider the best (Factory New) and the worst (Battle-Scarred) conditions in order to estimate the premium that comes from different exterior condition of a skin. This premium is not obvious since in some cases a Battle-Scarred exterior can actually be more valuable than Factory New, as the color of a gun changes completely and is more sought after.

Skins of all 8 rarity tiers<sup>10</sup> are included in the sample. It is obvious that the rarest items like Extraordinary or Contraband will command the highest prices, but it is not obvious for

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<sup>9</sup> For comparison, two other popular among gaming traders websites, CS.MONEY and BUFF163, have only 4.5 million and 2.3 million monthly visits in December 2024, respectively (<https://www.similarweb.com/website/buff.163.com/vs/cs.money/#overview>).

<sup>10</sup> CS:GO rarity tiers are explained in Churick (2023).



returns since very cheap skins with low rarity (e.g. Consumer or Industrial grade) may yield higher percentage returns, making them interesting for hobby investors.

Other cross-sectional characteristics of skins such as the weapon type, availability of StatTrack (a monitor on a gun that counts the number of kills made with it) and whether a skin comes from a case or a direct drop, are also included in our database in order to explore their influence on skin returns. Figure 1 displays examples of skins with different features.

Table 1 reports descriptive statistics of skin prices and various characteristics of the distribution of the overall dataset as well as for sub-samples of skins with particular features. Skin prices range from 1 cent to almost \$4,000 with the average price of \$155.3, the median price of \$11.5 and significant positive skewness. Skin prices tend to grow over time, so the minimum values are generally observed when a skin started trading and the maximum prices are observed towards the end of the sample period. Factory New skins are more than twice as expensive as comparable Battle-Scarred ones. Average and maximum prices increase monotonically as the rarity grade increases, so rarity is highly priced in the skin market. Availability of a StatTrack increases skin prices by 20%, on average. Skins originally from direct drops are much more valuable (the average price is \$262.3) than skins from cases (the average price is \$30.6), probably due to the fact that it is more complicated to obtain a particular skin in the game and traders turn to the secondary market to buy the desired skin.

Because we take an investor perspective and consider videogame skins as potential assets for investment and diversification, the subsequent empirical analysis is conducted for skin monthly returns, rather than prices.<sup>11</sup>

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<sup>11</sup> The prices in our dataset do not take into account the transaction costs incurred on the Steam platform. Steam charges a fee of 15% from each transaction.

## 5. Returns in the skin market

### 5.1 Time-series patterns

Table 2 reports the descriptive statistics of skin market returns. We create an equally-weighted skin market index (i.e. a portfolio of all skins in the sample) and track its performance over time. The average skin market return is 3.42% per month (41% annualized) and highly statistically significant. The median return is a little lower (3.13%), and the return distribution is not significantly skewed. There is modest volatility, the market sometimes experiences negative returns (in 33% of the months, predominantly before 2016), but in most cases and in the recent years the returns are positive and high.

The second row of table 2 provides a more conservative estimate. We consider a subsample of observations in the middle of the distribution, which fall within  $[Q1-1.5IQR; Q3+1.5IQR]$  range. Hence, we exclude a great number of extreme observations, which are on the both sides of the distribution, particularly on the right-hand side. Nevertheless, the mean market return is 1.55% per month (18.6% annualized) and highly significant.

Figure 2 plots the performance of the skin market index over time. Performance of traditional asset markets (the US stock market (CRSP), real estate (REITs), gold and Bitcoin) are plotted for comparison.<sup>12</sup> All indices are normalized to 1 at the start of the sample period and transformed to decimal logarithms. The skin market remarkably outperforms equities, REITs and gold during the studied period except the first few months after the Community Market was launched on Steam. Surprisingly, the profitability of skins is comparable to that of Bitcoin, but the volatility is significantly lower. Therefore, game attributes appear to be an attractive alternative investment, particularly when a diversified portfolio of skins is considered.

Table 3 reports correlations between skin market returns and returns on the traditional asset markets. We also report CAPM-type beta coefficients of regressions of skin returns on these indices, as well as coefficients of Carhart (1997) model with four common equity market factors (MKT, SMB, HML, WML). All beta coefficients are statistically insignificant except a negative (although economically small) exposure to Bitcoin. The alpha of skin index returns is 3% per month and highly significant. Therefore, the skin market is isolated from traditional asset markets, and factors, which explain returns in the stock market, do not

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<sup>12</sup> Return data for equities, real estate, gold and Bitcoin are collected from K. French data library and the following websites: <https://www.reit.com>, [www.gold.org](http://www.gold.org), [www.coinmarketcap.com](http://www.coinmarketcap.com).

explain returns on videogame items. This implies that videogame attributes possess diversification potential and could be used to hedge traditional market risks, particularly cryptocurrency risk.

Skin returns are prone to strong seasonality, as illustrated on figure 3, which plots average market returns by month. The highest returns are systematically observed in January, April and August, which coincide with common vacation periods when players tend to be more active. Moreover, the biggest Steam game sales usually happen in December (Christmas sale), March (Easter sale) and July (summer sale), when new users are attracted to the game and subsequently boost prices on the skin secondary market. We also observe negative skin market returns in June and November – exactly before the biggest sales. It seems that the market freezes in anticipation of the sales and new updates. The return boost in January and April may also be related to the fact that children receive money as Christmas, New Year or Easter presents and actively spend it on videogame attributes. Given that the median skin price is only \$11.5, these assets are affordable to all types of gamers.

## 5.2 Cross-sectional patterns

To analyze cross-sectional patterns in skin returns, we form highly diversified equally-weighted portfolios of skins with similar characteristics. Hence, we capture systematic differences, which appear to be significant. Table 4 reports the descriptive statistics of portfolios of skins, formed on the basis of their quality, rarity, availability of StatTrack and origin. A few patterns can be noted.

Firstly, Factory New skins' returns (4.13% per month) are almost twice as high as Battle-Scarred (bad condition) skins' returns (2.53% per month), and the difference in the returns is statistically significant. The same pattern is observed for skin prices. Secondly, more rare skins are associated with significantly lower average returns (in fact, there is a U-shaped relationship). The most common (and the cheapest) skins which come from direct drops (Consumer grade and Industrial grade) generate the highest returns (18.76% and 5.54% per month, respectively), whereas the rarest skins (Covert, Extraordinary<sup>13</sup> and Contraband) generate moderate monthly returns of 2.57%-2.9% per month. Skins with medium rarity (Restricted and Classified grades) generate low and statistically insignificant returns. Apparently, rarity is associated with higher

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<sup>13</sup> All Extraordinary skins are gloves.

skin prices, but not higher percentage returns. Thirdly, skins with a StatTrack, although being more expensive and sought after by players, generate significantly lower returns (1.95% per month) than similar skins without a StatTrack (4.24% per month). Finally, the average returns on skins from direct drops (5.28% per month) are about 7.6 times as high as the returns on skins from cases (0.69% per month), the latter being statistically not different from zero. All differences across the portfolios of skins with different features are statistically significant.<sup>14</sup>

The result that rarer skins and skins with premium features (like a StatTrack) generate lower returns seems counterintuitive at first sight. We observe a strong “penny stock effect” that cheap skins tend to experience a relatively low increase in prices, which constitutes a high percentage returns, whereas prices of expensive skins increase by significant amounts, which constitute low returns as a percentage of the initial price. Therefore, the majority of skins are not considered as collectible items, for which rarity is associated not only with higher prices, but also with higher returns, as for NFTs (Mekacher et al., 2022; Bianchi and Dobrynskaya, 2023).

Skins on different weapon types are not equally attractive either. As table 5 demonstrates, the top performing weapon types are machineguns, shotguns and submachine guns (SMGs), their average returns are 10.03%, 6.97% and 5.73% per month, respectively. The worst performing weapon types are gloves, pistols and rifles with respective average returns of 2.90%, 1.89% and 0.84% per month. Knives and Sniper Rifles are in the middle of the range with moderate average returns of 3.07-4.45% per month, respectively. All portfolios of skins have significant volatility with monthly returns fluctuating from -49% up to 173%. Needless to say, that individual skin returns may be order of magnitude higher (or lower).

The average returns on different weapon types are inversely related to the demand for them and, hence, their prices. All weapons have different characteristics in terms of damage, range, recoil patterns, magazine size, etc. For example, SMGs create small damage, whereas shotguns lack range. Hence, they are usually avoided, their prices are relatively low, but the returns are the highest. On the contrary, rifles like AK-47, M4A4, and sniper rifle like AWP are the most used weapons, since they create the most damage and have the best qualities. Therefore, they are more expensive, but, apparently, generate lower returns. We again observe the same effect that expensive items tend to yield lower percentage returns, which are likely compensated by greater consumption utility, “the emotional dividend”, of gamers.

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<sup>14</sup> These cross-sectional patterns in skin returns are not due to outliers since the same patterns are observed in the sub-sample restricted by the inter-quartile range [Q1-1.5IQR; Q3+1.5IQR] (the results are available upon request).

## 6. Conclusion

Since the rapid development and adoption of digital technologies, a new class of digital assets has appeared, for example NFTs, cryptocurrencies and tokens. These assets generate financial returns, like financial securities, and emotional utility, like physical collectibles, which can be derived from aesthetics and scarcity. At the same time, their virtual nature presents unique advantages. There are no storage costs associated with digital items, they are harder to steal, they generally cannot damage their condition. It is easy, fast and convenient to trade them, transaction costs are lower, hence, transactions are more frequent, and their markets are rather liquid. Due to these characteristics, digital assets have secured sizable portions in portfolios of high-net-worth individuals.

This paper sheds light on financial performance of a previously unexplored type of digital assets - videogame attributes, using CS:GO skins as an example. Our time-series analysis showed that average returns on videogame assets are significant and not susceptible to financial markets fluctuations. Thus, these assets can offer diversification benefits due to their independence from traditional markets. Our cross-sectional analysis revealed that the main factors, which influence prices and returns on the skin market are exterior condition, rarity, StatTrack feature and whether a skin comes from a case or a direct drop. We observe a general pattern that more rare skins or skins with premium features command higher prices, but generate lower percentage returns. The lower financial returns are, perhaps, compensated by greater emotional utility of gamers.

This paper provides evidence that in-game attributes not only yield investors high financial returns (41% per annum, on average) in addition to their emotional dividend, but also protect them from traditional market risks. Although Steam is the safest and most common marketplace for skins, professional traders who make high value purchases choose to do transactions on third-party websites due to lower transaction costs and ability to withdraw funds, which is unavailable in Steam. Therefore, our data do not include the highest skin prices, which have been observed on other platforms. Hence, our analysis is rather conservative, and potential skin returns may be even higher.

### 6.1 Directions for further research

Not all information and intricate details known to skin trading enthusiasts are explored in this research. Different skin patterns are treated as identical in this paper, however some patterns

can cause prices to reach enormous values. For example, Blue Gem pattern of a knife skin is very rare and highly priced. There is a list of such rare patterns, and while it is obvious that they are highly priced, it is not obvious whether they generate high returns to owners.

Skins are not the only type of assets in the game. There are cases that can be sold or bought, so there is a whole other market for cases. There are also stickers, which come from sticker capsules. A total of four stickers can be applied on a weapon in predetermined places, and some of them are so rare that they can add 10-15% to a weapon's price. A recent update of the game enabled players to rotate stickers and put them in any place on a gun. This extra freedom given to players caused a tremendous spike in sticker prices, which is worth studying.

There are tournaments in the game, where professional players implicitly advertise particular skins they are using, thus boosting the demand. One could measure the effect that tournaments have on prices and returns on skins.

So, this paper lays ground for further research, which can either broaden this topic or dive deeper into peculiarities of videogame attributes' markets.

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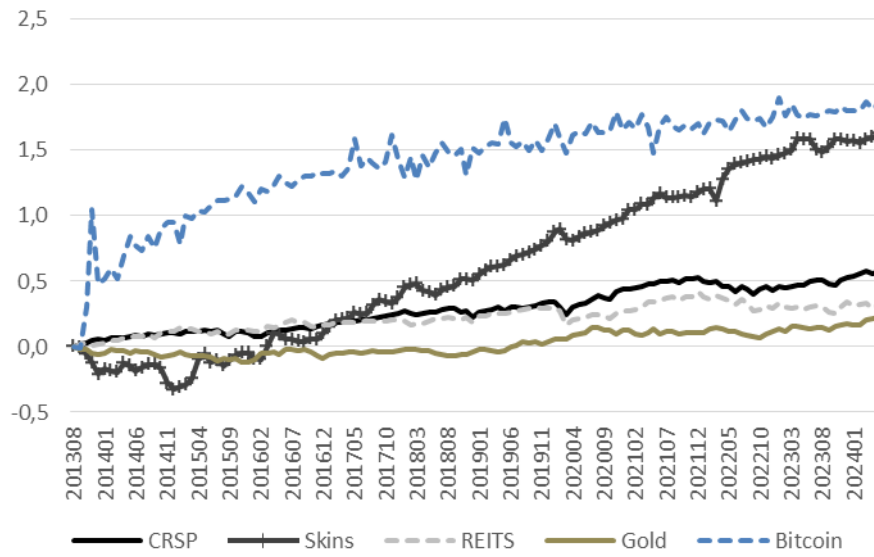
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**Figure 1. Examples of CS:GO skins**



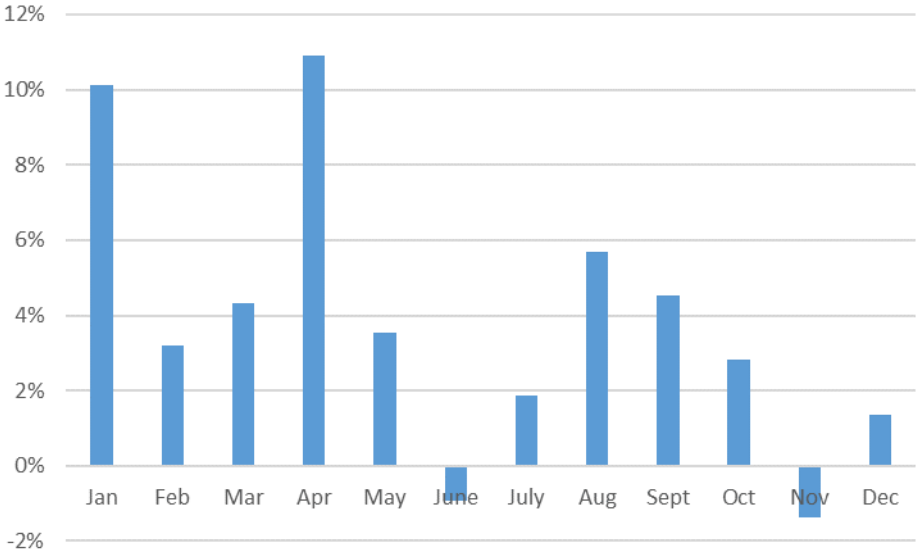
The figure presents examples of CG:GO skins from top to bottom:  
gun without a stat track, gun with a stat track, knives.

**Figure 2. Performance of videogame skin market and traditional financial markets**



The figure plots decimal logarithmic indices of returns on CS:GO skins, stocks (CRSP), REITs, gold and Bitcoin.  
Sample period: August 2013 – May 2024.

**Figure 3. Seasonality in skin returns**



The figure plots average monthly skin market returns in each month of a year.

**Table 1. Descriptive statistics of skin prices**

|                  | <b>Mean</b> | <b>Median</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Standard deviation</b> | <b>Skew</b> | <b>Number of skins</b> |
|------------------|-------------|---------------|----------------|----------------|---------------------------|-------------|------------------------|
| All prices       | 155.33      | 11.46         | 0.01           | 3904.73        | 331.02                    | 3.90        | 4565                   |
| <b>Quality</b>   |             |               |                |                |                           |             |                        |
| Factory New      | 216.47      | 20.12         | 0.01           | 3904.73        | 412.07                    | 3.85        | 2429                   |
| Battle-Scarred   | 83.83       | 5.06          | 0.01           | 3073.40        | 172.25                    | 4.82        | 2136                   |
| <b>Rarity</b>    |             |               |                |                |                           |             |                        |
| Consumer Grade   | 2.25        | 0.39          | 0.01           | 160.82         | 5.79                      | 7.10        | 290                    |
| Industrial Grade | 7.78        | 1.43          | 0.03           | 536.53         | 18.84                     | 6.75        | 242                    |
| Mil-Spec Grade   | 8.62        | 1.06          | 0.04           | 1080.51        | 34.56                     | 10.15       | 1111                   |
| Restricted       | 23.52       | 4.06          | 0.10           | 2051.60        | 81.18                     | 9.69        | 784                    |
| Classified       | 72.93       | 17.15         | 0.62           | 2852.23        | 201.17                    | 6.49        | 470                    |
| Covert           | 357.26      | 223.88        | 0.01           | 3904.73        | 395.72                    | 2.66        | 1523                   |
| Extraordinary    | 771.23      | 446.93        | 32.48          | 3105.57        | 738.59                    | 1.10        | 143                    |
| Contraband       | 1718.84     | 2018.45       | 185.21         | 3046.08        | 862.21                    | -0.39       | 2                      |
| <b>StatTrack</b> |             |               |                |                |                           |             |                        |
| Unavailable      | 144.88      | 6.70          | 0.01           | 3904.73        | 342.84                    | 4.11        | 2868                   |
| Available        | 173.36      | 31.38         | 0.01           | 3073.40        | 308.73                    | 3.41        | 1697                   |
| <b>Origin</b>    |             |               |                |                |                           |             |                        |
| Direct drop      | 262.28      | 125.93        | 0.01           | 3904.73        | 408.76                    | 2.93        | 2366                   |
| Case             | 30.60       | 3.26          | 0.04           | 2860.10        | 116.67                    | 9.98        | 2199                   |

The table reports the descriptive statistics of average prices (in USD) in sub-samples of skins by different features. Skins grouped by rarity are listed from most common (top) to most rare (bottom).

**Table 2. Average returns in the videogame skin market**

|                          | <b>Mean</b> | <b>Median</b> | <b>Standard<br/>deviation</b> | <b>Minimum</b> | <b>Maximum</b> |
|--------------------------|-------------|---------------|-------------------------------|----------------|----------------|
| Skin market              | 3.42***     | 3.13          | 10.00                         | -22.36         | 46.77          |
| Skin market<br>(1.5*IQR) | 1.55***     | 1.23          | 2.63                          | -5.53          | 9.23           |

The table reports the descriptive statistics of returns on an equally-weighted portfolio of all skins of CS:GO. All returns are expressed in percent per month. The \*\*\* denotes statistical significance at 0.01% confidence level.

**Table 3. Exposure of videogame skin market portfolio to other financial markets**

|                 | <b>Panel A</b> | <b>Panel B</b>        |                  |                |                  |                  | <b>Panel C</b>           |                  |
|-----------------|----------------|-----------------------|------------------|----------------|------------------|------------------|--------------------------|------------------|
|                 | <b>Corr</b>    | <b>Equity<br/>mkt</b> | <b>REITs</b>     | <b>Gold</b>    | <b>Bitcoin</b>   | <b>4 factors</b> | <b>Carhart<br/>model</b> |                  |
| Mkt beta        | -0.04          | -0.09<br>[-0.34]      |                  |                |                  | -0.03<br>[-0.08] | Mkt beta                 | -0.10<br>[-0.39] |
| REITs beta      | -0.02          |                       | -0.03<br>[-0.15] |                |                  | -0.01<br>[-0.03] | SMB beta                 | -0.57<br>[-1.58] |
| Gold beta       | 0.03           |                       |                  | 0.08<br>[0.45] |                  | 0.06<br>[0.34]   | HMLbeta                  | 0.37<br>[1.35]   |
| Bitcoin<br>beta | -0.14          |                       |                  |                | -0.03<br>[-2.87] | -0.03<br>[-2.72] | WML beta                 | -0.32<br>[-1.21] |
| Intercept       |                | 0.03<br>[3.67]        | 0.03<br>[3.73]   | 0.03<br>[3.71] | 0.04<br>[4.17]   | 0.04<br>[3.75]   | Intercept                | 0.03<br>[3.66]   |
| R <sup>2</sup>  |                | 0.00                  | 0.00             | 0.00           | 0.02             | 0.02             | R <sup>2</sup>           | 0.06             |

The table reports correlations (panel A), estimates (betas) of multi-factor time-series regressions of videogame market excess returns on various financial indices (panel B) and Carhart (1997) equity market risk factors (panel C). Newey-West t-statistics are reported in brackets.



**Table 4. Returns by quality, rarity, availability of StatTrack and origin**

|                  | Mean    | Median | Standard deviation | Minimum | Maximum |
|------------------|---------|--------|--------------------|---------|---------|
| <b>Quality</b>   |         |        |                    |         |         |
| Factory New      | 4.13**  | 3.64   | 10.79              | -21.93  | 46.18   |
| Battle-Scarred   | 2.53**  | 1.90   | 9.86               | -22.93  | 47.44   |
| Difference       | 1.66**  |        |                    |         |         |
| <b>Rarity</b>    |         |        |                    |         |         |
| Consumer Grade   | 18.76** | 16.30  | 24.54              | -57.21  | 126.29  |
| Industrial Grade | 5.54**  | 4.85   | 15.23              | -37.17  | 58.85   |
| Mil-Spec Grade   | 3.27**  | 3.78   | 13.10              | -35.67  | 59.10   |
| Restricted       | 0.71    | -0.35  | 11.11              | -23.05  | 57.64   |
| Classified       | -0.46   | -0.95  | 9.64               | -24.35  | 44.22   |
| Covert           | 2.57**  | 0.55   | 12.36              | -22.52  | 92.01   |
| Extraordinary    | 2.90    | 0.64   | 19.72              | -22.83  | 173.02  |
| Contraband       | 2.69*   | 0.41   | 16.24              | -25.42  | 107.20  |
| Difference       | 16.07** |        |                    |         |         |
| <b>StatTrack</b> |         |        |                    |         |         |
| Unavailable      | 4.24**  | 4.09   | 10.81              | -24.89  | 49.02   |
| Available        | 1.95**  | 1.38   | 9.83               | -24.42  | 42.93   |
| Difference       | 2.29**  |        |                    |         |         |
| <b>Origin</b>    |         |        |                    |         |         |
| Direct drop      | 5.28**  | 4.47   | 10.22              | -21.56  | 50.27   |
| Case             | 0.69    | 0.25   | 11.50              | -30.48  | 54.82   |
| Difference       | 4.59**  |        |                    |         |         |

The table reports the descriptive statistics of returns on sub-samples of skins by different features. Skins grouped by rarity are listed from most common (top) to most rare (bottom). All returns are expressed in percent per month. The \* and \*\* denote statistical significance at 10% and 5% confidence levels, respectively.

**Table 5. Returns by weapon type**

| <b>Weapon type</b> | <b>Mean</b> | <b>Median</b> | <b>Standard deviation</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Number of skins</b> |
|--------------------|-------------|---------------|---------------------------|----------------|----------------|------------------------|
| Machinegun         | 10.03**     | 5.89          | 27.12                     | -49.31         | 130.02         | 115                    |
| Shotgun            | 6.97**      | 6.15          | 15.26                     | -45.74         | 81.90          | 365                    |
| SMG                | 5.73**      | 5.68          | 14.73                     | -38.04         | 79.52          | 663                    |
| Sniper Rifle       | 4.45**      | 4.40          | 14.84                     | -40.40         | 74.51          | 337                    |
| Knife              | 3.07**      | 0.79          | 13.02                     | -22.39         | 101.60         | 1224                   |
| Gloves             | 2.90        | 0.64          | 19.72                     | -22.83         | 173.02         | 143                    |
| Pistol             | 1.89*       | 2.04          | 11.79                     | -35.95         | 47.76          | 974                    |
| Rifle              | 0.84        | 0.36          | 11.10                     | -25.95         | 47.57          | 740                    |

The table reports the descriptive statistics of returns on 8 broad weapon types sorted by the average returns in descending order. All returns are expressed in percent per month. The \* and \*\* denote statistical significance at 10% and 5% confidence levels, respectively.