The Performance of Private Video Game Equity

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Abstract

I use deal-level data from StepStone to perform the first ever analysis of private video game investment using 510 private video game investment deals, most of which come in the form of venture capital. Using these deals, I analyze private video game companies as a source of value accretion and as investment opportunities. Video game companies that receive private equity investment generally outgrow public markets, software private equity, entertainment private equity, and general private equity deals in their multiples and home run rates. Simulated video game funds demonstrate that at the fund level, private video game funds are attractive investments in terms of absolute return, relative to the public market, and relative to similar private investments, both in multiples and rates of return. A novel public video game equities index demonstrates that private video game investment substantially outperforms public video game investment, and public video game investment is generally unimpressive relative to the public equity market and especially relative to public software equities, albeit with relatively little risk factor exposure.

1 Introduction

Video game developers typically receive funding from publishers who take a share of revenue for a given project. These publishers further provide developers with additional services like marketing and distribution, and their terms usually involve some control over the development trajectory of the project, including on creative issues and even to the point of owning the intellectual property rights of a game (Ottarsson, 2021). Technological changes such as digital market places, digital advertising networks, and low-cost or even free development tools have made the revenue sharing model less appealing over time for developers since many of the tasks once specialized to publishers have been democratized (Afanasiev, 2024). Private investment on the other hand can provide funding through equity—that is, at the company level—and private equity firms typically

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leave creative control and intellectual property in the hands of the developers, emphasizing their own expertise in business management and not in creative matters or in the development process. To a large extent, the choice between publisher funding or private equity funding is the choice between project control or business control.

Highly successful games like Doom, Counter-Strike, Minecraft, and League of Legends began as small start-ups. Even within the typical developer-publisher relationship, publishers sometimes need access to capital to fund their range of projects, and private equity—especially venture capital, given its preference for larger portfolios to offset the riskiness of individual holdings—is an option (Limpach, 2020). But private video game investment remains the minority. One insider has submitted that the gaming industry, fundamentally a fusion of creative and technical endeavour, is unique to the point where the traditional investment community at large doesn't understand its idiosyncrasies, thereby rendering it too foreign to navigate given the risk and capital sums involved (Sinclair, 2018).

Even though the involvement of private equity in video games has generally been trending upward, the value accretion and performance of private video game investment are largely unstudied. This paper provides the first rigorous analysis of private video game investment, both of developers and publishers, from the perspective of both value accretion and investor returns. Studies on the economics of video games have focused on innovation and value creation from a conceptual point of view (Marchand and Hennig-Thurau, 2013; Davidovici-Nora, 2013), revenue drivers (Cox, 2014), industrial organization (Shankar and Bayus, 2003; Derdenger, 2014; Gil and Warzynski, 2015), geographical clustering (Johns, 2006; De Vaan et al., 2013; Pilon and Tremblay, 2013; Hanzawa and Yamamoto, 2017; Gandia and Gardet, 2019), decision-making (Toh, 2021), and labor (Pottie-Sherman and Lynch, 2019). But rigorous academic analysis of the financing of video game companies and results thereof, whether public or private, is scarce, despite the fact that revenue in the video game industry has come to exceed that of the movie and music industries combined (Arora, 2023). The majority of academic research on video game funding focuses on crowdfunding (Smith, 2015; José Planells, 2017; Cha, 2017; Lolli, 2019; Aygoren and Koch, 2021). The only academic study this author could find involving private finance analyzes which eSports companies were likely to receive funding from venture capitalists (Niculaescu et al., 2023). Some industry analysis of private equity in video games has been produced, for example by Pitchbook

(Bellomo and Mei, 2024) and S&P (2024), but these focus on size and number of investments rather than the performance of private equity in video games, or how video game investments might fit into a portfolio.

This paper seeks to fill that gap. In doing so, I ask two primary questions. First, how well do video game companies that receive private equity investment accrete value? Second, how do private equity video game investments perform for investors?

A major (and essential, really) advantage of using deal-level data is the isolation: most private funds that invest in video game companies also invest in other non-video game companies, but deal-level data can be filtered to include only video game companies. Another advantage is that the performance of deal-level data does not include fees charged by general partners, which makes deal-level performance a good measurement of company value accretion. On the other hand, it is also important to consider management fees and carried interest to measure performance from an investor point of view. Deal-level data also exhibits more variable and more extreme performance metrics than what would likely be in a fund because good and bad performance can somewhat balance out in a more diversified fund portfolio. It is also not as easy to contextualize deal-level performance since private investment performance is typically reported from the fund level. Accordingly, I also construct simulated funds using deals in order to generate analysis from a pseudo-fund level.

The paper is ordered as follows. In section 2, I use deal-level data from StepStone to describe private video game investments by asset class, region, and by game type. In section 3, the value accretion of these video game companies is captured using multiple of invested capital (MOIC) and the Kaplan and Schoar (2005) public market equivalent (PME), the latter which adjusts the MOIC by a public market index to measure whether the value accretion of the private company exceeded the concurrent value accretion of that public index.[1] Section 4 analyzes simulated "synthetic" funds of deals that include management fees and carried interest, and compares the results against non-video game synthetic funds to see how private video game deals compare against other private investments for investors. Section 5 compares video game private equity to a se-

[1] Like Braun et al. (2017), I do not consider internal rate of return (IRR) at the deal level because "IRRs are questionable as a performance measure, and extreme positive values can occur, resulting in a highly skewed distribution." That said, IRR (and two additional flavors thereof) are considered in the fund-level simulations of section 4 where simulated cash flows can be pooled.

ries of more targeted public markets, namely a novel public video game index, an entertainment public index, and a software public index. Section 6 concludes.

2 Data and Summary Statistics

2.1 Data and Categorization

The novel data in this paper consists of deal-level private video game investment deals provided by StepStone. StepStone data is categorized by GICS sector, and video games fall within the Interactive Home Entertainment sub-industry of the Communication Services industry. I focus specifically on video game developers and publishers (as opposed to video game related services like retailers and streaming platforms). The data set contains 510 deals. When considering value accretion and performance metrics, only deals of at least 3 years of age as of writing will be considered in order to minimize the impact of premature evaluation, unless those deals have been fully exited (unless otherwise noted), which leaves MOIC for 407 deals.

I classify game companies into casual/mobile games, core games, blockchain games, virtual reality games, education games, and unknown, largely following Kuittinen et al. (2007). Casual games have properties like ”generally appealing content, simple controls, easy-to-learn gameplay, fast rewards, or support for short play sessions.” By contrast, core games are more likely to have content with less mass appeal, more complex controls, more challenging gameplay with a steeper learning curve, slower buildups, and longer play times; that is, games that require a greater investment from the player. Mobile games almost invariable satisfy the criteria of a casual game.[2]

Blockchain games use blockchain technology such as cryptocurrencies and non-fungible tokens for monetization. For example, use of non-fungible tokens (NTFs) can allow for the creation of secured, unique digital in-game items that cannot be duplicated and whose ownership can be verified. This can prevent asset inflation in online communities (see Castronova (2008) for a discussion of inflation in video game currency), can prevent counterfeiting of rare digital items, and crypto marketplaces allow for digital items to be sold and traded for real world currencies (Chainalysis, 2023). The potential for crypto-based in-game currency to experience value accre-

[2]Some core games are ported to mobile, but typically require significant changes, especially to simplify the controls for phone or tablet, and nonetheless are still found on ”core” systems like consoles and PC.

tion seen in other cryptocurrencies is surely an appealing prospect as well. In other words, the use of crypto technology can ensure the integrity of a digital economy in such a way that makes the value, and therefore the stakes, of in-game items more salient and immersive.

Virtual reality (VR) games utilize virtual reality headsets. Although commercial VR headsets date back to the 1990s, the first modern VR headset was the Oculus Rift in 2012, soon purchased by Facebook, since followed by several new Oculus iterations, the HTC Vive in 2016, the Pico Neo 3 in 2021 (since purchased by ByteDawns, owners of TikTok), the Apple Vision Pro in 2023, among others (Barnard, 2024). By 2019, the number of VR headsets reported on Steam had surpassed 1 million, and the game Beat Saber became the first VR application to sell over one million copies in a year (Barnard, 2024).

Education games are either instructive or learning games. They can be aimed at children, students, employees, or even recreationally. For example, the Rocksmith series of games uses a real guitar or bass guitar hooked up via USB cable instead of a specialized instrument-shaped controller like in Guitar Hero or Rock Band, allowing for the development of a skill that transfers beyond the game itself.

The bulk of the sample lies with casual/mobile games and core game. Games are categorized as such both because the target audiences different but the development process is also quite different. For example, Kapalo et al. (2015) look at the difference between casual and core gamers and find that 8% of female gamers are core gamers versus 92% core gamers. On the other hand, they find that 37% of male gamers are casual gamers versus 63% core gamers. The difference is largely punctuated by time played, where male gamers on average play games almost twice as many days in a week (2.72 versus 5.02), and over an hour more on average in a typical day (2.17 versus 3.24). On the development side, core games—especially AAA games—can spend several years in development before the value of a game (or lack thereof) becomes evident. As one insider put it, ”In games it is extremely easy to spend $10 million and have nothing. It is extremely easy to spend $10 million and have a game that people do not want” (Boesky et al., 2010). Developing mobile and casual games however has a much shorter time frame and does not require such a large team, making it a potentially less risky investment and one more in line with typical private equity and venture capital workflows.

2.2 Statistics

The breakdown of the data set by investment size, game type, region, and asset class are shown in Table 1. The bulk of this paper focuses on casual/mobile gaming with 357 deals amounting to 4.6 billion USD invested. The data also includes 71 core game deals amounting to 3.5 billion USD invested, with 39 blockchain game deals with 360 million USD invested, 21 virtual reality deals with 121 million USD invested, and 20 education deals with 82 million USD invested; 2 deals are of unknown classification with 12 million USD invested. The majority of deals are under $10 million USD (the median is 4.1 million USD) with 18 deals in excess of 100 million USD. Unsurprisingly, core games receive the largest investments both in mean (201.5 million USD) and median (16.6 million USD).

The 347 venture capital deals are the majority of deals in the sample with a combined 2.7 billion USD invested, but the 41 buyout deals have a larger total investment with a combined 3.9 billion USD. There are also 34 growth equity deals worth 1 billion USD invested, 30 other deals (corporate, special situations, or non-classifiable) with 466 million USD, and 58 unknown deal types with 559 million USD. The majority of investment takes place in North American companies with 301 deals and 5.3 billion USD, with Europe the second most active region with 113 deals and 1.6 billion USD, Asia-Australia the third most active with 72 deals and 1.3 billion USD, the Middle East with 19 deals worth 443 million USD, and Latin America with a 5 deals for 11 million USD.

TABLE 1: GAME DEALS BY SIZE, REGION, AND ASSET CLASS

	Casual/Mobile	**Core**	**Blockchain**	**Virtual Reality**	**Education**
Total Deals Count	357	71	39	21	20
Total Deals Size	4648.1	3478.3	359.9	121.4	82.4
Mean Deal Size	13.0	49.0	9.2	5.8	4.1
Median Deal Size	6.1	9.2	4.0	5.2	2.0
	Venture Capital	**Buyout**	**Growth Equity**	**Other**	**Unknown**
Total Deals Count	347	41	34	30	58
Total Deals Size	2744.0	3925.8	1007.6	465.5	559.4
	North America	**Europe**	**Asia Australia**	**Middle East**	**Latin America**
Total Deals Count	301	113	72	19	5
Total Deals Size	5334.8	1636.5	1277.1	443.0	10.8

Deal sizes are in millions USD.

Figure 1 shows the number of deals and size of deals over time for each type of gaming deal by entry date; note that data for 2023 is incomplete as of writing, although other data indicates the funding decline in 2023 was in fact quite large (S&P, 2024). Most deals are typically casual/mobile deals, and casual/mobile deals usually constitute the most invested as well, albeit with extreme exceptions in 2017 and 2018 when the size of core deals dominates. In fact, the 17 core deals in 2007, 2017, 2018, and 2022—amounting to 3.3% of the sample in fund number—together constitute 2.1 billion USD of investment—amounting to 24% of the 8.7 billion of total investment found in the entire sample. The amount of private capital channeling into video game companies does appear to be growing over time, albeit with sizeable fluctuations along the way.

DEAL NUMBER AND SIZE OVER TIME BY TYPE AND ENTRY DATE

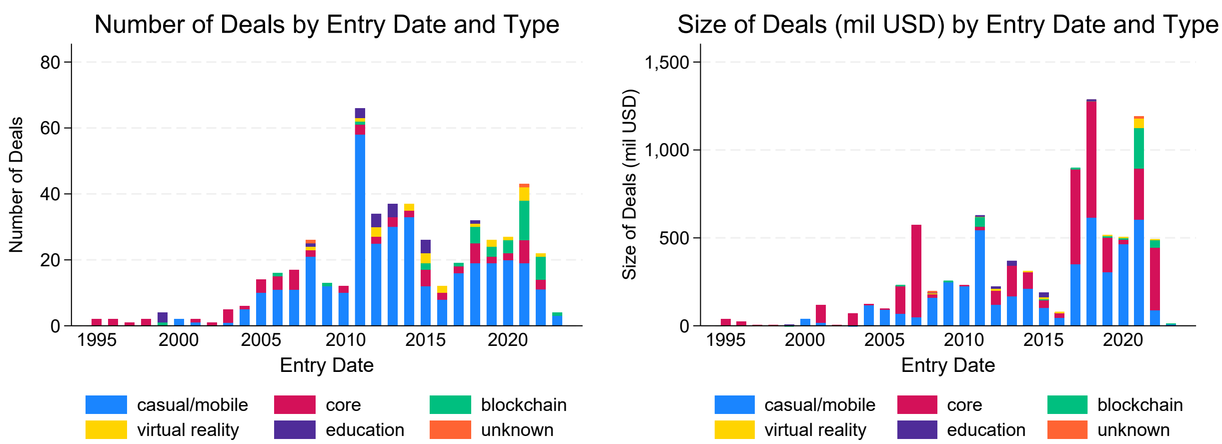

FIGURE 1: This figure shows the change over time of the number of deals and the size of deals in millions USD by entry date for each type of gaming deal in the sample, ranging from 1995 through 2020. Source: StepStone.

3 Company Value Accretion Statistics

Detailed summary statistics for the value accretion and investment size of all deals, casual/mobile deals, and core deals are shown in Table 3, including the number of observations, mean value accretion metrics, standard deviation, and quantiles. For perspective, venture capital, buyout, and growth equity deals with investment sizes of no greater then 750 million USD are also shown, as well as the performance of software and entertainment deals (since video games are a form of entertainment software, more or less).

The region weights of private equity video game companies, software companies, and entertainment companies are shown in Table 2. Overall the differences aren't enormous. North

America constitutes the majority of investment in each sector with 58% on the low end for entertainment and 74% on the high end for software with video games in between with 61%. The smaller share of North American investment in entertainment is mostly accounted for by higher European investment in entertainment, specifically 19% software compared to 27% entertainment. Likewise the smaller share of North American investment in video games is mostly explained by higher Asia-Australia investment in video games, specifically 5% software compared to 15% video games. The Middle East has 6% weight in video games, compared to about 1% for software and entertainment.

TABLE 2: VIDEO GAME, SOFTWARE, AND ENTERTAINMENT PRIVATE EQUITY DISTRIBUTION BY REGION

	North America	**Europe**	**Asia-Australia**	**Middle East**
Video Games	61%	19%	15%	5%
Software	74%	19%	5%	1%
Entertainment	58%	27%	12%	1%

Weights determined by investment size USD. Only regions with more than 1% shown.

The metrics of focus in this section are the multiple on invested capital (MOIC), and the public market equivalent (PME) of Kaplan and Schoar (2005), the latter which adjusts the MOIC by a public market index, in this case the Fama-French developed market return (Fama and French, 2023). Note that these value accretion metrics are gross measurements: they are based on reported investment amounts and valuations, but do not include the fees a limited partner would incur. (The effect of fees will be considered in section 4 when doing fund-level simulations.)

When calculating the PME of a private fund, one typically needs full cash flows so that each stage can be discounted appropriately. But the cash flows at the deal level are much simpler (roughly speaking: invest, grow, sell), so discounting the invested capital and the exit/latest valuation are likely close approximations to full cash flows. In the event that a true cash flow is more complicated and has some realization before the last reported valuation, the earlier realization will be discounted at the same (and typically higher) rate as the final reported valuation, suggesting that this measure of PME has a downward bias to some extent.

Both gross MOIC and gross PME have been winsorized at the 99.9th percentile of the full (under 750 million USD) sample. The histogram of the first 95% of data for each metric for the full sample is shown in Figure 2; the top 10% of omitted due to large outliers severely skewing the histograms. Note the large concentration of failed deals with multiples near zero, reflecting the reality that a gaming company can go totally bust with non-negligible frequency. That said, the majority of deals do produce positive value with MOICs above one. Also note the large right tails: 25% of gross MOICs exceed 3.00x and for gross PMEs, 1.66x.

VALUE ACCRETION DISTRIBUTIONS: ALL DEALS

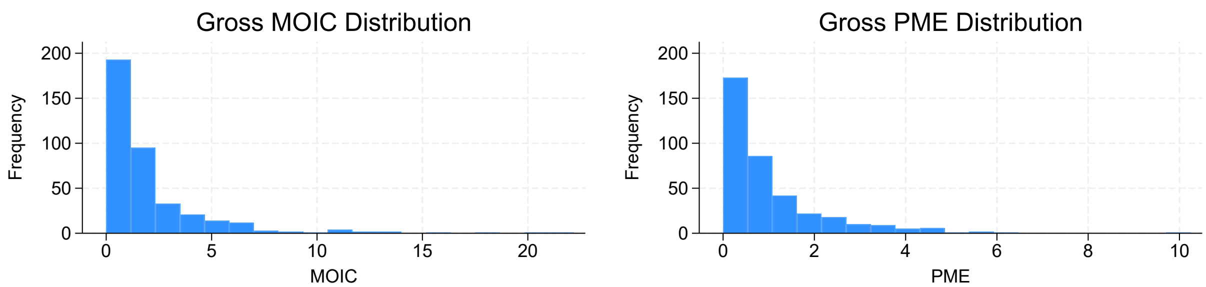

FIGURE 2: This figure shows histograms for the first 95 percent of data for gross MOIC and gross PME. The top 5 percent was omitted due to large outliers as shown in Table 3. Source: StepStone.

I use two ways of summarizing value accretion. The first way of summarizing value accretion has a company-level perspective: if I choose a random private company receiving investment, how much value accretion would I expect it to exhibit? This is answered by looking at the ordinary (i.e. unweighted) mean. Mean casual/mobile gross MOIC and gross PME are respectively 4.0x and 2.8x versus 4.5x and 3.2x for core, and median casual/mobile gross MOIC and gross PME are respectively 1.2x and 0.6x versus 1.6x and 1.0x for core. It is not surprising that the presence of a large right-tail would skew the means above the medians, nor is it inconsistent with the goal of most video game investment, namely, looking for ”home run” deals instead of the median deal. That said, it is still worth noting that the typical (i.e. median) casual/mobile deal has a PME of less than 1, suggesting poor typical value accretion relative to the public market.

The second way of summarizing value accretion has a market-level perspective: what is the value accretion of private video game portfolio companies overall? This is answered by weighting value accretion metrics by size, in this case by investment size in USD, as if considering the returns on an index.

TABLE 3: GAME DEAL SUMMARY STATISTICS: ALL, CASUAL/MOBILE, AND CORE

	N	Wgt $\bar{X}$	$\bar{X}$	SD	Min	5th	25th	50th	75th	95th	Max
All Deals											
Gross MOIC	407	3.60	4.17	10.9	0.0	0.0	0.1	1.2	3.0	23.4	93.0
Gross PME	407	1.93	2.83	9.5	0.0	0.0	0.0	0.7	1.7	11.3	85.5
Investment Size	510		17.1	48.0	0.0	0.1	1.0	4.1	12.2	75.0	538.3
Casual/Mobile											
Gross MOIC	296	3.54	3.99	11.5	0.0	0.0	0.0	1.2	2.6	20.0	93.0
Gross PME	296	2.06	2.75	10.3	0.0	0.0	0.0	0.6	1.5	10.2	85.5
Investment Size	357		13.0	28.5	0.0	0.1	1.0	4.0	12.0	50.0	248.0
Core											
Gross MOIC	59	3.76	4.51	8.9	0.0	0.0	0.6	1.6	3.8	32.8	47.8
Gross PME	59	1.80	3.23	8.1	0.0	0.0	0.3	1.0	2.2	17.1	54.5
Investment Size	71		49.0	105.4	0.2	0.4	2.4	9.2	43.7	353.5	538.3
Software											
Gross MOIC	15732	2.91	3.10	7.8	0.0	0.0	0.7	1.4	3.0	9.9	159.6
Gross PME	15732	1.60	1.85	5.2	0.0	0.0	0.3	0.9	1.8	5.5	85.5
Investment Size	23965		26.3	63.1	0.0	0.1	1.7	7.1	21.8	113.8	750.0
Entertainment											
Gross MOIC	7944	2.09	2.38	6.5	0.0	0.0	0.4	1.2	2.2	7.3	151.1
Gross PME	7944	1.19	1.54	5.0	0.0	0.0	0.2	0.8	1.4	4.4	85.5
Investment Size	10323		32.6	75.7	0.0	0.1	1.7	7.7	26.7	156.1	750.0
Venture Capital											
Gross MOIC	32504	3.05	3.02	8.3	0.0	0.0	0.1	1.1	2.7	10.8	161.0
Gross PME	32504	1.69	1.78	5.3	0.0	0.0	0.1	0.7	1.6	6.0	85.5
Investment Size	48924		8.8	19.3	0.0	0.1	0.8	3.6	10.0	31.0	718.3
Buyout											
Gross MOIC	32834	2.32	2.60	4.4	0.0	0.0	1.0	1.8	3.1	7.1	159.6
Gross PME	32834	1.31	1.67	3.9	0.0	0.0	0.5	1.1	1.9	4.4	85.5
Investment Size	39714		78.3	113.7	0.0	1.5	12.0	33.8	91.5	326.1	750.0
Growth Equity											
Gross MOIC	6469	2.53	2.73	5.0	0.0	0.0	0.9	1.7	3.1	8.0	152.0
Gross PME	6469	1.44	1.65	3.4	0.0	0.0	0.5	1.0	1.9	4.7	85.5
Investment Size	9662		36.9	49.5	0.0	2.0	9.0	20.1	45.3	127.0	637.7

Investment size is in millions USD.

3.1 Value Accretion Comparisons

Game Types. Weighted casual/mobile MOIC and PME are respectively 3.5x and 2.1x versus 3.8x and 1.8x for core. Notice that when comparing casual/mobile to core, the ranking of public market-adjusted value accretion reverses: a randomly selected (i.e. unweighted mean) casual/mobile gaming deal is likely to grow more than a core deal, but the core market as a whole (i.e. weighted mean) is likely to grow more than the casual/mobile market as a whole.

I calculate bias-corrected and accelerated bootstrap confidence intervals for weighted gross MOIC and PME of casual/mobile, core, and the difference between the two, reported in Table A1. Weighted gross MOIC and PME are both statistically significantly above unity at 99% confidence for both casual/mobile and core. Despite the difference in mean estimate, casual/mobile does not have statistically significant difference in value accretion than core in either weighted gross MOIC or gross PME even at 90% confidence. This does not imply that there is no difference; it could merely reflect the wide variation inherent in deal-level data that amplifies uncertainty.

Asset Classes. Both weighted and unweighted value accretion metrics for venture, buyout, and growth equity deals are markedly lower than those of video game deals. The respective weighted MOICs for venture, buyout, and growth equity are 3.1x, 2.3x, and 2.5x, compared to the video game weighted MOIC of 3.6x. Likewise the respective weighted PMEs are 1.7x, 1.3x, and 1.4x, compared to the video game weighted PME of 1.9x. The differences are even larger when looking at unweighted means. That said, the medians of buyout and growth equity tend to have higher estimates than those of video game deals. Table A2 shows BCa confidence intervals for the difference in weighted means by asset class, defined as the video game weighted mean minus the asset class weighted mean, a positive number indicating a superior video game metric relative to the asset class. For both weighted gross MOIC and gross PME, video game deals on average outgrow private equity deals as a whole, buyout deals, and growth equity deals with 99% confidence. Video game deals outgrow venture capital weighted gross MOIC at 95% confidence, but a comparison over gross PME does not exhibit statistical significance.

I also consider casual/mobile games and core games as separate types, with the caveat that doing so decreases the sample size and will therefore have more difficulty establishing statistical significance (especially for core). Casual/mobile games outgrow private equity deals as a whole and buyout at 95% with MOIC, with 99% for growth equity. For casual/mobile PME, video games outperform private equity at 95%, buyout at at 99%, and growth equity at 95%. For core game MOIC, games outgrow all equity, buyout, and growth equity at 95%, but none of the PMEs are significant even at 10%.

Sectors. Compared to software and entertainment private equity deals, the gaming size-weighted gross MOIC of 3.6x is higher than the respective 2.9x and 2.1x for software and entertainment, and the difference is even larger when looking at unweighted means. Likewise, the video game weighted gross PME of 1.9x is larger than the 1.6x for software and 1.2x for entertainment, and again the difference is higher for unweighted mean PME. The same pattern follows when focusing on casual/mobile or core games.

Table A3 provides BCa confidence intervals for the differences and demonstrate that video game gross MOIC are larger than both software and entertainment at 99% confidence, with 95% confidence for larger video game PME compared to software and 99% compared to entertainment. Casual/mobile games have higher gross MOIC and PME than software at 90%, and higher than entertainment at 99%. Core games have higher MOIC than software at 90% and than entertainment at 95%, and core game PME is higher than entertainment at 90%. The estimated median gross MOIC and gross PME for software of 1.4x and 0.9x exceed those of all video games and casual/mobile video games, about 1.2x and 0.7x respectively; but not those of core games with respective medians of 1.6x and 1.0x. Entertainment has estimated median gross MOIC and gross PME of 1.2x and 0.8x, which are slightly higher than those of casual/mobile games but below those of core gaming. The apparent skewness in video game metrics, even relative to venture capital, speaks to a need for portfolio-centric property of video game investment.

Regions. Table 4 shows statistics by region, omitting Middle East and Latin America due to having few deals. Weighted MOIC for Europe jumps out at 5x compared to 3.2x for North America and 3.1x for Asia-Australia. The difference in weighted PME is more subdued however, with Europe and Asia-Australia both at roughly 2.1x and North America at 1.8x. Unweighted gross MOIC for North America and Europe are roughly the same at about 4.3x, and Asia-Australia lags behind at 3.2x. On the other hand, Europe and Asia-Australia have median MOICs of 1.4x compared to 1.2x in North America. North American unweighted gross PME is highest at 3.1x compared to 2.6x for Asia-Australia and 2.2x for Europe. That said, North America has the lowest median gross PME at 0.6x compared to 0.8x for Europe and 0.9x for Asia-Australia.

TABLE 4: GAME DEAL SUMMARY STATISTICS BY REGION

	N	Weighted $\bar{X}$	$\bar{X}$	SD	Min	5th	25th	50th	75th	95th	Max
North America											
Gross MOIC	242	3.15	4.30	11.7	0.0	0.0	0.1	1.2	2.5	25.7	93.0
Gross PME	242	1.77	3.10	11.3	0.0	0.0	0.0	0.6	1.4	12.3	85.5
Investment Size	301		17.7	55.7	0.0	0.1	0.8	3.8	11.8	62.0	538.3
Europe											
Gross MOIC	89	5.02	4.24	11.3	0.0	0.0	0.0	1.4	3.9	15.8	93.0
Gross PME	89	2.07	2.20	4.4	0.0	0.0	0.0	0.8	2.0	11.0	27.0
Investment Size	113		14.5	26.4	0.0	0.1	1.3	5.0	18.0	55.9	184.2
Asia-Australia											
Gross MOIC	60	3.05	3.24	7.5	0.0	0.0	0.5	1.4	2.4	12.6	47.8
Gross PME	60	2.05	2.55	7.8	0.0	0.0	0.3	0.9	1.8	5.3	54.5
Investment Size	72		17.7	38.9	0.2	0.5	1.8	4.7	10.1	101.5	248.0

Investment size is in millions USD.

Table A4 shows BCa confidence intervals for weighted gross MOIC and gross PME of each region as well as the differences in regions. For all three regions, both gross MOIC and gross PME have statistical significance above unity at 99% confidence, suggesting that all three regions overall provide video game investment opportunities that outgrow public markets. None of the differences in regional metrics turn up statistical significance, even at 10% confidence. Again, this of course does not imply the differences are meaningless or zero; if anything, it highlights the high degree of variation inherent in deal-level data (as seen with some of the very wide confidence intervals) that highlights a challenge for traditional statistical inference. It also might speak to the global nature of video games, which are often translated for release in several languages and have trivial transportation costs in the digital age, such that regional differences are relatively unimportant.

3.2 Home Run Deals

I finish this section by focusing on ”home run” companies. Home run companies are of particular importance for those making venture capital investments, but not exclusively; and to ensure a sizeable sample, I consider video game deals of all asset classes. I do however focus on 42,232 venture capital deals as a comparison for video game deals.

The median holding length of all fully exited venture capital deals in the sample is 3.9 years, which I will round up to 4 for convenience. To define a home run, I convert gross MOIC into an annualized accretion rate using the number of days held, and then extrapolate that accretion rate to 4 years, giving what I call the 4-year MOIC. In other words, the 4-year gross MOIC answers the question, ”given the observed holding length and multiple, what would the multiple be if the holding length were actually 4 years?” If the 4-year MOIC of a deal exceeds 10x, I consider the deal to be a home run. Because gross MOICs are being converted into a hypothetical/extrapolated 4-year multiple, I include gross MOIC of any age, whether fully exited or not. This does introduce some uncertainty into unexited deals, especially recent ones since there's no reason to believe a deal will grow in value at a constant rate. I also consider 25x and 50x deals.[3] Furthermore, I analyze the sub-periods 2003-2006, 2007-2012, 2011-2016, 2017-2019, and 2020-2023, and compare video game home runs to software sector venture capital home runs, entertainment sector venture capital home runs, and venture capital home runs overall.[4]

The results are shown in Table 5. Over the entire sample, the estimated proportion of home run gaming deals is 11.3%, well above the software rate of 7.6%, the entertainment rate of 6.2%, and the general venture capital rate of 6.9%. The same holds for 25+ gross MOIC deals with a video game rate of 5.5% and a 50+ MOIC rate in gaming deals of 3.6%, both of which are roughly twice the rate of software and more than twice for entertainment. Core deals have a higher home run rate than casual/mobile games, respectively 11.3% versus 9.6%. Blockchain games have a very high home run rate of 26.3%, granted that crypto comes with a pointed caveat emptor.

I perform a series of BCa bootstraps, each with 100,000 iterations, to see if the apparent dif-

[3]Home runs are calculated at the gross level because the cash flows do not allow for the calculation of a hurdle IRR. The ”investor” 10+ home run therefore likely falls somewhere between the 10+ and 25+ rate. That said, co-movement and cross-sectional relationships tend to be common across 10+ and 25+ metrics.

[4]These sub-periods were chosen to reflect periods with distinct economic qualities. 2003-2006 represents the period before the Great Financial Crisis, 2007-2010 captures the Great Financial Crisis, 2011-2016 captures the post-Great Financial Crisis, 2016-2020 captures the pre-COVID19 period, and 2020-2023 captures the COVID era.

TABLE 5: HOME RUN VIDEO GAME DEALS BY TYPE AND SUB-PERIOD

	2003-2023	2003-2006	2007-2010	2011-2016	2017-2019	2020-2023
All Game Deals						
10+	11.3%	9.8%	11.8%	6.1%	14.3%	20.8%
25+	5.5%	4.9%	8.8%	1.9%	5.2%	11.5%
50+	3.6%	2.4%	4.4%	0.9%	2.6%	10.4%
Number of Deals	494	41	68	212	77	96
Casual/Mobile						
10+	9.6%	3.7%	14.8%	6.0%	11.1%	17.0%
25+	4.2%	0.0%	11.1%	1.2%	5.6%	7.5%
50+	2.8%	0.0%	5.6%	1.2%	3.7%	5.7%
Number of Deals	354	27	54	166	54	53
Core						
10+	11.3%	23.1%	0.0%	11.8%	10.0%	8.3%
25+	4.8%	15.4%	0.0%	5.9%	0.0%	0.0%
50+	1.6%	7.7%	0.0%	0.0%	0.0%	0.0%
Number of Deals	62	13	10	17	10	12
Blockchain						
10+	26.3%	0.0%	0.0%	0.0%	44.4%	25.0%
25+	13.2%	0.0%	0.0%	0.0%	11.1%	16.7%
50+	10.5%	0.0%	0.0%	0.0%	0.0%	16.7%
Number of Deals	38	1	1	3	9	24
Software VC						
10+	7.6%	4.5%	5.4%	5.1%	9.6%	9.9%
25+	3.9%	2.2%	2.3%	2.3%	4.3%	6.1%
50+	2.5%	1.4%	1.5%	1.5%	2.6%	4.0%
Number of Deals	13570	645	980	4591	3486	3868
Entertainment VC						
10+	6.2%	9.7%	5.5%	4.1%	8.3%	8.4%
25+	3.3%	6.6%	3.0%	2.2%	3.2%	5.2%
50+	2.3%	5.3%	1.8%	1.8%	1.8%	3.4%
Number of Deals	4766	226	704	1980	947	909
Venture Capital						
10+	6.9%	4.8%	4.5%	5.0%	8.4%	9.2%
25+	3.7%	2.7%	2.5%	2.6%	3.8%	5.6%
50+	2.5%	1.8%	1.6%	1.8%	2.4%	4.1%
Number of Deals	44634	2936	4480	14398	11047	11773

ferences (defined as video game home run rate minus alternative home run rate) are statistically significant. The results are shown in Tables A5 and A6. When looking at all video game types, the 10+ home run rate is significantly higher than the VC rate at 99% confidence and at 95% confidence for the 25+ home runs rate difference. If one focuses only on casual/mobile games, the difference in the 10+ deal rate is significant with at 90% confidence.

The difference between core 10+ home run rate and VC home run rate is not statistically significant even at 10%, and the difference for blockchain is statistically significant at 99% for 10+ and 50+ home run rates, and at 95% for the 25+ home run rate. The 10+ home run rate of video games is higher than those of software with 99% confidence and for 25+ is higher than software with 90% confidence. The 10+ home run rate of video games is higher than those of entertainment with 99% confidence, for 25+ is higher than software with 95% confidence, and for 50+ with 90% confidence.

I also compare home run rates across regions in Table 6 for 2003-2023, 2003-2010, 2011-2016, 2017-2019, 2020-2023. Overall from 2003-2023, Europe has the highest home run rate at 17.1% of its 105 total deals. The United States comes next with a 9.9% home run rate of its 294 deals, and Asia-Australia third with an 6.9% home run rate out of its 72 deals. The period from 2011-2016 appears to be the largest differentiator in that the European home run was 16.1% compared to only 2.7% for North America and Asia-Australia, and the period also exhibits the largest number of deals.

Table A7 shows confidence intervals comparing regions above each other and each region above general venture capital for 10+ home run rates (with 25+ and 50+ omitted due to total absence of statistical significance). For region-wise comparison, the Europe home run rate is above the North America home run rate at 90% and above the Asia-Australia home run rate at 95% confidence. Against general venture capital, the North American and European ratesa are higher at 90% confidence.

I conclude this section by noting that private video game deals on average accrete value well relative to other investments. Weighted average gross MOICs, gross PMEs, and home run rates are typically higher than what one would receive from general private equity, software private equity, and entertainment private equity; and weighted average gross PMEs are larger than 1 indicating that private video game deals outgrow the general public market in terms of valuation. The me-

TABLE 6: HOME RUN VIDEO GAME DEALS BY SUB-PERIOD AND REGION

Region	2003-2023	2003-2006	2007-2010	2011-2016	2017-2019	2020-2023
North America						
10+	9.9%	0.0%	14.3%	2.7%	13.7%	21.1%
25+	5.4%	0.0%	10.2%	1.8%	3.9%	12.3%
50+	4.1%	0.0%	6.1%	0.9%	3.9%	10.5%
Number of Deals	294	24	49	113	51	57
Europe						
10+	17.1%	11.1%	12.5%	16.1%	15.4%	26.3%
25+	7.6%	0.0%	12.5%	3.6%	7.7%	21.1%
50+	4.8%	0.0%	0.0%	1.8%	0.0%	21.1%
Number of Deals	105	9	8	56	13	19
Asia Australia						
10+	6.9%	37.5%	0.0%	2.8%	0.0%	12.5%
25+	2.8%	25.0%	0.0%	0.0%	0.0%	0.0%
50+	1.4%	12.5%	0.0%	0.0%	0.0%	0.0%
Number of Deals	72	8	10	36	10	8

dians are occasionally less flattering to video game deals, but medians are also less salient in a search for outliers that drive a venture-heavy portfolio. Video game deals also seem to outgrow private equity deals as a whole in terms of valuation, although the case against venture capital as a whole is less concrete. Casual/mobile deals give higher estimates for weighted gross PME, although the difference is not statistically significant (possibly due do sample size constraints). The same can be said of region-wise comparisons for weighted gross MOIC and gross PME, with Europe having the highest weighted metrics, Asia-Australia second, and North America third, but without the differences being statistically significant. Looking at the rate of home run deals suggests that the video game home run rate is higher than that of general venture capital. The case for casual/mobile and core are not as strong, but blockchain games are highly significant with an exceptionally high home run rate. North America and Europe deals appear to have a higher home run rate than general venture capital, and European deals appear to provide a higher home run rate than North America or Asia-Australia.

4 Simulated Funds

The previous section established that in terms of valuation, video game companies receiving private equity investment on average outgrow public market equivalents and generally outgrow general companies that receive private equity investment. But from an investment point of view, investors are typically thinking in terms of a portfolio of deals (or even a portfolio of funds), not a large set of deals. The performance of funds are a more natural unit of analysis since most investors commit capital to funds; performance metrics are most commonly reported in terms of funds, which makes funds-level metrics easier to contextualize (for example, funds will be more diversified and therefore exhibit less volatility than at the deal level); and fees are typically applied to funds, which affects the actual return an investor sees. To address the deals-versus-portfolio issue, I simulate private equity funds.

4.1 Generating Simulated Funds

To address the deals-versus-portfolio issue, I randomly select video game deals from the sample in order to construct a set of synthetic video game funds and compare these funds to similarly constructed synthetic private equity funds. Most real funds with video games deals do not invest strictly in video games, so isolating the performance of video game investment requires an approach that starts from the deal level. In fact, the 510 deals in the data set come from 343 funds, illustrating how funds containing video game deals primarily contains other non-video game deals, making it impossible to isolate the performance of video game investments at the fund level. I do not use real fund-level data as benchmarks in order to keep fund-level properties as similar as possible across the two sets. Rather, using synthetic private equity funds as a benchmark accomplishes this because the mechanical process used to construct a fund is the same, and also because the simulation process is coded to ensure that each synthetic video game fund will be matched with a private equity fund containing similar asset classes, fund size, and vintage.

Synthetic funds will consist of 15 deals each and are constructed as follows for the full set of video game deals. First, a random date is picked from the set of deals with entry years between 2004 through 2020. Second, a set of 15 deals made no later than 4 years of that date are randomly chosen as the synthetic fund's holdings; the ”vintage” of the synthetic fund is the year of the earliest entry found within the set of deals. Third, a synthetic private equity fund is constructed by randomly choosing 15 private equity deals within the same window, matching the distribution of asset classes found within the synthetic video game fund.[5] The pair of synthetic funds is kept if their fund sizes are within 50% of each other, otherwise the two synthetic funds are discarded.

Fees are applied as follows. The size of each fund is taken as the sum of investment in USD of each deal multiplied by 1.1 to account for management fees, thereby mimicking committed capital. To account for management fees, a capital call of 0.5% of fund size is charged once every quarter during the investment period, where the investment period is defined to be the interval of time from first to last investment deal of the fund. I apply carried interest at the fund level, partly because the majority of deals are venture capital, and partly because period-to-period IRR, which is required to determine whether a hurdle rate has been satisfied, can be more sensibly approximated using an entire fund's cash flows.

That said, carry is relatively complex because each fund can contain a mixture of venture capital, private equity, and growth equity (i.e. they are generalist equity funds), and hurdle rates on average differ across asset classes. To that end, I assume the venture capital hurdle IRR is 0% whereas buyout and growth equity have hurdle IRRs of 8%. When the IRR is between 0% and 8%, and therefore only the venture capital hurdle rate is satisfied, I take the carry rate to be proportional to the weight of venture capital in the fund. For example, if venture capital contributes to 25% of fund size and the IRR is 5%, then the carry rate is $0.25 \times 20\% = 5\%$; if the IRR is 8% or higher, then the carry rate is the full 20%.

The IRR of a fund at a given point in time is calculated based on pooled cash flows of all deals within the fund up until that point in time. Calculating the IRR at any arbitrary point requires assumptions about net asset value at any arbitrary point, however. For simplicity, the valuation of a deal is assumed to grow at a constant rate from investment amount to terminal amount. This assumption about deal valuation growth is undoubtedly rough, but it is only used for determining IRR apropos carried interest, and is not used at all when calculating final metrics since no intermediate valuations are required at that stage.

The carry rate is applied to incremental net profit (defined as total distributions net total con-

[5] Video game deals with an asset class of "other" are randomly assigned buyout, venture capital, or growth equity in equal proportion.

tributions, including net management fees) at the time of any realization, and the distribution of that realization is reduced at this rate (since that portion of the realization goes to the general partner). If the final IRR is less than 0, then all carried interest is distributed back to limited partners via claw back on the final date of the fund; if the final IRR is positive but less than 8%, then the buyout and growth equity proportion of carry is distributed back.

The resulting set of cash flows can be used to generate net performance metrics, including MOIC and PME, but also three flavors of IRR: the typical IRR; the direct alpha (or DA), a version of IRR which discounts cash flows by a public market (Gredil et al., 2023) and the modified IRR (or MIRR), which assumes that realizations are re-invested at 12% rate instead of at the IRR rate (Phalippou, 2008). For comparison, and also to convince the reader that the fund simulations yield believable results, I also simulate funds using pure buyout, venture capital, and growth equity funds and report the metrics.

4.2 Results

Table 7 shows the results for 5,000 simulated video game funds, similar (”matched”) private equity funds including software and entertainment sector-specific funds as sector comparables, and pure (”unmatched”) generalist private equity funds. Before comparing, note that the generalist synthetic fund performance metrics are all similar to what one would obtain on MSCI-Burgiss using global generalist equity funds with a maximum fund size of 1.5 billion USD and the MSCI ACWI index as a benchmark, namely a 12.58% IRR compared to the synthetic 12.52%, a 3.94% direct alpha compared to the synthetic 4.01%, 1.67x MOIC compared to the synthetic 1.96x, and 1.17x PME compared to the synthetic 1.25x.[6] I conclude that the synthetic fund process overall does a good job of capturing actual fund performance in the aggregate, especially when discounted against the public market, and therefore comparisons of these aggregates likely also capture actual differences.

To that end, the performance of synthetic video game funds is consistently above comparable private equity funds. Differences for multiples and MIRR are sober, with video game pooled MOIC of 2.56x compared to 2.26x for matched private equity, a difference of 0.3 of a multiple; video

[6]The most common reporting dates in the StepStone data are 2023Q2, 2023Q3, and 2023Q4, so I take the average reports at these three quarters in MSCI-Burgiss as an approximation.

game pooled PME of 1.66x compared to 1.37x for matched private equity, a difference of 0.29 of a multiple; and video game pooled MIRR of 14.0% compared to 12.8% for private equity, a difference of 1.1 percentage points. The video game MOIC is 0.11 of a multiple less than the matched software MOIC, its PME higher by 0.04 of a multiple, and its MIRR higher by 0.18 percentage points. Likewise, video game MOIC is 0.47 of a multiple larger than the matched entertainment MOIC, its PME higher by 0.35 of a multiple, and its MIRR higher by 1.3 percentage points.

IRR and direct alpha exhibit more extreme results in favor of video game fund performance. The pooled IRR for video games is 19.8% compared to 14.7% for matched private equity, a difference of 5.1 percentage points, whereas pooled direct alpha for video games is 11.8% compared to 5.6% for private equity, a difference of 6.2 percentage points. The video game IRR is 1.9 percentage points higher than the matched software IRR of 17.9% and 3.3 percentage points higher than the software direct alpha of 8.5%, and the video game IRR is 5.7 percentage points higher than the matched entertainment IRR of 14.2% and 6.8 percentage points higher than the entertainment direct alpha of 5.0%.

The confidence intervals in Table A8 indicate that all returns are positive (i.e. IRR of all varieties are all positive and multiples all exceed unity) with 99% confidence. As shown in Table A9, all differences are statistically significant at 99%, suggesting that the exhibited outperformance of video game funds is not due to chance, and the same can be said of the exhibited underperformance of video game fund MOIC relative to matched software MOIC.

TABLE 7: VIDEO GAMES VS. PRIVATE EQUITY SIMULATED FUND SUMMARY STATISTICS

	VG	**Matched Software**	**Matched Entertainment**	**Matched PE**	**Generalist PE**
IRR	19.8%	17.9%	14.2%	14.7%	12.5%
Direct Alpha	11.8%	8.5%	5.0%	5.6%	4.0%
MIRR (12%)	14.0%	13.8%	12.6%	12.8%	12.1%
MOIC	2.56x	2.67x	2.09x	2.26x	1.96x
PME	1.66x	1.62x	1.31x	1.37x	1.25x

Distributions for synthetic funds are shown in Figure A1 and quantiles are shown in Table A10. The central tendency of video game funds is higher as demonstrated by the consistently higher video game medians, but video game funds also exhibit a wholly thicker right tail. Which is to say, a video game fund seems to outperform private equity as a whole both in its typical performance as well as its probability of producing outsized performance. The median IRR, MIRR, direct alpha, and PME for video games is higher than the comparables, and MOIC is higher when compared to private equity and entertainment sector but not when compared to software.

Pooled performance metrics by vintage are shown in Figure 3. Video game performance exhibits especially strong performance for vintages earlier in the around 2004-2007. For vintages 2008 through 2012, however, video game performance is slightly weaker than the comparables. From vintages 2013 on, the performance of video games is generally comparable to the alternatives, with a noticeable outperformance again starting around 2017 through 2019. The greater apparent volatility by vintage of video game funds is consistent with the observation that video game deals exhibit a larger proportion of, and therefore have performance depending more on, home run deals that are inherently dispersed both in time and magnitude.

SYNTHETIC FUND PERFORMANCE BY VINTAGE

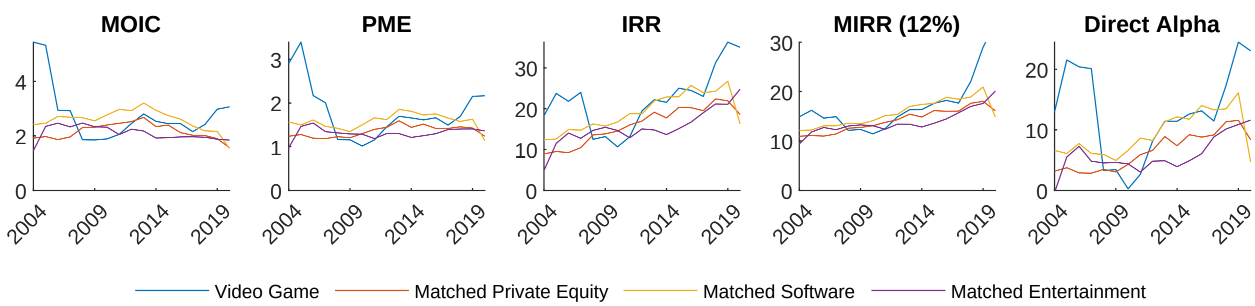

FIGURE 3: This figure shows the distributions of MOIC, PME, IRR, MIRR (12%), and direct alpha for 5,000 synthetic video games funds and 5,000 comparable private equity funds. Histograms truncate at the 99.5th quantile.

5 Public Video Game Index

It is also instructive to compare the performance of private video game investment to public video game investment and related public sectors This is not an easy task in general since the performance metrics used in private and public investment tend to be different.

To that end, I construct a public video game index ranging from 2004 through May 2024. The public video game index is constructed using the gross return (i.e. return including dividend reinvestment) of 59 public video game companies across the world as listed in Table A11. The index is constructed by weighing the daily return of each equity by its USD market cap and sequentially compounding returns over the window, starting at a level of 100. There are some notable omissions from the index constituents, most notably Tencent Holdings Limited, Microsoft Corporation, and Sony Group Corporation. These companies do have considerable presence in video games, but they also have dealings in so many other sectors that it is impossible to interpret their returns as video game returns. Tencent Holdings Limited for example is technically the largest video game company, but only 13% of its investment since 2019 has been in gaming or entertainment tech (Fu, 2024). The constituents of the public video game index therefore consist of companies that are almost, if not entirely, exclusively in video game development or publishing. Some of the companies, for example Activision Blizzard Inc, no longer exist but are still included in the index during extant periods to ensure historical validity of the index.

Along with the MSCI World Software & Services Index, the MSCI World Media and Entertainment Index, and the Fama-French developed market index, the public video game index is shown in Figure 4.[7] Compared to the market index, the video game index has moments of return excess as well as moments of return deficit. From 2001 through 2014, the video game index was consistently above the software index, but starting around 2017 or so the software index greatly outpaces the video game index. Until around 2012, the video game index was consistently above the entertainment index, the situation reversing until about 2017, and thereafter with no clear pattern. Over the entire period, the public video game index grew by 299% compared to 787% for the public software index, 383% for the entertainment index, and 415% for the developed market as a whole. Note that the entertainment index has 4.67% weight in Interactive Home Entertainment, the GICS subsector which contains video games.

The region weights for the public indices are shown in Table 8. Whereas the software and entertainment public indices are dominated by North American companies with market cap weights above 90%, the public video game index is majority Asia-Australia at 64% with only 30% in North America. The majority of weight comes from NetEase, a Chinese company accounting for 27% of total weight. Other companies with a weight in excess of 5% are Roblox Corp of the U.S. with 11% weight, Nintendo Co of Japan with 9% weight, Unity Software Inc of the U.S. with 6% weight, Activision Blizzard Inc of the U.S. with 6% (prior to its acquisition by Microsoft), and NEXON

[7] I also compared the MSCI ACWI Growth index, but the results were not notably different from those of the Fama-French developed market index and therefore were omitted.

Public Index Comparison: Video Games, Software, and Fama-French Developed

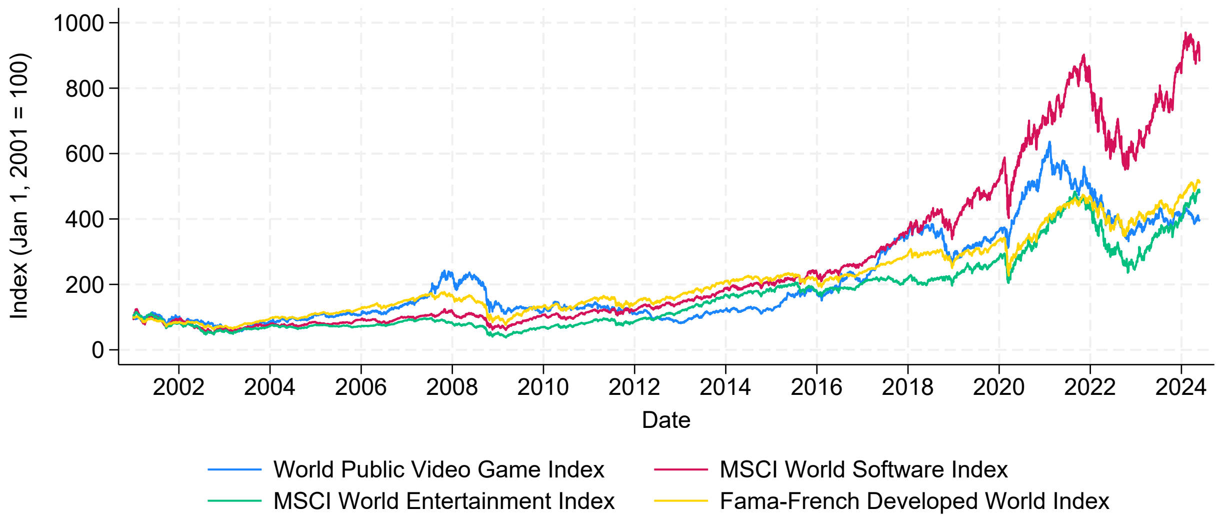

Figure 4: This figure shows the public video game index, the MSCI software index, and the Fama-French Developed index starting at a value of 100 on January 1, 2001. Source: MSCI and the Fama-French data library.

Co of Japan with 5%. The relatively heavy weight in Asia-Australia is a fairly unique property to public video game investment. Compared to the private equity weights in Table 2, regional diversification is almost zero for public software and entertainment indices, whereas the public video game index is at least somewhat shared between North America and Asia-Australia.

Table 8: Video Game, Software, and Entertainment Public Equity Distribution By Region

	North America	Europe	Asia-Australia	Middle East
Video Games Public	30%	4%	64%	2%
Software Public	92%	4%	2%	1%
Entertainment Public	94%	2%	3%	0%

Weights determined by median market cap USD. Only regions with more than 1% shown.

I briefly summarize some properties of each index by estimating the 5-factor model of Fama and French (2015), having collapsed the data into monthly periods so as to reduce noise. The five factors are Small Minus Big (SMB), the average return of small stock portfolios minus the average return of big stock portfolios, meant to capture a risk factor related to size; High Minus Low (HML), the average return on value portfolios minus the average return on growth portfolios, meant to capture a risk factor related to book-to-market equity; Robust Minus Weak (RMW), the average return on robust operating profitability portfolios minus the average return on weak operating profitability portfolios, meant to capture a risk factor related to profitability; Conservative Minus Aggressive (CMA), the average return on conservative portfolios minus the average return on aggressive portfolios, meant to capture a risk factor for investment intensity; and the market return above the risk-free rate, meant to capture a risk factor relative to market exposure.

The results are shown in Table 9. The video game index exhibits less market exposure overall when compared to software with a respective adjusted R-squared of 0.38 compared 0.80. Video game market beta is a statistically significant 0.69, indicating lower volatility than market returns, whereas software has a market beta of 0.97, practically equal to that of the market. Video games and software both exhibit statistically significant SMB exposure, but video games have positive exposure whereas software has negative exposure. Both are tilted towards growth stocks given the negative HML coefficients, which is unsurprising since software tends to have relatively little by way of tangible assets. The negative coefficient for software RMW suggests that general software has behavior seen in lower-profit companies, but the same is not true for video games which has a small and statistically insignificant coefficient. The estimates for CMA do not come close to statistical significance. The results for entertainment are largely the same as for software, albeit slightly muted in comparison, the exception being the absence of HML statistical significance for entertainment. Notice that software and entertainment both have statistically significant and positive alpha, amounting to 10.6% annualized for software and 4.5% for entertainment.

I now compare video game private equity investments to these three public sector indices by calculating deal-level gross PME, and also by using the sector indices in the fund simulation exercise to generate net PMEs and net direct alphas. The results are shown in Table 10. When using the entertainment sector index to calculate PME, the results are mostly unchanged: weighted video game gross PME remains at 2.0x and unweighted at 3.3x, although the median falls slightly from 0.8x to 0.7x. The results against the public video game index and public software index paint a different picture, however. Against the software sector index, video game weighted gross PME falls to 1.7x and 2.8x unweighted. Against the public video game index, on the other hand, the video game weighted gross PME jumps to 2.6x with a mean 4.4x and a median of 0.8x. All weighted gross PME estimates are above unity at 99% confidence as shown in Table A12 all, suggesting that private video game companies with private equity investments accrete value faster than public video games companies, public entertainment companies, and public software companies.

TABLE 9: 5-FACTOR REGRESSION OF PUBLIC VIDEO GAME, SOFTWARE, AND ENTERTAINMENT RETURNS, 2001 - MAY 2024

	World Video Games	World Software	World Entertainment
Market Excess Return	0.685***	0.967***	1.052***
	(0.000)	(0.000)	(0.000)
Small Minus Big	0.716***	−0.428***	−0.361***
	(0.001)	(0.003)	(0.002)
High Minus Low	−0.536**	−0.702***	−0.194
	(0.047)	(0.000)	(0.105)
Robust Minus Weak	−0.099	−0.611***	−0.392***
	(0.744)	(0.000)	(0.008)
Conservative Minus Aggressive	−0.076	−0.183	−0.147
	(0.805)	(0.293)	(0.407)
Constant	0.005	0.008***	0.004**
	(0.163)	(0.000)	(0.040)
N	281	281	281
Adj R-sq	0.377	0.797	0.784

p-values in parentheses

Calculated using HC3-robust standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

From an investor point of view with synthetic funds, using the video game index as the public market makes a small difference for PME, going from 1.66x with the Fama-French developed market index to 1.54x with the video game market. Direct alpha on the other hand is slightly larger, from 11.8% with the Fama-French market to 12.2%. Discounting with the public entertainment index generates a lower PME of 1.41x and direct alpha of 7.6%, and the public software index yields the lowest metrics thus far at 1.22x PME and 5.1% direct alpha. Even though the software-discounted metrics are the lowest, PME is still distinctly above unity and direct alpha distinctly above 0, as shown by the 99% confidence intervals in Table A13. The results again suggest that private equity video game investments outperform public comparables, and especially public video game investment.

I conclude this section by noting that the private video game value accretion and returns outperform public comparables. The evidence again points towards video game private equity offering a good return relative to both public and private market comparables. On the other hand, public video game investment does not appear to be particularly attractive. While it appears to have less market exposure than public software or entertainment, it has not generated returns that

TABLE 10: VIDEO GAME ALTERNATIVE MARKET PME AND DIRECT ALPHA

	Deals		Synthetic Funds	
	Gross PME, Wgt $\bar{X}$	**Gross PME, $\bar{X}$**	**Net Pooled PME**	**Net Pooled DA**
Public Video Game Index	2.40	3.85	1.54	12.2
Public Entertainment Index	1.87	2.84	1.41	7.6
Public Software Index	1.53	2.44	1.22	5.1
Observations/Simulations	386	386	5000	5000

differ from the market as a whole in the long run.

6 Conclusion

This paper presents the first analysis of the performance of private video game investment. The findings demonstrate that video game private equity portfolio companies generally outgrow public markets, software private equity portfolio companies, entertainment private equity portfolio companies, and general private equity portfolio companies in their gross MOIC and gross PME, and also include home run companies at a higher rate. The value accretion of casual/mobile games and core games are roughly similar, depending on the measurement used. Deals in Europe have done particularly well in terms of home run rates, but otherwise regional differences are minor or unclear.

A simulated fund-level analysis with net fees likewise demonstrates that private video game funds can be attractive investments in terms of absolute return, relative to the public market, and relative to similar private investments. A novel public video game index suggests that private video game investment outperforms public video game investment, and indeed public video game investment is unremarkable relative to the general equity market, although public video game investment does exhibit relatively low factor exposure, in particular a market beta less than unity.

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Appendix

TABLE A1: CONFIDENCE INTERVALS FOR WEIGHTED MOIC AND PME ACROSS CASUAL/MOBILE AND CORE GAMING DEALS

	Casual/Mobile		**Core**		**Casual/Mobile Above Core**	
	MOIC	PME	MOIC	PME	MOIC	PME
99% CI	(2.28, 10.95)	(1.38, 3.56)	(1.97, 5.83)	(1.01, 2.78)	(-2.53, 4.35)	(-0.89, 1.77)
95% CI	(2.42, 7.51)	(1.51, 3.09)	(2.35, 5.28)	(1.18, 2.47)	(-2.07, 2.96)	(-0.61, 1.36)
90% CI	(2.52, 6.57)	(1.58, 2.88)	(2.57, 5.03)	(1.28, 2.34)	(-1.83, 2.32)	(-0.48, 1.16)

Confidence intervals are bias-corrected and accelerated with 100,000 iterations each.

TABLE A2: CONFIDENCE INTERVALS FOR WEIGHTED MOIC AND PME OF VIDEO GAME DEALS ABOVE EQUITY ASSET CLASSES

	VG Above PE		**VG Above VC**		**VC Above Buyout**		**VG Above Growth Equity**	
All	MOIC	PME	MOIC	PME	MOIC	PME	MOIC	PME
99% CI	(0.25, 3.50)	(0.05, 1.34)	(-0.22, 3.05)	(-0.24, 1.06)	(0.30, 3.54)	(0.08, 1.37)	(0.35, 3.60)	(0.06, 1.35)
95% CI	(0.50, 2.93)	(0.17, 1.13)	(0.04, 2.48)	(-0.11, 0.85)	(0.55, 2.99)	(0.21, 1.16)	(0.60, 3.04)	(0.18, 1.14)
90% CI	(0.64, 2.68)	(0.23, 1.03)	(0.18, 2.22)	(-0.05, 0.75)	(0.69, 2.73)	(0.27, 1.07)	(0.74, 2.78)	(0.25, 1.04)
Cas/Mob	MOIC	PME	MOIC	PME	MOIC	PME	MOIC	PME
99% CI	(-0.06, 5.13)	(-0.04, 1.94)	(-0.52, 4.67)	(-0.32, 1.67)	(-0.01, 5.17)	(0.00, 1.98)	(0.05, 5.24)	(-0.03, 1.96)
95% CI	(0.16, 4.07)	(0.12, 1.61)	(-0.30, 3.60)	(-0.16, 1.33)	(0.21, 4.12)	(0.16, 1.65)	(0.26, 4.17)	(0.13, 1.62)
90% CI	(0.28, 3.59)	(0.21, 1.45)	(-0.18, 3.14)	(-0.07, 1.18)	(0.33, 3.65)	(0.24, 1.49)	(0.39, 3.70)	(0.22, 1.47)
Core	MOIC	PME	MOIC	PME	MOIC	PME	MOIC	PME
99% CI	(-0.26, 3.54)	(-0.32, 1.46)	(-0.72, 3.09)	(-0.60, 1.17)	(-0.21, 3.59)	(-0.28, 1.50)	(-0.16, 3.65)	(-0.31, 1.48)
95% CI	(0.15, 3.07)	(-0.15, 1.14)	(-0.30, 2.62)	(-0.43, 0.86)	(0.20, 3.12)	(-0.11, 1.18)	(0.25, 3.18)	(-0.14, 1.15)
90% CI	(0.39, 2.85)	(-0.05, 1.01)	(-0.06, 2.39)	(-0.33, 0.74)	(0.44, 2.90)	(-0.01, 1.05)	(0.50, 2.96)	(-0.04, 1.03)

Confidence intervals are bias-corrected and accelerated with 100,000 iterations each.

TABLE A3: CONFIDENCE INTERVALS FOR WEIGHTED MOIC AND PME OF VIDEO GAME DEALS ABOVE SOFTWARE AND ENTERTAINMENT DEALS

	VG Above Software		**VG Above Entertainment**	
	MOIC	**PME**	**MOIC**	**PME**
All				
99% CI	(0.06, 3.31)	(-0.08, 1.21)	(0.48, 3.74)	(0.17, 1.47)
95% CI	(0.30, 2.75)	(0.04, 1.00)	(0.73, 3.18)	(0.30, 1.26)
90% CI	(0.45, 2.49)	(0.11, 0.91)	(0.88, 2.92)	(0.37, 1.16)
Cas/Mob				
99% CI	(-0.25, 4.94)	(-0.16, 1.82)	(0.17, 5.37)	(0.09, 2.08)
95% CI	(-0.03, 3.88)	(-0.01, 1.49)	(0.39, 4.30)	(0.25, 1.74)
90% CI	(0.10, 3.41)	(0.08, 1.33)	(0.52, 3.83)	(0.34, 1.59)
Core				
99% CI	(-0.45, 3.35)	(-0.45, 1.33)	(-0.02, 3.78)	(-0.19, 1.59)
95% CI	(-0.04, 2.89)	(-0.27, 1.01)	(0.39, 3.31)	(-0.01, 1.28)
90% CI	(0.20, 2.66)	(-0.17, 0.89)	(0.63, 3.09)	(0.09, 1.15)

Confidence intervals are bias-corrected and accelerated with 100,000 iterations each.

TABLE A4: CONFIDENCE INTERVALS FOR WEIGHTED MOIC AND PME OF NORTH AMERICA, EUROPE, AND ASIA-AUSTRALIA VIDEO GAME DEALS

	North America		**Europe**		**Asia-Australia**	
	MOIC	PME	MOIC	PME	MOIC	PME
99% CI	(2.02, 4.83)	(1.16, 2.57)	(2.04, 25.19)	(1.10, 7.66)	(1.53, 8.07)	(1.05, 8.74)
95% CI	(2.23, 4.40)	(1.29, 2.34)	(2.28, 16.21)	(1.21, 5.10)	(1.68, 6.39)	(1.14, 5.66)
90% CI	(2.36, 4.19)	(1.36, 2.23)	(2.44, 13.19)	(1.29, 4.36)	(1.82, 5.66)	(1.21, 4.68)
	NA − EU		**NA − AA**		**EU − AA**	
	MOIC	PME	MOIC	PME	MOIC	PME
99% CI	(-21.10, 1.42)	(-4.85, 0.87)	(-4.20, 2.22)	(-5.62, 0.92)	(-2.03, 18.16)	(-3.34, 2.92)
95% CI	(-12.20, 1.06)	(-3.10, 0.68)	(-2.89, 1.83)	(-3.61, 0.73)	(-1.35, 11.73)	(-2.36, 2.12)
90% CI	(-9.55, 0.83)	(-2.48, 0.57)	(-2.28, 1.60)	(-2.77, 0.62)	(-0.95, 9.47)	(-1.89, 1.74)

Confidence intervals are bias-corrected and accelerated with 100,000 iterations each.

TABLE A5: DIFFERENCE IN VIDEO GAME AND VENTURE CAPITAL HOME RUN RATES, BCA BOOTSTRAP CONFIDENCE INTERVALS

	All Games Above VC			Casual/Mobile Above VC		
Type	10+	25+	50+	10+	25+	50+
99% CI	(1.15, 8.55)	(-0.46, 4.95)	(-0.66, 3.84)	(-0.86, 7.41)	(-1.72, 4.02)	(-1.43, 3.41)
95% CI	(1.89, 7.53)	(0.01, 4.09)	(-0.29, 3.11)	(-0.06, 6.16)	(-1.23, 3.09)	(-1.10, 2.56)
90% CI	(2.28, 7.01)	(0.27, 3.69)	(-0.08, 2.76)	(0.37, 5.58)	(-0.97, 2.62)	(-0.88, 2.09)

	Core Above VC			Blockchain Above VC		
Type	10+	25+	50+	10+	25+	50+
99% CI	(-3.63, 18.87)	(-3.68, 14.03)	(-2.59, 8.92)	(3.66, 40.62)	(-1.08, 28.12)	(0.00, 26.50)
95% CI	(-2.02, 14.18)	(-2.18, 9.24)	(-2.56, 5.72)	(6.38, 35.28)	(1.50, 22.73)	(0.14, 21.22)
90% CI	(-0.56, 12.54)	(-2.11, 7.62)	(-2.54, 4.03)	(8.90, 32.63)	(1.60, 20.10)	(2.63, 18.58)

Confidence intervals are bias-corrected and accelerated with 100,000 iterations each.

TABLE A6: DIFFERENCE IN SECTOR HOME RUN RATES, BCA BOOTSTRAP CONFIDENCE INTERVALS

	Games Above Software VC			Games Above Entertainment VC		
Type	10+	25+	50+	10+	25+	50+
99% CI	(0.38, 7.84)	(-0.71, 4.74)	(-0.66, 3.85)	(1.65, 9.27)	(-0.17, 5.37)	(-0.51, 4.11)
95% CI	(1.12, 6.80)	(-0.22, 3.90)	(-0.29, 3.13)	(2.44, 8.21)	(0.35, 4.55)	(-0.12, 3.37)
90% CI	(1.51, 6.27)	(0.04, 3.48)	(-0.08, 2.79)	(2.83, 7.69)	(0.63, 4.13)	(0.11, 3.02)

Confidence intervals are bias-corrected and accelerated with 100,000 iterations each.

TABLE A7: DIFFERENCE IN REGION HOME RUN RATES, BCA BOOTSTRAP CONFIDENCE INTERVALS

	NA Above EU	NA Above AA	EU Above AA	NA Above VC	EU Above VC	AA Above VC
	10+ Home Runs			10+ Home Runs		
99% CI	(-19.12, 2.18)	(-8.53, 10.12)	(-2.38, 22.06)	(-0.89, 8.14)	(-0.89, 8.14)	(-5.49, 11.24)
95% CI	(-15.99, 0.07)	(-5.39, 8.45)	(0.75, 19.21)	(-0.06, 6.82)	(-0.06, 6.82)	(-4.18, 8.32)
90% CI	(-14.56, -1.09)	(-4.00, 7.74)	(2.14, 17.74)	(0.38, 6.15)	(0.38, 6.15)	(-4.04, 6.90)

Confidence intervals are bias-corrected and accelerated with 100,000 iterations each.

TABLE A8: FUND METRICS, 99% CONFIDENCE INTERVALS, VIDEO GAMES AND PE

	VG	Matched Software	Matched Entertainment	Matched PE	Generalist PE
IRR	(19.5, 20.2)	(17.7, 18.1)	(13.9, 14.5)	(14.4, 14.9)	(12.3, 12.7)
Direct Alpha	(11.4, 12.3)	(8.3, 8.7)	(4.8, 5.3)	(5.4, 5.8)	(3.9, 4.2)
MIRR (12%)	(13.9, 14.0)	(13.7, 13.8)	(12.5, 12.7)	(12.7, 12.9)	(12.1, 12.2)
MOIC	(2.53, 2.60)	(2.64, 2.71)	(2.07, 2.12)	(2.24, 2.29)	(1.95, 1.98)
PME	(1.64, 1.68)	(1.60, 1.64)	(1.29, 1.33)	(1.36, 1.39)	(1.24, 1.26)

Confidence intervals are bias-corrected and accelerated with 10,000 iterations each over 5,000 simulated funds.

TABLE A9: FUND METRICS DIFFERENCES, 99% CONFIDENCE INTERVALS, VIDEO GAMES VS. PE

	VG Above Software	VG Above Entertainment	VG Above Matched PE
IRR	(2.2, 3.5)	(4.8, 6.1)	(4.6, 5.8)
Direct Alpha	(3.5, 5.2)	(5.6, 7.1)	(5.6, 7.0)
MIRR (12%)	(0.2, 0.4)	(1.2, 1.5)	(1.0, 1.3)
MOIC	(-0.18, -0.04)	(0.43, 0.57)	(0.24, 0.37)
PME	(0.02, 0.10)	(0.31, 0.40)	(0.25, 0.33)

Confidence intervals are bias-corrected and accelerated with 10,000 iterations each over 5,000 simulated funds.

TABLE A10: SUMMARY STATISTICS FOR SIMULATED FUNDS

Metric	Min	P01	P10	P25	P50	P75	P90	P99	Max
VG IRR	-33.3	-11.7	1.5	9.6	19.5	31.3	43.4	82.9	426.4
PE IRR	-36.2	-8.5	3.1	7.8	14.0	21.8	30.4	53.9	178.2
Software IRR	-32.6	-3.4	6.1	11.1	17.0	24.6	33.4	58.0	98.8
Entertainment IRR	-37.3	-12.4	0.4	5.7	12.1	20.0	29.3	58.9	1043.8
VG MOIC	0.13	0.47	1.08	1.47	2.23	3.19	4.23	9.72	30.81
PE MOIC	0.20	0.60	1.18	1.49	1.96	2.70	3.74	8.68	24.58
Software MOIC	0.21	0.83	1.38	1.75	2.32	3.13	4.40	10.50	32.34
Entertainment MOIC	0.12	0.50	1.02	1.33	1.79	2.52	3.60	8.55	25.89
VG MIRR	-11.9	-0.4	7.7	11.5	15.4	20.0	25.8	36.7	52.2
PE MIRR	-14.4	1.7	7.8	10.3	13.3	17.1	21.3	32.9	57.9
Software MIRR	-14.9	4.2	9.3	11.9	14.9	18.6	23.6	36.3	50.7
Entertainment MIRR	-17.1	-1.0	6.0	9.2	12.4	16.1	20.4	32.9	53.5
VG DA	-38.0	-18.5	-6.9	0.3	9.2	20.4	31.5	94.9	505.7
PE DA	-42.1	-15.5	-5.5	-1.1	4.4	11.5	19.3	39.2	165.8
Software DA	-38.5	-12.1	-2.8	1.8	7.4	14.1	21.8	44.6	96.8
Entertainment DA	-44.9	-19.4	-8.0	-3.0	2.7	9.9	18.1	43.2	894.3
VG PME	0.09	0.28	0.69	1.01	1.46	2.12	2.75	6.31	16.27
PE PME	0.11	0.38	0.74	0.94	1.25	1.68	2.25	4.58	12.05
Software PME	0.15	0.49	0.85	1.11	1.44	1.91	2.58	5.79	15.62
Entertainment PME	0.06	0.30	0.62	0.85	1.14	1.58	2.19	4.72	15.19

SYNTHETIC FUND PERFORMANCE DISTRIBUTIONS

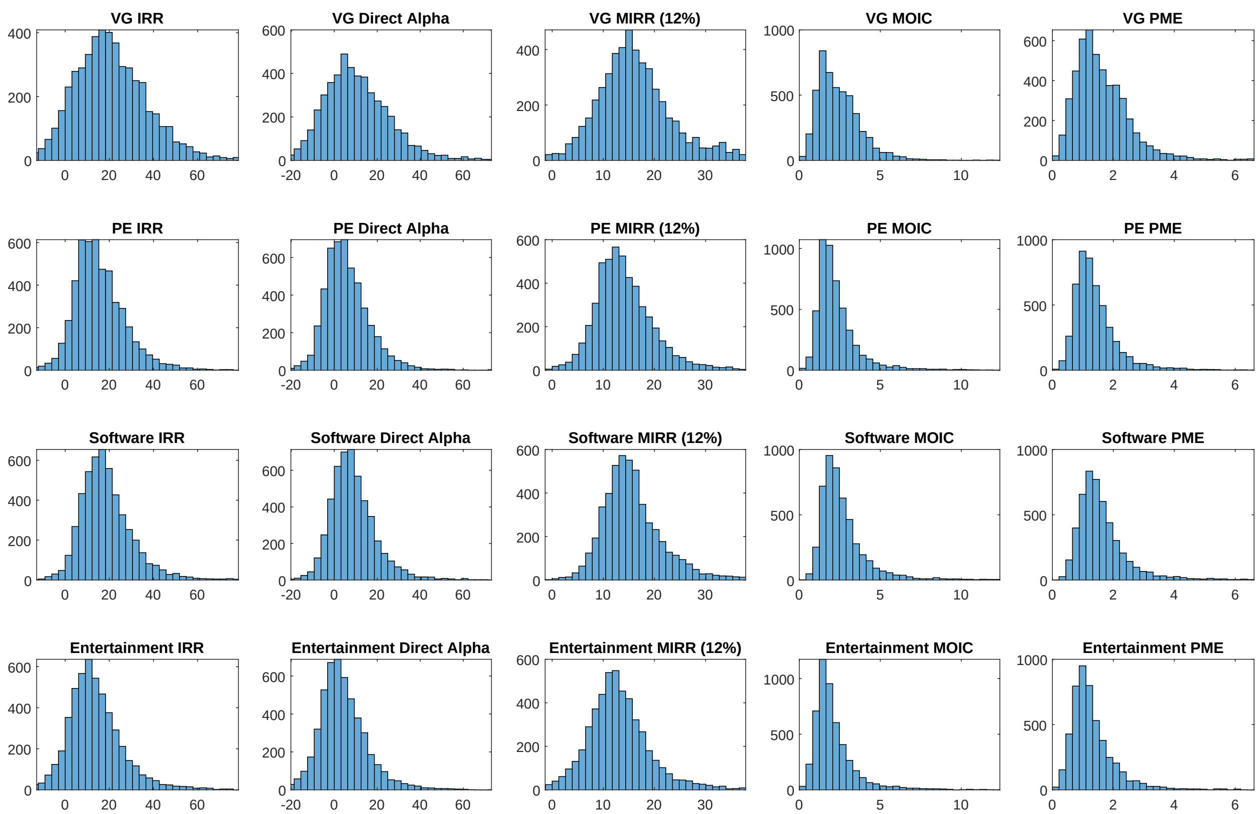

FIGURE A1: This figure shows the distributions of IRR, direct alpha, MIRR, MOIC, and PME for 5,000 synthetic video games funds and 5,000 comparable private equity funds. Histograms truncate at the 99.5th quantile.

TABLE A11: COMPANY AND BB TICKER LIST (UPDATED)

Company	BB Ticker	Company	BB Ticker
11 bit studios S.A.	11B PW Equity	NetEase, Inc.	9999 HK Equity
37 Interactive Entertainment Network Technology Group Co., Ltd.	002555 CH Equity	Netmarble Corporation	251270 KP Equity
Activision Blizzard Inc.	ATVI US Equity	NEXON Co., Ltd.	3659 JT Equity
BANDAI NAMCO Holdings Inc.	7832 JT Equity	Nihon Falcom Corporation	3723 JT Equity
Blue Hat Interactive Entertainment Technology	BHAT US Equity	Nintendo Co., Ltd.	7974 JT Equity
Capcom Co., Ltd.	9697 JT Equity	Nippon Ichi Software, Inc.	3851 JT Equity
CAVE Interactive CO.,LTD.	3760 JT Equity	Paradox Interactive AB	PDX SS Equity
CD Projekt S.A.	CDR PW Equity	PCF Group Spólka Akcyjna	PCF PW Equity
China CGame, Inc.	CCGM US Equity	Pearl Abyss Corp.	263750 KQ Equity
CyberStep, Inc.	3810 JT Equity	PLAYSTUDIOS, Inc.	MYPS US Equity
Devolver Digital, Inc.	DEVO LN Equity	Playtika Holding Corp.	PLTK US Equity
Digital Bros S.p.A.	DIB IM Equity	Remedy Entertainment Oyj	REMEDY FH Equity
Don't Nod Entertainment S.A.	ALDNE FP Equity	Roblox Corporation	RBLX US Equity
Electronic Arts Inc.	EA US Equity	SciPlay Corporation	SCPL US Equity
Embracer Group AB	EMBRACB SS Equity	Sega Sammy Holdings Inc.	6460 JT Equity
Enad Global 7 AB	EG7 SS Equity	Skillz Inc.	SKLZ US Equity
Focus Entertainment	ALPUL FP Equity	Snail, Inc.	SNAL US Equity
FURYU Corporation	6238 JT Equity	Square Enix Holdings Co., Ltd.	9684 JT Equity
GDEV Inc.	GDEV US Equity	Starbreeze AB	STARA SS Equity
Glu Mobile Inc.	GLUU US Equity	Super League Enterprise, Inc.	SLE US Equity
Interplay Entertainment Corp.	IPLY US Equity	Take-Two Interactive Software, Inc.	TTWO US Equity
Kakao Games Corp.	293490 KS Equity	Team17 Group plc	TM17 LN Equity
Koei Tecmo Holdings Co., Ltd.	3635 JT Equity	The Farm 51 Group	F51 PW Equity
Konami Group Corporation	9766 JT Equity	Thunderful Group AB	THUNDR SS Equity
KRAFTON, Inc.	259960 KP Equity	Tose Co., Ltd.	4728 JT Equity
Marvelous Inc.	7844 JT Equity	Ubisoft Entertainment SA	UBI FP Equity
Motorsport Games Inc.	MSGM US Equity	Unity Software Inc.	U US Equity
Nacon S.A.	NACON FP Equity	YUKE'S Co.,Ltd.	4334 JT Equity
Ncsoft Corporation	036570 KP Equity	Zynga Inc.	ZNGA US Equity
NetDragon Websoft Holdings Limited	777 HK Equity		

TABLE A12: GROSS PME CONFIDENCE INTERVALS: PRIVATE VIDEO GAME DEALS VS. ALTERNATIVE PUBLIC MARKETS

	Above Public Games	Above Public Entertainment	Above Public Software
99% CI	(1.66, 3.54)	(1.35, 2.73)	(1.13, 2.14)
95% CI	(1.82, 3.19)	(1.46, 2.47)	(1.21, 1.96)
90% CI	(1.91, 3.05)	(1.52, 2.36)	(1.26, 1.88)

Confidence intervals are bias-corrected and accelerated with 100,000 iterations each.

TABLE A13: NET POOLED PME AND DIRECT ALPHA 99% BCA CONFIDENCE INTERVALS FOR SIMULATED FUNDS USING ALTERNATIVE PUBLIC MARKETS

	Public Video Game Index	Public Entertainment Index	Public Software Index
Net Pooled PME	(1.52, 1.57)	(1.39, 1.43)	(1.20, 1.24)
Net Pooled DA	(11.6, 12.9)	(7.2, 8.1)	(4.6, 5.6)

Confidence intervals are bias-corrected and accelerated with 10,000 iterations each over 5,000 simulated funds.